PROPOSED BLACKWOOD SOLAR ENERGY FACILITY NEAR BOSHOF, FREE STATE PROVINCE

DEA Reference: 14/12/16/3/3/2/281

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

Submitted as part of the Final Environmental Impact Assessment Report
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 60 years, including artefacts, human and hominid remains and artificial features and structures.

Cumulative impacts: The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Drainage: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Photovoltaic effect: Electricity can be generated using photovoltaic solar panels which are comprised of individual photovoltaic cells that absorb solar energy to directly produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded,

abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste.

Watercourse: as per the National Water Act means -
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetlands: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).

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PROJECT DETAILS *CHAPTER 1*

Blackwood Solar Energy Facility (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with a maximum contracted capacity of up to 75MW, as well as associated infrastructure on a site located in the Free State approximately 25km south-east of Kimberley and 45km south-west of Boshof (refer to **Figure 1.1**).

This project is proposed on the remainder of Portion 1 of the Farm Pandamsfontein 1593. The broader site is approximately 1468ha in extent, is technically preferred for the development of a solar energy facility by way of the solar resource, the topography, and slope of the site, the current land use, accessibility to the land, and the potential for power evacuation options.

The facility is proposed to be developed over an area of 300ha in extent, and will include the following associated infrastructure:

» Solar panels (fixed/tracking technology) with a maximum contracted capacity of 75MW
» Mounting structures for the solar panels to be rammed steel piles, piles with pre-manufactured concrete footings or ground screw anchors to support the PV panels.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» Internal access roads
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity
» Area for workshop/maintenance, warehouse/storage, and offices.
» Security fencing around the complete proposed facility

Figure 1.2 provides the preliminary layout of the facility as provided by Blackwood Solar Energy Facility (Pty) Ltd.

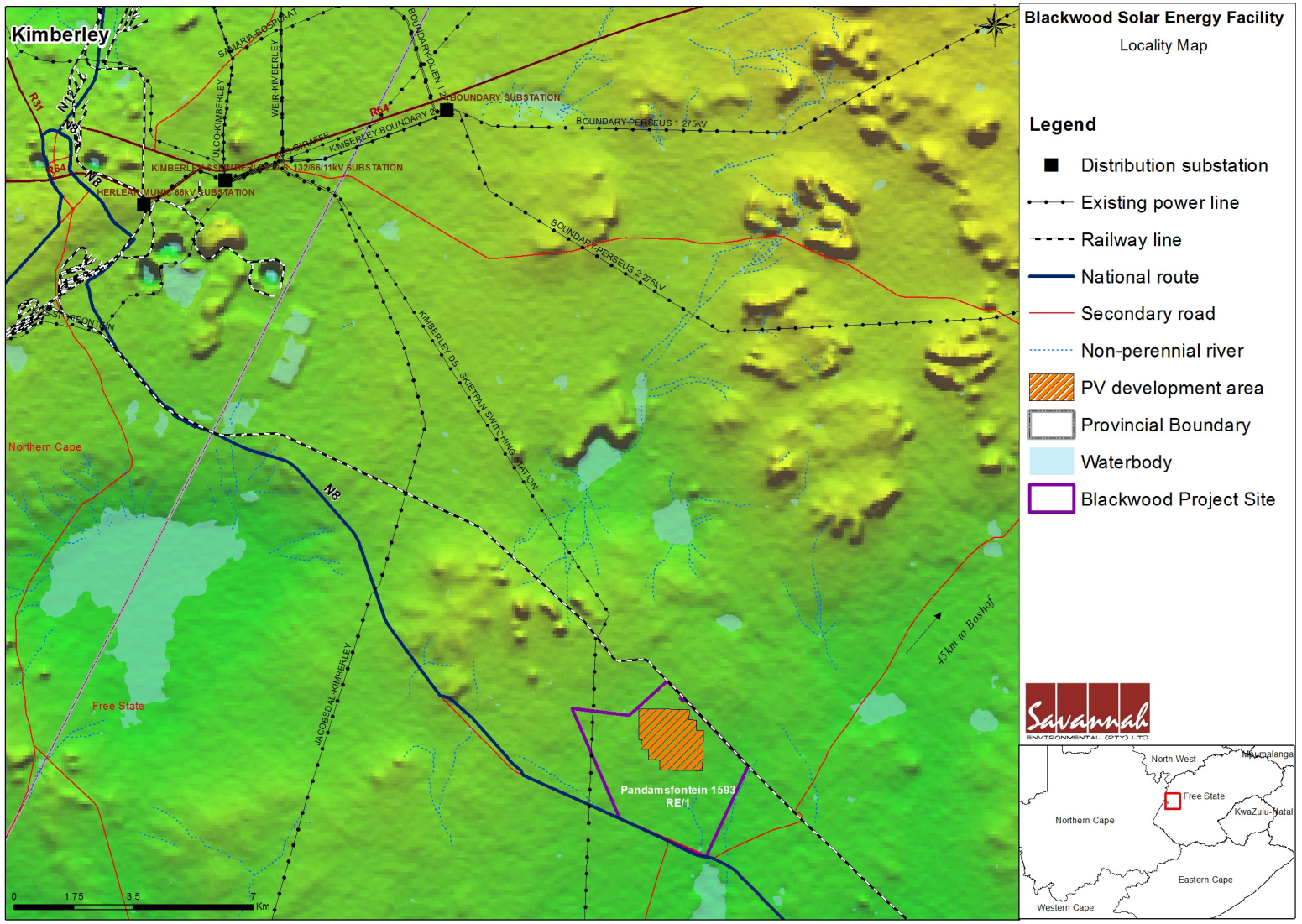

Figure 1.1: Locality map showing the broader study site identified for the proposed facility

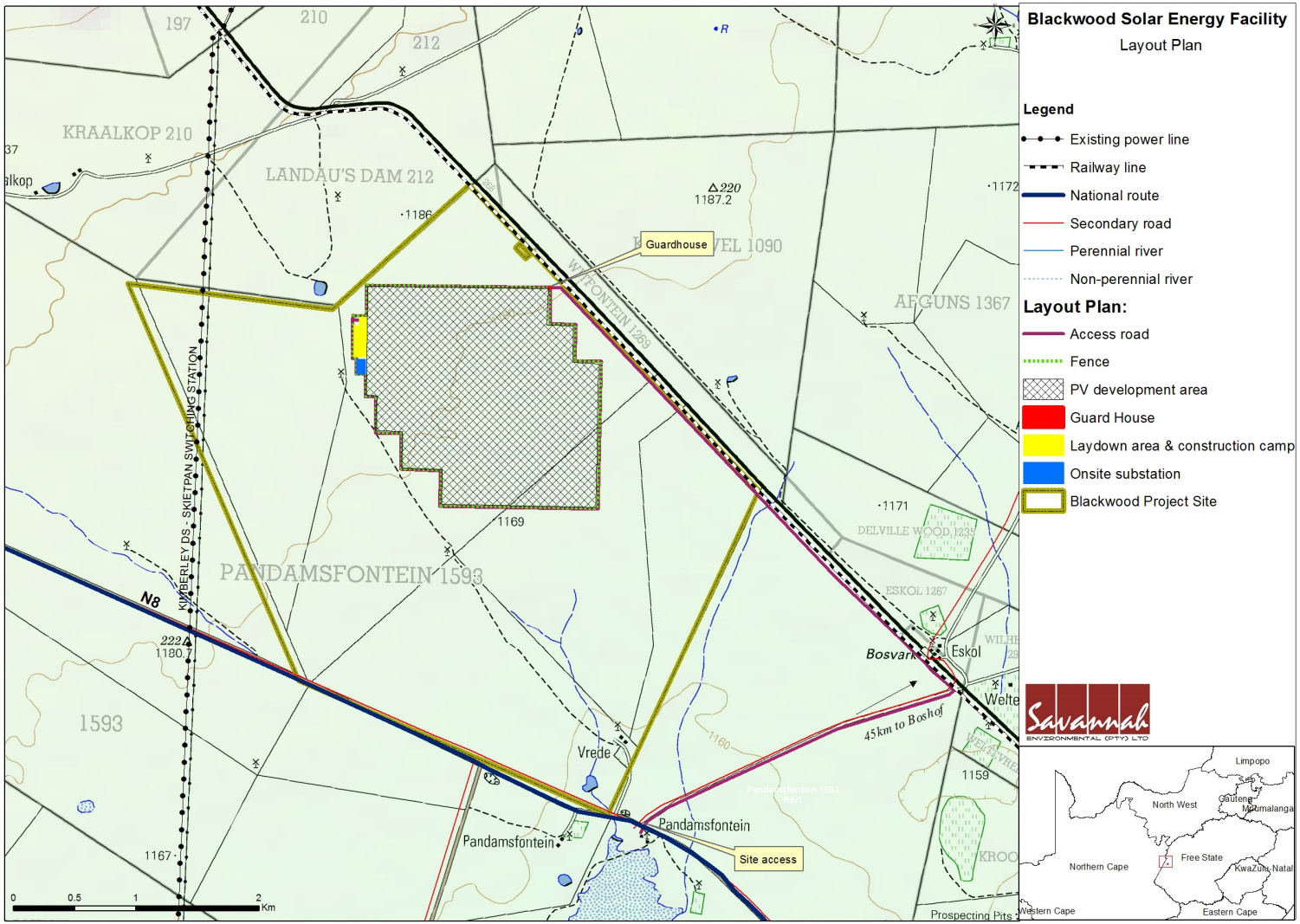

Figure 1.2: Layout map showing the location of PV facility and associated infrastructure within the proposed Blackwood Solar Energy Facility

1.1. Activities and Components associated with the Solar Energy Facility

In order to construct the solar energy facility and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

1.1.1 Design and Pre-Construction Phase

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, substation and the facility's associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed site. An ecological, avifauna and heritage walkthrough survey prior to commencement of activity will be required. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

1.1.2 Construction Phase

The construction the proposed project is expected to extend over a period of approximately 15-18 months and create at least 250-300 employment opportunities at peak. The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to local residents in the area. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community, representing a significant positive social benefit in an area with limited employment opportunities. The construction phase will entail a series of activities including:

Undertake Site Preparation

Site preparation involves construction of new access roads and improvement of existing on-site construction access roads with compacted native soil, installation of drainage crossings, setup of construction staging areas, storm water management work, preparation of land areas for array installation, and other activities needed before installation of the solar arrays can begin. The work would involve trimming of vegetation, agricultural rolling of PV array areas, selected compacting and grading, and setup of modular offices and other construction facilities. The PV arrays require a relatively level and stable surface for safe and effective installation.

Topographic and geotechnical studies will be used to determine the necessary grading and compaction of the surface.

Trenching would occur within each array to bury the electrical cables. Minimal ground disturbance may occur within the trenched corridors to restore them after soil has been replaced in the trenches, so that the corridor can conform to the existing surface contours.

Transport of Components and Construction Equipment to Site

The components for the proposed facility will be transported to site by road. Some of the substation components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[1] by virtue of the dimensional limitations (i.e. size and weight). The typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks,), as well as the components required for the establishment of the substation.

Establishment of Access Roads to the Site

A major national road found in the broader study area, the N8 links Kimberley and Bloemfontein via Petrusburg in a SE direction. Direct access to the site can be obtained from this road (N8) using an existing gravel road. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). Upgrade of existing access roads within the site will be required and new access roads will be required (±5m wide). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Installation of the PV Facility

The construction phase involves installation of the solar PV panels and the entire necessary structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue throughout the majority of the construction process. For array

[1] A permit will be required for the transportation of these abnormal loads on public roads.

installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical report a different foundation method, such as screw pile, helical pile, micropile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV modules would be mounted. Brackets attach the PV modules to the tables. Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. While cables are being laid and combiner boxes are being installed, the PV tables are erected. Wire harnesses connect the PV modules to the electrical collection systems. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the PVCS and from the PVCS to the onsite substation.

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include: a workshop, laydown area and office. The laydown area will be a temporary area. The establishment of these areas/facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

Construct an on-site Substation

Substations are constructed in the following simplified sequence:

Step 1: Survey the area
Step 2: Final design of the substation and placement of the infrastructure
Step 3: Vegetation clearance and construction of access roads (where required)
Step 4: Construction of foundations
Step 5: Assembly and erection of infrastructure on site, connect conductors
Step 6: Rehabilitation of disturbed area and protection of erosion sensitive areas

The expected lifespan of the proposed on-site substation associated with the PV facility is 35 – 50 years. During the life span of the substation, inspections are undertaken and on-going maintenance is performed.

Undertake Site Rehabilitation

As construction is completed in an area, and as all construction equipment is removed from the site, the site must be rehabilitated where practical and reasonable. Upon completion of commissioning of the facility, any access points to

the site, which are not required during the operation phase, will be closed and prepared for rehabilitation.

1.1.3 Operational Phase

The solar energy facility is expected to be operational for a minimum of 25 years, with an opportunity for a lifetime of 50 years or more with equipment replacement and repowering. The project will operate continuously, 7 days a week, during daylight hours depending on prevailing climatic conditions. While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required. Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project. The operational phase (for one 75MW solar energy facility) will create ~ 7-15 full-time employment positions. No large-scale energy storage mechanisms for the facility, which would allow for continued generation at night or on cloudy days are proposed.

1.1.4 Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 25-year operational period, the solar energy facility will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to extend the operational phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology/ infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment and possibly establishing areas for placement and storage of decommissioning equipment and machinery.

Disassemble and Remove Existing Components

All above-ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will either be removed, or cut off 1m below the ground surface, and the surface restored to the original contours. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in

accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other land-use.

1.2 Findings of the Environmental Impact Assessment

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Blackwood Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified (refer to Figure 1.3). In summary, the most significant environmental impacts associated with Blackwood Solar Energy Facility, as identified through the EIA include:

» Impacts on ecology and avifauna on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (access road).
» Social and economic impacts.
» Cumulative impacts.

1.2.1. Impacts on Ecology

The vegetation unit covering the study area is mostly Kimberley Thornveld. Vegetation overall is considered as of least conservation concern, but within the vegetation types more sensitive plant associations, habitats and species of conservation concern, including protected trees and geophytes. Most of these trees are concentrated within limited planta associations, which have been excluded from the development as far as possible. Several protected geophytic and succulent species occur within the study area – smaller patches of distinct sub-populations should be excluded from the development footprint. In general, it is not expected that the PV array and associated infrastructure will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measure are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented.

1.2.2. Impact on avifauna

There are no known nationally critical populations of impact susceptible species within or close to the development area; however the White-backed Vulture breeding colonies are regionally significant and any impact on these breeding populations should be avoided at all costs. The proposed site is not known to impinge on any major migration routes or avian fly-ways but the data does suggest that flight paths of numerous medium-large waterbirds (e.g. Yellow-billed Duck,

Egyptian Goose), raptors (e.g. White-backed Vulture) and migrant passerines (e.g. Barn Swallow) could be affected or impacted, the PV arrays are likely to have a negligible impact on flight paths or patterns.

Overall, development and construction of the Solar Energy Facility is predicted to have an impact on the avifauna present on site. The predicted disturbances will vary between the construction and operational phases. It is difficult to predict at this stage how detrimental the impacts will have on bird populations in the short or long-term but based on the relatively small footprint of the Solar Energy Facility, bird species present and flight path analyses, **low-moderate** impacts are probable.

1.2.3. Impact on Soils, Land Capability and Agricultural Potential

The site is used only for the grazing of cattle. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts. There are no agriculturally sensitive areas that occur within the proposed development footprint. The major limitations to agriculture are the aridity and lack of access to water, as well as the shallow soils. The development will have **low to medium** negative impacts on agricultural resources and productivity. The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided being implemented.

1.2.4. Visual Impacts

Due to the flat topography and terrain of the area, there is little in the surrounding landscape (such as trees and buildings) that can shield the development from view. The landscape character of the site, and surrounds, is open grassland with few homesteads, the visual exposure of the facility is therefore rated high for the immediate vicinity of the site. Industrial-type infrastructure such as electrical transmission lines and pylons and a railway line already exist in the immediate surroundings therefore; the overall visual environment has already been impacted upon to some extent. The study concluded that the significance of the visual impact of the proposed development would be **moderate-low** due to its extent, long term duration and medium magnitude. A number of mitigation measures are proposed which could moderate that visual impact. It is important that mitigation measures are complied with and it is advised that the environmental management programme set out principles for the implementation of these measures.

1.2.5. Impacts on Heritage and Paleontological Resources

Generally sparse **heritage** traces were found over almost all of the proposed development area. Remains of a colonial era (post-1907) railway-associated feature alongside the Kimberley-Bloemfontein line located close to the proposed development area should be avoided as far as possible. From an archaeological perspective the observed heritage resources over the indicated footprint of the Blackwood Solar Energy Facility were found to be mainly of low density and **low significance**.

In terms of the **palaeontology**, It is expected that infrastructure development will involve installation of multiple photovoltaic panels, underground cables and new buildings, resulting in construction activities extending over a relatively large surface area. The field assessment indicates that the construction of the photovoltaic panels and associated infrastructure at the remainder of Portion 1 of the Farm Pandamsfontein 1593 will primarily impact on Quaternary-age surface deposits (Qs). There is a **low** probability that Quaternary fossil remains will be adversely impacted during the construction phase of the proposed project.

1.2.6. Social and Economic Impacts

The findings of the SIA indicate that the development of the proposed Blackwood facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. In addition, the proposed establishment of a number of renewable energy facilities in the area will create socio-economic opportunities, which, in turn, will result in a positive social benefit. The significance of this impact is rated as **high positive**.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Blackwood facility is therefore supported by the findings of the SIA. However, the potential impacts associated with large, solar energy facilities on an areas sense of place and landscape cannot be ignored. These impacts are an issue that will need to be addressed by the relevant environmental authorities, specifically given the large number of applications for solar facilities in the Free State and Northern Cape Province. In addition, the potential impact of the site on the areas sense of place and character is likely to be of **low significance**. It is therefore recommended that the facility as proposed be supported, subject to the

implementation of the recommended mitigation measures and management actions contained in the report.

