AEP BLOEMSMOND SOLAR 1 PV FACILITY ON A SITE SOUTH WEST OF UPINGTON, NORTHERN CAPE PROVINCE

DEA REFERENCE NUMBER: 14/12/16/3/3/2/815

ENVIRONMENTAL MANAGEMENT PROGRAMME

Submitted as part of the Final Environmental Impact Assessment Report

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Prepared for

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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 100 years, including artefacts, human and hominid remains and artificial features and structures.

Cumulative impacts: In relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

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 line: 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.

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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INTRODUCTION CHAPTER 1

1.1. Summary of the Proposed Project

AEP Bloemsmond Solar 1 (Pty) Ltd (herein referred to as the "Developer") is proposing the development of the AEP Bloemsmond Solar 1 photovoltaic (PV) Facility (herein referred to as the "Solar Facility") as well as all associated infrastructure on a site to be located within Portion 5 and Portion 14 (two adjacent farm portions) of the farm Bloemsmond 455 (refer to Figure 1.1). The proposed project development site is located approximately 30 km south west of Upington and 16 km north east of Keimoes in the Kai !Garib Local Municipality (ZF Mgcawu District Municipality) in the Northern Cape. A second PV Facility is also being proposed on the farm Bloemsmond 455 and will be known as the AEP Bloemsmond Solar 2 PV Facility, and is assessed through a separate EIA process.

The Solar Facility will have a contracted capacity of 75MW which will accommodate several arrays of PV panels and associated infrastructure. The project will comprise of the following typical infrastructure which is included in the scope of this EIA:

- mounting structures to support the PV panels;
- on-site inverters to step up the power and a substation to facilitate the connection between the Solar Facility and the Eskom electricity grid;
- a new 132kV power line between the on-site substation and the Dyason's Klip Substation (located on the farm Dyason's Klip RE/454);
- cabling between the project components, to be laid underground where practical;
- offices and workshop areas for maintenance and storage;
- temporary laydown areas; and
- internal access roads and fencing around the development area.

Refer to layout map in Figure 1.1

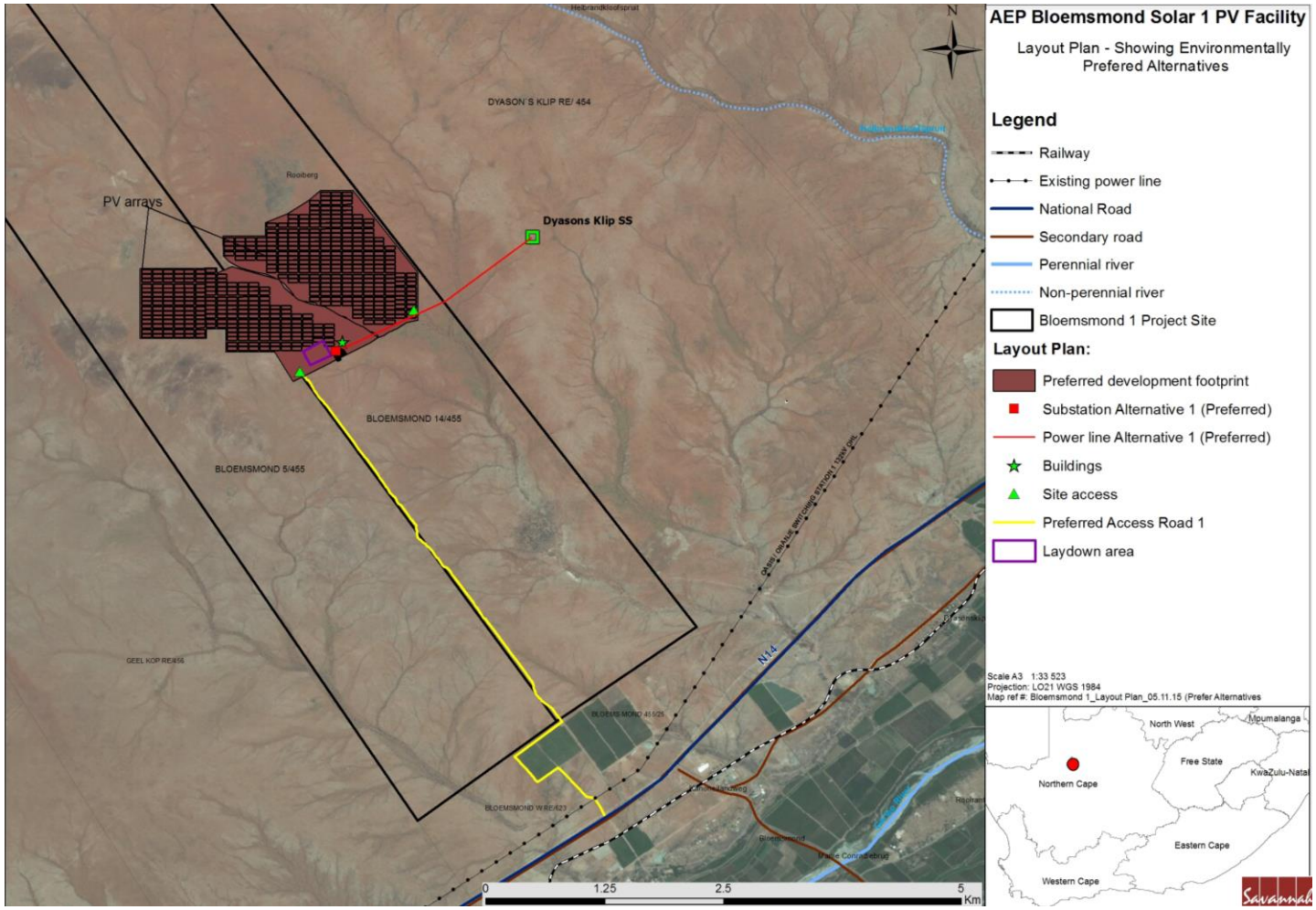

Figure 1.1: Preferred Layout alternative for the Solar Facility

1.2 Findings of the Environmental Impact Assessment

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated from the proposed project conclude that:

Impacts on Ecology:
As the final layout of the facility avoids the major sensitive features of the site, there are no highly sensitive features within the development footprint. The abundance of species of concern within the development area is also low and while there are some protected species present, such as *Boscia foetida*, there are no species of high conservation concern present and no significant impacts on the local populations of the protected species present can be expected. Overall and with the suggested mitigation measures implemented, the ecological impacts of the development are likely to be of **moderate to low significance** and no impacts of high significance are likely. As a result, there are no ecological fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Avifauna:
The proposed solar photovoltaic facility will have an impact on avifauna due to the extensive spatial requirements of the development. The study site is not considered unique and is not considered critical for the conservation of Red Data species. The impacts of the development on avifauna are likely to be of **low significance** and no impacts of high significance are likely, with the implementation of mitigation measures. The facility is unlikely to have any long-term significant impacts of avifaunal species within the study area. Collisions are the biggest single threat posed by transmission power lines to birds in Southern Africa. Potential collision impacts (risk) with the proposed powerline by certain species such as Ludwig's Bustard, Kori Bustard and Secretarybird are possible, albeit low due to the low abundance of these species within the study area. This is particularly true for the Bustards which have low manoeuvrability once in flight. All three species mentioned have been recorded within the top ten avian species in South Africa prone to collisions with overhead powerlines. Overall, the impact assessment found this risk impacts to be of moderate significance. However, this is directly related to the length of the power line. The impact assessment found the risk of collision with the power line from the preferred substation position to be of **low significance** after mitigation.

» ***Impacts on Soils, Land Capability and Agricultural Potential:*** The overall impacts of the proposed facility on agriculture and soil conditions will be **low**, principally because of the climatic conditions and the low agricultural and grazing potential of the site. There are farming practices (agriculture and grazing) on the south western portions of the site properties but the specific developable area is of lesser value and currently not considered for grape production. The dominant climatic and prevailing soil conditions,

low annual rainfall, long periods of drought and other soil-related factors lead to low agricultural potential.

Impact on the water resources:
The overall impact on the water resources is of a moderate significance. These impacts are reduced to **low significance** through mitigation (primarily avoidance). The development should have limited impact on the overall status of the riparian systems within the region. The relevant Water Use Licenses for water uses (abstraction and impacting of water courses) are required to be obtained from DWA.

Impacts on Heritage and Paleontological Resources:
Very sparse heritage resources were found during the field survey undertaken for the site. Isolated Middle Stone Age artefacts are scattered over both the preferred site and alternative site in very low density's (less than 1 artefacts per 10m²). These artefacts are not in-situ and are scattered too sparsely to be of any significance apart from noting their presence, are therefore considered of **low significance**, which has been done in this report. A Stone Age site was recorded at Field nr 157 in the southern portion of the preferred site and a direct impact is foreseen on the site. The site is marked by exposed bedrock with !gorras (hollows where water collects) with widely scattered/isolated stone artefacts. Artefacts consist of both MSA and LSA and could mark an ephemeral camp especially during the LSA and it is therefore of **medium significance**.

The igneous and metamorphic Precambrian basement rocks underlying the Bloemsmond study area at depth are entirely unfossiliferous. The overlying aeolian sands and stream gravels of the Kalahari Group mantling the older bedrocks are generally of **low** palaeontological **sensitivity**. Therefore the proposed Solar Facility including the associated power line and other infrastructure, are unlikely to have significant impacts on local palaeontological heritage resources.

Impacts on Visual Quality of the area:
Due to the flat landscape and the limited vegetation, the Visual Absorption Capacity of the landscape is low as the site landscape offers little topographic, vegetation or structural visual screening. The visibility of the both the layout options is defined as low. This is due to the moderately undulating terrain surrounding the proposed site as well as the higher VAC levels associated with the agricultural development along the N14 National Road, with adjacent structures and vineyards, which would restrict views towards the north. The nearest receptor is the N14 National Road users and is located approximately 5.2 km to the south of the proposed sites. Exposure for both sites is defined as low.

The Scenic Quality of the area is defined as medium. This is due to the predominantly flat landform that offers limited terrain variation, only one or two vegetation types and the limited presence of water. The colour contrast generated by the khaki coloured grasses, the red earth and the reddish background hills does add value to the scenic

quality but the scenery is fairly common in the area and Scarcity is low. Cultural modifications are mainly related to agricultural grassland farming which adds to the rural sense of place. The approximately 200m high Khi Solar One CSP located 4 km to the northeast, is clearly visible from the site and does influence the site sense of place.

Other than the N14 National Road, there are no tourist activities located within the foreground / middle ground distance zone. The N14 National Road does carry tourist traffic, and these road users would be more sensitive to landscape modification. As the area is not associated with formal conservation, it is unlikely that public interest is high. The presence of the Khi Solar One CSP tower creates dominant features in the landscape. There is no unique landscape features associated with the site, and the overall receptor sensitivity towards landscape change on the proposed sites was defined as medium to low.

Impact **significance** was assessed and it was found that the visual significance of either of the layout options, with either of the technology alternatives (3m high fixed PV and 6m high tracking PV) likely to be **low** with mitigation.

Social and Economic Impacts:

The overall social impact is likely to be of a **medium significance** in terms of positive impacts, and a **low significance** in terms of the negative impacts. From a social perspective it is concluded that the project is supported, but that mitigation measures should be implemented and adhered to. Positive and negative social impacts have been identified. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws and which are of such significance that they cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning. Based on the social assessment, the following general conclusions and findings have been made:

- The preferred Access Option from a social perspective is the preferred access road 2, provided that a consent agreement with the Dyason's Klip Site is in place for shared use of their access road; taking into account the matter of protecting the vineyards (from dust pollution and theft risks) located near the other access road options. It furthermore makes sense from an access management point of view that neighbouring solar farms share an access point to limit the number of accesses along the N14 (provided that construction phases are at different times).
- The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of PV facilities (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety and security) and could be reduced with the implementation of the mitigation measures proposed.
- Employment opportunities will be created in the construction and operation phase and the impact is rated as positive even if only a small number of individuals benefit in this regard.

» The proposed project could assist the local economy in creating entrepreneurial development, especially if local business could be involved in the provision of general material and services during the construction and operational phases.
» Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
» The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the increased awareness of climate change, represents a positive social benefit for society as a whole.

Assessment of Potential 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 surrounding Upington area has been identified for a number of solar energy projects, with the proposed Solar Facility forming part of this area. The project site falls within the REDZ 7, and within the Municipality's identified renewable energy corridor. These studies have shown support for this area for the development of multiple projects, and due to the nature of the area, cumulative impacts have not been shown to compromise the area's environmental integrity. There are already more than ten projects are being proposed in the area of the Solar Facility. 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 proposed in the area will be constructed in the short-term due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed the Solar Facility are considered to be of **low significance**.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project. The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the

information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

There are **no environmental fatal flaws** that should prevent the proposed Solar Facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the facility layout.

Refer to environmental sensitivity map in Figure 1.2.