1.2.7 Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Blackwood Solar Energy Facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Free State Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 20km radius will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. The cumulative impacts for the proposed Blackwood Solar Energy have been assessed to be of low to moderate significance

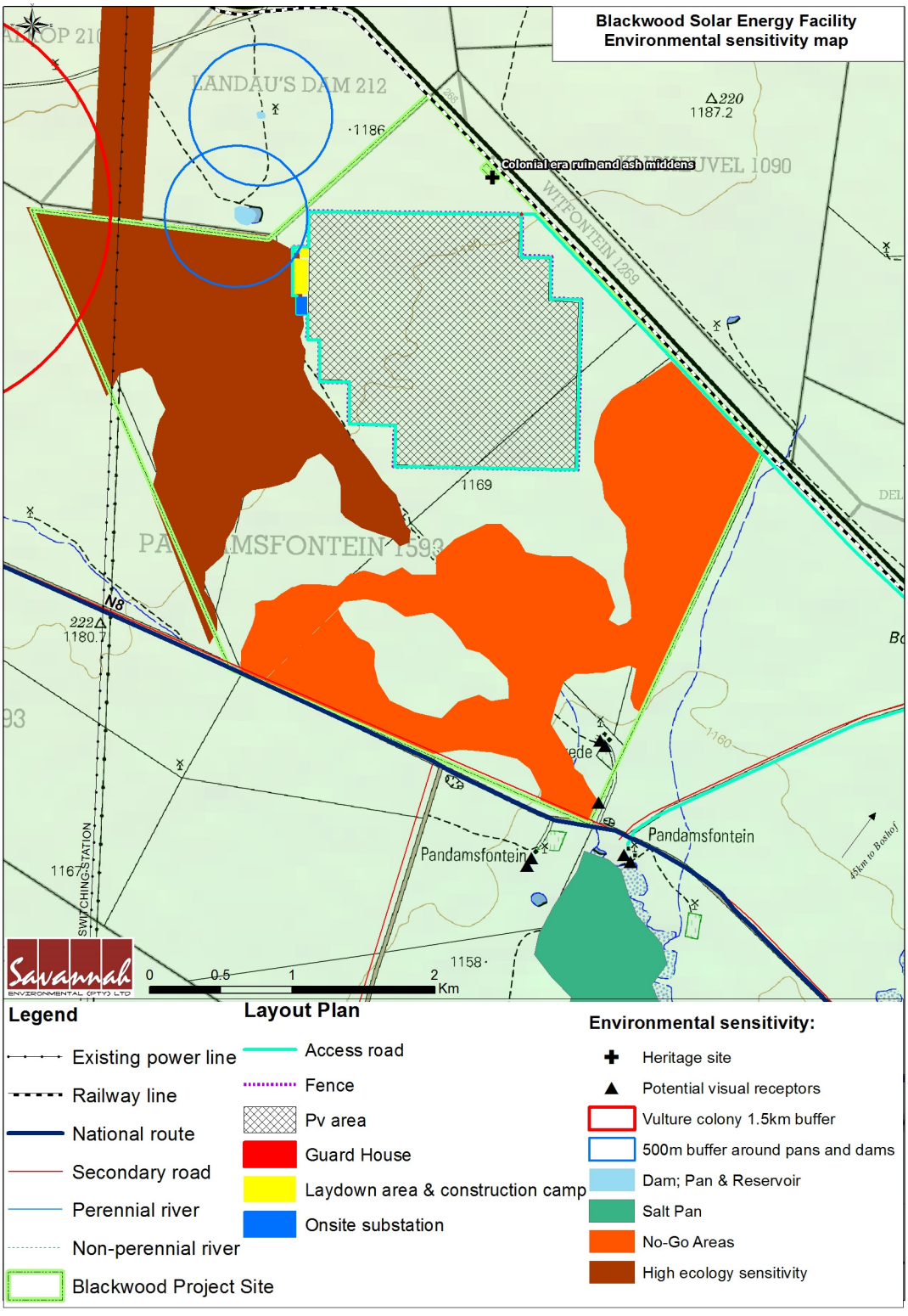

Figure 1.3: Environmental Sensitivity map for the proposed Blackwood Solar Energy Facility

PURPOSE AND OBJECTIVES OF THE EMPR CHAPTER 2

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts associated with the planning, construction, operation and decommissioning of a project are avoided or mitigated, and that the positive benefits of the projects are enhanced."[2] The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (i.e. site clearing and site establishment), during the construction activities themselves (i.e. erosion, noise, dust, and visual impacts), during site rehabilitation (i.e. soil stabilisation, re-vegetation), during operation and during decommissioning (i.e. similar to construction phase activities).

This Environmental Management Programme has been compiled for the design, construction and operation of the 75MW Blackwood Solar Energy Facility. This EMPr is applicable to all employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the project. The document will be adhered to, updated as relevant throughout the project life cycle.

This EMPr has been compiled in accordance with Section 33 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools).

[2] Provincial Government Northern Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

This EMPr has the following objectives:

» Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction and rehabilitation, operation, and decommissioning phases of the project in order to manage and minimise the extent of potential environmental impacts associated with the facility.
» Ensure that all the phases of the project do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
» Identify entities responsible for the implementation of the measures and outline functions and responsibilities.
» Propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The management and mitigation measures identified within the Environmental Impact Assessment (EIA) process are systematically addressed in this EMPr, and ensure the minimisation of adverse environmental impacts to an acceptable level.

The developer must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr and through its integration into the contract documentation. Since this EMPr is part of the EIA process for Blackwood Solar Energy Facility, it is important that this document be read in conjunction with the final Scoping and EIA Reports compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the environmental authorisation, the stipulations in the environmental authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr shall be binding on all the parties involved in the construction and operational phases of the project, and shall be enforceable at all levels of contract and operational management within the project. The document will be adhered to, and updated as relevant throughout the project life cycle.

KEY LEGISLATION APPLICABLE TO THE DEVELOPMENT CHAPTER 3

The following legislation and guidelines have informed the scope and content of this EMPr:

- National Environmental Management Act (Act No. 107 of 1998)
- EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  - Public Participation in the EIA Process (DEA, 2010)
  - Integrated Environmental Management Information Series (published by DEA)
- Tokologo Local Municipality Integrated Development Plan (2012-2017)
- Lejweleputswa District Municipality, Integrated Development Plan (2011/2012)
- International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in Table 3.1 and Table 3.2.

Table 3.1: Relevant legislative permitting requirements applicable to the proposed Blackwood Solar Energy Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of 18 June 2010, a Scoping and EIA Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA) commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA). This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs	Noise impacts are expected to be associated with the construction

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
		Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA) - Local Authorities	phase of the project and are not likely to present a significant intrusion to the local community. Therefore is no requirement for a noise permit in terms of the legislation. On-site activities should be limited to 6:00am - 6:00pm, Monday – Saturday (excluding public holidays). Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b.	Department of Water and Sanitation Provincial Department of Water and Sanitation	A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of such features. Should water be extracted from groundwater/ a borehole on site for use within the facility, a water use license will be required in

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.		terms of Section 21(a) and 21 (b) of the National Water Act. The storage of water in reservoirs may also require approval from DWA.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.	Department of Mineral Resources	A Section 53 application has been submitted the Free State DMR office.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013. Measures to control noise (S34) - no regulations	Department of Environmental Affairs	No permitting or licensing requirements arise from this legislation. However, National, provincial and local ambient air quality standards (S9 - 10 & S11)

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	promulgated yet.		to be considered. Measures in respect of dust control (S32) and the National Dust Control Regulations of February 2014. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36). » Lists activities which require developers or any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development	South African Heritage Resources Agency	An HIA was undertaken for the proposed facility and a no go area have been highlighted. No development will take place in the no go areas. Should a heritage resource be impacted upon, a permit may be required from SAHRA.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	(S38). » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act:	Department of Environmental Affairs	Under this Act, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species. An ecological study has been undertaken as part of the EIA Phase. There is a pan and areas of protected trees and the potential for them to be affected has been considered. This report is contained in Appendix E.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011).		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants & restrictions in terms of where these species may occur - Regulation 15 of GN R1048 and Regulation 598 GN 37885 of NEM:BA (Act No. 10 of 2004) » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048 & Regulation 598 GN 37885 of NEM:BA (Act No. 10 of 2004)).	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. There are none for the projects.
National Forests Act (Act No. 84 of 1998)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.	National Department of Forestry	A licence is required for the removal of protected trees. There were protected tree species recorded during the ecological survey within the broader study area. Few *Acacia* species and other small trees and geophytes scattered in on certain section of the site. Should protected trees need to be removed, a permit will

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			be required to be obtained from DAFF.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S13 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance	Department of Health	It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Group IV: any electronic product; and » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S(2-4) provide general principles for land development and conflict resolution.	Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of	National Department of Water and Environmental Affairs (hazardous waste) Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the proposed project, and waste volumes stored on site would not exceed the specified volumes, a waste license will not be required for the project. General waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMPrs. The DWAF (1998) Waste Management Series. Minimum Requirements for the

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	this Act (GN 921), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unlit for the safe storage of waste; » Adequate measures are taken to prevent accidental spillage or leaking; » The waste cannot be blown away; » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		Handling, Classification and Disposal of Hazardous Waste will also need to be considered.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the Province	Department of Agriculture	Subdivision will have to be in place prior to any subdivision approval in terms of S24 and S17 of the Act.
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		» Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the facility and substation components may not meet specified dimensional limitations (height and width).
Provincial Legislation			
Free State Provincial Spatial Development Framework (2013)	As a provincial policy framework, it sets the tone and pace for shared growth and development in the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province. According to the FS (PSDF – 2013), the Free State renewable energy is a key focus area of the Free State Development Corporation, especially the solar energy sector.	Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA)	A permit is not required but this provincial legislation has been incorporated in this report and will remain applicable through the life cycle of the proposed project.
The Nature Conservation Ordinance (NCO) 8 of 1969 and subsequent amendments	To provide for the conservation of fauna and flora and the hunting of animals causing damage and for matter incidental thereto	Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA)	The following species protected by this provincial legislation : Aardvark (Orycteropus afer), Aardwolf (Proteles cristatus), Bat-eared Fox (Otocyon megalotis), *Aloinopsis rubrolineata , edebouria crispa, Ammocharis coranica, Ledebouria revolute, Boophane disticha, edebouria undulate, Chortolirion angolense (Aloe welwitschii), Nerine species* *Cynanchum orangeanum, Stapelia*

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			species, Helichrysum lucilioides and Titanopsis calcarea – permit will be required for their removal

Table 3.2: Standards and guidelines applicable to the Blackwood Solar Energy Facility

Theme	Standard/Guidelines	Summary
Air	South African National Standard (SANS) 69	Framework for setting and implementing national ambient air quality standards
	SANS 1929: Ambient Air Quality	Sets limits for common pollutants
Noise	SANS 10328:2003: Methods for Environmental Noise Impact Assessments	General procedure used to determine the noise impact
	SANS 10103:2008: The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication	Provides noise impact criteria
	National Noise Control Regulations	Provides noise impact criteria
	SANS 10210: Calculating and Predicting Road Traffic Noise	Provides guidelines for traffic noise levels
Waste	DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste	DWAF Minimum Requirements
	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) – National norms and standard for the storage of waste.	» Provides uniform national approach relating the management of waste facilities » Ensure best practice in management of waste storage Provides minimum standards for the design and operation of new and existing waste storage
Water	Best Practise Guideline (G1) Stormwater Management DWA 2006	Provides guidelines to the management of storm water
Water	South African Water Quality Guidelines	Provides water quality guidelines
Others	Tokologo Local Municipality, Integrated Development Plan (2010/2011) and Lejweleputswa District Municipality, Integrated Development Plan (2011/2012)	According to the Municipal Systems Act of 2000, all Municipalities have to undertake an Integrated Development Planning (IDP) process to produce Integrated Development Plans (IDPs). As the IDP is a legislative requirement it has a legal status and it supersedes all other plans that guide development at local government level.

STRUCTURE OF THIS EMPR CHAPTER 4

The first two chapters provide background to the EMPr and the proposed project, while the chapters which follow consider the following:

» Pre-Construction (Planning & Design) activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for Blackwood Solar Energy Facility (Pty) Ltd, as the project developer, to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMPr has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the EIA specialist studies

Project Component/s	» List of project components affecting the objective.
Potential Impact	» Description of potential environmental impact if objective is not met.
Activity/Risk Source	» Description of activities which could affect achieving objective.
Mitigation: Target/Objective	» Description of the target and/or desired outcomes of mitigation.

Mitigation: Action/Control	Responsibility	Timeframe
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures?	Periods for implementation.

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the EMPr.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods, and reporting.

The objectives and EMPr tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components and/or layout of the facility);
» Modification to or addition to environmental objectives and targets;
» Relevant legal or other requirements are changed or introduced; and
» Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant or should be modified.

4.1 Project Team

This draft EMPr was compiled by:

	Name	Company
EMPr Compilers:	Sheila Muniongo Karen Jodas	Savannah Environmental
Specialists	Marianne Strohbach	Savannah Environmental
	David Morris	McGregor Museum
	Lloyd Rossouw	Palaeo Field Services
	Tony Barbour	Environmental Consulting and Research
	Johann Lanz	Johan Lanz Consulting
	Karen Hansen	Karen Hansen Landscape Architects
	Doug Harebottle	Doug Harebottle Consulting

The Savannah Environmental team have extensive knowledge and experience in EIAs and environmental management, having been involved in EIA processes over the past fifteen years. They have managed and drafted EMPrs for other power generation projects throughout South Africa, including numerous wind and solar energy facilities.

ROLES AND RESPONSIBILITIES CHAPTER 5

5.1 Roles and Responsibilities for the Construction Phase of the Solar Energy Facility

As the Proponent, Blackwood Solar Energy Facility (Pty) Ltd must ensure that the implementation of the solar energy facility complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation. Blackwood Solar Energy Facility (Pty) Ltd will retain various key roles and responsibilities during the construction of the solar energy facility. These are outlined below.

Specific responsibilities of the Owner's Representatives; Environmental Control Officer and EPC Contractor for the construction phase of this project are as detailed below.

The **Owner's Representative (i.e. General Manager and/or Site Manager)** will:

» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that Blackwood Solar Energy Facility (Pty) Ltd and its Contractor(s) are made aware of all stipulations within the EMPr.
» Ensure that the EMPr is correctly implemented throughout the project cycle by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully knowledgeable with the EIA for the project, the EMPr, the conditions of the facility Environmental Authorisation, and all relevant environmental legislation.

The **Owner's Engineer (i.e. Project Manager and/or Site manager)** will:

» Be fully knowledgeable with the contents and conditions of the facility Environmental Authorisation.
» Be fully knowledgeable with the contents of the EMPr.
» Have overall responsibility for the implementation of the EMPr .
» Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on matters concerning the environment.
» Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
» Confine activities to the demarcated construction site.

An independent[3] **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

» Be fully knowledgeable with the contents with the EIA.
» Be fully knowledgeable with the contents with the conditions of the facility Environmental Authorisation.
» Be fully knowledgeable with the contents with the EMPr.
» Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
» Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
» Ensure that the compliance of the EMPr is monitored through regular and comprehensive inspection of the site and surrounding areas.
» Ensure that if the EMPr conditions or specifications are not followed then appropriate measures are undertaken to address this.
» Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
» Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
» Ensure that activities on site comply with all relevant environmental legislation.
» Ensure that appropriate measures are undertaken to address any non-compliances recorded.
» Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
» Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
» Ensure that there is communication with the Site Manager regarding the monitoring of the site.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.
» Independently report to DEA in terms of compliance with the specifications of the EMPr and conditions of the facility Environmental Authorisation .
» Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.

[3]A person who is not from any of the parties involved in the design or construction of the Solar Energy Facility

Contractors and Service Providers: It is important that contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The contractor's obligations in this regard include the following:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» A copy of the EMPr must be easily accessible to all on-site staff members.
» Employees must be familiar with the requirements of this EMPr and the environmental specifications as they apply to the construction of the proposed facility.
» Prior to commencing any site works, all employees and sub-contractors must have attended an environmental awareness training course which must provide staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Staff will be informed of environmental issues as deemed necessary by the ECO.

All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

» Ensuring adherence to the environmental management specifications.
» Ensuring that appropriate Method Statements are drafted submitted to the Site Manager for approval before any work is undertaken.
» Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
» Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
» Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
» Ensuring that a register of all public complaints is maintained.
» Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations).

Environmental officer:

» Ensure that environmental issues receive adequate attention in the site induction training
» prepare and conduct awareness training (e.g. posters, tool box talks, signage)
» conduct monthly observation and inspection and audit of all work places
» monitor Contractor's compliance with EA, EMPr, and any permits and licenses on site
» conduct daily observations and monthly environmental audits of all Contractor's and work areas
» ensure that all environmental monitoring programmes are carried out according to protocols and schedules
» monitoring of completed work (e.g. areas top-soiled, re-vegetated, stabilised etc.)
» maintain site documentation related to environmental management (permits, CEMP, method statements, EA, reports, audits, monitoring results, receipts for waste removal etc.)
» Inspect and report on environmental incidents and check corrective action
» keep a regular photographic record of all environmental incidents
» management of complaints register
» review and of method statements prepared by contractors
» audit site performance against environmental method statements

5.2. Roles and Responsibilities for the Operation Phase of the Solar Energy Facility

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of Solar Energy Facility Operations Manager, and Environmental Manager for the operation phase of this project are detailed below.

The **Facility Manager** will:

» Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
» Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
» Take appropriate action as a result of findings and recommendations in management reviews and audits.
» Provide forums to communicate matters regarding environmental management.

The **Environmental Manager** will:

» Develop and Implement an Environmental Management System (EMS) for the solar energy facility and associated infrastructure.
» Manage and report on the facility's environmental performance.

- Maintain a register of all known environmental impacts and manage the monitoring thereof.
- Conduct internal environmental audits and co-ordinate external environmental audits.
- Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA) on environmental performance and other issues.
- Conduct environmental training and awareness for the employees who operate and maintain the solar energy facility.
- Compile environmental policies and procedures.
- Liaise with interested and affected parties on environmental issues of common concern.
- Track and control the lodging of any complaints regarding environmental matters.

MANAGEMENT PROGRAMME: PLANNING & DESIGN CHAPTER 6

Overall Goal: undertake the pre-construction activities (planning and design phase) in a way that:

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements
» Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the linear components, including the access roads alignments.
» Enables the solar energy facility construction activities to be undertaken without significant disruption to other land uses and activities in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

6.1Objectives

OBJECTIVE PD1: Ensure the selection of the best environmental option for the alignment of the development areas and access roads AND Ensure all environmental sensitivities and possible impacts are fully accounted for and methods in place for mitigation prior to commencement of activity

» The study area is covered by the Kimberley Thornveld as described by Mucina and Rutherford (2006), although this vegetation type is regarded as least threatened, the relatively high biodiversity and nature of the species present renders some of the plant associations and portions within these in the study area a medium to high sensitivity. Several protected plant species occur in the study area, some with red data status, whilst many of the geophytic protected species can be relocated with relative ease. Of the latter, only very dense patches should be excluded from the development footprint – the latter will need to be confirmed by a final footprint investigation.
» Considering the revised layout proposed for the Blackwood development together with the associated available bird and habitat data, no highly sensitive species or processes (e.g. raptor breeding sites) should be severely impacted by the proposed development. However, a buffer of 1.5 km is

suggested around the *Kraalkop White-backed Vulture colony* so that any impacts/activities do not impinge on the breeding productivity of the colony.

Opportunities to mitigate the negative impacts of large-scale PV developments largely arise during the planning and design stages. The correct choice of footprint location and layout is paramount, thus ecosystem components such as biodiversity and ecosystem function should be given full consideration during the design phase, as determined by the Environmental Impact Assessment. The design of PV arrays (panel size, height, spacing, and nature of panels – tracking or fixed) can be equally important. The timing of pre-commencement, construction, maintenance and decommissioning activities also provides opportunities to reduce negative impacts on biodiversity.

Once the layout has been finalised, a detailed investigation of the footprint area, during the optimal growing season and as described below must be conducted before the activity commences. The footprint investigation can still be used for micro-siting where desirable.