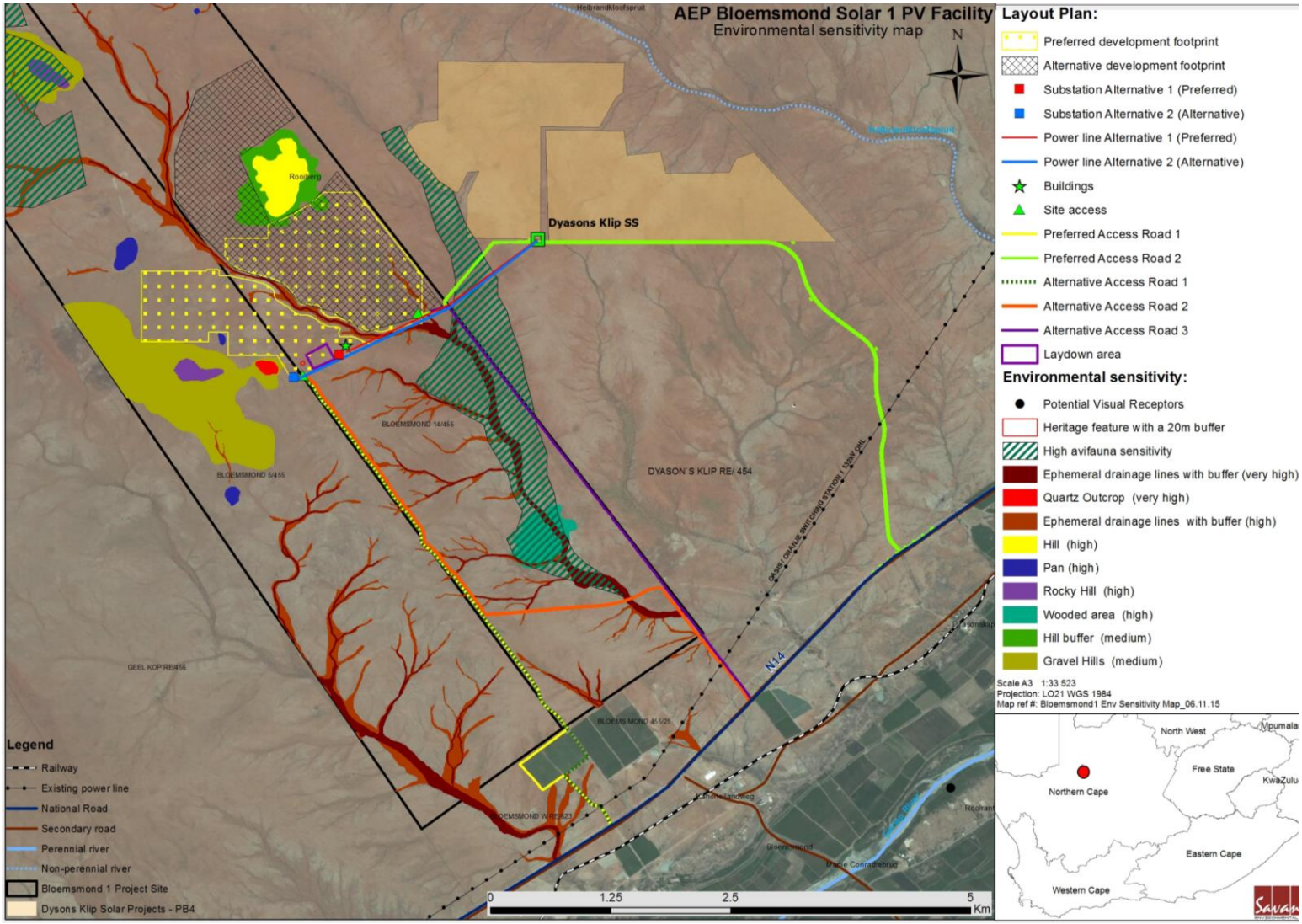

Figure 1.2: Combined Layout and Environmental Sensitivity Map for the Solar Facility

1.3 Activities and Components associated with the Solar Facility

In order to construct the Solar 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.

1.3.1 Design and Pre-Construction Phase

Pre-planning: Several post-authorisation factors are expected to influence the final design of the Solar Facility and could result in small-scale modifications of the PV array or associated infrastructure. While an objective of the Engineering, Procurement and Construction (EPC) Contractor who will be responsible for the overall construction phase of the project will be to comply with the approved Solar Facility design as far as possible, it should be understood that the construction process is dynamic and that unforeseen changes to the project specifications will result. This EIA Report therefore describes the project in terms of the best available knowledge at the time. The final Solar Facility design is required to be approved by the DEA. Importantly, should there be any substantive changes or deviations from the original scope or layout of the project, the DEA will need to be notified and where relevant, approval obtained.

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 plant'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. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

1.3.2 Construction Phase

The construction phase will entail a series of activities including:

Procurement and employment - The proposed Solar Facility is likely to create approximately 300-400 employment opportunities depending on the final design. Of this, 60% of the opportunities (240 employees) will be available to low-skilled workers (construction labourers, security staff etc.), 25% (100 employees) to semi-skilled workers (drivers, equipment operators etc.), and 15% (60 employees) to skilled personnel (engineers, land surveyors, project managers etc.). Approximately 50% of jobs will be sourced from local communities. The injection of income into the area in the form of wages will represent a significant opportunity for the local economy and businesses in the Upington area. The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to residents in Upington, Keimoes, Kakamas and surrounding areas. 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 where unemployment is in the region of 10%.

Establishment of an Access Road to the Site – The Solar Facility is directly accessible via the N14 national road. Within the site itself, new access roads may be required to be constructed for construction purposes (and limited access for maintenance during operation) where existing roads do not suffice. Internal access roads of up to 5m in width will be required to access the individual components within the facility during construction and operation. . Where necessary, it may be required, in some areas, to strip off the existing vegetation and level the exposed ground surface to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation - Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site - The components for the proposed Solar Facility will be transported to site by road via the N14. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.

Establishment of Laydown Areas on Site - Laydown and storage areas will be required for the typical construction equipment which will be required on site. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area will need to be established adjacent to the workshop area. The equipment construction camp serves to confine activities and storage of equipment to one designated area to limit the potential ecological impacts associated with this phase of the project. The laydown area will be used for the assembly of the PV panels and the general placement/storage of construction equipment.

Erect PV Cells and Construct Substation and Invertors - 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 for most of the construction phase. For array 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 on-site AC electrical infrastructure and ultimately the project's substation. The construction of a substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure - Ancillary infrastructure will include a power line for connection to the Eskom national grid, workshop, storage and laydown areas, gatehouse and security complex, as well as a temporary contractor's equipment camp.

The establishment of these 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.

Construction of power line

A power line is constructed by surveying the power line route, construction of foundations for the towers, installation of the towers, stringing of conductors and finally the rehabilitation of disturbed area and protection of erosion sensitive areas.

Undertake Site Remediation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the Soalr Facility, any access points to the site which are not required during the operational phase must be closed and rehabilitated.

1.3.3 Operational Phase

The proposed Solar Facility is expected to be operational for a minimum of 20 years. The project will operate continuously, 7 days a week, during daylight hours. While the project will be largely self-sufficient upon completion of construction, and 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 will create about 60 full-time employment positions. No large scale energy storage mechanisms, which would allow for continued generation at night or on cloudy days, are proposed for the Solar Facility.

1.3.4 Decommissioning Phase

Depending on the continued economic viability of the Solar Facility following the initial 25 year operational period, the Solar 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 Solar 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.

Disassemble and Remove Existing Components - When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be removed, 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 beneficial land-use.

Future plans for the site and infrastructure after decommissioning - The plant capacity would have degraded by ±15% over 20 years. The plant will have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market).

PURPOSE & 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 of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"[1]. 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 remediation (i.e. soil stabilisation, re-vegetation), during operation, and also during decommissioning (i.e. similar to construction phase activities).

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 and the development of Method Statements). During its lifecycle, projects journey through four distinctive phases, i.e. planning, construction, operational, and decommissioning phases. The EMPr is accordingly separated into measures dealing with the various project phases.

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.

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

» 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 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 all relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr through its integration into the contract documentation. Since this EMPr is part of the EIA process it is important that this management programme be read in conjunction with the Scoping Report and EIA Report. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMPr has been compiled in accordance with Section 23 and appendix 4 of the EIA Regulations on December 2014, and will be further developed in terms of specific requirements as the project develops.

In order 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 Contractor's obligations in this regard include the following:

» Ensuring that employees 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.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course

must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.

» Providing basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.

» Ensuring awareness of any other environmental matters, which are deemed to be necessary by the Environmental Control Officer (ECO).

STRUCTURE OF THE EMPr *CHAPTER 3*

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

» Roles of responsibilities for implementation of the EMPr
» Pre-construction (planning and design) activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for the Solar Facility to achieve environmental compliance. For each of the phases of implementation for the Solar Facility, an over-arching environmental **goal** is stated, and in order to meet this goal, a number of **objectives** are listed. The management programme 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, and is illustrated below:

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

Project Component/s	List of project components affecting the objective.
Potential Impact	Brief description of potential environmental impact if objective is not met.
Activity/Risk Source	Description of activities which could impact on achieving objective.
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion.

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

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management programme.
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 amended or introduced.
» 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, should be modified, etc.

3.1 Project Team

This EMPr was compiled by:

	Name	**Area of Expertise**
EMPr Compilers:	Sheila Muniongo Karen Jodas	EAP
Specialists:	Simon Todd (Simon Todd Consulting)	Ecology
	Craig Widdows (Afzelia Consulting)	Avifauna
	Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))	Heritage and Archaeology
	John Almond (Natura Viva cc)	Palaeontology
	Jaco Jansen (Savannah Environmental) and Jasper Dreyer (North West University)	Soils and Agricultural Potential
	Candice Hunter (Savannah Environmental) and Neville Bews (Neville Bews & Associate)	Social
	Steven Stead (Visual Resource Management Africa)	Visual
	Brian Collogy (Scherman Colloty & Associates Eastern Cape Heritage Consultants cc)	Water Resources
	Gabriele Wood	Public Participation

The Savannah Environmental team have extensive knowledge and experience in EIA and environmental management, having been involved in EIA processes over the past ten (10) years. They have managed and drafted EMPrs for power generation projects throughout South Africa, including numerous wind and solar energy facilities.

ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF THE EMPR *CHAPTER 4*

4.1 Roles and Responsibilities for the Construction Phase of the Solar Facility

As the Proponent, the Developer must ensure that the implementation of the Solar Facility complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from all 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. The Developer will retain various key roles and responsibilities during the construction of the Solar Facility. These are outlined below.

Specific responsibilities of the Owner's Representatives, ECO and EPC Contractor for the construction phase of this project are as detailed below.

The **Project 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 its Contractors 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 conversant with the EIA for the project, the EMPr, the conditions of the Environmental Authorisation, and all relevant environmental legislation.

The **Site Manager** (On-site Representative) will:

» Be fully knowledgeable with the contents of the EIA.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation.
» Be fully knowledgeable with the contents of the EMPr.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Have overall responsibility of the EMPr and its implementation.
» Conduct audits to ensure compliance to the EMPr.
» Ensure there is communication with the Project Manager, the ECO/s 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 ECO must be appointed by the project proponent prior to the commencement of any listed activities, and must remain employed until rehabilitation of the site is complete. The ECO 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. The ECO will:

» Be fully knowledgeable of the contents with the EIA.
» Be fully knowledgeable of the contents with the conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable of the contents with the EMPr.
» Be fully knowledgeable of the contents with all relevant environmental legislation, and ensure compliance with them.
» Be fully knowledgeable of all the licences and permits issued to the site.
» 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 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 a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.
» Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
» Independently report to DEA in terms of compliance with the specifications of the EMPr and conditions of the Environmental Authorisation (once issued).
» Keep record of all reports submitted to DEA.

The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

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

» Ensuring adherence to the environmental management specifications.
» Ensuring that Method Statements are submitted to the Site Manager for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMPr.
» 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).

Contractor's Environmental Representative: The Contractor's Environmental Representative (CER), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the CER must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's Environmental Representative should:
» Be well versed in environmental matters.
» Understand the relevant environmental legislation and processes.
» Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
» Know the background of the project and understand the implementation programme.
» Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
» Keep accurate and detailed records of all EMPr-related activities on site.

4.2. Roles and Responsibilities for the Operation Phase of the Solar Facility

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Solar Facility's 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 Facility and associated infrastructure.
» Manage and report on the Solar 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, as required.
» 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 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: PRE-CONSTRUCTION (PLANNING & DESIGN) CHAPTER 5

5.1 Goal for Planning and Design

Overall Goal for Planning and Design: Undertake the planning and design phase of the Solar Facility in a way that:

» Ensures that the design of the Solar 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 concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the project, including the power line alignment and substation site.
» Enables the Solar Facility construction activities to be undertaken without significant disruption to other land uses in the area.