Project Component/s	» PV Array » Access roads » Workshop, guardhouses, and other related infrastructure » Temporary construction camps » Protective fencing around development » Potential topsoil stockpiles and/or borrow pits
Potential Impact	» Placement of infrastructure that damages and degrades the environment unnecessarily, particularly with respect to habitat destruction, loss of indigenous flora, damage to rocky niche habitats, establishment, and persistence of alien invasive plants, and erosion.
Activities/Risk Sources	» Positioning of solar components and internal access routes » Positioning of workshop, guardhouses, and other related infrastructure » Alignment of access roads to development » Positioning of temporary sites
Mitigation: Target/Objective	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts

Mitigation: Action/Control	Responsibility	Timeframe
Undertake pre-construction walk-through footprint investigation for protected flora and burrowing terrestrial vertebrates:	Project Company, carried out by	Design review phase

Mitigation: Action/Control	Responsibility	Timeframe
The final footprint investigation (walkthrough) is aimed to fully inform the Project Company, responsible conservation authority (that will issue the relevant permits and authorisations), contractors, EO and ECO about: » Potential micro-siting requirements » Protected and red data species that will be affected by the development » Location of protected plant species within the footprint area – either individually mapped or approximate areas of occurrence, especially dense patches (alternatively, for linear structures, between which structures or other markers) » Identification of the affected species by providing a representative photo record that enables EO/ECOs and contractors to identify such plants » How many specimens per species may be affected – estimate based on random transect surveys » Which species can be successfully relocated, which and how many will have to be destroyed » Location and nature of any nesting sites or active burrows of vertebrate species (birds, amphibians, reptiles and mammals), that will have to be inspected and cleared/relocated prior to construction by the contractor or duly appointed person(s) » Approximate location and nature of any alien invasive species that will have to be cleared by the contractor » Location and nature of any other significant environmental concerns, e.g. extreme gully erosion, that will need to be addressed by the contractor to prevent any unnecessary (further) degradation of the development footprint » Note: should more than 1000 specimens of any critically endangered or endangered species be affected, a risk assessment report for that species must be prepared according to Section 15 of the NEMA:BA Draft Threatened or Protected Species Regulations, Gazetted General Notice 388 of 2013.	Specialist	
The above pre-construction footprint investigations must be used together with results from the ecological specialist report to draft the following: » A comprehensive search and rescue program for plants and possible burrowing animals » Update and finalise the rehabilitation and revegetation plan	Project Company, carried out by Specialist	Design review phase

Mitigation: Action/Control	Responsibility	Timeframe
Although no White-browed Sparrow-weaver colonies were located in the revised PV array layout it is suggested that if any additional colonies are found close to the boundary of the new PV array that a buffer of 100 m is created.	Project Company	Design phase
The final site layout must be developed to avoid: » All vegetation with high sensitivity » New disturbance to riparian vegetation where such may be crossed » Dense patches of protected geophytes and protected trees Minimise: » Clearing of indigenous trees with a stem diameter exceeding 15 cm must be kept to the lowest number possible, regardless of species/protection status	Project Company	Design phase
Compile a detailed invasive plant management (**Appendix B**) and monitoring programme as guideline for the entire construction, operational and decommissioning phase » This plan must contain WfW-accepted species- specific eradication methods » It must also provide for a continuous monitoring programme to detect new infestations	Specialist	Pre-construction
Obtain permits for protected plant removal and relocation prior to commencement of any activity related to this development » As a minimum, permits will be required to remove all **or** some of the following species: o *Aloinopsis rubrolineata* o *Ammocharis coranica* o *Boophane disticha* o *Helichrysum lucilioides* o *Ledebouria cooperi* o *Ledebouria crispa* o *Ledebouria revoluta* o *Ledebouria undulata* o *Nerine spp* o *Stapelia species* o *Titanopsis calcarea*	Project Company, or contractor responsible for vegetation clearing	Pre-commence-ment
Access roads and machinery turning points must be planned to minimise the impacted area, avoid the initiation of accelerated soil erosion and prevent unnecessary compaction and disturbance of topsoils, prevent obstruction or alteration of natural water flow.	Project Company	Design phase

Mitigation: Action/Control	Responsibility	Timeframe
Permissible biodiversity: » Depending on the final PV array and mechanism developed and taking all potential impacts, fire risks and maintenance requirements into consideration, it has to be decided upon and made clear: o Permissible vegetation: maximum height, desirable density and composition o Maintenance of this vegetation – mowing, small livestock grazing, etc. Note: there may be no application of herbicides for maintaining vegetation in a desirable state o Permissible terrestrial fauna that could be allowed to migrate/return to the area below/between the PV arrays – including species that must be excluded due to potential damage to the development	Project Company, in consultation with relevant specialist	Design phase
After the permissible biodiversity has been determined, compile a comprehensive vegetation rehabilitation management plan.	Project Company and relevant specialist	Design phase

Performance Indicator	» Solar components and all associated temporary and permanent infrastructure and access road alignments meet environmental objectives » Ecosystem fragmentation is kept to a minimum » Ecosystem functionality is retained and any unjustified disturbance and degradation prevented
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA Report through review of the design by the Project Manager, and the ECO prior to the commencement of activity.

OBJECTIVE PD2: To ensure effective communication mechanisms

On-going communication with affected and surrounding landowners is important to maintain during the construction and operational phases of the solar energy facility. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project	» Solar energy facility

component/s	
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with solar energy facility construction » Activities associated with solar energy facility operation
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public (as outlined in **Appendix A**) to be implemented during both the construction and operational phases of the facility. This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues. This procedure should be in line with the South African Labour Law.	Developer	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaison with landowner is to be undertaken prior to the commencement of construction in order to provide sufficient time for him to plan agricultural activities.	Developer / Contractor	Pre-construction

Performance Indicator	» Effective communication procedures in place.
Monitoring	» An incident reporting system should be used to record non-conformances to the EMPr.

MANAGEMENT PROGRAMME: CONSTRUCTION CHAPTER 7

Overall Goal: Undertake the construction phase in a way that:

» Ensures that construction activities are appropriately managed in respect of environmental aspects and impacts.
» Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
» Minimises the impact on indigenous natural vegetation and habitats of ecological value.
» Minimises impacts on fauna using the site.
» Minimises the impact on heritage sites should they be uncovered.

7.1 Objectives

In order to meet the overall goal for construction, the following objectives, actions, and monitoring requirements have been identified.

OBJECTIVE C1: Securing the site and site establishment

Project Component/s	» Area infrastructure (i.e. PV panels, and substation). » Linear infrastructure (i.e. access roads). » Laydown areas and site camps
Potential Impact	» Hazards to landowners and public. » Damage to indigenous natural vegetation, due largely to ignorance of where such areas are located. » Loss of threatened plant species
Activities/Risk Sources	» Open excavations (foundations and cable trenches). » Movement of construction vehicles in the area and on-site. » Site clearance and levelling activities.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents. » No loss of or damage to sensitive vegetation in areas outside the immediate development footprint.

Mitigation: Action/Control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the Environmental Officer.	Contractor	Erection: during site establishment

Mitigation: Action/Control	Responsibility	Timeframe
		Maintenance: for duration of Contract
Where the public could be exposed to danger by any of the works or site activities, the contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English and any other relevant locally spoken languages, all to the approval of the Site Manager.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area (especially relevant to no-go areas).	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Contractors and construction workers must be informed of the no-go areas and areas of high sensitivity as detailed in Figure 1.3.	Developer	Construction
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Perimeter fencing around the broader site/ farm portions for the facility (which is clearly indicated with flags) to be implemented. All deep excavations must be adequately protected. There is to be no unauthorised disturbance outside the demarcated development footprint.	Contractor	Erection: during site establishment Maintenance: for duration of Contract

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured. » Appropriate and adequate waste management facilities provided at construction site. » No disturbance of vegetation outside of development footprint.
Monitoring	» An incident reporting system will be used to record non-conformances to the EMPr. » ECO to monitor all construction areas on a continuous basis until all construction is completed. Non-conformances will be immediately reported to the site manager.

OBJECTIVE C2: To avoid and/or minimise the potential negative impact on current and future farming activities during the construction phase

The development site is located within a cattle farming agricultural region. There has not been any cultivation or irrigation on the site. The only agricultural infrastructure at the solar site is fencing into camps. There are stock watering points and a farmstead with a predator rehabilitation centre elsewhere on the farm. Agricultural potential is uniform across the site and the choice of placement of the facility on the site therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the proposed development footprint.

Construction and operational activities of the proposed facility could lead to the loss of farm land. This could be either due to extensive loss of topsoil, soil seed banks, natural vegetation, erosion, or pollution.

Project component/s	» PV Array » Temporary construction camps » Workshops and/or other permanent infrastructure » Access roads
Potential Impact	» The footprint of the development will result in a loss of land that will impact on farming activities on the site. » Displacement of indigenous vegetation by invasive vegetation
Activities/risk sources	» The footprint of the development » Accelerated erosion
Mitigation: Target/Objective	» To minimise the loss of land and plantatable vegetation by the construction of the development and to enable farming activities to continue..

Mitigation: Action/control	Responsibility	Timeframe
The footprint for *all* development components should be defined before the construction phase commences	Contractor	Before and during construction, operational phase
Specific Plans shall provide for the mitigations of the impacts of the different types of development components, e.g. if topsoil will have to be stored, a topsoil management plan will have to be drafted	Contractor Specialist	Before and during construction, operational phase
Rehabilitate disturbed areas on completion of the construction phase. Rehabilitation targets must be set according to the original vegetation cover.	Contractor, rehabilitation specialist	Ongoing during construction phase
Monitor erosion and manage all occurrences according	Contractor	Ongoing,

Mitigation: Action/control	Responsibility	Timeframe
to the erosion management plan		from construction to decom-missioning
Eradicate all weeds and indigenous and alien invasive plants as far as practically possible. Continually monitor the re-emergence of these species and manage according to the invasive species management plan	Contractor, to be monitored by EO	Ongoing, from construction to decom-missioning

Performance Indicator	» All relevant and specific EMPs developed and then diligently implemented by the contractor and developer » Stable vegetation cover established throughout the development area following rehabilitation as determined desirable to curb erosion and maintain ecosystem functionality
Monitoring	» Regular monitoring and audits of construction activities and the footprint area by the ECO to prevent any degradation of the ecosystem by monitoring any erosion present » A photographic record must be established before, during and after mitigation » An incident reporting system should be used to record non-conformances to the EMPr, followed by the necessary action from the developer to ensure full compliance

OBJECTIVE C3: To Minimise loss of indigenous biodiversity, including plants of conservation concern

Prior to commencement of any activity, including earthworks (grading, road construction, etc.) within areas of natural vegetation a plant Search and Rescue program should be developed and implemented, preceded by a meticulous investigation of all footprint areas by a suitably qualified botanist, conducted during the optimal growing season (late January to March) within the entire footprint area.

Project Component/s	» PV Array » Access roads » Workshop, guardhouses, and other related infrastructure » Temporary construction camps » Protective fencing around development » Potential topsoil stockpiles and/or borrow pits
Potential Impact	» Substantially increased loss of species of conservation concern and other natural vegetation at construction phase, waste of on-site plant resources, lack of locally sourced material for

	rehabilitation of disturbed areas; » Increased cost of rehabilitation
Activities/Risk Sources	» Construction related loss and damage to remaining natural and semi-natural vegetation
Mitigation: Target/Objective	» Rescue, maintenance and subsequent replanting of at least some of the bulbous protected plant species within the specific land portion

Mitigation: Action/Control	Responsibility	Timeframe
Ecological footprint investigation and recording by GPS of localities of all red data species should be undertaken and an indication of presence of other species of conservation concern provided	Ecologist	Prior to commencement of activity
» Search and Rescue (S&R) of all protected plants that must be affected by the development, especially species occurring in long term and permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, laydown areas, and panel positions). » Plants that can be considered for rescue and included in subsequent rehabilitation programs are all tubers, bulbs, and indigenous succulents » All development footprints must be surveyed and pegged out as soon as possible, after which a local specialist with Search and Rescue experience should be appointed to undertake the S&R. » All rescued species should be bagged (or cuttings taken where appropriate) and kept in a formal or designated, well-maintained on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is required. » Replanting should occur in spring to early summer once sufficient rains have fallen, in order to facilitate establishment.	Specialist Contractor	Prior to construction
In line with specifications regarding permissible biodiversity and the rehabilitation plan, a minimum i.e. percentage 30% cover of vegetation must be established and permanently maintained post-construction	Developer and specialist contractor	Prior to and after construction, throughout operational phase
All cable trenches, excavations, etc. through sensitive areas should be excavated carefully in order to minimise damage to surrounding areas. » The trenches must be checked on a daily basis for the presence of trapped animals.	Contractor	Duration of construction

Mitigation: Action/Control	Responsibility	Timeframe
» Any animals found must be removed in a safe manner, unharmed, and placed in an area where the animal will be comfortable. » If the ECO or contractor is unable to assist in the movement of a fauna species, ensure a member of the conservation authorities assists with the translocation. » All mammal, large reptiles and avifauna species found injured during construction will be taken to a suitably qualified veterinarian or rehabilitation centre to either be put down in a humane manner or cared for until it can be released again. The following species observed on the study site during this survey are protected: o Aardvark (*Orycteropus afer)* o Aardwolf (*Proteles cristatus*) o Bat-eared Fox (*Otocyon megalotis*)		

Performance Indicator	» Rescue of species of conservation concern » No damage or injury to fauna » Re-establishment of rescued species
Monitoring	» ECO to monitor Search and Rescue, assist with the continuation of search and rescue operations during the construction process where it becomes necessary after the initial S&R (e.g. geophytes that emerge later in the season) » It may be possible that geophytic species may emerge during construction that were not accounted for in the original S&R plan – once observed the ECO should consult the botanists on the identification and possible S&R for those plant species

OBJECTIVE C4: Minimisation of disturbance to topsoil

Topsoil conservation is an integral part of rehabilitation efforts and helps to maintain the productive capability and ecological functionality of rangelands.

Removal of topsoil should be done where:
» Areas will be excavated
» Areas will be severely compacted
» Areas will be buried with excavated material
» Areas will be permanently covered with altered surfaces

Project Component/s	» PV Array supports and trenching » Access roads

	» Workshop, guardhouses, and other related infrastructure » Potential topsoil stockpiles and/or borrow pits
Potential Impact	» Loss of topsoil and natural resources and biological activity within the topsoil » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils.
Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » PV array construction activities » Stockpiling of topsoil, subsoil and spoil material.
Mitigation: Target/Objective	» To retain full biological activity and functionality of topsoil » To retain desirable natural vegetation, where possible » To minimise footprints of disturbance of vegetation/habitats » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas » Minimise spoil material

Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary disturbance.	Contractor	Pre-construction
Construction activities must be restricted to demarcated areas so that impact on topsoil is minimised.	Contractor,	Before and during construction
» Topsoil must always be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. » Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. » Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contractor,	During construction
Storing topsoil: » Viability of stored topsoil depends on moisture, temperature, oxygen, nutrients and time stored. » Rapid decomposition of organic material in warm, moist topsoils rapidly decreases microbial activity necessary for nutrient cycling, and reduces the amount of beneficial micro-organisms in the soil. » Stockpile location if not adjacent to a linear development, ideally a disturbed but weed-free area » *Topsoil is typically stored in berms with a width of 150 – 200 cm, and a maximum height of 2m, preferably lower*	Contractor,	During construction

Mitigation: Action/Control	Responsibility	Timeframe
» Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the piling and reapplication, stored topsoils should not undergo any further handling except control of erosion and (alien) invasive vegetation » Where topsoil can be reapplied within six months to one year after excavation, it will be useful to store the topsoil as close as possible to the area of excavation and re-application, e.g. next to cabling trenches » In cases where topsoil has to be stored longer than 6 months or during the rainy season, soils should be kept as dry as possible and protected from erosion and degradation		
Reapplying topsoil: » Spoil materials and subsoil must be back-filled first, then covered with topsoil » Generally, topsoils should be re-applied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site » The minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm » If the amount of topsoil available is limited, a strategy must be worked out to optimise revegetation efforts with the topsoil available » Reapplied topsoils should be landscaped in a way that creates a variable micro topography of small ridges and valleys that run parallel to existing contours of the landscape. The valleys become catch-basins for seeds and act as run-on zones for rainfall, increasing moisture levels where the seeds are likely to be more concentrated. This greatly improves the success rate of revegetation efforts. » To stabilise reapplied topsoil and minimise raindrop impact and erosion » Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation	Contractor	During construction
Re-applied topsoils need to be re-vegetated as soon as possible, following the revegetation and rehabilitation plan.	Contractor	During construction, monitored during operational phase

Performance Indicator	» Minimal disturbance outside of designated work areas. » Topsoil appropriately stored, managed, and rehabilitated.

	» No signs of accelerated erosion[4] from construction to completion of decommissioning
Monitoring	» Monitoring of appropriate methods of vegetation clearing and soil management activities by ECO throughout construction phase. » An incident reporting system must be used to record non-conformances to the EMPr. » Regular monitoring of topsoil after construction by Environmental Manager until such topsoil can be regarded as fully rehabilitated, stable and no longer prone to accelerated erosion

OBJECTIVE C5: Manage and reduce the impact of invasive vegetation

Within the project area invasive species – indigenous and alien - occur, which all have a potential of reproducing to such an extent that the ecosystem within and beyond the project area could be impaired. Additional alien species grow along major transport routes to the area and thus could be potentially spread there as well. Species that must be monitored and eradicated according to CARA, includes:

[4]Accelerated soil erosion: Soil erosion induced by human activities and ultimately leading to irreversible degradation of the ecosystem and loss of ecosystem functionality

- » *Agave sisalana* (growing in road reserves outside study area)
- » *Alternanthera pungens*
- » *Argemone ochroleuca* (growing on embankments of railway track)
- » *Datura* species (growing around watering points and along drainage lines)
- » *Nicotiana glauca* (growing in road reserves outside study area)
- » *Opuntia ficus-indica*
- » *Opuntia humifusa* (growing in road reserves outside study area)
- » *Opuntia imbricata* (growing on neighbouring farm)
- » *Parkinsonia aculeata* (growing in road reserves outside study area, closer to KDS substation)
- » *Pennisetum setaceum* (growing in road reserves outside study area closer to KDS substation)
- » *Prosopis glandulosa* (but see notes above)
- » *Salsola kali* (growing in road reserves outside study area)
- » *Schinus molle* (growing in road reserves outside study area closer to KDS substation)
- » *Xanthium strumarium* (growing around watering points)

Project Component/s	» Permanent and temporary infrastructure » Access roads
Potential Impact	» Impacts on natural vegetation » Impacts on soil » Impact on faunal habitats » Degradation and loss of agricultural potential
Activity/Risk Source	» Transport of construction materials to site » Movement of construction machinery and personnel » Site preparation and earthworks causing disturbance to indigenous vegetation » Construction of site access road » Stockpiling of topsoil, subsoil and spoil material » Routine maintenance work – especially vehicle movement
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate alien invasive species » To avoid the introduction of additional alien invasive plants to the project control area » To avoid further distribution and thickening of existing alien plants and invasive shrubs on the project area » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the project control area

Mitigation: Action/Control	Responsibility	Timeframe
Compile a detailed invasive plant management and monitoring programme as guideline for the entire construction, operational and decommissioning phase. This plan must contain Working for Water (WfW) - accepted species-specific eradication methods. It must also provide for a continuous monitoring programme to detect new infestations.	Specialist	Pre-construction
Avoid creating conditions in which invasive plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Shred all non-seeding material from cleared invasive shrubs and other vegetation an use as mulch as part of the rehabilitation and re-vegetation plan » Do not import soil from areas with alien plants	Contractor	Construction phase
Eradicate all invasive plants that occur within the development's temporary and permanent footprint areas	Contractor	Construction phase
Immediately control any alien plants that become newly established using registered control measures	Contractor	Construction phase
Ensure that material from invasive plants that can regenerate – seeds, suckers, plant parts are adequately destroyed and not further distributed	Contractor	Construction phase

Performance Indicator	» Visible reduction of number and cover of alien invasive plants within the project area. » Improvement of vegetation cover from current dominance of invasive shrubs to dominance of perennial grasses and dwarf shrubs » No establishment of additional alien invasive species.
Monitoring	» Ongoing monitoring of area by ECO during construction. » Ongoing monitoring of area by Environmental Manager during operation » Undertake an audit every two to three years by a suitably qualified botanist to assess the status of infestation and success of eradication measures » If new infestations are noted these must be recorded. A comprehensive eradication programme with the assistance of the WfW (Working for Water) Programme is advisable.