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

5.2 Objectives

OBJECTIVE PD1: Ensure the design of the Solar Facility responds to the identified environmental constraints and opportunities

The most sensitive landscape features for planning purposes in the study area will be the presence of the followings features on site:
» Rocky Hills – while the largest hill at the site lies outside of the development footprint, the western margin of the solar field encroaches onto the low gravel hills, but not onto the rocky outcrops themselves
» Quartz Outcrops – there are some quartz outcrops at the site, the largest of which contains a population of *Dinteranthus wilmotianus* as well as several other protected species.
» Plains Washes - these areas are considered to be moderately sensitive due to the higher biomass they support and the increased abundance of protected species such as *Boscia foetida.*
» Ephemeral Drainage Courses - the abundance of protected species such as *Acacia erioloba* is high and occasional individuals of *Boscia foetida* may also be present.
» Pans

» A heritage site (Stone Age) recorded at Field nr 157 in the southern portion of the preferred site.

Project Component/s	» PV panels. » Substation and power line. » Access roads. » Laydown areas and construction camp area
Potential Impact	Design fails to respond optimally to the environmental consideration.
Activities/Risk Sources	» Positioning of solar components and access roads. » Positioning of substation. » Alignment of power line and pipeline.
Mitigation: Target/Objective	Ensure that the design of the Solar Facility responds to the identified environmental constraints and opportunities.

Mitigation: Action/Control	Responsibility	Timeframe
Plant Rescue and Protection Plan: » 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 specialist, conducted during the optimal growing season (January to March) along within the entire footprint area. » Search and Rescue (S&R) of all protected plants that will 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) should take place. o The necessary permits must be in place » 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 horticulturist/contractor with Search and Rescue experience should be appointed to undertake the S&R. » All rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a designated on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is	Specialist	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
required. Replanting should occur in spring to early summer once sufficient rains have fallen, in order to facilitate establishment.		
Plan and conduct pre-construction activities in an environmentally acceptable manner	Developer	Pre-construction
Undertake pre-construction geotechnical surveys.	Specialist	Design phase
Obtain any additional environmental permits required (e.g. water use license, protected tree and protected plant permits, etc.).	Developer	Design phase
Develop a procedure which details what to do in the event of any major heritage feature being encountered during any phase of development or operation (for the construction and operational phase). A procedure regarding fossil finds must be developed and included in the EMPr. Once the tower positions of the power line have been confirmed a heritage walk-through of the power line is required.	Developer Specialist	Pre-construction
Consult a lighting engineer in the planning and placement of light fixtures for the plant and the ancillary infrastructure.	Developer	Pre-construction
Access roads to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil.	Developer	Design phase
Road alignments must be planned in such a way that the minimum of cut and fill operations are required.	Developer	Design phase
As far as possible, existing roads must be used.	Developer	Design phase
Submit a final layout of the facility and associated infrastructure to DEA prior to the commencement of construction.	Developer	Pre-construction
Compile a comprehensive stormwater management plan for hard surfaces as part of the final design of the project. This must include appropriate means for the handling of stormwater within the site, e.g. separate clean and dirty water streams around the plant, install stilling basins to capture large volumes of run-off, trapping sediments, and reduce flow velocities (i.e. water used when washing the mirrors), as well as appropriate drainage around the site. Refer to Appendix A for the stormwater management plan	Developer	Pre-construction
Develop a site specific waste management plan for the construction phase.	Contractor	Planning
Develop a comprehensive rehabilitation plan for the site	Developer	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
Due to the number of channels and drainage lines within the area, a 1:100 year floodline delineation must be conducted, if possible, using Lidar data.	Developer	Planning & design phase
An emergency response and management plan must be drafted and available to deal with chemical spillages.	Developer	Planning & design phase
The possibility of spillages should be catered for in the design of the infrastructure development where, pollution control dams or evaporation ponds could contain water prior to the discharge.	Developer	Planning & design phase
Plan for installation of markers on the power line, which will increase the visibility of the power line. The two most common bird marking devices include Bird Flight Diverters and Bird Flappers, both of which are effective.	Developer	Planning & design phase
The holder of an environmental authorisation has the responsibility to notify the competent authority of any alienation, transfer and, change of ownership rights in the property on which the activity is to take place.	Developer	On-going
Submit a revised layout plan for the entire solar facility for approval to the department, as required by the Environmental Authorisation	Developer	Pre-construction
Fourteen (14) days written notice must be given to the Department that the activity will commence. The notification must include a date on which the activity will commence as well as the reference number.	Developer	Pre-construction
ECO to be appointed prior to the commencement of any authorised activities. Once appointed the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring at the DEA.	Developer	Pre-construction

Performance Indicator	» Design meets objectives and does not degrade the environment. » Design responds to the mitigation measures and recommendations in the EIA report. » Minimal impact on the riparian environment.
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, Developer and the Contractor prior to the commencement of construction.

OBJECTIVE PD2: Ensure effective communication mechanisms with the various stakeholders

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

Project component/s	» Solar energy facility » Substation and power line
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 to be implemented during both the construction and operational phases of the facility (refer to the draft generic grievance mechanism included within Appendix B). 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.	Developer	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaison with landowners is to be undertaken prior to the commencement of construction should they be required to plan accordingly.	Developer	Pre-construction

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

OBJECTIVE PD3: Ensure protection of fauna and avifauna during the Solar Facility design

A total of 184 avifaunal species were recorded in 2821CA by SABAP2, with nine species (4.9%) classified as Red Data species (Barnes, 2014). Furthermore, 14 species are southern African endemics and 23 are near-endemics (33%). Southern Africa contains 13 avifaunal endemic biomes including Grasslands, Western Arid, Woodland, Evergreen Forest, Fynbos, Montane, Rocky slopes and cliffs, Marine and Inland Waters (MacLean

1998). The Western Arid avifaunal biome, where the study area is located, contains the highest number of endemics (30 species). Overall, the study area potentially contains a total of 34 endemic and near-endemic species, which is 20% of the total southern African endemics and near-endemics (Hockey et al. 2005).

Three listed terrestrial mammals may occur at the site, the Honey Badger *Mellivora capensis* (Endangered), Brown Hyaena *Hyaena brunnea* (Near Threatened) and Black-footed cat *Felis nigripes* (Vulnerable). Within the proposed development area, there are no large rocky outcrops or other specialised reptile habitats. As with mammals, the development is likely to result in local habitat loss for reptiles but as there are no listed or range-restricted reptiles that are likely to occur at the site, the impacts are not likely to be of broader significance. The site lies within the distribution range of 10 amphibian species. The only listed species which may occur at the site is the Giant Bullfrog *Pyxicephalus adspersus* which is listed as Near Threatened.

Project component/s	» PV panels. » Substation and power line » Access roads. » Laydown areas and construction camp area		
Potential Impact	» Loss and injury of fauna and avifauna from facility infrastructure. » Loss of protected and endangered faunal and avifaunal species.		
Activity/risk source	» Activities associated with site infrastructure.		
Mitigation: Target/Objective	» Prevent or minimise loss of avifauna. » Prevent or minimise the loss of protected, endangered and endemic species.		
Mitigation: Action/control		**Responsibility**	**Timeframe**
Identify where anti-perching devices and bird flight diverters are to be installed along the power line.		Contractor	Planning and design.
Avoid clearing vegetation in drainage channels or washes where bird density and diversity has the potential to be higher		Contractor/ECO	Planning and design.
Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in Chapter 8 of the EIA report (Savannah Environmental, 2015).		
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 ECO prior to the commencement of construction.		

MANAGEMENT PROGRAMME: CONSTRUCTION CHAPTER 6

6.1 Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the Solar Facility in a way that:

» ensures that construction activities are properly managed in respect of environmental aspects and impacts;
» enables construction activities to be undertaken without significant disruption to other land uses in the area, in particular concerning noise impacts, dust, farming practices, traffic and road use, and effects on local residents;
» minimises the impact on the indigenous natural vegetation, protected tree species, and habitats of ecological value (i.e. ephemeral drainage lines);
» minimises impacts on avifauna and other fauna using the site; and
» minimises the impact on the heritage and historical value of the site.

6.2 Objectives

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

OBJECTIVE C1: Securing the site and site establishment

Project Component/s	» PV panels » Access roads » Substation » Power line
Potential Impact	» Hazards to adjacent landowners and public. » Security of materials. » Substantially increased damage to sensitive vegetation.
Activities/Risk Sources	» Open excavations (foundations and cable trenches). » Movement of construction vehicles in the area and on-site.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents.

Mitigation: Action/Control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. 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 suitable languages, all to the approval of the Site Manager.	Contractor	Construction
All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with two coloured shade cloth netting).	Contractor	Construction
Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor	Construction
Fence and secure Contractor's equipment camp.	Contractor	Construction
Access control should be implemented and maintained for the duration of the construction period.	Contractor	Construction
Provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Construction
Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including watercourses, drainage lines or within a horizontal distance of less than 100 m, whichever is applicable.	Contractor	During site establishment, construction, and operation
Supply adequate waste collection bins at site where construction is being undertaken.	Contractor	Construction

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured.
Monitoring	» An incident reporting system will be used to record non-conformances. » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager.

OBJECTIVE C2: Minimise loss of indigenous biodiversity, including plants of conservation concern

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. Due to disturbance of vegetation, there is a higher risk of alien species dominating disturbed areas. Therefore, control of alien invasive plants is required (refer to alien plant management plan contained in Appendix F and Open Space Management Plan contained in Appendix I).

Project Component/s	» PV panels » Access roads » Substation » Power line » Topsoil stockpiles
Potential Impact	» Substantially increased loss of species of conservation concern and other natural vegetation at construction phase, » 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 all bulbous protected plant species within the specific land portion

Mitigation: Action/Control	Responsibility	Timeframe
For vegetation clearance/trimming (e.g. protected plants and trees), a permit must be obtain all relevant permits	Developer	Prior to construction
Prior to commencement of construction, including earthworks (grading, road construction, etc.) within areas of natural vegetation a plant search and rescue program must be developed and implemented, preceded by an investigation of all footprint areas by a suitably qualified botanist. This survey must be conducted during the optimal growing season (February to April) within the entire development area.	Developer	Prior to construction
» Search and Rescue (S&R) of protected plants that can be transplanted should be undertaken. Plants that should be considered for rescue and included in subsequent rehabilitation programs are all tubers, bulbs, and indigenous succulents (refer to Appendix C for an example of the a rehabilitation & re-vegetation plan) » Rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a 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.	Developer	Prior to construction
» All trenches within the development area must be checked on a daily basis for the presence of trapped animals. Any animals found must be removed in a safe manner, unharmed, and placed in an area where the animal will be safe. » 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.	Contractor	Duration of construction
All mammal, large reptiles and avifauna species found injured during construction must be taken to a suitably qualified	Contractor	Duration of construction

Mitigation: Action/Control	Responsibility	Timeframe
veterinarian or rehabilitation centre to either be put down in a humane manner or cared for until it can be released again		
Reduce risk of vehicle movement injuring animals, especially at night or in low light conditions by vehicles maintaining low speeds.	Contractor's Environmental Representative	Duration of construction and operation
Monitor intermittent pans after larger rainfall events to see if any amphibians (tadpoles) or tadpole shrimps will hatch. If this happens in pans that will be transformed by the development, such species must be relocated as best possible to similar suitable habitats either within the study area or beyond.	Contractor's Environmental Representative	Duration of construction

Performance Indicator	» Rescue of species of conservation concern » No damage or injury to fauna » Re-establishment of rescued plant species
Monitoring	» CER to monitor Search and Rescue, continue search and rescue operations during the construction process where it becomes necessary after the initial S&R » 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 C3: Minimise impact on avifauna during construction

A total of 184 avifaunal species were recorded in 2821CA by SABAP2, with nine species (4.9%) classified as Red Data species (Barnes, 2014). Furthermore, 14 species are southern African endemics and 23 are near-endemics (33%). Southern Africa contains 13 avifaunal endemic biomes including Grasslands, Western Arid, Woodland, Evergreen Forest, Fynbos, Montane, Rocky slopes and cliffs, Marine and Inland Waters (MacLean 1998). The Western Arid avifaunal biome, where the study area is located, contains the highest number of endemics (30 species). Overall, the study area potentially contains a total of 34 endemic and near-endemic species, which is 20% of the total southern African endemics and near-endemics (Hockey et al. 2005).

Project component/s	» PV panels » Substation » Power line
Potential Impact	» Loss and injury of avifauna from facility infrastructure. » Loss of protected and endangered, endemic avifaunal species.
Activity/risk source	» Activities associated with site infrastructure.
Mitigation:	» Prevent or minimise avifauna fatalities.

Target/Objective	» Prevent or minimise the loss of protected, endangered and endemic species.