OBJECTIVE C6: Maximise local employment and business opportunities associated with the construction phase

Employment opportunities will be created during the construction phase (i.e. ~250-300 staff at peak periods of construction), specifically for semi-skilled and unskilled workers. The unemployment rate in the study area is noted to be high and there will therefore be individuals in the area in search of employment. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs.

Project Component/s	Construction and establishment activities associated with the establishment of the solar energy facility, including infrastructure .
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/Risk Sources	The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	Employ local labour as far as possible

Mitigation: Action/control	Responsibility	Timeframe
Aim for the majority of the low-skilled workers are sourced from the local area.	Developer & contractors	Preconstruction/ construction
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase.	Developer & contractors	Preconstruction/ construction
Skills audit to be undertaken to determine training and skills development requirements.	Developer & contractors	Preconstruction/ construction
Develop a database of local BBBEE service providers and ensure that they are informed of tenders and job opportunities.	Developer & contractors	Preconstruction/ construction
Identify potential opportunities for local businesses	Developer & contractors	Preconstruction/ construction

Performance Indicator	» Employment and business policy document that sets out local employment and targets completed before construction phase commences. » Majority of semi and unskilled labour locally sourced. » Database of potential local BEE services providers in place

	before construction phase commences. » Skills audit to determine need for training and skills development programme undertaken within 1 month of commencement of construction phase.
Monitoring	» The proponent and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE C7: Avoid the potential impacts on family structures and social networks associated with presence of construction workers from outside the area

While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including an increase in alcohol and drug use, an increase in crime levels, the loss of girlfriends and or wives to construction workers, an increase in teenage and unwanted pregnancies, an increase in prostitution and an increase in sexually transmitted diseases.

The potential risk to local family structures and social networks is, however, likely to be low. The low and semi-skilled workers are likely to be local residents and will therefore from part of the local family and social network.

An inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities.

Project Component/s	Construction and establishment activities associated with the establishment of the solar energy facility, including infrastructure.
Potential Impact	The presence of construction workers who live outside the area and who are housed in local towns can impact on family structures and social networks.
Activities/Risk Sources	The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities.
Mitigation: Target/Objective	To avoid and or minimise the potential impact of construction workers on the local community. This can be achieved by maximising the number of locals employed during the construction phase and minimising the number of workers housed on the site.

Mitigation: Action/Control	Responsibility	Timeframe
Ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct. Ensure that construction workers attend a briefing session before activities on site commence. The aim of the briefing session is to inform them of the rules and regulations governing activities on the site as set out in the Code of Conduct.	Contractors	Prior to the commencement of construction
Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Contractors	Prior to the commencement of construction
Construction workers who are found guilty of breaching the Code of Conduct must follow disciplinary processes in terms of the South African Labour Laws. All dismissals must be in accordance with South African labour legislation.	Contactors	Construction phase
Provide opportunities for workers to travel to their home town at regular intervals or over weekends.	Contactors	Construction phase
Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE)	Contractors	Construction

Performance Indicator	» Employment policy and tender documents that sets out local employment and targets completed before construction phase commences. » Majority of semi- and unskilled labour locally sourced. » Local construction workers employed have proof that they have lived in the area for five years or longer. » Tender documents for contractors include recommendations for construction camp. » Code of Conduct drafted before commencement of construction phase. » Briefing session with construction workers held at outset of construction phase.
Monitoring	» The proponent and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE C8: Minimise impacts related to traffic management and transportation of equipment and materials to site (Traffic Management and Transportation Plan)

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment (including PV panels components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary and external works outside the site boundary.

A major national road found in the broader study area, the N8 links Kimberley and Bloemfontein via Petrusburg in a SE direction. Direct access to the site can be obtained from this road (N8) using an existing gravel road on site. The site is therefore appropriately located for easy transport of components and equipment as well as labour movement to and from the site., minor upgrades to existing farm roads will be undertaken and no new roads outside of the development area are anticipated.

The section below provides a guideline for the Traffic Management and Transportation Plan on site and will need to be supplemented with the relevant final transport plan devised by the EPC partner during the final design phase of the facility.

Project Component/s	» Delivery of any component required within the construction phase.
Potential Impact	» Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals. » Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.
Activities/Risk Sources	» Construction vehicle movement. » Speeding on local roads. » Degradation of local road conditions. » Site preparation and earthworks. » Foundations or plant equipment installation. » Transportation of ready-mix concrete from off-site batching plant to the site. » Mobile construction equipment movement on-site. » Substation construction activities.
Mitigation: Target/Objective	» Minimise impact of traffic associated with the construction of the facility on local traffic volume, existing infrastructure,

	property owners, animals, and road users. » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction » To ensure all vehicles are roadworthy and all materials/ equipment are transported appropriately and within any imposed permit/licence conditions

Mitigation: Action/Control	Responsibility	Timeframe
The contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified with affected parties prior to the commencement of construction activities on site.	Developer	Pre-construction
Source general construction material and goods locally where available to limit transportation over long distances.	Developer and Contractor	Pre-construction and construction
Appropriate dust suppression techniques must be implemented to minimise dust from gravel roads.	Developer	Construction
Construction vehicles and those transporting materials and goods should be inspected by the contractor or a sub-contractor to ensure that these are in good working order and not overloaded.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	Developer	Construction
All relevant permits for abnormal loads must be applied for from the relevant authority.	Contractor (or appointed transportation contractor)	Pre-construction
A designated access to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved transportation routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
The movement of all vehicles within the site must be on designated roadways. Signage must be appropriately maintained and placed in areas visible to all road users.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
signage to be in accordance with prescribed standards). Signage must be appropriately maintained and placed in areas visible to all road users.		
Appropriate maintenance of all vehicles must be ensured.	Contractor	Duration of contract
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits of 30-40km/hr and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract
Signs must be placed along construction roads to identify speed limits, travel restrictions and other standard traffic control information.	Contractor	Duration of contract
» Install temporary high visibility advanced warning signs (intersection ahead) on the N8 in both directions prior to construction. » Install permanent high visibility advance warning signs - (Intersection Ahead) - on the N8 once operation commences » Maintain communication with the Free state Provincial road authority regarding their requirements for measures to be instituted	Contractor	Duration of contract

Performance Indicator	» Vehicles keeping to the speed limits within the site and on public roads. » Vehicles are in good working order and safety standards are implemented. » Local residents and road users are aware of vehicle movements and schedules. » No construction traffic related accidents are experienced. » Local road conditions and road surfaces are up to standard. » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).
Monitoring	» Developer and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE C9: Management of dust, vehicle emissions and damage to roads

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-

site, as well as vehicle entrained dust from the movement of vehicles on the main and internal access roads.

Project Component/s	» Construction and establishment activities associated with the establishment of the PV facility, including infrastructure
Potential Impact	» Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads.
Activities/Risk Sources	» The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads.
Mitigation: Target/Objective	» To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and minimise damage to roads.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Implement dust suppression measures on site, such as, for example, wetting roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Contractor	Construction
Ensure that all vehicles are road-worthy, drivers are qualified and are made aware of the potential noise, dust and safety issues.	Contractor	Construction
Ensure that drivers adhere to speed limits. Vehicles should be fitted with recorders to record when vehicles exceed the speed limit.	Contractor	Construction
Ensure that any damage to roads is repaired before completion of construction phase.	Contractor	Construction

Performance Indicator	• Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase commences. • Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	» The proponent and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

OBJECTIVE C10: Minimise soil degradation and erosion (Erosion management Plan)

Compacted and/or denuded and disturbed soils are usually prone to surface capping – even more so if the soils have a fine texture due to higher clay or loam contents. Such capped soils are prone to accelerated erosion, creating a dysfunctional landscape and ecosystem that rapidly loses soil, nutrients and seeds from the ecosystem.

Management of erosion will be required during the construction phase of the facility. An erosion management plan is required to ensure compliance with applicable regulations and to prevent increased soil erosion and sedimentation of the downstream environment. The section below provides a guideline for the management of erosion on site and will need to be supplemented with the principles for erosion management contained in the Erosion Management plan included in **Appendix C**.

Project Component/s	» PV arrays and foundations to support them » Substation » Access roads. » Underground cabling. » Storage and maintenance facilities and foundations to support them.
Potential Impact	» Soil degradation including erosion, dust and siltation. » Reduction in agricultural potential.
Activities/Risk Sources	» Earthworks & activity on site. » Rainfall and concentrated discharge causing water erosion of disturbed areas. » Wind - erosion of disturbed areas.
Mitigation: Target/Objective	» Minimise soil degradation (removal, excavation, mixing, wetting, compaction, pollution » Minimise erosion. » Minimise sediment transport downstream (siltation). » Minimise dust pollution.

Mitigation: Action/Control	Responsibility	Timeframe
Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling)	Contractor	During construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary degradation of soil.	Contractor	At design stage and during construction
Dust control on construction site through, e.g.	Contractor	Daily during

Mitigation: Action/Control	Responsibility	Timeframe
wetting or covering of cleared areas or use of appropriate dust suppressant.		construction
Minimise removal of vegetation which aids soil stability.	Contractor	Continuously during construction
Rehabilitate disturbance areas as soon as construction in an area is completed.	Contractor	Continuously during and after construction
Soil conservation - stockpile topsoil for re-use in rehabilitation phase. Protect stockpile from erosion. Topsoil should be stockpiled below 1 m height as far as possible, and for as short a period as possible to ensure survival of the soil seed bank and other soil-borne organisms.	Contractor	Continuously during construction
Erosion control measures - run-off control and attenuation on slopes bags, logs), silt fences, stormwater channels and catch-pits, shade nets, soil binding, geofabrics, hydroseeding or mulching over cleared areas.	Contractor	Erection: Before construction Maintenance: Duration of contract
All vehicles on site must be appropriate to access the site. No off-road driving is permitted.	Contractor	Pre-construction, Construction & operation
4x4's or diff lock vehicles must be used in wet slippery conditions to reduce the erosion on the roads and the surrounding area.	Contractor	Construction
Construct an effective run-off control system to collect and safely disseminate water from all surfaces and during all phases of the project, without causing downstream erosion. The system will need to adapt to changing conditions through the construction phase into the operational phase.	Construction managers / Environmental manager	Construction

Performance Indicator	» Minimal level of soil erosion around site » Minimal level of increased siltation in drainage lines or pans » Minimal level of soil degradation » Acceptable state of excavations, as determined by EO » Progressive return of disturbed and rehabilitated areas to the desired end state
Monitoring	» Fortnightly inspections of the site by ECO » Fortnightly inspections of sediment control devices by ECO » Fortnightly inspections of surroundings, including drainage

	lines by ECO » Immediate reporting of ineffective sediment control systems » An incident reporting system must record non-conformances according to the EMPr. » After construction, a continued bi-annual monitoring of the entire development until the completion of decommissioning for signs of erosion

OBJECTIVE C11: Limit impacts on heritage resources

Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility.

Generally sparse heritage traces were found over almost all of the proposed development area. Remains of a colonial era (post-1907) railway-associated feature alongside the Kimberley-Bloemfontein line should be avoided. Heritage materials from Colonial frontier, i.e. the railway and middle stone age, are notable feature near the site (none impacted by the project footprint).

The project area is completely underlain by the Quaternary-age aeolian deposits, surface calcretes, dolerite outcrop, as well as older Ecca sediments of the Prince Albert Formation. Impact on Quaternary sediments within the footprint will be extensive, but impact on potential in situ Quaternary fossils, within the confines of the affected area is considered unlikely

Project component/s	» PV panels » Roads » Substation » Ancillary infrastructure
Potential Impact	The potential impact if this objective is not met is that wider areas or extended developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects from their current context on the site.
Activity/risk source	Activities which could impact on achieving this objective include deviation from the planned lay-out of infrastructure without taking heritage impacts into consideration.
Mitigation: Target/Objective	Mitigation measures as recommended, namely exclusion if possible of the colonial era foundations beside the railway.

Mitigation: Action/control	Responsibility	Timeframe
Avoid disturbing to the heritage materials from the Colonial frontier, beyond the indicated PV array layout	Contractor	Construction
Should archaeological sites, graves or fossils be exposed during construction work, work in the area must be stopped and the find must immediately be reported to a suitably qualified heritage practitioner such that an investigation and evaluation of the finds can be made.	Contractor Heritage specialist	Construction
If required, measures must be put in place to prevent vandalism of any archaeological heritage.	Contractor	Construction
The EO must be trained in basic archaeological site identification in order to immediately inform the archaeologist of any chance discovery of archaeological sites or burials. The archaeologist will then implement the required legal steps in terms of the applicable section of the NHRA.	Contractor Specialist	Construction
The Contractor shall make provision for accidental discovery of archaeological sites and graves on the construction site. In the event that any sites found are significant enough to warrant conservation, the Contractor shall ensure that the requirements of SAHRA are fulfilled.	Contractor	Construction
The Contractor shall also prepare the necessary documentation and obtain the permits from the SAHRA to construct through a site, which is directly affected by the construction works but is considered to be of low significance. It should be noted that buildings 60 years and older must be assessed and a permit obtained from SAHRA before demolition is considered.	Contractor	Construction

Performance Indicator	» Preservation of archaeological traces of the colonial era foundations and ash middens next to the railway. » Inclusion of further heritage impact consideration in any future extension of infrastructural elements. » Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
Monitoring	Officials from relevant heritage authorities (National and Provincial)

	to be permitted to inspect the operation at any time in relation to the heritage component of the management plan.

OBJECTIVE C12: The mitigation and possible negation of the visual impacts associated with the construction of the solar energy facility

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as road users. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility. Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

Project Component/s	Construction site, various buildings, a substation, a fence and internal access roads.
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.
Activity/Risk Source	The viewing of the above-mentioned by observers on or near the site (i.e. within 2 km of the site).
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.

Mitigation: Action/Control	Responsibility	Timeframe
During the construction phase of the project, assembly areas and work camps must be kept free of litter. These sites would be visible from the N8 and thus in order to reduce the visual impact of these sites should be kept presentable and neat.	Developer	Construction
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Contractor	Construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Contractor	Construction phase.
Plan the placement of lay-down areas and	Developer /	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	contractor	phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Contractor	Construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works in an area.	Contractor	Construction phase.

Performance Indicator	» Vegetation cover on and near the site is intact with no evidence of degradation or erosion. » Construction site is kept in a neat and tidy state.
Monitoring	» Monitoring of vegetation clearing during construction. » Monitoring of rehabilitated areas post construction.

OBJECTIVE C13: Appropriate handling and management of waste

The main wastes expected to be generated by the construction of the solar energy facility will include general construction waste, hazardous waste (i.e. fuel), and liquid waste (including grey water and sewage). In order to manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented. A generic waste management plan in included as **Appendix D**.

Project Component/s	» PV panels. » Ancillary buildings. » Access roads.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation.

	» Litter or contamination of the site or water through poor waste management practices.
Activity/Risk Source	» Packaging. » Other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks, and site preparation.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Uncontaminated waste will be removed at least weekly for disposal; other wastes will be removed for recycling/ disposal at an appropriate frequency.	Contractor	Duration of contract
Hydrocarbon and other hazardous waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Documentation (waste manifest) must be maintained	Contractor	Duration of

Mitigation: Action/Control	Responsibility	Timeframe
detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.		contract
Regularly serviced chemical toilets facilities must be used to ensure appropriate control of sewage, proof . of disposal for this waste needs to be kept on record	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction
Dispose of all solid waste collected at an appropriately registered waste disposal site. Waste disposal shall be in accordance with all relevant legislation and under no circumstances may waste be burnt on site.	Contractor	Duration of construction
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.	Contractor	Duration of construction

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of waste management practices throughout construction phase. » Waste collection will be monitored on a regular basis. » Waste documentation completed. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE C14: Appropriate handling and storage of chemicals, hazardous substances

The construction phase will involve the storage and handling of a variety of chemicals including fuels, adhesives, abrasives, oils and lubricants, paints and solvents.

Project Component/s	» Storage and handling of chemicals, hazardous substances.

Potential Impact	» Release of contaminated water from contact with chemicals or hazardous substances. » Generation of contaminated wastes from used chemical or hazardous substances containers.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Construction activities of area and linear infrastructure. » Hydrocarbon use and storage.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals, hazardous substances and hydrocarbons on-site does not cause pollution to the environment or harm to persons. » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons.

Mitigation: Action/Control	Responsibility	Timeframe
Develop and implement an emergency preparedness plan during the construction phase.	Contractor	Pre-construction and implement for duration of Contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Pre-construction and implement for duration of Contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes halting further contamination, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Cement dust, slurry from cement batching, or spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not to take place outside of designated areas on-site (except in the case of emergency). Where repairs of	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
vehicles take place, an appropriate sealed surface and/or drip tray must be used to contain any fuel or oils.		
All stored fuels to be maintained within a bund and on a sealed surface. The bunded area must be provided with a tap-off system through which spillages and leakages that might occur will be removed without any spillage outside the bunded area.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations	Contractor	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Duration of contract

Performance Indicator	» No chemical spills outside of designated storage areas. » No unattended water or soil contamination by spills. » No complaints received regarding waste on site or indiscriminate dumping.
Monitoring	» Implement an effective monitoring system to detect any leakage or spillage of all hazardous substances. » Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE C15 : To avoid and/or minimise the potential risk of increased veld fires during the construction phase

The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project Component/s	» Construction and establishment activities associated with the establishment of PV facility, including infrastructure .
Potential Impact	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences.
Activities/Risk Sources	» The presence of construction workers and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Contractor (and sub-contractor/s)	Duration of contract
Provide adequate fire fighting equipment onsite.	Developer and contractors	Duration of construction
Provide fire-fighting training to selected construction staff.	Contractors	Duration of construction
Compensate farmers / community members at full market related replacement cost for any losses, such as livestock, damage to infrastructure etc.	Contractors	Duration of construction

Performance Indicator	» Designated areas for fires and smoking identified on site at the outset of the construction phase. » Fire fighting equipment and training provided before the construction phase commences. » Proven compensation claims resolved and settled.
Monitoring	» The developer and/or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE C16: Management of the Contractors Camp and open spaces during construction to avoid negative environmental impacts

The construction camp will include workshop, ablutions and storage area. The location of the construction camp and accommodation facilities must be reflected in the layout plan.