Mitigation: Action/control	**Responsibility**	**Timeframe**
It is recommended that a post construction (once operational) site walk over be conducted by an avifaunal specialist to determine whether an avifaunal mortality monitoring programme is required for the site. This will contribute significantly towards understanding the short and long term impacts of these facilities of avifauna.	Contractor/ specialist	Construction
Install anti bird collision line marking devices on high risk sections of power line. Placement of bird flappers as markers on the earth wire, which will increase the visibility of the power line. Markers should be placed with sufficient regularity (at least every 5-10m).	Contractor/ specialist	Construction
Eagle eye devices may be used, to deter birds from the PV facility area, where considered to be required	Contractor	Construction
Avoid clearing vegetation in drainage channels or washes where bird density and diversity has the potential to be higher	Contractor/ECO	Construction
The servitude of the power line exiting the site should follow existing roads and not cut across habitat.	Contractor	Construction
Bird friendly tower structures will be utilised in the development. This will significantly minimise the number of electrocutions.	Contractor	Construction
If the nest of a large species is detected within the vicinity of the area to be disturbed, then the Northern Cape Department needs to be notified and all attempts made to minimise the amount of disturbance near it.	Contractor/ ECO	Construction
All construction activities must be undertaken in accordance with Eskom Transmission's Environmental Best Practise Standards. All construction activities and access roads should be restricted as much as possible.	Contractor	Construction
All construction activities should be carried out according to generally accepted environmental best practices. No additional habitat destruction should take	Engineering contractor Environmental Control Officer	Construction

Mitigation: Action/control	Responsibility	Timeframe
place beyond the demarcated site boundaries or power line and/or road servitudes. Existing roads should be used during construction and maintenance.		

Performance Indicator	» Minimum disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna » Limited impacts on faunal species (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring	» Observation of vegetation clearing activities by ECO throughout construction phase » Supervision of all clearing and earthworks by ECO » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site » ECO to monitor the extent of the disturbance and habitat clearance on a weekly basis during construction and a monthly basis during operation

OBJECTIVE C4: Good management of the construction equipment camps and all other temporary structures

No staff will be accommodated on site. All construction staff will reside within existing accommodation in nearby towns. Construction equipment and machinery will be stored on the site for the duration of the construction period, and temporary staff facilities (such as ablutions) will be made available.

Project Component/s	» Construction equipment camp » Facilities for storing, mixing and general handling of materials » Storage areas
Potential Impact	» Damage to indigenous natural vegetation » Damage to and/or loss of topsoil » Initiation of accelerated erosion » Compacting of soil » Pollution of the surrounding environment due to excessive dust, inadequate and/or inappropriate facilities provided or procedures implemented
Activities/Risk Sources	» Vegetation clearing and levelling of temporary construction or storage area/s » Transport to and from the temporary construction or storage area/s » Types of materials or equipment and the manner in which they are stored or handled » Dust emissions
Mitigation: Target/Objective	» To minimise impacts on the biophysical and social environment » To prevent any residual or cumulative impacts arising from temporary construction or storage areas

Mitigation: Action/Control	Responsibility	Timeframe
The location of the construction equipment camp to take cognisance of any ecologically sensitive areas identified in the EIA and must located outside these areas.	Contractor	Pre-construction
Cooking on open fires must be prohibited, if staff need cooking/kitchen facilities on site, such should be provided by the contractor	Contractor	Construction
Adequate ablution facilities must be provided for construction staff	Contractor	Construction
Create specific turning points and parking areas for vehicles and heavy machinery as needed	Contractor	Construction
Fuels, lubricants and other chemicals to be stored in appropriately bunded areas	Contractor	Construction

Performance	» No visible erosion scars or any pollution once construction in an area is

Indicator	completed » All damaged areas successfully rehabilitated
Monitoring	» Regular monitoring and audits of the construction camps and temporary structures on site by the CER and ECO » 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 C5: Appropriate handling and storage of chemicals, hazardous substances and waste (waste management plan)

The construction phase will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility will include will include general solid waste and liquid waste, and may include hazardous waste.

Project Component/s	» Substation » Construction camp » Storage areas » Workshop
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices. » Pollution of water and soil resources.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Power line construction activities. » Substation construction activities. » Packaging and other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals 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. » To comply with waste management guidelines. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Implement a site specific waste management plan (Appendix D) during the construction phase	Contractor	Duration of contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
Implement an effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Contractor	Duration of contract
Leakage of fuels must be avoided at all times and if spillage occurs, it must be remediated immediately.	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
Spilled cement, fly ash and concrete 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
All stored fuels to be maintained within a sealed bund and on a sealed concrete surface. The bund must be at least 110% of the volume of the total containers.	Contractor	Duration of contract
Adjacent fuelling areas situated around fuel tanks must be provided with an impervious paving or concrete slab upon which vehicles must park during refuelling.	Contractor	Duration of contract
Areas around fuel tanks must be appropriately bunded or contained in an appropriate manner as per the requirements of SABS 089:1999 Part 1.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor, and ECO	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractors	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 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
Construction sub-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	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
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.		
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 etc.).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors and disposal at appropriately licensed waste disposal sites.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste and surplus dangerous goods 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 detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor and ECO	Duration of contract
An incident/complaints register must be established and maintained on-site.	Contractor and ECO	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in a fully operational state at all times.	Contractor	Duration of contract
An integrated waste management approach that is based on waste minimisation must be used and must incorporate reduction, recycling, re-use and disposal where appropriate.	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 contract
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.		

Performance Indicator	» Limited chemical spills outside of designated storage areas. » No water or soil contamination by spills. » 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 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. » 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 C6: Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report, and this EMPr, as well as the requirements of all relevant environmental legislation.

Project Component/s	» Construction staff » Contractors » Sub-contractors
Potential Impact	» Pollution/contamination of the environment. » Disturbance to the environment.
Activity/Risk Source	Contractors are not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment.
Mitigation: Target/Objective	To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.

Mitigation: Action/Control	Responsibility	Timeframe
The terms of this EMPr and the Environmental Authorisation (once issued) must be included in all tender documentation and Contractors contracts.	Developer and Contractor	Tender process

Mitigation: Action/Control	Responsibility	Timeframe
Implement Health and Safety Plan	Developer	Duration of construction
An Environmental Officer representing the Contractor must be on site prior to the commencement of any construction activities including early works.	Developer	Duration of construction
» Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no ablution activities must be permitted outside the designated area. » These facilities must be regularly serviced by appropriate contractors. » A minimum of one toilet shall be provided per 15 persons at each working area such as the Contractor's camp.	Contactor	Duration of contract
Construction workers must have a form of identification such as ID tags/ ID cards.	Contractor	Construction
Access to the construction site must be controlled.	Contractor	Construction
Cooking/meals must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor	Duration of contract
Contractors appointed by the developer must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct and trespassing on adjacent farms.	Contractor	Construction
On completion of the construction phase all construction workers must leave the site.	Contractor	Construction

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMPr. » No complaints regarding contractor behaviour or habits. » Fire fighting equipment and training provided before the construction phase commences. » Code of Conduct drafted before commencement of construction phase » Briefing session with construction workers held at outset of construction phase.
Monitoring	» Observation and supervision of Contractor practices throughout construction phase. » 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 C7: Minimisation of disturbance to and loss of 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 is required for:

» Areas will be severely compacted
» Areas will be buried with excavated material
» Areas will be permanently covered with altered surfaces

Topsoil must at all times be treated as a valuable natural resource, and may thus not be discarded or degraded. In many sections of the development area, topsoils are very shallow or rocky, which would make topsoil removal difficult. Grading in such areas should be kept as low as possible.

Project Component/s	» PV panels » Access roads » Substation » Power line » Temporary construction camps » Topsoil stockpiles
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 and associated rangelands
Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » Power line construction activities
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.	Contactor	Pre-construction
Construction activities must be restricted to demarcated construction areas so that impact on topsoil is minimised.	Contactor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Salvaging topsoil: » Topsoil to be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. » Topsoil stripping removes up to 30 cm or less of the upper soils. o Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. This will give an indication of total volumes of topsoil that need to be stored to enable the proper planning and placement of topsoil storage. » 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.	Contactor	Construction
Storing topsoil: » Topsoil is typically stored in berms. Place berms along contours or perpendicular to the prevailing wind direction. » If volumes of topsoil and subsoil are very high, a stockpile with landscaped and compacted subsoil at the base and topsoil over the top can be created, but this stockpile may not exceed a height of 2m, and needs to be managed permanently to prevent erosion and maintain a permanent vegetation cover » 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 pipeline trenches » In such case, use one side of the linear development for machinery and access only » Place topsoil on the other/far side of this development, followed by the subsoil (also on geotextile) » For long-term storage of topsoil in specified stockpiles, this must be indicated in the design phase already and accompanied by a detailed topsoil stockpile management plan » 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 by: * Covering topsoil berms * Monitoring establishment of all invasive vegetation and removing such if it appears	Contactor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
* Keeping slopes of topsoil at a maximal 2:1 ratio * Where topsoil needs to be stored in excess of one year, it is recommended to either cover the topsoil or allow an indigenous grass cover to grow on it – if this does not happen spontaneously, seeding should be considered (refer to Appendix E for Soil Management Plan)		
Reapplying topsoils: » Spoil materials and subsoil must be back-filled or landscaped first, then covered with topsoil. » It is recommended that where feasible, spoil materials be used to fill in and close old mine pits in the development area that currently pose a great safety risk to man and animals » 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 » Reapplied topsoils should be landscaped in a way that creates a variable microtopography 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 topsoils and minimise raindrop impact and erosion: * Use organic material from cleared and shredded woody vegetation where possible * Alternatively, suitable geotextiles or organic erosion mats can be used as necessary » Monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation	Contactor	Construction
Re-applied topsoils need to be re-vegetated as soon as possible	Contactor	Before and during construction

Performance Indicator	» Minimal disturbance outside of designated work areas. » Topsoil appropriately stored, managed, and rehabilitated.
Monitoring	» Monitoring of appropriate methods of vegetation clearing and soil management activities by CER and ECO throughout construction phase. » An incident reporting system will be used to record non-conformances to the EMPr. » Regular monitoring of topsoil after construction by developer until such

	topsoil can be regarded as fully rehabilitated, stable and no longer prone to accelerated erosion » A photographic record must be established before, during and after rehabilitation of topsoil stockpiles, these must be continually monitored and also evaluated at least once a year with the Landscape Function Analysis Method or similar until decommissioning

OBJECTIVE C8: Effective management of concrete batching plants

Project component/s	» Concrete batching plant
Potential Impact	» Dust emissions » Release of contaminated water » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation
Activity/risk source	» Operation of the batching plant » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	» To ensure that the operation of the batching plant does not cause pollution to the environment or harm to persons

Mitigation: Action/control	Responsibility	Timeframe
Concrete batching plants to be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised	Contractor	Construction phase
Access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment	Contractor	Construction phase
The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up	Contractor	Construction phase
The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind.	Contractor	Construction phase
Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and reduce water usage	Contractor	Construction phase
Conveyors must be designed and constructed to prevent fugitive dust emissions. This may include covering the conveyor with a roof, installing side protection barriers and equipping the conveyor with spill trays, which direct material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage.	Contractor	Construction phase
The site should be designed and constructed such that clean stormwater, including roof runoff, is diverted away from contaminated areas and directed to the stormwater discharge system.	Contractor	Construction phase

Mitigation: Action/control	Responsibility	Timeframe
Any liquids stored on site, including admixtures, fuels and lubricants, should be stored in accordance with applicable legislation	Contractor	Construction phase
Contaminated stormwater and process wastewater should be captured and recycled where possible. A wastewater collection and recycling system should be designed to collect contaminated water.	Contractor	Construction phase
Process wastewater and contaminated stormwater collected from the entire site should be diverted to a settling pond, or series of ponds, such that the water can be reused in the concrete batching process. The settling pond or series of ponds should be lined with an impervious liner capable of containing all contaminants found within the water they are designed to collect	Contractor	Construction phase
Areas where spills of oils and chemicals may occur should be equipped with easily accessible spill control kits to assist in prompt and effective spill control	Contractor	Construction phase
Ensure that all practicable steps are taken to minimise the adverse effect that noise emissions. This responsibility includes not only the noise emitted from the plant and equipment but also associated noise sources, such as radios, loudspeakers and alarms	Contractor	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor	Construction phase
The batching plant to be monitored by the ECO to ensure that the plant is operating according to its environmental objectives and within legislative requirements.	ECO	Construction phase

Performance Indicator	» No complaints regarding dust or contamination » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase » 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 » 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 » Developer or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

OBJECTIVE C9: Limit damage to ephemeral drainage lines and pan features

Project Component/s	» PV facility » Access roads » Power line » Substation » Other associated infrastructure
Potential Impact	Damage to watercourses by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands).
Activity/Risk Source	Construction and operation of the facility.
Mitigation: Target/Objective	» No unnecessary damage to watercourse areas within project area. » The focus should be on the functioning of the watercourse as a natural system.