Project component/s	» Construction camp - Housing facilities (including kitchens, canteens, toilets, bedrooms and open spaces)
Potential Impact	» Water contamination » Waste generation – potential soil pollution » Noise » Traffic » Safety risks
Activities/risk sources	» Construction workers » Living areas » Noise due to people residing on the site
Mitigation: Target/Objective	» Appropriate management of housing facilities » Zero complaints from surrounding landowners/ community/ stakeholders » Zero pollution/ contamination due to construction camp and facilities

Mitigation: Action/control	Responsibility	Timeframe
Ablution facilities must be provided for use by construction staff residing on site.	Contractor	Construction
Waste bins must be strategically located around the labour camp for ease of waste management	Contractor	Construction
No littering, burning or burying of waste must be allowed. The waste should be removed regularly and appropriately disposed of.	Contractor	Construction
Develop a waste management plan for the construction camp.	Contractor	Construction
Excessive noise must be prohibited at the accommodation facilities.	Contractor	Construction
No open fires must be permitted out of the designated areas	Contractor	Construction
Safe water for drinking must be provided at the labour camp	Contractor	Construction
Access to the labour camp must be limited to labourers residing on site	Contractor	Construction
Designated areas for smoking must be provided at the labour camp	Contractor	Construction
Due care must be employed in ensuring that water is not wasted at the labour camp	Contractor	Construction
The construction camp used to house equipment an accommodate must be located in a disturbed or low	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
sensitivity area and must be screened off as far as practical during the entire construction phase.		
Avoid light pollution due to the construction camp and keep lighting to a minimum.	Contractor	Construction
No temporary site camps will be allowed outside the footprint of the development area.	Contractor	Contract duration
Rehabilitate and revegetate all disturbed areas at the construction equipment camp as soon as construction is complete within an area.	Contractor	Duration of Contract

Performance Indicator	» Appropriate management of housing facilities » No complaints from surrounding landowners/ community/ stakeholders » No pollution/ contamination due to construction camp and facilities
Monitoring	» ECO to monitor the construction camp for duration of construction period

7.2 Detailing Method Statements

OBJECTIVE C17: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

The environmental specifications are required to be underpinned by a series of Method Statements, within which the EPC Contractor and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the EPC Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Owner's Representative.

There are two types of method statements, (1) method statements which carryover throughout the project, which are applicable to all activities and, (2) specific method statements used for one task only. The carryover method statements would be method statements pertaining to (waste management, dust control, cement and concrete batching, top soil management, hydrocarbon and emergency spill procedures, alien and invasive plant control, rehabilitation and plant management, erosion management, storage and management of hazardous substances) the specific method statements are specifically related to one activity. These kinds of method statements are drawn up at the beginning of each new task.

The Method Statement must cover applicable details with regard to:

» Details of the responsible person/s
» Construction procedures;
» Materials and equipment to be used;
» Getting the equipment to and from site;
» How the equipment/material will be moved while on-site;
» How and where material will be stored;
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
» Timing and location of activities;
» Compliance/non-compliance with the Specifications; and
» Any other information deemed necessary by the Site Manager.

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific method statements could include:

» Construction procedures (for example: site clearing, working within watercourses).
» Materials and equipment to be used.
» Transporting the equipment to and from the site.
» How the equipment will be used while on site.
» How and where the material will be stored.
» The containment (or action to be taken if containment is not possible) of the leaks or spillages of any liquid or material that may occur.
» Timing and location of activities.
» Compliance/Non compliances with the EMPr specifications and any other information that is deemed necessary.
» Method Statement for Corrective Actions

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Owner's Representative except in the case of emergency activities and then only with the consent of the Owner's Representative. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract. The content and requirements of Method Statements are to be clearly explained to all plant operators and general workers

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Owner's Representative except in the case of emergency activities and then only with the consent of the Owner's

Representative. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

Once a Method Statement has been submitted it must be evaluated and checked to ensure that all the activities mentioned on the statement are conducted in a manner which ensures environmental compliance. If all the information on the method statement is correct and compliant, the contractor and the EO must sign the statement. Once all the parties have signed the method statements, copies must be made and submitted to all management parties on site, including the ECO and the EO.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The ECO must/shall monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

7.3 Awareness and Competence: Construction Phase of the Solar Energy Facility

OBJECTIVE C18: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts.

The Contractors obligations in this regard include the following:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document.
» Employees will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
» Employees must undergo training for the operation and maintenance activities associated with a PV plant and have a basic knowledge of the potential

environmental impacts that could occur and how they can be minimised and mitigated.

» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
» The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Awareness of any other environmental matters, which are deemed necessary by the ECO.
» Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.
» Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
» Records must be kept of those that have completed the relevant training.
» Training should be done either in a written or verbal format but must be appropriate for the receiving audience.
» Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

7.3.1 Environmental Awareness Training

Environmental Awareness Training must take the form of an on-site talk and demonstration by the ECO or EO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the EO on site.

7.3.2 Induction Training

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should include discussing the developer's environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE Officer on site.

7.3.3 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

7.4 Monitoring Programme: Construction Phase

OBJECTIVE C19: To monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, the developer will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
» Ensure adequate and appropriate interventions to address non-compliance.

» Ensure adequate and appropriate interventions to address environmental degradation.
» Provide a mechanism for the lodging and resolution of public complaints.
» Ensure appropriate and adequate record keeping related to environmental compliance.
» Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site.
» Aid communication and feedback to authorities and stakeholders.

7.4.1 Non-Conformance Reports

All supervisory staff including Foremen, Resident Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

7.4.2 Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out.

7.4.3 Final Audit Report

A final environmental audit report must be submitted to DEA upon completion of the construction and rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions (as appropriate) and the requirements of the EMPr.

MANAGEMENT PROGRAMME: REHABILITATION CHAPTER 8

Overall Goal: Undertake the rehabilitation measures in a way that :

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

8.1. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

OBJECTIVE R1: Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A perennial vegetation cover of at least 30%, preferably more, will be desirable (on all areas where vegetation is permissible).

The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

The first vegetation layer must be developed further until a desirable end state, as determined during the design phase and taking the original vegetation description as guideline, is established.

Project Component/s	» PV Array supports and trenching » Access roads » Workshop, guardhouses, and other related infrastructure » Potential topsoil stockpiles and/or borrow pits
Potential Impact	» Within the footprint, a change of plant species composition with lower productivity and agricultural potential can be expected due to removal, disturbance and continued long-term shading of vegetation » A largely reduced vegetation cover will cause the ecosystem to be more prone to erosion and irreversible degradation » Disturbance of indigenous vegetation creates opportunities for

	the establishment of invasive vegetation or creation of surfaces that do not support the permanent (re-) establishment of vegetation » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils.
Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » PV array construction activities » Stockpiling of topsoil, subsoil and spoil material.
Mitigation: Target/Objective	» Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » Prevent and accelerated erosion of ecosystem degradation

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Rehabilitation of surface		
Prior to the application of topsoil » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » any foreign objects, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place » shaping will be to roughly round of cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes	Contractor	During and after construction
Application of topsoil » topsoil shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil	Contractor	During and after construction

Mitigation: Action/Control	Responsibility	Timeframe
Soil stabilisation » mulch, if available from shredded vegetation, shall be applied by hand to achieve a layer of uniform thickness » mulch shall be renovated into the upper 10 cm layer of soil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas » runnels or erosion channels developing shall be back-filled and restored to a proper condition where erosion cannot be remedied with available mulch or rocks, geojute or other geotextiles shall be used to curtail erosion	Contractor	Construction phase Operational phase, followed up until desired end state is reached
Borrow-pits (if required) » shall be shaped to have undulating, low-gradient slopes and surfaces that are rough and irregular, suitable for trapping sediments and facilitation of plant growth » upon completion of rehabilitation these reshaped and revegetated areas shall blend into the natural terrain	Contractor	After construction
Revegetation		
» revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » revegetation will be done according to an approved planting/landscaping plan, also indicating the desirable end states of permissible vegetation	Contractor	Construction phase Operational phase, followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species » re-seeding shall occur at the recommended time to take advantage of the growing season » in the absence of sufficient follow-up rains after seeds started germinating, irrigation of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seed bank	Contractor	Construction phase Operational phase, followed up until desired end state is reached

Mitigation: Action/Control	Responsibility	Timeframe
Planting of species » the composition of the final acceptable vegetation will be according to the vegetation descriptions of the original ecological EIA and final footprint investigations, and will include rescued plant material » geophytic plants shall be planted in groups or as features in selected areas » during transplanting care shall be taken to limit or prevent damage to roots » plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots	Contractor	Construction phase Operational phase, followed up until desired end state is reached
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil must be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from newly revegetated areas, until vegetation is well established	Contractor	Construction phase Operational phase
» The establishment and new growth of revegetated and replanted species shall be closely monitored	Contractor	Construction and Operational phase, followed up until desired end state is reached
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	EO and ECO during construction, suitable designated person / contractor after that	Construction phase Operational phase
Weeding » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils	Contractor	Construction phase Operational phase

Performance	» No activity in identified no-go areas

Indicator	» Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction » An incident reporting system must record non-conformances to the EMPr. » Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol up to completion of decommissioning

MANAGEMENT PROGRAMME: OPERATION CHAPTER 9

Overall Goal: To ensure that the operation of the solar energy facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the facility in a way that:

» Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
» Enables the solar energy facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents.
» Minimises impacts on fauna using the site.

An environmental manager must be appointed during operation whose duty it will be to ensure the implementation of the operational EMPr.

9.1. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE OP1: Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation

Indirect impacts on vegetation and fauna during operation could result from maintenance activities and the movement of people and vehicles on site and in the surrounding area. In order to ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

Project component/s	» Areas requiring regular maintenance. » Route of the security team. » Areas disturbed during the construction phase and subsequent rehabilitation at its completion. » Areas where the natural microclimate and thus vegetation composition has changed due to structures such as PV panels erected.
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Environmental integrity of site undermined resulting in reduced

	visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/Risk Source	» Movement of employee vehicles within and around site. » Excessive shading by PV panels. » Altered rainfall interception and resultant runoff patterns by infrastructure.
Mitigation: Target/Objective	» Maintain minimised footprints of disturbance of vegetation/habitats on-site. » Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Operator	Operation
An on-going invasive and alien plant monitoring and eradication programme must be implemented, where necessary	Operator	Operation
In line with specifications regarding permissible biodiversity and the rehabilitation plan, a minimum percentage cover of vegetation must be established and permanently maintained post construction	Developer and horticultural contractor	After construction, throughout operational phase

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats. » Continued improvement of rehabilitation efforts. » No disturbance of vegetation outside of project site. » No further thickening of invasive shrubs on site. » Gradual disappearance of all alien plant species on site.
Monitoring	» Observation of vegetation on-site by facility manager and environmental manager. » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas.

OBJECTIVE OP2: Manage and reduce the impact of invasive vegetation

It can be expected that more species may be added after the pre-commencement walk-through survey. A detailed Invasive Management Plan needs to be drafted after this walk-through. Operational standards must adhere to those set out by Working for Water (**Appendix B).** The use of chemicals may only commence with the approval of the relevant authorities.

Project Component/s	» Permanent and temporary infrastructure » Access roads
Potential Impact	» Impacts on natural vegetation » Impacts on soil » Impact on faunal habitats » Degradation and loss of agricultural potential
Activity/Risk Source	» Transport of construction materials to site » Movement of construction machinery and personnel » Site preparation and earthworks causing disturbance to indigenous vegetation » Construction of site access road » Stockpiling of topsoil, subsoil and spoil material » Routine maintenance work – especially vehicle movement
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate alien invasive species » To avoid the introduction of additional alien invasive plants to the project control area » To avoid further distribution and thickening of existing alien plants and invasive shrubs on the project area » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the project control area

Mitigation: Action/Control	Responsibility	Timeframe
Avoid creating conditions in which invasive plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Shred all non-seeding material from cleared invasive shrubs and other woody vegetation and use as mulch as part of the rehabilitation and revegetation plan » Where possible, destroy seeding material of weeds and invasive by piling and burning (in designated areas or suitable containers) » Do not import soil from areas with alien plants	Operator	Operational phase
» Eradicate all invasive plants that occur within the development's temporary and permanent footprint areas » Ensure that material from invasive plants that can regenerate – seeds, suckers, plant parts are adequately destroyed and not further distributed	Operator	Operational phase
» Immediately control any alien plants that become newly established using registered control measures	Operator	Operational phase

Performance Indicator	» Visible reduction of number and cover of alien invasive plants within the project area. » Improvement of vegetation cover from current dominance of invasive shrubs to dominance of perennial grasses and dwarf shrubs » No establishment of additional alien invasive species.
Monitoring	» Ongoing monitoring of area by ECO during construction. » Ongoing monitoring of area by EO during operation » Audit every two to three years by a suitably qualified botanist to assess the status of infestation and success of eradication measures » If new infestations are noted these must be recorded. A comprehensive eradication programme with the assistance of the WfW (Working for Water) Programme is advisable.

OBJECTIVE OP3: The mitigation and possible negation of visual impacts associated with the Operation of the Blackwood Solar Energy Facility

Project Component/s	Solar energy facility and ancillary infrastructure (i.e. access roads and fencing).
Potential Impact	Visual impact of facility degradation and vegetation rehabilitation failure.
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 2 km of the site).
Mitigation: Target/Objective	Well maintained and neat facility.

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility as a whole.	Operator	Throughout the operational phase.
Maintain roads to forego erosion and to suppress dust.	Operator	Throughout the operational phase.
Maintain servitudes to forego erosion and to suppress dust.	Operator	Throughout the operational phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Operator	Throughout the operational phase.
With regards to lighting, the following should be considered: 1. Lighting on the fence line and security lighting should be faced inwards, except for nocturnal safety lighting; and 2. Lighting internally, wherever possible, should be low foot-level lighting, fitted with low intensity bulbs should be used.	Operator	Throughout operational phase

Mitigation: Action/control	Responsibility	Timeframe
These lighting recommendations should be considered only if they do not pose a threat to site safety.		

Performance Indicator	Well-maintained facility that has a small footprint on the environment.
Monitoring	Environmental manager to undertake monitoring functions after construction has been completed to ensure compliance with mitigation measures.

OBJECTIVE OP4: Minimise soil degradation and erosion (Erosion Management Plan)

The soil on site may be impacted in terms of:

» Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern across the entire site which is underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion).
» Uncontrolled run-off relating to construction activity (excessive wetting, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation of drainage systems.
» Degradation of the natural soil profile due to pollution.

Management of erosion will be required during the operation phase of the facility. An erosion management plan is required to ensure compliance with applicable regulations and to prevent increased soil erosion and sedimentation of the downstream environment. The section below provides a guideline for the management of erosion on site and will need to be supplemented with the principles for erosion management contained in the Erosion Management Plan (**Appendix C**).

Project Component/s	» PV panels. » Ancillary buildings. » Access roads.
Potential Impact	» Soil degradation. » Soil erosion. » Increased deposition of soil into drainage systems. » Increased run-off over the site.
Activities/Risk Sources	» Poor rehabilitation and/or revegetation of cleared areas. » Rainfall - water erosion of disturbed areas. » Wind erosion of disturbed areas.

	» Concentrated discharge of water from construction activity.
Mitigation: Target/Objective	» Ensure rehabilitation of disturbed areas is maintained. » Minimise soil degradation (i.e. wetting). » Minimise soil erosion and deposition of soil into drainage lines. » Ensure continued stability of embankments/excavations.

Mitigation: Action/Control	Responsibility	Timeframe
Rehabilitate disturbance areas should the previous attempt be unsuccessful.	Operator	Operation
Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes, bags, logs), silt fences, storm water catch-pits, and shade nets).	Operator	Operation
Develop and implement an appropriate stormwater management plan for the operational phase of the facility	Operator	Operation

Performance Indicator	» Acceptable level of soil erosion around site, as determined by the environmental manager. » Acceptable level of increased siltation in drainage lines, as determined by the site manager.
Monitoring	» Inspections of site on a bi-annual basis by the Environmental Manager

OBJECTIVE OP5: Minimise dust and air emissions

During the operational phase, limited gaseous or particulate emissions are anticipated from the facility. Windy conditions and the movement of vehicles on site may lead to dust creation.

Project Component/s	» Hard engineered surfaces. » On-site vehicles.
Potential Impact	» Dust and particulates from vehicle movement to and on-site.
Activities/Risk Sources	» Re-entrainment of deposited dust by vehicle movements. » Wind erosion from unsealed roads and surfaces. » Fuel burning vehicle and construction engines.
Mitigation: Target/Objective	» To ensure emissions from all vehicles are minimised, where possible. » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements.

Mitigation: Action/Control	Responsibility	Timeframe
Roads must be maintained in a manner that will ensure that nuisance impacts to the community from dust is not visibly excessive.	Operator	Operation
Appropriate dust suppressants must be applied to the roads as required to minimise/control airborne dust.	Operator	Duration of contract
Speed of vehicles must be restricted on site, as defined by the Environmental Manager.	Operator	Duration of contract

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures implemented where required.
Monitoring	» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMPr.

OBJECTIVE OP6: Ensure the implementation of an appropriate fire management plan during the operation phase

The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project Component/s	» Operation and maintenance of the solar energy facility and associated infrastructure.
Potential Impact	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a risk to the solar energy facility infrastructure.
Activities/Risk Sources	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
Join the local Fire Protection Agency.	Operator	Operation
Provide adequate fire fighting equipment at specified localities on the PV facility to meet emergencies from fire.	Operator	Operation

Mitigation: Action/Control	Responsibility	Timeframe
Provide adequate fire fighting equipment on site.	Operator	Operation
Provide fire-fighting training to selected operation and maintenance staff.	Operator	Operation
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	Operator	Operation
Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing).	Operator	Operation
Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.	Operator	Operation
Contact details of emergency services should be prominently displayed on site.	Operator	Operation

Performance Indicator	» Fire-fighting equipment and appropriate training provided before the operational phase commences. » Appropriate fire breaks in place and maintained.
Monitoring	» Developer must monitor indicators listed above to ensure that they have been met.

OBJECTIVE OP7: Maximise local employment and business opportunities associated with the operational phase

The facility is expected to be operational for 25 years during which time approximately 7-15 staff members are expected to be required on-site. Therefore, long-term direct job opportunities for locals could exist, although limited. However, in an area with such high unemployment figures, these limited opportunities should still be seen as a positive impact on the quality of life of those benefiting from the employment.

Some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. These opportunities for local service providers to render services to the proposed facility could include maintenance of the guardhouse, gardening at the guardhouse, cleaning services, security services and maintenance or replacement of general equipment

Project Component/s	» Day to day operational activities associated with the PV facility, including maintenance .
Potential Impact	» The opportunities and benefits associated with the creation of

	local employment and business should be maximised
Activities/Risk Sources	» The operational phase of the PV facility will create up to 15 full time employment opportunities.
Mitigation: Target/Objective	» In the medium to long term employ as many locals as possible to fill the full time employment opportunities.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
The workforce staff is likely to be based in Kimberley or Boshof. The developer should commit to implementing a training and skills development and training programme to maximise employment for locals.	Operator	Prior to commencement of operation
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	Operator	Prior to commencement of operation

Performance Indicator	» Training and skills development programme developed and designed before construction phase completed. » Potential locals identified before construction phase completed.
Monitoring	» The developer must monitor indicators listed above to ensure that they have been met for the operational phase.

OBJECTIVE OP8: Appropriate handling and management of waste

The operation of the facility will involve the storage of chemicals and hazardous substances, as well as the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, and liquid waste. A guideline for integrated management of waste is included as **Appendix D** of this EMPr.

Project Component/s	» PV facility » Substation. » Operation and maintenance staff. » Workshop.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices. » Contamination of water or soil because of poor materials management.
Activity/Risk	» Transformers and switchgear for the substations.