Mitigation: Action/Control	Responsibility	Timeframe
For any new construction, cross watercourses perpendicularly to minimise disturbance footprints.	Contractor	Construction
Rehabilitate any disturbed areas as soon as possible after construction is completed in an area.	Contractor	Construction
Control stormwater and runoff water.	Contractor	Construction, and operational phase
Any stormwater within the site must be handled in a suitable manner, i.e. clean and dirty water streams around the plant must be separated and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities (i.e. water used when washing the mirrors).	Contractor	Planning, design, construction and operation phase

Performance Indicator	Limited impact on water quality, water quantity, wetland vegetation, natural status of watercourses outside of footprint of infrastructure.
Monitoring	» Habitat loss in watercourses should be monitored before and after construction. » The environmental manager should be responsible for driving this process.

OBJECTIVE C10: 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. Indigenous invasive species that need to be controlled include: *Acacia mellifera* subsp. *mellifera,* and *Rhigozum trichotomum.* Alien invasives that must be controlled and eradicated to prevent degradation include *Nicotianan glauca, Prosopis glandulosa, Salsola kali.* Weeds and potentially invasive species on and around the site that need to be monitored and managed include: *Melia azedarach, Tribulus terrestris, Alternanthera pungens.* An Alien Invasive Management Plan in attached as Appendix F.

Project Component/s	» PV facility » Access roads » Substation » Power line » Temporary construction camps » Topsoil stockpiles
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 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
The Alien Invasive Management Plan must be implemented and can be updated as and when required.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Eradicate and control invasive plants that occur within the development's footprint area	Contractor CER	Construction

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 the CER and ECO during construction.

OBJECTIVE C11: Protect of heritage sites or finds

Project component/s	» PV facility » Access roads » Substation » Power line
Potential Impact	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 are not considered necessary. However, should any heritage resources be found, it needs to be dealt with.

Mitigation: Action/control	Responsibility	Timeframe
Avoid the Stone Age Site (Field nr 157) marked as a no go area on development plans with a 20 meter buffer zone.	Contractor	Pre-Construction
Chance find procedure: This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below. » If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider,	Contractor	Pre-Construction Construction

finds any artefact of cultural significance or rock engraving, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. » It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area. » The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify		
Develop and implement a procedure in the event that heritage resources (including fossils) are found during construction which details what to do in the event of any major heritage feature being encountered during any phase of development or operation.	Contractor	Construction
Grave and burial areas must be identified and cordoned off prior to the commencement of development so that negative impact and vandalism is avoided.	Contractor	Pre-Construction
Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.	Contractor	Pre-Construction
The CER is to be trained to assist in identifying fossils, as required by the recommendations from SAHRA.	CER Specialist	Construction
In the event of any archaeological deposits or features (such as a grave or an ostrich eggshell cache) being encountered, relevant personnel should halt work and notify SAHRA immediately (Tel: 021 462 4502. Fax: 021 462 4509; 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000) to allow for investigation and possible mitigation.	Contractor in consultation with Specialist	Construction

Performance Indicator	» 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: Avoid and or minimise the potential risk of increased veld fires during the construction phase

Project component/s	» PV facility » Access roads » Substation » Power line
Potential Impact	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.
Activity/risk source	The presence of construction workers and their activities on the site can increase the risk of grass fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of grass fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Open fires on the site are not allowed.	Contractor	Construction
Designate areas for cooking or heating food.	Contractor	Construction
Provide adequate firefighting equipment onsite in a designated area.	Contractor	Construction
Provide fire-fighting training to selected construction staff.	Contractor	Construction
Should any proven losses to farm equipment, land or infrastructure occur as a result of fires started on site or as a result of construction activities, compensate farmers / affected parties. A legal process will have to be undertaken in this regard.	Contractor	Construction

Performance Indicator	» Fire-fighting equipment and training provided before the construction phase commences. » Resolving social issues that may arise timeously
Monitoring	» The proponent and must monitor indicators listed above

OBJECTIVE C13: Traffic management and transportation of equipment and materials to site

The construction phase of the project will be the most significant in terms of generating traffic impacts resulting from the transport of equipment (including solar 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. Existing national

roads (i.e. the N14) and access roads will be used to access the sites in conjunction with the proposed access road during construction and operational phases. Refer to Appendix G for the traffic management and transportation plan.

Project Component/s	» Construction vehicles » Abnormal loads/ trucks
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Risk of accidents. » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.
Activity/Risk Source	» Traffic congestion increase. » Site preparation and earthworks. » Foundations or plant equipment installation. » Transportation of ready-mix cement from off-site batching plant to the site. » Mobile construction equipment movement on-site. » Power line and substation construction activities.
Mitigation: Target/Objective	» To minimise impact of traffic associated with the construction of the facility on local traffic. » 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 carried appropriately and within any imposed permit/licence conditions.

Mitigation: Action/Control	Responsibility	Timeframe
Permits for abnormal loads must be applied for from the relevant authority, if required.	Contractor	Pre-construction
A designated access to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
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	Pre-construction
Implement the traffic management plan and transport plan include within this EMPr document (Appendix G)	Contractor	Pre-construction Duration of contract
Appropriate dust suppression techniques must be used to minimise dust emissions on un-surfaced roads when and if required.	Contractor	Duration of contract
Times for arrival and departure of heavy vehicles must be co-ordinated to minimise congestion as is possible.	Contractor	Duration of contract
Any traffic delays as a result 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	Contractor	Duration of

Mitigation: Action/Control	Responsibility	Timeframe
designated roadways.		contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards and must be maintained for the duration of construction).	Contractor	Duration of contract
Appropriate maintenance of all vehicles of the contractor must be ensured.	Contractor	Duration of contract
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits 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
Prevent damage to roads by construction vehicles.	Contractor	Duration of contract
Fine grained aggregates transported to and from site must be covered with tarpaulins.	Contractor	Duration of contract
Overloading of any transport vehicles is prohibited.	Contractor	Duration of contract
Compile and implement a traffic management plan for the site access road to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters.	Contractor	Construction

Performance Indicator	» No traffic incidents involving the project construction personnel or appointed contractors. » Appropriate signage in place. » No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the solar energy facility.
Monitoring	» Visual monitoring of dust produced by traffic movement. » Visual monitoring of traffic control measures to ensure they are effective » 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: Minimise social nuisances such as noise and dust and damage to roads caused by construction vehicles during the construction phase.

Project component/s	» Construction activities » Construction vehicles utilising public roads
Potential Impact	Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads.
Activity/risk source	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 also minimise damage to roads.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Implement dust suppression measures for heavy vehicles on gravel roads.	Contractor	Construction
Consider upgrading the access road to tar surfaced road for the section passing the vineyards,	Contractor	Construction
Ensure that vehicles used to transport fine or wind-blown 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 low speed limits.	Contractor	Construction
Ensure that any proven damage to public roads due to the construction of the solar energy facility and associated infrastructure is repaired before completion of construction phase.	Contractor	Construction
Performance Indicator	• Dust suppression measures implemented. • No complaints from the community or landowners.	
Monitoring	• A complaints register to be kept on site and filled in. • ECO to monitor and report on the complaints register log	

OBJECTIVE C15: Stimulate and enhance positive socio-economic impacts during the construction phase

Project component/s	PV facility All linear infrastructure
Potential Impact	High local economic benefits
Activities/risk sources	Construction procurement practices
Mitigation: Target/Objective	» Employ local community members as far as possible » Stimulate the local economy

Mitigation: Action/control	**Responsibility**	**Timeframe**

Mitigation: Action/control	Responsibility	Timeframe
Increase the local procurement practices and employment of people from local communities as far as feasible to maximise the benefits to the local economies.	Developer and contractors	Construction
Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods, and products from local suppliers where feasible.	Developer and contractors	Construction
Inform the local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for.	Developer and contractors	Construction
Sub-contract to local construction companies where possible	Developer and contractors	Construction
Use local suppliers where feasible.	Developer and contractors	Construction
As much local labour as possible, should be considered for employment to increase the positive impact on the local economy	Developer and contractors	Construction
Facilitate knowledge and skills transfer between workers	Developer and contractors	Construction
Implement apprenticeship programmes to build onto existing or develop new skills of construction workers, especially those coming from the local communities	Developer and contractors	Construction

Performance Indicator	» Developer has engaged with local authorities and business organisations. » Percentage of the expenditure spent on the project spent in the local communities versus the entire nation. » Percentage of labour force employed from local community. » Number of contracts signed between contractor and the local construction companies to supply goods and services directly used in the construction and support of site activities
Monitoring	» Developer to appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

6.3 Detailing Method Statements

OBJECTIVE C16: To ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMPr.

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors 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 Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". 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
» 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 areas to be addressed in the method statement pre, during and post construction include:

» Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and to be established etc. Including a site camp plan indicating all of these).

- Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.
- Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions)
- Stipulate the storm water management procedures recommended in the storm water management method statement.
- Ablution facilities (placement, maintenance, management and servicing)
- Solid Waste Management:
  - Description of the waste storage facilities (on site and accumulative).
  - Placement of waste stored (on site and accumulative).
  - Management and collection of waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - The design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
  - Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed of, link into an existing facilities where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into wetlands or natural watercourses.
- Dust and noise pollution
  - Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
  - Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
  - Lists of all potentially hazardous substances to be used.
  - Appropriate handling, storage and disposal procedures.
  - Prevention protocol of accidental contamination of soil at storage and handling areas.
  - All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- Fire prevention and management measures on site.

» Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary).
  * Rehabilitation and re-vegetation process.
» Incident and accident reporting protocol.
» General administration
» Designate access road and the protocol on while roads are in use.
» Requirements on gate control protocols.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

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 should monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

6.4 Awareness and Competence: Construction Phase of the Solar Facility

OBJECTIVE C17: 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 Contractor is 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.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training session.

» The training session 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 to be necessary by the ECO.
» Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" are erected at prominent locations throughout the site.
» Records must be kept of those that have completed the relevant session.
» 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:

7.4.1. 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 - such as, the 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 Safety manager/ officer on site.

7.4.2. 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.

6.5 Monitoring Programme: Construction Phase of the Solar Facility

OBJECTIVE C18: 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 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.

The following reports will be applicable:

7.5.1. 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.

7.5.2. 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.

7.5.3. 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 and the requirements of the EMPr.

MANAGEMENT PROGRAMME: REHABILITATION CHAPTER 7

7.1. Overall Goal for the Rehabilitation of Disturbed Areas

Overall Goal for the Rehabilitation of Disturbed Areas: 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.

7.2. Objectives

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

OBJECTIVE R1: To ensure rehabilitation of disturbed areas

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. Refer to Appendix C for a rehabilitation plan.

Project Component/s	» PV Array supports and trenching » Grid connection and associated servitudes » Access roads » Workshop, guardhouses, substation and other related infrastructure » Potential topsoil stockpiles and/or borrow pits
Potential Impact	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	» Temporary construction areas. » Temporary access roads/tracks. » Other disturbed areas/footprints.
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas. » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.

Mitigation: Action/Control	Responsibility	Timeframe
All temporary facilities, equipment, and waste materials	Contractor	Following

Mitigation: Action/Control	Responsibility	Timeframe
must be removed from site.		execution of the works
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
A rehabilitation plan (see Appendix C) should be drawn up that specifies the rehabilitation process.	Contractor, Developer	Pre-construction
Rehabilitate and re-vegetate all disturbed areas at the construction equipment camp when construction is complete within an area.	Contractor	Following completion of construction activities in an area
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. .	Contractor, ECO	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Developer	Post-rehabilitation
Erosion control measures should be used in sensitive areas such as steep slopes, hills and drainage lines where necessary.	Developer	Post-rehabilitation
On-going alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Developer	Post-rehabilitation

Performance Indicator	» All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised where practicable or required after construction and temporally utilised areas. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Completed site free of erosion and alien invasive plants.
Monitoring	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented during the operational lifespan of the facility. » On-going alien plant monitoring and removal should be undertaken on an annual basis.

MANAGEMENT PROGRAMME: OPERATION CHAPTER 8

8.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the Solar 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 Solar Facility in a way that:

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

8.2. 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	» Movement of employee vehicles within and around site.

Source	» 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
Vehicle movements must be restricted to designated roadways.	Operator	Operation
No disturbance of vegetation outside of the project site must occur.	Operator	Operation
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 (refer to **Appendix E**).	Operator	Operation
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis.	Operator in consultation with Specialist	Annual monitoring until successful re-establishment of vegetation in an area
All cable trenches, excavations through sensitive areas should be excavated carefully in order to minimise damage to surrounding areas and biodiversity. » The trenches must be checked on a daily basis for the presence of trapped animals. » 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. (Note: DENC or the McGregor Museum in Kimberley could be approached for *advice* on relocating animals if required) » 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	Contractor / ECO	Operation

A botanist familiar with the vegetation of the area should monitor the vegetation composition and – density immediately adjacent to new infrastructure and decide on additional revegetation measures that may be required to maintain sufficient vegetation to prevent habitat degradation and accelerated erosion, especially underneath/around PV panels.	Operator in consultation with Specialist	Annual monitoring until successful re-establishment of vegetation in an area

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

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. Indigenous invasive species that need to be controlled include: *Acacia mellifera* subsp. *mellifera,* and *Rhigozum trichotomum.* Alien invasives that must be controlled and eradicated to prevent degradation include *Nicotianan glauca, Prosopis glandulosa, Salsola kali.* Weeds and potentially invasive species on and around the site that need to be monitored and managed include: *Melia azedarach, Tribulus terrestris, Alternanthera pungens.* An Alien Invasive Management Plan in attached to Appendix E.

Project Component/s	» PV Array » Grid connection and associated servitudes » Temporary construction camps » Workshops and/or other permanent infrastructure » Access roads
Potential Impact	» Impacts on natural vegetation. » Impacts on soil. » Impact on faunal habitats. » Loss of agricultural potential.
Activity/Risk Source	» Transport of construction materials. » 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.
Mitigation: Target/Objective	» To avoid the introduction of additional alien invasive plants to the project control area. » To avoid further distribution and thickening of existing alien plants 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 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 revegetation plan » Do not import soil from areas with alien plants	Operator	Construction phase 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	Construction phase Operational phase
» Immediately control any alien plants that become newly established using registered control measures	Operator	Construction phase 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 the environmental manager 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: 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 H).

Project Component/s	» PV panels. » Power line. » 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
Implement an appropriate stormwater management plan (Appendix B)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 operation phase ECO

OBJECTIVE OP4: 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.

Project Component/s	» 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 Source	» Transformers and switchgear for the substations. » 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
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.

OBJECTIVE OP5: To avoid and or minimise the potential impacts of the power line during maintenance events

The expected lifespan of the proposed power line is approximately 40 years, depending on the maintenance undertaken on the power line structures. During the life-span power line, on-going maintenance is performed. Power line inspections are undertaken on an average of 1 – 2 times per year, depending on the area. During this maintenance period, the line is accessed via the access routes established during the construction phase. Maintenance of the power line is required to be undertaken in accordance with the specifications of this EMPr.

The management of power line servitude is dependent on the details and conditions of the agreement between the project development company, the landowner and Eskom, and are therefore site-specific. These may, therefore, vary from one location to another. However, it is a common occurrence that there is a dual responsibility for the maintenance of the servitude:

» Eskom will be responsible for the tower structures, maintenance of access roads, watercourse crossings, and gates and fences relating to servitude access.
» The landowner will retain responsibility for the maintenance of the land and land use within the servitude (e.g. cropping activities, veld management).

Exceptions to the above may arise where, for example dual use is made of the access roads and gates or specific land use limitations are set by Eskom within the servitude

which directly affects the landowner. Maintenance responsibilities are, ultimately, clearly set out in the servitude agreement. Once agreed upon, these maintenance agreement conditions must be deemed to form part of this EMPr and must be adhered to at all times.

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	» Power Line Servitude
Potential Impact	» Disturbance to or loss of fauna and/or habitat » Increased erosion
Activity/risk source	» Management of power lines servitude area
Mitigation: Target/Objective	» To minimise disturbance of natural vegetation/habitats within the servitude » To minimise erosion

Mitigation: Action/control	Responsibility	Timeframe
Utilise existing access roads as far as possible	Operator (Eskom) and maintenance contractors	Operations & Maintenance
Clear servitude of alien vegetation along power line servitude and implement an appropriate alien plant management plan.	Operator (Eskom) and maintenance contractors	Operations & Maintenance
Implement appropriate erosion management measures within the servitude area. he servitude and its access route must be monitored for signs of erosion, and signs of erosion remedied immediately	Operator (Eskom) and maintenance contractors	Operations & Maintenance
Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, and shade nets	Operator (Eskom) Operator	Operations
» Marking powerlines appropriately (with bird flight diverters) to increase visibility to birds. » Minimising length of powerlines as much as possible. » Ensuring powerlines are properly insulated and bird friendly prior to installation. » Responding rapidly to high risk sections of powerlines where collision mortalities are high.	Operator (Eskom) /Developer	Operations & Maintenance

Mitigation: Action/control	Responsibility	Timeframe
» For vegetation clearance/trimming (e.g. protected plants and trees), a permit must be obtain all relevant permits	Developer	Operations & Maintenance

Performance Indicator	» Limited disturbance to natural vegetation/habitats within the servitude area
Monitoring	» Annual monitoring must be carried out together with monitoring of the remainder of the development to detect and eradicate new infestations of alien plant species before they become well established and may spread » Monitoring of erosion within servitude.

OBJECTIVE O6: Minimise the potential negative impact on farming activities and on the surrounding landowners

Once operational, the negative impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (i.e. the increase in traffic to and from site, possible dust creation of vehicle movement on gravel roads on site and possible increase in criminal activities). The number of workers on site on a daily basis is anticipated to have minimal negative social impacts in this regard.

Some positive impacts will be experienced with farmers gaining more access to land through the high quality site roads. Farmers involved with the project will also receive additional income, which can be invested into farming activities.

Once construction is completed, negative impacts on farming activities on the site must be limited as far as possible.

Project Component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners. » Impact on farming activities on site.
Potential Impact	» Limited intrusion impact on surrounding land owners. » Interference with farming activities on site.
Activities/Risk Sources	» Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents. » Operational activities on site could interfere with farming activities of landowner.
Mitigation: Target/Objective	» Effective management of the facility. » Communication with landowner and local farming bodies regarding operational activities. » Mitigation of intrusion impacts on property owners.

	» Mitigation of impact on farming activities.

Mitigation: Action/Control	Responsibility	Timeframe
Effective management of the facility and accommodation facility to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services.	Operator	Operation
Vehicle movement to and from the site should be minimised as far as possible.	Operator	Operation
Local roads should be maintained to keep the road surface up to a reasonable standard.	Operator	Operation
Limit the development of new access roads on site.	Operator	Operation
Ensure on-going communication with the landowners of the site in order to ensure minimal impact on farming activities	Operator	Operation

Performance Indicator	» No environmental pollution occurs (i.e. waste, water and sanitation). » No intrusion on private properties and on the activities undertaken on the surrounding properties. » Continuation of farming activities on site.
Monitoring and reporting	» Operator should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met.

MANAGEMENT PROGRAMME: DECOMMISSIONING CHAPTER 9

The solar infrastructure which will be utilised for the proposed Solar 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.

9.1. 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.

9.2 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	» 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

FINALISATION OF THE EMPR CHAPTER 10

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 of the Solar Facility development area and power line. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features.

APPENDIX A:
STORMWATER MANAGEMENT PLAN

Stormwater, Wastewater and Erosion Management Plan for AEP Bloemsmond Solar 1

Report Prepared for

AEP Bloemsmond Solar 1 (Pty) Ltd

Report Number 495722/1

Report Prepared by

srk consulting

October 2015

Stormwater, Wastewater and Erosion Management Plan for AEP Bloemsmond Solar 1

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SRK Project Number 495722/1

October 2015

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Executive Summary

This report documents the stormwater, wastewater and erosion management plan (shortened to SWMP) for the AEP Bloemsmond Solar 1, a proposed solar power generation facility planned on portions 5 and 14 of the farm Bloemsmond 455 in the Northern Cape of South Africa. The facility will include a substation, offices, a control room, a workshop, a warehouse and solar panel arrays, with the arrays accounting for the bulk of the development area. The SWMP aims to facilitate protection of surface water resources and covers two options for the development area and the access road as indicated in Figure 1.

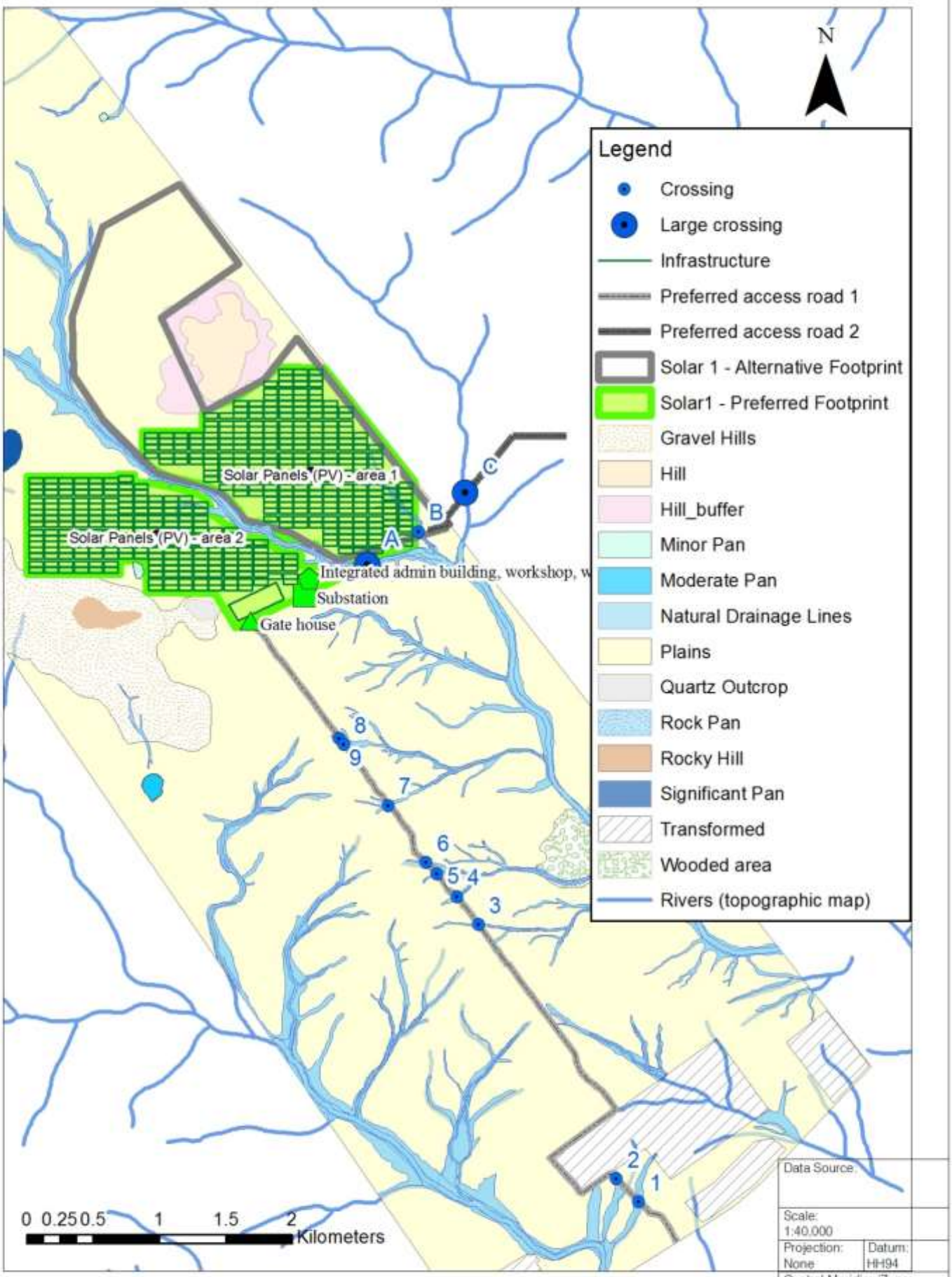
The first step in SWMP development is an analysis of the site and proposed facilities. The analysis found that the proposed facilities are likely to have an intrinsically low impact on surface water resources because:

- The vegetation, soil and topography will remain mostly undisturbed;
- The site and roads are well placed such that they lie mostly outside of the natural watercourses (Figure 1) and most river crossings will have low flows;
- Water use at the site, with the potential to generate runoff, such as solar panel washing, is negligible in volume compared to stormflows;
- Sewage and landfill waste will be taken offsite for disposal;
- Rainfall in the area is low and few steep gradients exist.

Despite the low impact on surface water resources, some potential impacts are possible including:

- Dirty areas will exist which could contribute to contamination including:
    - Transformers which could leak oil,
    - The workshop which may store oils or lubricants that could enter wash down water;
    - The sewage conservancy tank which could overflow.
- Erosion where stormwater drains discharge to the natural environment or around stockpiles – estimated stormflow indicated that erosion could be significant without proper detailed design;
- Road crossings (Figure 1), which could exacerbate erosion without proper design, were identified – two of these crossed drainage lines with larger peak flows;
- Disruption of flow, and possibly erosion, if infrastructure is placed within water courses or if infrastructure is placed within the 1:100 year flood line especially given the relatively large stormpeaks calculated in combination with the flat topography which could result in wide floodways during larger events.

Based on the potential impacts, as well as legal requirements and best practice guidelines, specific objectives were developed for stormwater and erosion management. A plan was then developed to address each objective such that surface water resources will be protected. The objectives, as well as the plan, are shown in Table 1 for the operational phase of the project, and in Table 2 for the construction phase of the project.