Source	» Ancillary buildings.
Mitigation: Target/Objective	» Comply with waste management legislation. » Minimise production of waste. » Ensure appropriate waste disposal. » Avoid environmental harm from waste disposal. » Ensure appropriate storage of chemicals and hazardous substances.

Mitigation: Action/Control	Responsibility	Timeframe
Hazardous substances (such as used/new transformer oils) must be stored in sealed containers within a clearly demarcated designated area.	Operator	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Operator	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Operator	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.	Operator	Operation and maintenance
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Operator	Operation and maintenance
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Operator / waste management contractor	Operation
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	Operator/ waste management contractor	Operation
Used oils and chemicals: » Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority » Waste must be stored and handled according to the relevant legislation and regulations	Operator	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Operator	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Operator	Operation

Mitigation: Action/Control	Responsibility	Timeframe
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Operator	Operation

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests. » No contamination of soil or water.
Monitoring	» Waste collection must be monitored on a regular basis. » Waste documentation must be completed and available for inspection » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. » Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager . » All appropriate waste disposal certificates accompany the monthly reports.

MANAGEMENT PROGRAMME: DECOMMISSIONING CHAPTER 10

The solar infrastructure which will be utilised for the proposed solar energy facility is expected to have a lifespan of 25 years (i.e. with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the solar infrastructure with more appropriate technology/infrastructure available at that time.

The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at that time.

10.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required equipment, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

10.2 Disassemble Infrastructure

Disassembled components will be reused, recycled, or disposed of in accordance with regulatory requirements.

OBJECTIVE D1: To avoid and or minimise the potential impacts associated with the decommissioning phase

Project Component/s	» Decommissioning phase of the PV facility and associated infrastructure
Potential Impact	» Decommissioning will result in job losses, which in turn can result in a number of social impacts, such as reduced quality of life, stress, depression . However, the number of people

	affected is relatively small. Decommissioning is also similar to the construction phase in that it will also create temporary employment opportunities.
Activity/Risk Source	» Decommissioning of the PV facility
Mitigation: Target/Objective	» To avoid and or minimise the potential social impacts associated with decommissioning phase of the PV facility.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Explore options of re-use and recycling of the PV facility components/ structures. This will be informed by legislative requirements, environmental analyses and costs at the time.	Developer	Prior to decommissioning
Where disposal of components and materials is required, this must be appropriately carried out in accordance with prevailing legal requirements, in designated waste disposal facilities.	Developer	When PV facility is decommissioned
Retrenchments should comply with South African Labour legislation of the day	Developer	When PV facility is decommissioned
Undertake site rehabilitation to restore the environment to a condition whereby the natural functioning of the ecosystem can take place	Developer	When PV facility is decommissioned
If scarring of the landscape/ site occurs, utilised landscaping to restore the site	Developer	When PV facility is decommissioned
Re-vegetate disturbed areas utilising indigenous plant species.	Developer	When PV facility is decommissioned
Correct salvage, disposal and preferably also recycling of PV panels	Developer and relevant waste management specialist	When PV facility is decommissioned

Performance Indicator	» South African Labour legislation relevant at the time » Area appropriately rehabilitated.
Monitoring	» Monitoring of decommissions activities

10.3 Rehabilitation

The site will be rehabilitated and can be returned to the current or other beneficial land-use. Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

FINALISATION OF THE EMPR CHAPTER 11

The EMPr is a dynamic document, which must be updated to include any additional specifications as and when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through survey by specialists by the ecologist of the PV facility development area. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features.

APPENDIX A:
GRIEVANCE MECHANISM FOR PUBLIC COMPLAINTS AND ISSUES

GRIEVANCE MECHANISM / PROCESS

AIM

The aim of the grievance mechanism is to ensure that grievances / concerns raised by local landowners and or communities are addressed in a manner that is:

- Fair and equitable;
- Open and transparent;
- Accountable and efficient.

It should be noted that the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. However, the aim should be to address grievances in a manner that does not require a potentially costly and time consuming legal process.

Proposed generic grievance process

- Local landowners, communities and authorities will be informed in writing by the proponent (the renewable energy company) of the grievance mechanism and the process by which grievances can be brought to the attention of the proponent.
- A company representative will be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person will be provided to local landowners, communities and authorities.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
- The grievance will be registered with the contact person who, within 2 working days of receipt of the grievance, will contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting. Unless otherwise agreed, the meeting will be held within 2 weeks of receipt of the grievance.
- The contact person will draft a letter to be sent to the Complainant acknowledging receipt of the grievance, the name and contact details of Complainant, the nature of the grievance, the date that the grievance was raised, and the date and venue for the meeting.
- Prior to the meeting being held the contact person will contact the Complainant to discuss and agree on who should attend the meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the grievance mechanism

process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

- The meeting will be chaired by the company representative appointed to address grievances. The proponent will provide a person to take minutes of and record the meeting/s. The costs associated with hiring venues will be covered by the proponent. The proponent will also cover travel costs incurred by the Complainant, specifically in the case of local, resource poor communities.
- Draft copies of the minutes will be made available to the Complainant and the proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of a dispute between the Complainant and the proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s will note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned;
- In the event that the parties agree to appoint a mediator, the proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the proponent, will identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator will be borne by the proponent. The proponent will provide a person to take minutes of and record the meeting/s.
- In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of the dispute not being resolved, the mediator will prepare a draft report that summaries the nature of the grievance and the dispute. The report should include a recommendation by the mediator on the proposed way forward with regard to the addressing the grievance.

- The draft report will be made available to the Complainant and the proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days.

The way forward will be informed by the recommendations of the mediator and the nature of the grievance. As indicated above, the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the proponent, either party may be of the opinion that legal action may be the most appropriate option.

APPENDIX B:
INVASIVE PLANT SPECIES MANAGEMENT

ALIEN INVASIVE PLANT MANAGEMENT PLAN

OVERALL OBJECTIVE

Manage alien and invasive plant species during the construction and operation of the solar energy facility, through the implementation of an alien invasive species management and control programme.

PROBLEM OUTLINE

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties. A list of declared weeds and invader plants is attached.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use license as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species:

Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

SPECIFIC MANAGEMENT OBJECTIVES:

- Ensure alien plants do not become dominant in parts or the whole landscape

- Initiate and implement a monitoring and eradication programme for alien and invasive species
- Control alien and invasive species dispersal & encroachment
- Promote the natural reestablishment and planting of indigenous species

VULNERABLE ECOSYSTEMS AND HABITATS

Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following

- Wetlands, drainage lines and other mesic areas
- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc.
- Construction camps and lay-down areas which are cleared or are active for an extended period

Wetlands, drainage lines and other mesic areas

There are a relatively large number of drainage lines at the site as well as a number of natural and artificial wetlands. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas should be minimized and these areas should be checked for alien species more often than the surrounding landscape.

Cleared and disturbed areas

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion as well as the disturbance which created during construction which promotes the germination and establishment of alien plant species.

Construction camps and laydown areas

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials.

GENERAL CLEARING & GUIDING PRINCIPLES

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien

problems at the site should be identified during preconstruction surveys of the development footprint. This may occur simultaneously to other required searches and surveys. The clearing plan should then form part of the preconstruction reporting requirements for the site.
- The plan should include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Dense mature stands of woody species where present should be left for last, as they probably will not increase in density or pose a greater threat than they are at the moment.
- Collective management and planning with neighbours may be required as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

CLEARING METHODS

- Different species require different clearing methods such as manual, chemical or biological or a combination of both.
- However care should be taken that the clearing method (s) used does not encourage further invasion. As such, regardless of the method (s) used, disturbance to the soil should be kept to a minimum. Fire is not a natural phenomenon at the site and fire should not be used as a clearing method or vegetation management approach at the site.
- The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. http://www.dwaf.gov.za/wfw/Control/

USE OF HERBICIDES FOR ALIEN CONTROL

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- Specific care must be taken to prevent contamination of any water bodies. This includes: due care in storage, application, cleaning of equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products used should have least effect on non-target vegetation.

- Coarse droplet nozzles should be fitted to avoid drift onto neighboring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines should be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

ALIEN PLANT MANAGEMENT PLAN

CONSTRUCTION PHASE ACTIVITIES

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation must be undertaken as the work front progresses – mass clearing is not allowed unless the entire cleared area is to be rehabilitated immediately.	Weekly
Should re-vegetation not possible immediately, the cleared areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. Arid soils are usually very low in organic matter and the use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation should not be allowed within 50m of any wetland or pan, 80m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly

Alien vegetation regrowth must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	Monthly
Drainage lines and other sensitive areas should remain demarcated with appropriate fencing or hazard tape while construction activities within the area are underway. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

MONITORING – CONSTRUCTION PHASE

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indictor	Timeframe
Document alien species present at the site	List of alien species	Preconstruction
Document alien plant distribution	Alien plant distribution map	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

OPERATIONAL PHASE ACTIVITIES

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Action	Frequency
Surveys for alien species should be conducted regularly. Every 3 months for the first two years after construction and biannually thereafter. All aliens identified should be cleared.	Every 3 months for 2 years and biannually thereafter
Re-vegetation with indigenous, locally occurring species should take	Biannually, but re-

place in areas where natural vegetation is slow to recover or where repeated invasion has taken place.	vegetation should take place at the start of the rainy season.
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

MONITORING – OPERATIONAL PHASE

The following monitoring and evaluation actions should take place during the operational phase of the development.

Monitoring Action	**Indictor**	**Timeframe**
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

DECOMMISSIONING PHASE ACTIVITIES

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Action	**Frequency**
All damaged areas shall be rehabilitated if the infrastructure is removed and the facility is decommissioned.	Once off
All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Once off, with annual follow up re-vegetation where

	required.
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

MONITORING – DECOMMISSIONING PHASE

The following monitoring and evaluation actions should take place during the decommissioning phase of the development.

Monitoring Action	**Indictor**	**Timeframe**
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation.	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation.	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Annually for 3 years

REFERENCES:

AGIS (2006) Weeds and Invasive Plants Atlas (www.agis.agric.za/wip)

APPENDIX C:
EROSION MANAGEMENT

PRINCIPLES FOR EROSION MANAGEMENT

1. Purpose

An Erosion Management Plan addresses the management and mitigation of significant impacts relating to soil erosion. The objective of the plan is to provide:

» A general framework for erosion management, which enables the contractor to identify areas where erosion can be accelerated from their action.
» An outline of general methods to monitor, manage and rehabilitate erosion in ensuring that all erosion caused by this development is addresses.

2. Legislation and Standards

Soil conservation pertaining to erosion has been a topic within legislation form the 1930's till today in South Africa. Internationally, standards have been set by the International Finance Corporation and the World Bank to address soil erosion in construction and decommissioning of areas. Therefore this document will ensure that the developer meets the South African legislative requirements and the IFC standards with regards to monitoring, managing and rehabilitating soil erosion on the solar energy facility site.

Relevant legislation:

» Conservation of Agricultural Resources Act No 43 of 1983
» Environmental Conservation Act No 73 of 1989
» National Forestry Act No 84 of 1998
» National Environmental Management Act No 107 of 1998
» The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.

3. Areas with a high soil erodability potential

The following areas are generally associated with high soil erodibility potential:

» Any areas without vegetation cover
» Excavated areas
» Steep areas
» Areas where the soil has been degraded already
» Dispersive, duplexed soil areas
» Areas with fine grained soil material with a low porosity
» Areas which undergo overland flow of water.
» Areas close to water
» Irrigated areas
» Compacted areas
» Rivers

» Drainage lines
» And any areas where developments cause water flow to accelerate on a soil surface.
» Coarsely gravelly covered surfaces

4. Precautionary management activities to avoid erosion

In the assessment process the contractor must assess all:
» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerating soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

5. Monitoring

5.1. General Erosion

The developer must assess the site for erosion indicators in the monitoring process, which include:

» Bare soil
» Desiccation cracks
» Terracettes
» Sheet erosion
» Rill erosion (small erosion features with the same properties and characteristics as gullies)
» Hammocking (Soil build-up)
» Pedestalling (Exposing plant roots)
» Erosion pavements
» Gullies
» Evidence of Dispersive soils

In the assessment process, the contractor must assess all:

» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerated soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

If any activities or placement of equipment cause pooling on the site, degrade the vegetation, result in removal of the surface or subsurface soil horizons, create compacted surfaces with steep gradients, or minimise runoff areas, the erosion potential on the site will increase.

If any erosion features are begin forming or are present as a result of the activities mentioned above the developer:

» Assess the situation.

» Take photographs of the soil degradation.
» Determine the cause of the soil erosion.
» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Report and monitor the progress of the rehabilitation weekly and recorded all the findings in a site diary.
» All actions with regards to the incidents must be reported on a monthly compliance report which will be submitted to the department.

The contractor/ developer (in consultation with the ECO) must:

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to see if the system functions like it should, if the system fails, the method must be adapt or adjust to ensure the accelerated erosion is controlled.
» Monitoring must continue until the area has been stabilised

5.2. Stormwater Management

The developer must assess the site for erosion indicators such as:

» Bare soil
» Exposed plant roots, pedestalling
» Sheet erosion
» Rill erosion
» Hammocking
» Erosion pavements
» Terracettes
» Gullies

In the assessment process the developer must assess all:

» Disturbed watercourse areas by the development: roads, bridges, river crossings, cabling, permanent laydown areas, crane pads and any other remaining hard surfaces.
» Construction activity limited to specified areas. Stockpiles of aggregate and material will be positioned at least 50 m away from drainage lines and wetlands.

If any erosion features are present as a result of the activities mentioned above the developer must:

» Assess the situation
» Take photographs of the soil degradation.
» Determine the cause of the erosion.

» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Monitor the rehabilitation weekly and record the findings in a site diary.
» All actions with regards to the incidents must be reported on in the monthly compliance monitoring report.

The contractor/ developer must (in consultation with the ECO):

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to ensure that the erosion has been addressed adequately.
» Monitor the erosion until the area has been stabilised.

6. Rehabilitation

The following erosion control measures and rehabilitation specifications must be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

6.1. General Erosion Management

In this section the equipment needed to remediate erosion, the precautionary measures which must be taken to avoid erosion and mitigation requirements for already degraded areas.

6.1.1. Equipment

The civil works contractor may use the following instruments to combat erosion when necessary:

» Reno mattresses
» Slope attenuation
» Hessian material
» Shade catch nets
» Gabion baskets
» Mulching Run-off control (increase the amounts of runoff areas to disperse the water)
» Silt fences
» Storm water channels and catch pits
» Shade / catch nets
» Soil bindings
» Geofabrics
» Hydroseeding and/or re-vegetating
» Mulching over cleared areas
» Stone packing
» Tilling (roughing the surface)

6.1.2. Methods to prevent accelerated erosion

The following practises should be considered and adhered to:

» Ensure steep slopes are stabilised.
» Ensure that steep slopes are not stripped of vegetation and left to dry out and become water repellent (which will case increased runoff and a decreased infiltration rate) increasing the erosion potential.
» Ensure that all water on site (rain water or water wastage from the construction process) does not result in any surface flow (increase velocity and capacity of water) as a result of the poor drainage systems.
» Ensure that pooling of water on site is avoided, as the site and the general area consists of dispersive soils, pooling will cause an increase of infiltration on one area, causing the subsurface to begin eroding.
» Ensure that heavy machinery does not compact those areas which are not intended to be compacted (i.e. areas intended to be managed), as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. where compaction does occur, the areas should be ripped.
» Ensure that compacted areas have adequate drainage systems to avoid pooling and surface flow.
» Prevent the concentration or flow of surface water or stormwater down cut or fill slopes, or along pipeline routes or roads, and ensure measures to prevent erosion are in place prior to construction.
» Ensure that stormwater and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that surface flows are managed prior to being discharged back into a natural watercourse to support the maintenance of natural base flows within the ecological systems and prevent erosion, i.e. hydrological regime (water quantity and quality) is maintained.
» Ensure siltation and sedimentation through the use of the erosion equipment mentioned structures.
» Ensure that all stormwater control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local ground watertable in low quantities (to reduce runoff but prevent subsurface erosion).
» Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
» Ensure that vegetation clearing is conducted in parallel with the construction progress across the site to minimise erosion and/or run-off.
» Ensure that large tracts of bare soil which would cause dust pollution in high winds, or have high erosion susceptibility and increase sedimentation in the lower portions of the catchment are controlled through temporary surface covering.
» Ensure no diversion of water flows in catchment occurs.

» Ensure that dust control measures are implemented, but prevent over-wetting/ saturating the area (to cause pooling) and run-off (that may cause erosion and sedimentation).
» Watercourse (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing watercourses.

6.1.3. Mitigation for previously degraded areas

Previously degraded areas could pose a threat to construction activities in the area and must therefore be stabilised, then remediated and rehabilitated through:

» Protecting, stabilise and isolate the degraded areas to ensure no further damage is caused by erosion due to construction activities.
» Increase the drainage in the area but avoid pooling.
» Prevent increasing sedimentation in areas that have been chocked by soils from degraded areas.
» Once construction has been completed, a method statement must be drafted for the rehabilitation of the previously degraded areas, using equipment mentioned above and implemented.
» Stabilisation of steep slopes must be undertaken.
» Ensure that bare soil is covered and hydro seeded to reduce topsoil loss.

6.2. Methodologies

The following erosion control measures and rehabilitation specifications may be required to be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

» Topsoil covered with a geotextile or hessian material and a grass seed mixture (see Rehabilitation Specifications).
» Logging or stepping following the contours of the slope, to reduce surface runoff.
» Earth or rock-pack cut-off berms.
» Packed branches to roughen the surface and promote infiltration.
» Benches (sand bags).
» Stabilisation of near vertical slopes (1:1 – 1:2), if created during construction, will be required to utilise hard structures that have a natural look. The following methods may be considered:
  • Gabions (preferred method with geotextile material).
  • Retaining walls.
  • Stone pitching.
» The slopes of all stream diversions must be protected. The following methods may be considered:
  • Reno mattresses (preferred method), ensure that the reno mattresses are buried deep into the subsurface, to avoid undercutting from the water.
  • Coarse rock (undersize rip-rap)

  - Sandbags.
  - Stone packing with geotextile
» Where feasible use rubber dams as stream diversions when establishing water course crossings. Although (and considering that these are non-perennial watercourses) the recommendation is to construct watercourse crossings during dry periods (or no flow periods), where possible.
» Any concentration of natural water flow caused by road works or hardstands areas will be treated as follows:
  - if water flow is sub-critical, nothing is required
  - if water flow is supercritical, the outlets will be provided with protection (either gabions or stone pitching – depending on the flows) to release water subcritical back into the watercourse at a low velocity.

6.3. Engineering Specifications

A detailed Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers and this includes erosion control.

Requirements for project design:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» The location, area/extent (m^2/ha) and specifications of all temporary and permanent water management structures or stabilisation methods.
» A resident Engineer to be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The Developer holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.
» Concrete lined drains placed adjacent to road to transfer the water to the existing water courses.
» Frequent gravel drains hydroseeded placed on permanent roadway edges.
» At the point where stormwater is discharged, energy dissipaters to be constructed to reduce the flow rate of run-off.
» All cut and fill banks will be seeded with an approved seed mix (as per the rehabilitation specifications) to ensure bank stabilisation and the elimination of potential erosion. Reno mattresses may be used to ensure that the area remains stable.

6.4. Rehabilitation Specifications

» Employ a Horticultural Landscape Contractor to fulfil the rehabilitation of disturbed areas post-construction.