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AEP Bloemsmond Solar 1 SWMP

Layout, hydrology and road crossings

Date: 10/10/2015	Compiled by: MAYE
Project No. 495722	Fig No. 1

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Table 1 Summary of the operational SWMP plans

Objective	Plan to meet objective
Keep clean water clean	Construct stormwater drains to divert clean runoff around the workshop, transformers and wastewater conservancy tank
Collect and treat any dirty water (waste water management)	Bund transformers and contaminants in the workshop; Include an oil and grease trap for any wash water exiting the workshop area; Capture and treat oil and grease from the workshop and oil from the transformers offsite; Dispose and treat wastewater by collection in a conservancy tank (with overflow tank) and transport to municipal treatment works.
Do not impede natural surface or subsurface flows	Minimise dirty areas by placing clean water diversions as close to these as possible; Ensure any engineered drainage delivers clean stormwater to the drainage line it would have reached before the development.
Control erosion and dissipate stormwater	Design channels such that 1:50 year flows do not present undue erosion risks; Design proper sediment transport controls from any stockpiles from piling spoils; Design crossings (concrete drifts for larger crossings) such that 1:50 year flows do not present undue erosion risks; Dissipate energy at stormwater drainage outlets
Monitor and manage erosion, wastewater and stormwater	Inspect the site for erosion, leaks or spills and oil and grease trap capacity every 3 months in the first 2 years of operation and annually thereafter; Install a rain gauge, collect rain data and inspect the site for erosion after any rainfall event exceeding a 10 year return period storm or where damage has been noticed; Install a float switch alarm system on wastewater conservancy tank to prevent overflow; Annual brief training of staff and incorporation of well-placed signage, to facilitate reporting.
General	Ensure no infrastructure is built in the 1:100 year floodline on major watercourses unless it can withstand a 1:100 year flood without causing undue erosion and does not contain potential pollutant sources (transformers, workshop, conservancy tank) Do not build infrastructure containing potential pollutants (transformers, workshop, conservancy tank) in any of the natural drainage lines indicated in Figure 1; Review and improve the stormwater management plan every 5 years.

Table 2 Summary of the SWMP plans for construction

Objective	Plan to meet objective
Keep clean water clean	Excavate clean water diversion channels to direct clean runoff around dirty areas such as stockpiles and laydown areas.
Collect and treat dirty water	Construct silt fences or berms to prevent the sediment transport into rivers; Dispose of general waste, oils and other contaminants offsite; Supply chemical toilets ; Construct temporary bunds for potential contaminants.
Do not impede natural surface or subsurface flows	Minimise laydown areas and stock piles; Ensure that any temporary stormwater drains or diversion berms direct water towards the drainage line to which it would naturally flow.
Control erosion and dissipate stormwater	Disturb the natural topography, soil or vegetation as little as possible. Drains sloped and sized such that velocities do no exceed 1 m/s in a 1 in 5 year event Build roads and road crossings, including any dissipaters, before other infrastructure.
Monitor and manage erosion, wastewater and stormwater	Regularly inspect the site for leaks and erosion Install a rain gauge and inspect the site for erosion after rain events and remediate if necessary. Brief training for all construction staff including who to contact if erosion or leaks are found.
General	Do not place laydown areas, stockpiles or other materials in the 1:100 year floodline of the larger rivers or within any natural drainage lines.

The plan for the preferred and the alternative development areas will be the same in all respects except for river crossings. However, the differences between the two road options are not marked – Access Road 1 will largely require minor crossings whereas Access Road 2 will require fewer crossings but an additional larger crossing. Hence, from a stormwater point of view, there is no significant difference between the different options and selection of these should be based on other factors. The report concluded that stormwater impacts can be managed at the site in a practical way that will protect water bodies and minimise erosion. It is recommended that the stormwater management plan be further developed with detailed designs that have sufficient detail to confirm conceptual plans. The plan will be incorporated into an environmental specification for use during construction, and be implemented during operation of the facility.

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by AEP Bloemsmond Solar 1. The opinions in this Report are provided in response to a specific request from AEP Bloemsmond Solar 1to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

1 Introduction

This report documents the stormwater, wastewater and erosion management plan (shortened to SWMP) to be implemented at the AEP Bloemsmond Solar 1 facility, a proposed solar power generation facility in the Northern Cape of South Africa. It is a conceptual level plan, based on practical considerations, regulations and best practice guidelines and is developed to manage stormwater at the site during construction and operation.

2 Objectives and scope of the report

2.1 Objectives

The objective of this report is to document a stormwater, wastewater and erosion management plan that protects the surface water resources, manages erosion risks and complies with regulations and guidelines for the construction and operational phases of the AEP Bloemsmond Solar 1 facility.

2.2 Scope

This report covers the following scope:

- The site covered by the report lies on portion 5 and 14 of the farm Bloemsmond 455 in the Northern Cape of South Africa;
- The report covers the site and any catchments contributing to the site;
- The report covers both a preferred and an alternative development area as well as preferred road 1 and preferred road 2 alignments;
- The report covers both the construction and operation phases of the project;
- The management plan is conceptual at this stage, as detailed survey is outstanding – however, the conceptual designs have been developed specifically for the project and its particular needs.

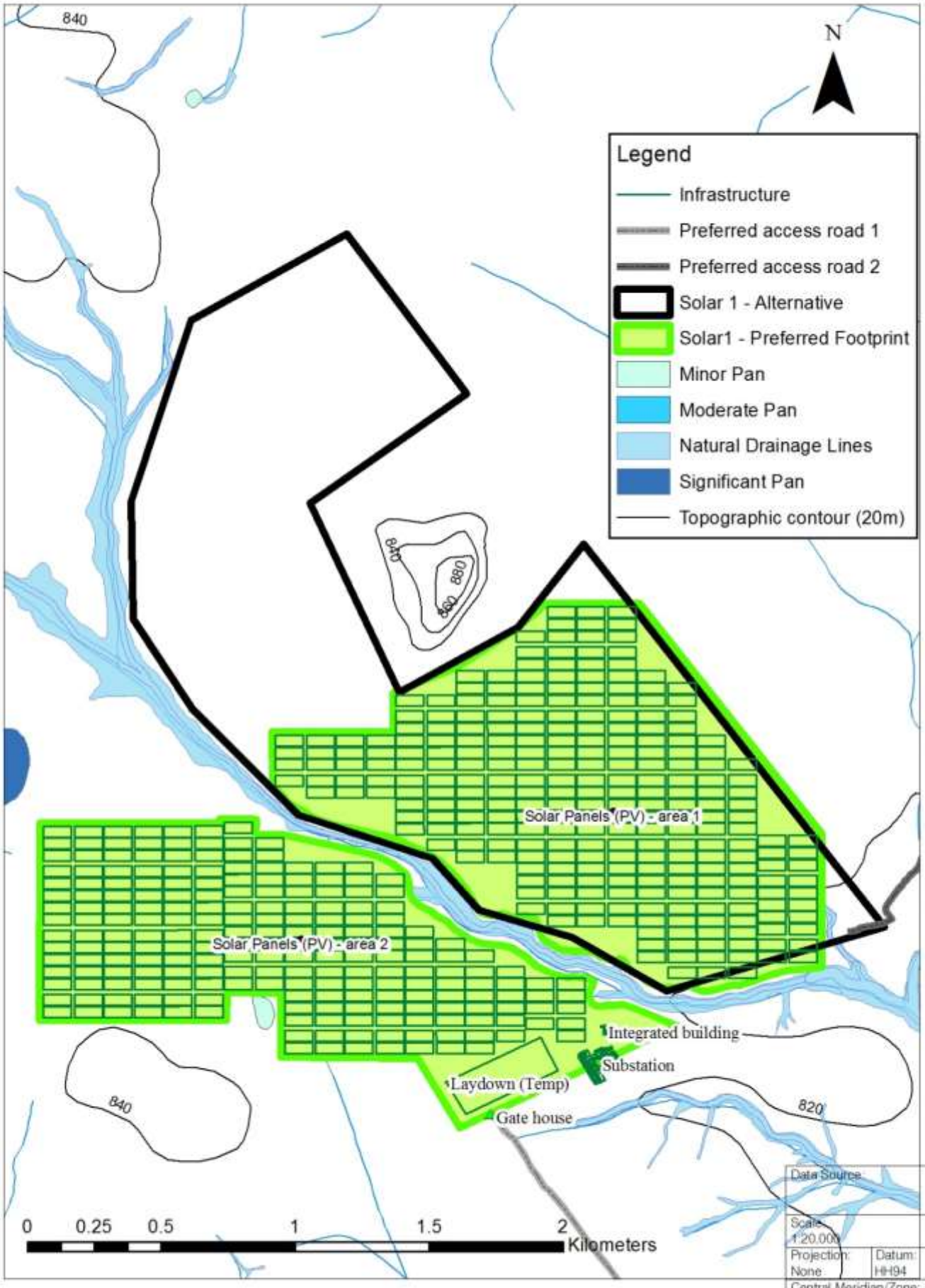
3 Supporting information

This section summarises all the information and assumptions upon which the SWMP is based. This section is included because the plan is developed by matching regulations and guidelines to the specific needs of the project and the specific natural conditions at the site and hence the information is key to understanding the plan. The relevant information can be divided into:

- Project information;
- Guidelines and regulations;
- Natural characteristics at the site.

3.1 Project information

The site information was obtained from the Background Information Document (Savannah Environmental, June 2015) and the Final Scoping Report (Savannah Environmental, July 2015). Further site information was provided by the client in the form of electronic maps and discussions with design engineers. The layout of the site is shown in Figure 3-1. The development area of the facility is anticipated to be approximately 281 hectares with about 240 hectares of actual footprint.



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Date: 10/10/2015	Compiled by: MAYE
Project No. 495722	Fig No. 3-1

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AEP Bloemsmond Solar 1 SWMP

Site Layout

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Revision: A Date: 00 00 2011

The infrastructure at the site and the associated potential pollutants are as follows:

- A security entrance with a small toilet and a conservancy tank for wastewater;
- An electrical substation including transformers containing oil;
- About 40 medium-voltage inverter stations located between the panels. Transformers within the stations will contain oil. However, these will be housed within containers otherwise protected from rainfall;
- A main facilities area made up of a complex of buildings including:
    - Administration offices and a control room;
    - Toilets;
    - A workshop for minor repairs where small quantities of oils and lubricants may be used;
    - A warehouse storing spare parts for the solar panels but no contaminants;
    - One clean 10 000 litre water tank with drinking water tanked in from the municipal water treatment plant;
    - Another 5 tanks with water from boreholes to be used for toilets, washing of solar panels and other general uses.
    - A conservancy tank to collect waste water from the toilets – waste water will be taken offsite for treatment.
- Photovoltaic cells with mounting structures. These will be washed about twice a year with water from boreholes on the site or water trucked in from the local municipality supply point. The volume of wash water is approximately 3 l/m^2 per wash for each 1.95 m^2 panel and it is expected that 287,500 panels will be installed (AEP Bloemsmond Solar 1, 2015). No additives will be used in the wash water;
- Cabling between the projects components to be laid underground where practical;
- A 132 kV power line between the on-site substation and the Eskom grid connection point;
- Roads
    - Existing roads will be used as access roads but will be upgraded to 6 m wide with gravel surfacing;
    - 5 m wide roads within the site, running between the solar panel blocks will need to be built.

  During construction the following will be added:
    - A temporary laydown area;

Contaminants considered a high risk to stormwater that were considered, but ruled out, include fuel and acids. Neither will be stored or used on site. General waste will only be stored temporarily and taken offsite regularly for disposal at landfill.

3.2 Legislation and guidelines

Stormwater management plans are generally required as part of Environmental Management Plan (EMPr) and for Water Use License Applications. This SWMP was specifically requested as part of any EMPr in a letter from the Department of Environment (DEA reference 14/12/16/3/3/2/815).

The SWMP was developed based on the guidelines in the Best Practice Guidelines (DWAF, 2006) and the guidelines for human settlement planning and design as well as specific requests in the letter from the DEA. The plan was also developed in compliance with the National Water Act and specifically Regulation 704 which applies to mining and associated activities but includes principles that should be applied at all sites. Municipal regulations, which usually lay down specific standards for each municipality, but still adhere to the overall principles of the regulations and guidelines above, will be consulted during detailed design.

3.3 Natural conditions

3.3.1 Climate

The site lies in an arid to semi-arid climatic region with average annual rainfall below 200 mm per year.

3.3.2 Design rainfall

Design rainfall data was extracted from the Design rainfall estimation software (Gorven 2002) and is shown in Table 3-1 below. The values were interpolated from the six closest stations, all of which had long records of 30 to 96 years with the closest station, Geelkop 0283098W, less than 6 km away.