» A detailed Rehabilitation Plan describing and illustrating the proposed rehabilitation activities on site must be prepared i.e. areas of top soiling, seeding and replanting of vegetation; species mix; requirements for fertilisation; seed sowing rates; watering etc. (i.e. bill of quantities).
» The following document should be consulted for further support with respect to information regarding rehabilitation, namely: The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
» These specifications may be modified by the Horticultural Landscape Contractor on consideration of site conditions.

6.5. Post- and during construction rehabilitation activities

» Correct and appropriate stockpile management of topsoil will be required during the construction phase.
» Rehabilitation of disturbed areas will be implemented as these areas become available for rehabilitation.
» Disturbed areas will include, for example: construction camp site, areas where underground cabling has been layed/buried, roadsides of new access roads.

7. Rehabilitation steps to mitigate the eroded areas

» Stockpiled topsoil must be spread over disturbed areas (150 – 200mm thick) just prior to planting/seeding.
» Rip and scarify along the contours of the newly spread topsoil prior to watering and seeding.
» Organic fertilizers or compost shall be used if site conditions require it and can be applied as part of hydro-seeding applications.
» Seed should be sown into weed-free topsoil that has been stockpiled (i.e. original topsoil from the site).
» Indigenous plants shall be used to rehabilitate disturbed areas.
» Applying the seed through hydromulching (hydro-seeding) is advantageous (or organic mulching after seeding).
» Watering is essential and rehabilitation should ideally occur during the wet season.
» The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.

7.1. ‘Watering’ to avoid erosion

» Movement of livestock in newly rehabilitated areas must be restricted, where possible, while taking into consideration drinking areas/paths.
» Watering the rehabilitated areas should be undertaken in the wet/rainy season essential but if this is not possible, an initial watering period (supplemental irrigation) will be required to ensure plant establishment (germination and established growth).
» Generous watering during the first two weeks, or until the seeds have germinated, is required (unless adequate rainfall occurs) i.e. seed beds will need to be kept moist for germination to occur.
» For grass to establish (once germination has occurred), rainfall or irrigation is needed at regular intervals, ideally every few days and possibly every day if weather conditions require it.
» During dry periods, with no rainfall, 100 litres per m² (or 100mm of rain) over a month or more, may be necessary to establish plants capable of surviving dry weather (or otherwise specified by the Horticultural Landscape Contractor).

7.2. Seeding

The developer should make use of an appropriate mix of grass species for rehabilitation 9to be determined in consultation with a suitably qualified ecologist) and they must be mixed for sowing either in summer or in winter. Grass species application (Rutherford, 2006) is at the rate secified as kg/ha.

7.3. Steep slopes

» Areas that have a steep gradient and require seeding for rehabilitation purposes should be adequately protected against potential run-off erosion e.g. with coir geotextile netting or other appropriate methodology.
» Provision for wind should also be made on these slopes to ensure the fine grained soil is not removed.

7.4. Maintenance and duration

» Rehabilitation will occur during construction, as areas for plant rehabilitation become available.
» The rehabilitation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 6 months (depending on time of seeding and rainfall) to ensure establishment of plants with a minimum 80% cover achieved (excluding alien plant species).

» If the plants have not established and the 80% is not achieved within the specified maintenance period, maintenance of these areas shall continue until at least 80% cover is achieved (excluding alien plant species).
» Additional seeding may be necessary to achieve 80% cover.
» Any plants that die during the maintenance period must be replaced.
» Succession of natural plant species should be encouraged.

8. Conclusion

The Erosion Management Plan is a document to assist the Developer with guidelines on how to manage erosion. The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure comply with legislative requirements. This document forms part of the EMPr, and is required to be considered and adhered to during the design, construction, operation and decommissioning phases of the project.

9. References

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APPENDIX D:
GUIDELINES FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

ENVIRONMENT PROCEDURE

Waste Management Plan

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Introduction

Sound waste management is better achieved when an Integrated Waste Management System is implemented. This is more evident on sites or in areas where different parties and aspects are involved. Integrated Waste Management is better achieved when system is underlined by sound environmental principles. These principles derived from section 2 of the National Environmental Management Act (Act 107 of 1998). The following principles apply to waste management.

A **Precautionary approach** will be followed in the sense that harm to health and the environment is prevented when waste is generated, treated and disposed off. The contractor as the generator of waste have to abide by the **Duty of Care** principle by ensuring that waste is disposed off in a manner that is environmentally sound and responsible. Management of waste must also follow an **Integrated and Holistic Approach** integrating health, safety and the environment in to the management approach and managing all aspects as a whole. By following the Best Practical Environmental Option one selects and implements the most sustainable management option in terms of the environment and the people surrounding it. The last principle that has to be considered in waste management is the **Polluter Pays** principle. This principle indicates that the costs for remediation and prevention of further pollution will fall on the responsible party.

Purpose of this document

A Waste Management Plan plays a key role in achieving sustainable waste management. This document is set to indicate the procedure that has to be followed during the handling, storage, transportation and disposal of waste that is generated from the activities on site.

Scope

The Waste Management Plan Procedure provides guidelines for waste management and applicable to employees, sub-contractors working on behalf of the Developer.

Waste Management Strategy

Waste will be managed according to the waste hierarchy as set in the National Environmental Management: Waste Act (Act 59 of 2008).The waste hierarchy dictates that the generation of waste should be avoided and minimised. If this is not possible the most desirable options will be reuse, recycle and recover waste. The last option will be disposal.

When waste is disposed it must be done in an environmentally safe manner and at a disposal site that is permitted and authorised to dispose of that waste. It is the generators duty to ensure that such disposal sites have sound and responsible management practices.

Waste will be segregated at source to facilitate re-use, recycling, and recovery. Segregation of waste will be made possible by means of waste containers that are allocated and marked for different waste streams that are identified within the content of this document.

Emergency Procedures will be followed in the unforeseen event of a spill or if waste burns on site.

All employees will receive training on waste management issues by means of induction training and toolbox talks that will take place once per week. Littering on site is prohibited. No person is allowed to discard of any litter on site expect in bins provided for that purpose.

Waste generation

Daily operational activities will generate general waste, metal waste as well as hazardous waste on monthly basis. Figures of these wastes are not yet known and will vary within project cycles as there will be times of acceleration in activity and times decreased activity.

Sources of waste will include: empty containers, office paper, plastic water bottles, and food waste canteens, printer cartridges, and used vehicle oil from workshops

Legal Requirements

The following sources of South African Law have been identified and will form the basis of the (WMP). Developer will comply with all environmental policies or Acts that apply to the Project, and the Project Manager should familiarize himself with, and have access to, the following pieces of legislation as a minimum:

- Constitution of South Africa (Act No. 108 of 1996);
- National Environmental Management Act (Act 107 of 1998);
- National Environmental: Waste Act (Act No. 59 of 2008);
- Hazardous Substances Act (Act No. 15 of 1973);
- Impacts and Aspects Register;
- Environmental Management Plan (EMPr)
- Environmental Authorisation
- Minimum Requirements for the Disposal of Waste by Landfill, Edition 3 (2005); and
- Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Edition 3 (2005).

Definations and Abbreviations

a. **Defination of waste relevant to operations**

Environment Surroundings within which human exists and that are made up of:

- The land, water and atmosphere of the earth;
- Micro- organisms, plant and animal life;

- Any part or combination of the above and the interrelationships among and between them; and
- The physical, chemical, aesthetic and cultural properties and conditions of foregoing that influence human health and well-being. (NEMA Act, Act No. 107 of 1998).

Waste means any substance, whether or not that substance can be reduced, re-used, recycled or recovered:

a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
b) which the generator has no further use of for the purposes of production;
c) that must be treated or disposed of; or
d) that is identified as a waste by the minister, by notice in the Gazette, but:
   i) a by-product is not considered waste; and
   ii) any portion of waste, once re-used, recycled and recovered, ceases waste.

Hazardous Means a source of or exposure to danger (NEMA, 1998)

Recovery Means the controlled extraction of a material or the retrieval of energy from waste to produce a product

Recycle a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

Re-use to utilise articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles

Container means a disposable or re-usable vessel in which waste is placed for the purposes of storing, accumulating, handling, transporting, treating or disposing of that waste, and includes bins, bin –liners and skips

Disposal Means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into air or any land.

Hazardous Waste

Waste that has the potential to cause a negative threat/impact to humans and/or the environment. It includes, but is not limited to, batteries, neon lights, fluorescent lights, printer cartridges, oil, paint, paint containers, oil filters, IT equipment etc.

General waste Waste which does not pose an immediate hazard or threat to health or to the environment' and includes the following waste flows: domestic waste, construction and demolition waste, business waste, insert waste.

EMP	Environmental Management Plan. A detailed plan of action prepared to ensure that recommendations for preventing the negative environmental Impacts and where possible improving the environment are implemented during the life cycle of the project. (Project EMP).

b. Abbreviations

ECO	Environmental Control Officer
EMP	Environmental Management Plan
WMP	Waste Management Plan
NEM: WA	National Environmental Management: Waste
(Act 59 of 2009)	
DWA	Department of Water Affairs
I&AP	Interested and Affected Parties/Person

Responsibilities

i) The Developer Environmental Officer shall be responsible for compliance with this waste management plan and ensure that all waste generated during construction activities on site is managed in safely and in accordance with legislations..

ii) Developer EO shall provide the Team HSE and ECO with a written monthly waste report, detailing both compliance with the environmental Specifications as well as Environmental Performance;

iii) It is the responsibility of all employees to segregate at source and store waste in the appropriate bins and in designated areas and to ensure that waste is kept to a minimum and environment is not polluted and contaminated.

General waste

a. Management of general waste

General waste will be segregated at source and place in the correct waste bins designated for each waste stream. General waste will not be stored on site for longer than 30 days and will be collected and emptied on a weekly basis by waste management company for disposal.

b. General waste stream

This is waste that does not pose an immediate threat to health or the environment. Most of these waste streams will be designated to be re-used, recycle and recovered.

i) Compactable General waste

This is any waste type that are small in size and that can be compacted

- General waste: waste that does not fall within the defined waste streams that will be disposed of in landfill. Domestic waste will be discarded in waste bins that are labelled "General Waste". Source of this waste will be kitchen, beverage cans, plastic waste and carteens.
- Waste papers: These are waste paper boxes that are unwanted. This waste will be discarded in waste bins labelled "Waste paper, Boxes"

ii) Un-compactable general waste

This is waste that is large in size that cannot be disposed of in normal waste bins or skip. Most of the waste types in this category can be recycled or re-used within the operations on a construction site or can be recycled in to the local community.

- Scrap metals: all metal or steel that is discarded or termed off-cuts will form the bulk of the scrap metal waste stream. These metals will be placed in waste bins labelled "Metal Waste"

c. Recycling Procedure

All scrap/metal waste generated will be collected and sent to the recycling facilities for recycling purpose. Used oil shall be collected by recycling companies where applicable.

Hazardous waste

a. Management of hazardous waste

Hazardous waste will be stored in a safe and responsible manner. Hazardous waste will not be stored on site for more than 30 days. This hazardous waste will be placed in a waste bin labelled 'Hazardous Waste" and will be collected and disposed of as Hazardous waste at approved landfill site. All hazardous waste types will be identifiable at all times. Incompatible waste type will be stored separately.

b. Hazardous waste types

- Hydrocarbon contaminated materials: such as soil due to spills and oil leaks;
- Used equipments/vehicles oils: from vehicles being serviced at workshop;
- Printing cartridges; and
- Chemical waste (such as used oil, paint, insecticide).

Waste bins

a. Waste bins conditions

Developer will ensure that the waste bins used are suitable for the waste that is to be stored within. The waste bins will be in a good condition, not be corroded and may not permit leachate or be otherwise unfit for the safe storage of waste designated to that container. Bins will have mechanisms in place to prevent waste from becoming wind blow litter and it must be scavenger proof. Hazardous waste bins will be sealed to ensure that no spillages can occur. These bins will be also be labelled so as to identify type of waste, date of storage commencement and generator details.

b. Inspections of waste bins

Waste bins will be inspected on a daily basis to ensure that they remain in an acceptable condition for safe storage of waste. These inspections will be documented and records will be kept for future references.

c. Placement of waste bins

The bins will be placed in centralised locations in order to ensure that it is accessible to all employees. The waste bins will be emptied and the waste will be taken to the relevant designated areas (the central storage area or the waste transfer station) awaiting collection by waste removal companies.

Waste storage areas and collecion points

a. Specifications of waste storage areas

Waste will be managed in such a way as to prevent it from becoming a nuisance such as odour and to prevent the breeding of vermin and vectors. Management practices will ensure that no environmental harm is caused. All waste area will be clearly marked with signs to specify that waste is being stored in that area and to indicate what the nature of waste is. Storage areas will be fenced with access control to prevent unauthorised access.

i) General waste storage areas

Storage areas for general waste will be kept clean and neat, with a high level of housekeeping.

ii) Hazardous waste storage areas

Storage areas for hazardous waste will be having a roof to divert rain water from waste containers and must be fully bunded (110%) with pollution collection measurements in place in case of any spills or leakages. A high level of house keeping must be maintained in and around the storage. A file with (MSDS) documents and waste acceptance forms must be kept on site.

b. Requirements of collection points

Points from which waste is collected to be taken to the storage areas or the transfer stations will be clearly accessible for vehicles.

d. Waste removal schedule

Waste bins will be emptied on a regular basis. This will either be daily, weekly or when bins have reached their capacity. A call for service will be issued to the waste removal company when bins are full.

General rules

a. Records

All waste removal records will be maintained on site where it is accessible to all interested and affected parties. These records will include an updated list of the waste streams and volumes generated and disposed of, all collection certificates and disposal certificate and all material recycled or re-used and the volume thereof.

b. Review

Developer Project Manager and Developer Environmental Officer will review this Waste Management Plan on a monthly basis.

c. Reporting

Waste disposal figures will be reported on a monthly basis to the HSE and ECO.

Conclusion

Compliance and implementation of this procedure will ensure effective management of waste on site. Developer and their sub-contractors will comply with the requirements of the EMP, the project RoD and other legislative requirements that may have an impact on waste management in general.

References

- (Emergency preparedness and Response Plan
- ISO 14001:2004;

APPENDIX E:
PRINCIPLES FOR PLANT SEARCH AND RESCUE, REHABILITATION AND RE-VEGETATION

METHODS FOR PLANT RESCUE AND RE-VEGETATION MANAGEMENT PLAN

List of Abbreviations

CARA:	Conservation of Agricultural Resources Act 43 of 1983
DEA:	Department of Environmental Affairs
EA:	Environmental Authorisation
ECO:	Environmental Control Officer
EMP:	Environmental Management Plan
NEMA:	National Environmental Management Act 107 of 1998
LFA:	Landscape Functional Analysis (Tongway and Hindley 2004)
IAP:	Invasive Alien Plant

List of Definitions:

Accelerated soil erosion: Soil erosion induced by human activities.

Acceptable cover: An acceptable cover shall mean that not less than 75% (in an area with rainfall above 400 mm per annum), or 40% (in regions receiving less than 400 mm rain per annum), of the area planted or hydroseeded shall be covered with grass and that there shall be no bare patches of more than 500 mm in maximum dimension.

Alien: originating from another country or continent and originally different environment, commonly used to describe plants that are not indigenous to South Africa and have become problematic (spreading rapidly, threatening existing biodiversity).

Allelopathic components: one or more biochemical compound produced by a plant and released through leaf litter or roots that suppresses the growth, survival, and reproduction of other surrounding vegetation.

Bare soil: Un-vegetated soil surface, unaltered by humans.

Compacted soil surface: A soil surface that has been hardened by an outside source, causing the soil to be more compacted than the surrounding area.

Container plants: Container plants include all vegetation which are bought or supplied in acceptable containers from nurseries or vegetation lifted out of their natural position and placed in containers.

Desirable end state: the future condition or target on which the rehabilitation is designed and that will serve later as a basis for rehabilitation success evaluation. This can be based on a reference site or modelled according to available information on historic vegetation.

Ecological rehabilitation: The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that renders the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original historic state.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded damaged or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

Ecosystem: The combination of biota within a given area, together with a suitable environment that sustains the biota and the interactions between biota. It can have a spatial unit of any size, but shows some degree homogeneity as far as structure, function and species composition is concerned. Small-scale ecosystems typically link up to larger scale ecosystems and all contribute to the ecosystem function and services at the landscape-scale.

Establishment of grass: All procedures necessary to produce an acceptable cover of grass on an area.

Establishment Period: The Establishment Period is defined as the period beginning from the actual planting or placing of vegetation until three months thereafter, unless otherwise specified or unless grass cover is unacceptable or unless plants have not taken.

Extinction debt: is a concept that describes the future extinction of species due to events in the past. Extinction debt occurs because of time delays between impacts on a species, such as destruction of habitat or reduction of population size, and the species' ultimate disappearance.

Geophytic: resprouting during the growing season from an underground storage organ such as bulbs, corms, tubers or rhizomes, and dying back completely during unfavourable seasons.

Hydroseeding: To apply seed in a slurry with water (plus other materials to enhance growth) by means of a spraying device.

Indigenous: refers to a plant or animal that occurs naturally in the place in which it is currently found.

Invasive plant: a kind of plant which has under section 2 (3) of CARA been declared an invader plant, and includes the seed of such plant and any vegetative part of such plant which reproduces itself asexually.

Landscape: Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

Nursery conditions: These are the necessary conditions to maintain healthy growth of rescued and/or container plants. This includes protection of such plants against wind, frost, direct sunlight, pests, rodents, diseases, and drought. It also includes the provision of suitable water, fertilizer and any other measures required to maintain the container plants.

Period of Maintaining: The Period of Maintaining is defined as the period following directly after the Establishment Period until the end of the Period of Maintenance for the whole Contract as defined in the General Conditions of Contract, unless otherwise specified.

Revegetation: The process of establishing a vegetative cover on exposed soils, regardless of species composition or structure, as long as the species are

non-invasive and their presence will not impede the gradual process of ecological rehabilitation or –restoration.

Soil Erosion: is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and or physical transport on the land surface**.**

Scarifying: To roughen the surface of soil as a preparation for seeding or topsoil addition.

Trimming: To neatly round off the levels of existing or previously shaped earthworks to blend in with the levels of other earthworks, constructed works, or natural landforms.

Transformation: The conversion of an ecosystem to a different ecosystem or land use type.

Topsoil: uppermost layer of soil, in natural vegetation maximally 30 cm, in cultivated landscapes the total depth of cultivation, containing the layer with humus, seeds and nutrients. Topsoils that are applied to landscapes to be rehabilitated must be free of refuse, large roots and branches, stones, alien weeds and/or any other agents that would adversely affect the topsoils suitability for re-vegetation.

Weed: a plant that grows where it is not wanted, and can therefore be an indigenous or alien species. An unwanted plant growing in a garden is just called a weed, but the 198 listed IAPs are called "declared weeds and invaders".

1. Purpose

The Plant Rescue and Revegetation Management Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site.

The objective of the plan is therefore to provide:

» Protocols for the removal, temporary storage and replanting of plant species of conservation concern
» Protocols for the rehabilitation of vegetative cover across the project area
» Tools for planning the rehabilitation work and responding to unforeseen events
» Guidelines on implementation and post-implementation tasks
» Criteria for evaluating rehabilitation success
» A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPR-related activities is consistent with the significance of project impacts

2. Scope

This document is a plant rescue, rehabilitation, and revegetation plan that provides a guideline to be applied by all contractors on the development site. This plan, as part of the project EMPr, is a legally binding document that must be implemented to fullfil the requirements of relevant legislation. However, the management plan is an evolving guideline that needs to be updated or adapted as progress is made with the rehabilitation and revegetation of the project area, and successes and failures of procedures identified.

The objective of rescuing plants, rehabilitation and revegetation on the project area is:

» Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.
» Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
» Preserving or re-creating the structural integrity of natural plant communities.
» Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.
» Improving the ecosystem function of natural landscapes and their associated vegetation.

3. Legislation and Standards

Relevant legislation:

» Conservation of Agricultural Resources Act 43 of 1983
» Environmental Conservation Act 73 of 1989
» National Forestry Act 84 of 1998
» National Environmental Management Act 107 of 1998
» Northern Cape Nature Conservation Act (Act No. 9 of 2009)

4. Effect of clearing alien vegetation

Invasive and Alien Plants (IAPs) gradually displace and suppress indigenous and/or herbaceous vegetation as their stands become bigger and denser. In addition, they use more water, hence desiccate the soil more, and may alter chemical properties of the soil – partially through secondary compounds released from their litter, partially from compounds released from roots. These altered soils suppress the germination and establishment of herbaceous species, leading to bare soil underneath dense IAP canopies.

After clearing dense stands of invasive shrubs, soil surfaces are thus generally bare with topsoil exposed to erosion and often already somewhat capped and eroded.

5. Effect of removing individuals of species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

6. General: Plant rescue and protection

Successful plant rescue can only be achieved if:

» Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
» All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
» They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
» Timing of planting activities is planned with the onset of the growing season.
» Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

6.1. Time of planting

» All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.
» Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas should commence during early spring after the first rains.

7. General: IAP removal

Removal of invasive plants should at all time follow the specifications and guidelines of the Working for Water Programme (refer also to invasive plant management plan).

Information can be obtained from the relevant website:
http://www.dwaf.gov.za/wfw

Detailed information on clearing methods is available on the above websites "Alien Invasive Plants" menu (clearing methods, operational standards and species-specific treatment methods).

8. General: Rehabilitation and re-vegetation

Successful rehabilitation can only be achieved with:
» A long-term commitment
» Practical, adaptive management
» Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved should be consulted to determine:

» What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?

» A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation
» Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.

The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

8.1. Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

» Current land cover
  - Roads and residential
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
  - Transformed areas
  - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

» what will happen there
» what needs to be mitigated – including storm water- and erosion management
» which management units need priority intervention/mitigation
» how will this mitigation / intervention be done (method statements) including schedule of work
» realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation
» approximate timeframes
» monitoring protocol to evaluate success or failures of interventions

  - establish permanently marked transects and monitor with fixed-point photography
- » who will be responsible for doing what
- » how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

8.2. Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:

- » Stabilisation of soils
- » Stabilisation of riparian areas
- » Storm water reduction through management and wetland integrity
- » Clearing of IAPs
  - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
- » Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely

8.3. Remove or ameliorate the cause of degradation

This will include:

- » Physical rehabilitation of topsoil where it has been removed.
- » Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds.
- » Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils
- » Stabilisation of topsoils and prevention of erosion – refer to the Erosion management pan

» Removal of all invasive vegetation – refer to the Invasive Management Plan
  - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers

8.4. Initial revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

8.5. Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the operation standards.

8.6. Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species should be re-introduced, seed should be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover should resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

» First restore drainage line morphology following the guidelines of the Erosion management plan – without that ecological recovery cannot be initiated
» Determine if natural seed sources may be present further upstream
» If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
» Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

8.7. Monitoring and follow-up action

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that should be monitored:
» Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
» Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
» Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
» Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting
  - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are

not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

8.8. Timeframes and duration

» Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
» The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
» If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds).
» Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
» Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
» Succession of natural plant species should be encouraged
» Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

9. Conclusion

The Plant Rescue and Revegetation Management Plan is a document to assist the contractor and the developer with guidelines on how to plan and implement the required work, and understand the concepts behind successful rehabilitation. The exact details of the rehabilitation plan will depend on the determined extent of rehabilitation that will have to be undertaken, available funding, and desirable end state of the vegetation after rehabilitation.

10. References and further reading

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A. APPENDIX: RECOMMENDED OPERATIONAL STANDARDS

OBJECTIVE: Revegetate and Rehabilitate disturbed areas

The Contractor must take all reasonable measures to ensure that plant species of conservation concern are rescued and survive indefinitely. Landscaped topsoils as well as areas cleared of IAPs must be adequately rehabilitated and /or revegetated to ensure that the ecosystems affected by the development regain and/or retain their functionality indefinitely.

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development and remedy these as soon as detected.

Mitigation measures relating to the vegetative cover as part of a healthy ecosystem must be implemented in order to effectively limit and gradually reverse the impact on the environment. The focus of the mitigation measures laid out below relate to project-related disturbances. Where such disturbances are exacerbated by farming-related disturbances or vice versa, mitigation measures must be carried out in consultation with the land-user responsible.

Project component/s	Project components affecting the objective: » Turbines » Access roads and cabling between and to turbine units » Power line » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas) » Substation » All other infrastructure
Potential Impact	» Loss of suitable substrate for a stable vegetation cover » De-stabilisation and/or alteration of substrate and hence degradation of vegetation cover, significant change in species composition or loss of agricultural potential » Loss of suitable habitat for flora and fauna » Leaky ecosystem due to loss of nutrients and moisture from the system, leading to a less resilient vegetation cover and loss of ecosystem function and -services » Degradation and/or loss of riparian areas and wetlands on and beyond the project boundaries » A loss of indigenous vegetation cover and possibly endangered species » Disturbance of fauna species
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Existing IAPs as well as clearing thereof » Concentrated discharge of water from construction activity or new

	infrastructure » Storm water run-off from sealed, altered or bare surfaces » Mobile construction equipment movement on site » Cabling and access roads construction activities » Power line construction activities » River/stream/drainage line road crossings » Roadside drainage ditches » Project related infrastructure » Premature abandonment of follow-up monitoring and adaptive management of rehabilitation
Mitigation: Target/ Objective	» To minimise loss of plant species of conservation concern » To minimise unfavourable runoff conditions and loss of resources from the ecosystems » To minimise erosion of soil from site during and after construction » To minimise and mitigate unfavourable alteration to drainage lines, especially incision » To minimise damage to indigenous vegetation during and after construction » No accelerated overland flow related surface erosion as a result of project infrastructure » No reduction in the surface area or general nature and functionality of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure on the project areas and beyond its boundaries » A clear reduction of IAPs on the project area and replacement thereof by indigenous vegetation according to a pre-determined desirable end state

Mitigation: Action/control	**Responsibility**	**Timeframe**
Planning		
Classify the entire project area into management units according to current land cover and state of the environment and map accordingly	Developer / Contractor	Prior to construction
For each management unit » establish what interventions will be necessary relating to IAPs, soil erosion management, topsoil handling, landscape rehabilitation and revegetation » where rehabilitation and revegetation will be necessary, decide on the desired end state of vegetation for that management unit and create a list of species to be established on specific sites » outline the management of construction activities, including topsoils, excavated materials and felled biomass in a manner that will optimise the rehabilitation goals as fast and as effective as possible for that management unit	Developer / Contractor in collaboration with ECO and land-users	Prior to construction
Plant Rescue and indigenous plant materials		
All harvested plant materials shall be labelled with » Genus as minimum, species if known	Contractor	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
» Habitat from which materials were collected		
Indigenous plant materials for re-vegetation: » All plant material shall be obtained from the search-and-rescue operation on the site prior to clearing or from local nurseries or reputable seed providers » Indigenous materials shall only be removed from their habitat with the necessary permits whenever applicable » Each plant removed shall be handled, packed and stored in a manner suitable for that species » Removed plants shall be protected from windburn or other damage during transportation » No plants or plants with exposed roots shall be subjected to excessive exposure to drying winds and sun, or subjected to water logging » All plants shall be kept free from plant diseases and pests and protected from rodents or other damaging agents » All indigenous plants that have been removed prior to clearing shall be returned to conditions resembling their original habitat as close as practically possible	Contractor in collaboration with ECO	Before, during and after construction
Seed stocks for rehabilitation » Seed can be used for cultivation of desirable species for revegetation » Seed shall be utilised for direct sowing or hydroseeding » Seed collected from the site must be dried and stored in a suitable facility under cool (7-10°C), dry, insect free conditions until required for cultivation or seeding. Only viable, ripe seed shall be used » Seed harvested shall be insect- and pathogen free » Seed harvested shall not contain materials of any invasive species » Prior to clearing, seed should be collected from the site on a regular basis as species start to seed to maximise the amount of fully developed seed secured » From sites that will be cleared, 100% of all seeds available may be collected » From sites adjacent to the development, 25% of seeds can be collected for rehabilitation	Contractor and ECO	Before, during and after construction
Site-specific nursery » On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for re-vegetation » Where nursery facilities can only cater for rescued plants, a suitable (local) nursery shall be identified that will be willing to receive seeds collected and propagate the necessary species for later revegetation » Soil or other propagation media, were used, shall be weed- and pathogen free » Argentine ants shall be controlled at all times	Contractor, ECO to control	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
» The area where plants are stored shall be kept free of weeds » Plants stored in the designated area shall be protected from rodents, excessive sun and wind, and inspected regularly until being planted for pathogens and pests, and then treated accordingly » The nursery shall be adequately secured to prevent loss or theft of species		
Protected flora » Ensure that no indigenous protected flora is removed from its original habitat in the project area without legal documents from the relevant authorities	Contractor	Before, during and after construction
Topsoil		
Avoid » Management units that will not be developed or selected elements – trees, rocky outcrops on site shall be maintained in situ and demarcated clearly to prevent any disturbance during construction » These units will be considered as NO-GO areas during construction	Contractor and ECO	Before, during and immediately after construction
Invasives » Remove all invasive shrubs as per the Working for Water specifications	Contractor, ECO to control	Before, during and after construction
Mulch » all trees felled shall be debranched and the logs used in controlling erosion from re-landscaped topsoils and/or adding surface roughness and organic matter to topsoils to be rehabilitated » all cut branches from trees, as well as all shrubs cleared from the construction site shall be shredded to mulch, either by a chipper or by hand to sticks no longer than 10 cm » preparation of mulch shall be done at source » mulched material shall be free of seed-bearing invasive plant material » the mulch shall be suitably stored – bagged if necessary - and will be used in rehabilitation and soil erosion management on the site » should additional mulch be used for rehabilitation, this should be obtained from invasive shrubs of areas not cleared » mulch shall be stored for as short a period as possible	Contractor, ECO to control	Before, during and immediately after construction
Storage of topsoil and subsoil: » topsoils constitute the upper 20 – 30 cm of soil only, lower layers of soil are regarded as subsoil » stockpiling of topsoils and subsoils shall only be done on previously transformed areas, and be kept at least 50 m from any remaining natural vegetation	Contractor, ECO to control	During and immediately after construction

Mitigation: Action/control	Responsibility	Timeframe
» care shall be taken during stockpiling to prevent the mixing of topsoil with subsoil and/or any other material » topsoils shall be stored in heaps no higher than 100 cm, and shall be re-applied as soon as possible » care shall be exercised during stockpiling of topsoils to prevent compaction thereof » topsoils shall be adequately protected from erosion by preventing concentration of surface water and scouring of slopes » erosion of topsoils has to be contained and repaired as soon as it occurs, before large scale erosion and loss of topsoil develops » any logs obtained during clearing operations can be used in continuous rows to curtail erosion where necessary. Geojute (geotextile) shall be used additionally if the logs are not sufficient to remedy any erosion – for details refer to the erosion management plan » where topsoils need to be stored longer than 6 months, such stockpiles shall be revegetated, even if this has to include re-seeding to achieve an acceptable cover of vegetation		
Boulders and rocks » where removed during clearing, should be stored separately and used in the rehabilitation program » boulders and rocks must be partially buried within the topsoil layer wherever practical to provide greater soil-holding stability and reduce water erosion » placement of rocks and boulders shall mimic the natural occurrence of rocks and boulders in the area	Contractor, ECO to control	During and after construction
Rehabilitation of surface		
Prior to the application of topsoil » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm, » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » any rubbish, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place » shaping will be to roughly round off cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes	Contractor, ECO to control	During and after construction

Mitigation: Action/control	Responsibility	Timeframe
Application of topsoil » topsoils shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil » where applicable, the final prepared surface will also contain scattered rocks and/or logs to mimic the natural condition of the original habitat or area and to aid in soil stabilisation and erosion control	Contractor, ECO to control	During and after construction
Soil stabilisation » mulch from brush shall be applied by hand to achieve a layer of uniform thickness » mulch shall be rotovated into the upper 10 cm layer of soil o this operation shall not be attempted if the wind strength is such as to remove the mulch before it can be incorporated into the topsoil » in very rocky areas a layer of mulch shall be applied prior to adding the topsoil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas o if mulch is limited, available mulch, together with harvested seeds, should be concentrated in these hollows to promote rapid re-vegetation in them » runnels or erosion channels developing shall be back-filled and restored to a proper condition o such measures shall be effected immediately before erosion develops at a large scale » where erosion cannot be remedied with available mulch, logs or rocks, geojute shall be used to curtail erosion	Contractor, ECO to control	During and after construction
Borrow-pits » shall be shaped to have undulating, low-gradient slopes and surfaces that are rough and irregular, suitable for trapping sediments and facilitation of plant growth » upon completion of rehabilitation these reshaped and	Contractor, ECO to control	After construction

Mitigation: Action/control	Responsibility	Timeframe
revegetated areas shall blend into the natural terrain		
Revegetation		
Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » revegetation will be done according to an approved planting/landscaping plan according to the management units initially delineated and their respective desirable end states and permissible vegetation	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species o previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools » re-seeding shall occur at the recommended time to take advantage of the growing season » in the absence of sufficient follow-up rains after seeds started germinating, watering of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seedbank » where, after initial re-seeding, the no acceptable vegetation cover has established within 12 months, hydroseeding should be considered as an option for follow-up revegetation work » sowing rates of seeds used during hydro-seeding should be obtained from the relevant supplier and in accordance with the existing environment	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Planting of species » species to be planted include all rescued species » the size of planting holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil » soil around the roots of container plants shall not be disturbed » bulbous plants shall be planted in groups or as features in selected areas » before placement of larger plant specimens into prepared holes, the holes shall be watered if not sufficiently moist	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired

Mitigation: Action/control	Responsibility	Timeframe
» during transplanting care shall be taken to limit or prevent damage to roots » plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots		end state is reached
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil must be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from revegetated areas	Contractor	Before, during and after construction
Establishment » The establishment and new growth of revegetated and replanted species shall be closely monitored » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	Contractor	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	ECO during construction, suitable designated person/institution after that	During and after construction, during operational and decommis-sioning phase
Weeding » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications		

Performance Indicator	» No activity in identified no-go areas

	» Acceptable level of activity within disturbance areas, as determined by ECO » Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction » An incident reporting system must record non-conformances to the EMPr. » Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol

B. APPENDIX: CHECKLIST OF ACTIONS FOR REHABILITATION PLANNING

Conceptual Planning	» Identify rehabilitation site locations and its boundaries » Identify ownership of rehabilitation program » Describe improvements that are anticipated following rehabilitation » Identify the kind of ecosystem to be rehabilitated at each site » Identify rehabilitation goals and desirable end state » Identify physical site conditions in need of repair » Identify stressors in need of regulation or re-initiation to maintain the integrity of the ecosystem, such as aliens, erosion, fire-regime » Identify the list and kinds of interventions of abiotic and biotic interventions that are and will be needed » Identify landscape restrictions and whether or not its integrity is dependent on a functioning ecosystem outside the project area » Determine project funding and sources » Identify labour sources and equipment needs » Identify biotic resource needs and sources, e.g. suitable topsoil, seeds » Identify any permit requirements or other legal issues » Determine project duration » Outline adaptable strategies for long-term protection and management
Preliminary Tasks	» Appoint a rehabilitation practitioner who is in charge of all the technical aspects of rehabilitation » Appoint a restoration team and train where necessary to ensure effective implementation » Prepare a budget to accommodate the completion of preliminary tasks » Document existing site conditions, also describing biota » Conduct pre-project monitoring as needed, including soil chemistry, that may affect the success of the rehabilitation program » Establish a reference site or past reference that represents the desired end state of the site » Gather information on key species to be re-introduced » Conduct investigations as needed to assess the effectiveness of restoration methods and strategies used in similar habitats up to date » Decide if rehabilitation goals are realistic or need modification » Prepare a list of objectives that need to be reached to achieve restoration goals » Ensure liaison with affected stakeholders, especially as far as rehabilitation goals are concerned » Investigate available accedes and infrastructure needed to facilitate implementation of rehabilitation
Implementation phase	» Describe the interventions that will be implemented to attain each set objective » Acknowledge potential for passive restoration where viable » Prepare performance standards and monitoring protocols to measure the attainment of each objective » Schedule tasks needed to fulfil each objective

	» Obtain equipment, supplies and biotic resources as needed » Prepare an appropriate budget
Implementation tasks	» Mark boundaries and work areas » Install permanent monitoring fixtures » Implement restoration tasks
Post-implementation tasks	» Protect the rehabilitation site against initial disturbance, including herbivores » Perform post-implementation maintenance, especially continued monitoring and eradication of emerging IAPs » Monitor site at least once per year, using the LFA technique, and identify needs for adaptive management
Evaluation	» Assess monitoring data to determine whether performance standards are met and rehabilitation objectives reached and maintained » Conduct an ecological evaluation of the newly completed rehabilitation

C. APPENDIX: TRANSPLANTING GUIDELINES FOR PLANTS WITH UNDERGROUND STORAGE ORGANS

Many of the plants in harsh environments have underground storage organs from which they resprout every year after sufficient rains, flower and then die back soon after fruiting and remain dormant, out of sight until the next growing season. All species of the families Amaryllidaceae, Iridaceae, Orchidaceae are protected provincially, nationally and/or internationally, as are many species of other monocot species.

Root system: underground storage organs are variable in size, but usually between 15 and 40 cm deep in the soil

Transplanting: success of transplanting is usually very high IF handled correctly

Rescue 101: Plants should be lifted and transplanted after flowering and fruiting, preferably as the leaves start to die back. For lifting, loosen the soil or wedge apart rocks working from a circle of about 20 cm away from the base of the plant, working inwards but not closer than about 5 cm of the plant with a sharp narrow object such as a koevoet. Once the soil is loosened, gently feel by hand where the bulb, corm, or other storage organ is, and wedge out by hand, taking care not to damage it. Remove loose soil, gently cleanse off most of remaining soil, or rinse off the storage organ. Group these according to species and label clearly, keep records of labels to include name if that is known, or a brief description or photo, also the average depth of the organs when they were removed, and the habitat they were removed from. Spread these plants so that the storage organ can dry completely, and then loosely pack into newspaper or paper bag and then store in a shaded, dry position for maximally 3 months. Transplant into soil that is as similar as possible to the original habitat, TAKING CARE that the growing point of the organ points to the top, else the plant will die. Make sure the storage organs are positioned according to the records kept about original depth of the storage organ.

Aftercare: Firm down soil around the base of the plant once it is in a new position. Allow plant to resprout naturally after sufficient rains, do not water. As these plants may not be visible for a while, clearly demarcate the area where these have been planted to avoid disturbing and potentially destroying them later on.