Table 3-1 Design rainfall data (mm) interpolated from the six closest stations

Design Rainfall Data (mm) interpolated from six closest stations							
Mean annual rainfall	152 mm		Latitude	-28.587237 degrees			
Altitude	775 mamsl		Longitude	21.040049 degrees			
Storm duration	**Return Period (Years)**						
	2	**5**	**10**	**20**	**50**	**100**	**200**
5 minutes	5.9	9.3	11.8	14.4	18.1	21.1	24.4
15 minutes	11.1	17.3	22	26.8	33.7	39.3	45.4
1 hour	16.5	25.9	32.9	40.1	50.3	58.8	67.9
1.5 hours	18.6	29.2	37	45.1	56.6	66.1	76.4
2 hours	20.2	31.7	40.2	49	61.6	71.9	83
8 hours	26.2	41.2	52.1	63.6	79.9	93.3	107.7
24 hours	32.2	50.6	64.1	78.2	98.2	114.6	132.4
5 day	36.8	57.8	73.2	89.3	112.2	131	151.3

3.3.3 Landforms and stream morphology

Landforms influence runoff because steeper areas generate more stormflow, whereas water flows slowler in flatter areas, thus allowing more opportunity for infiltration. The typical landscape of the site is open plains, with low rocky hills in a few areas (Figure 3-2 and Figure 3-3). The topographical contours indicate a slope of less than 3 % over most of the area. The drainage lines and stream morphology in the area consist of ephemeral washes with deep sandy soil and indistinct channels (Figure 3-4). For the purposes of stormflow estimation the site was assumed to be mostly flat, with localised steeper areas.

Figure 3-2 Plains that dominate most of the site (Savannah Environmental, July 2015)

Figure 3-3 Low hills that exist in some areas of the site (Savannah Environmental, July 2015)

Figure 3-4 Empheral drainage line showing deep sandy soils and little channelization

3.3.4 Soil

Soil type influences soil permeability which, in turn, influences how much water will infiltrate or runoff in a storm event. The soil type and permeability was obtained from the agricultural study which investigated the general characteristics of soils in the area (Savannah Environmental, Draft 2015). From a hydrological point of view, most of the site and the catchments contributing to the site are covered by well-drained sandy soil, although a small portion of the northern part of the farm includes soils that are quite shallow and sandy to loamy. These conclusions were substantiated by photographs from the site shown in Figure 3-5 to Figure 3-7. Based on this, and erring on the conservative side, the overall soil condition was considered to be medium permeability for the purposes of stormflow estimation.

Figure 3-5 Soil type that covers most of the preferred and alternative layouts of AEP Bloemsmond Solar 1 (Savannah Environmental, Draft 2015)

Figure 3-6 Deep sandy soils in the southern portion of the farm (Savannah Environmental, Draft 2015)

The erodibility of the soil in the area could not be conclusively classified without detailed investigations (Savannah Environmental, Draft 2015). Some minor erosion was, however, noted (Figure 3-7).

Figure 3-7 Eroded ephemeral drainage line embankment with weak soil structure containing a low clay percentage (Savannah Environmental, Draft 2015)

3.3.5 Land use and vegetation

The main land use in the area around the site is for stock grazing. This will have some impact on the runoff of stormwater from the catchment as livestock tend to compact and harden the earth. The vegetation in the area is mostly shrubby grassland (Savannah Environmental, July 2015). Photographs of the typical vegetation are shown in Figure 3-5 and Figure 3-8. Note the very sparse vegetation in some areas.

Figure 3-8 Typical vegetation in the area (Savannah Environmental, July 2015)

4 SWMP development

4.1 Step 1: Development of specific objectives

The specific objectives were developed based on the laws and guidelines covered in Section 3.2 and specific requests outlined in a letter from the Department of Environment (DEA reference 14/12/16/3/3/2/815).

The specific objectives are as follows:

- Keep clean water clean by diverting any clean runoff around any potentially dirty areas. The diversion should be designed for a 1 in 50 year event for operation;
- Collect and treat discharge water or runoff from any dirty areas. Dirty water should not be likely to spill into clean water systems more than once every fifty years;
- Bund any hazardous substances or pollutants including any oils as per regulations;
- Do not impede surface or subsurface water flows:
    - Minimise dirty areas such that surface and subsurface movement of water along the drainage lines is not reduced;
    - Ensure any engineered clean stormwater drainage directs water to the naturally receiving drainage line.
- Erosion control:
    - Prevent erosion in general, and minimize erosion in large storm events of 1 in 50 years or greater;
    - Dissipate stormwater energy at all drainage outlets to velocities that are unlikely to cause erosion in a 1 in 50 year storm event (i.e. <1 m/s).
- Monitoring and management
    - Include an erosion monitoring plan that ensures that any noticable erosion is detected and rehabilitated within 6 months, and any acute erosion due to large storm events is detected within two weeks;
    - Include a monitoring system for spills and leaks such that they are detected and remediated as soon as practically possible.
- General
    - Ensure no infrastructure is built in the 1:100 year floodline on major watercourses unless it can withstand a 1:100 year flood without causing undue erosion and does not contain potential pollutant sources;
    - Do not build infrastructure containing potential pollutants in any of the natural drainage lines;
    - Review and improve stormwater management plan regularly.

4.2 Step 2: Technical situation analysis and evaluation

4.2.1 Analysis of potential stormwater, wastewater and erosion impacts

An overall analysis of the data and plans for the site provides the following conclusions on potential impacts:

- The facility presents a very low risk to surface water resources because:
    - The development will leave the natural vegetation, soil conditions and topography largely undisturbed;
    - The site and roads have been well placed such that they lie mostly outside of the natural water ways and most river crossings are over very small rivers characterised with small catchments and thus low flows;
    - Sewage and landfill waste will be taken off site for disposal;
    - Rainfall in the area is low and few steep slopes exist.
- Some potential impacts do exist including:
    - Possible contamination of stormwater by:
        - Oil leaks from the transformers;
        - Oil and lubricant in wash down water from the workshop;
        - Overflow of wastewater from the conservancy tanks;
    - Potential for erosion:
        - Where any stormwater drains discharge into rivers or onto the natural land surface;
        - At river / road crossings.
    - Potential exists to impede and disrupt flow if infrastructure is placed within water courses;
    - Potential exists to damage infrastructure and exacerbate erosion if infrastructure is placed within the 1:100 year flood line.

4.2.2 Delineation of clean and dirty areas

The site was divided into clean and dirty areas as follows:

- Dirty areas:
    - The workshop because oils and lubricants may be stored and used in the workshop;
    - The medium-voltage 40 transformers (at the inverter stations) placed around the site because these will contain oil;
    - Transformers at the substation because they will contain oil;
    - The conservancy tank because it will contain sewage.
- Clean area:
    - Areas outside of those stated above.

4.2.3 Delineation of catchments and identification of road crossings

Road crossings were identified for all the roads that will be upgraded or built as part of the project, and that were available at the time of writing. Note that the roads, and thus river crossings are conceptual at this stage, and their locations approximate. However, the roads will have to cross rivers and the number of crossings will likely be the same as shown in this report. It is extremely unlikely that minor modifications in road position will change the assessments and conclusions in this report. Also note that most of the road crossings are over minor natural drainage lines near the source of their flow and will experience very low velocity flows. The relevant roads are the preferred access road 1 and 2. More crossings might be necessary for the internal roads in the solar panel areas for which only preliminary layouts are available. Hence crossings were not delineated for these internal roads at this stage. However, it is possible to conclude that any internal road crossings will be minor and that conceptual designs provided in this report will be more than sufficient for these crossings. The crossings are shown in Figure 4-1, and their locations provided in

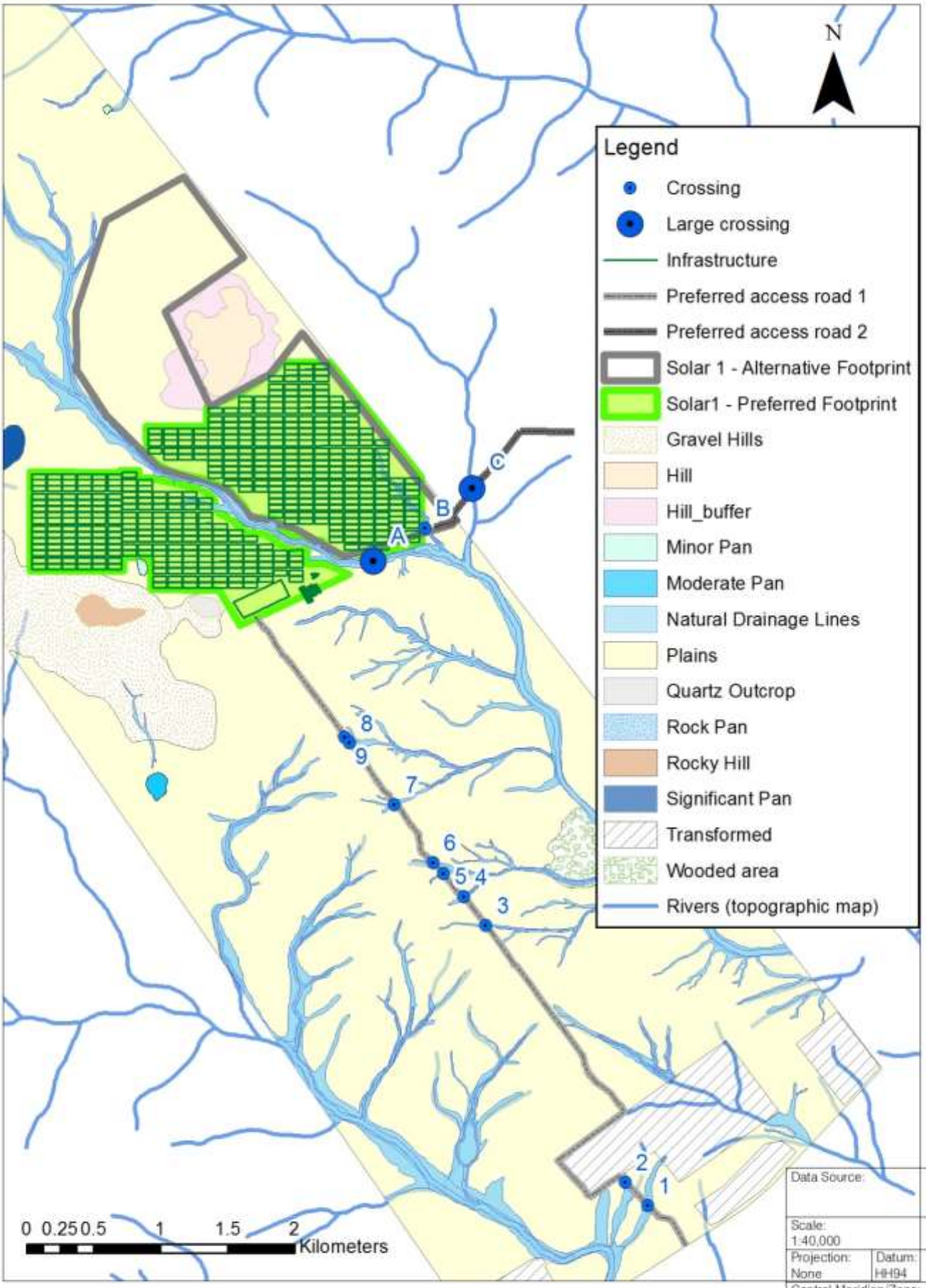
Table 4-1 below. Note that the drainage lines in the figure are, wherever possible, the drainage lines delineated during the scoping study (Savannah Environmental, July 2015).

Table 4-1 River crossings with approximate latitude and longitude

Name	Type	Road	Latitude	Longitude
1	Crossing	Preferred access road 1	-28.6290047096	21.0654266843
2	Crossing	Preferred access road 1	-28.6274480998	21.0639174821
3	Crossing	Preferred access road 1	-28.6102182890	21.0545803705
4	Crossing	Preferred access road 1	-28.6083052023	21.0531193814
5	Crossing	Preferred access road 1	-28.6067633116	21.0517488119
6	Crossing	Preferred access road 1	-28.6060109104	21.0510298869
7	Crossing	Preferred access road 1	-28.6021376394	21.0484556378
8	Crossing	Preferred access road 1	-28.5980016446	21.0454476714
9	Crossing	Preferred access road 1	-28.5975928689	21.0451101156
A	Larger crossing	Preferred access road 2	-28.5858247701	21.0470358882
B	Crossing	Preferred access road 2	-28.5835821109	21.0505016465
C	Larger crossing	Preferred access road 2	-28.5809278394	21.0536603076

The following catchments were delineated:

- Conceptual stormwater catchments of the preferred and alternative development areas – for these, the area was divided into sections depending on the nearest receiving watercourse (Figure 4-2);
- Catchments of the major rivers where they cross any of the upgraded roads (A and C in Figure 4-3);
- The receiving catchment close to where it discharges to the Orange River complex.



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Central Meridian/Zone: N/A	
Date: 10/10/2015	Compiled by: MAYE
Project No. 495722	Fig No. 4-1

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AEP Bloemsmond Solar 1 SWMP

Road crossings

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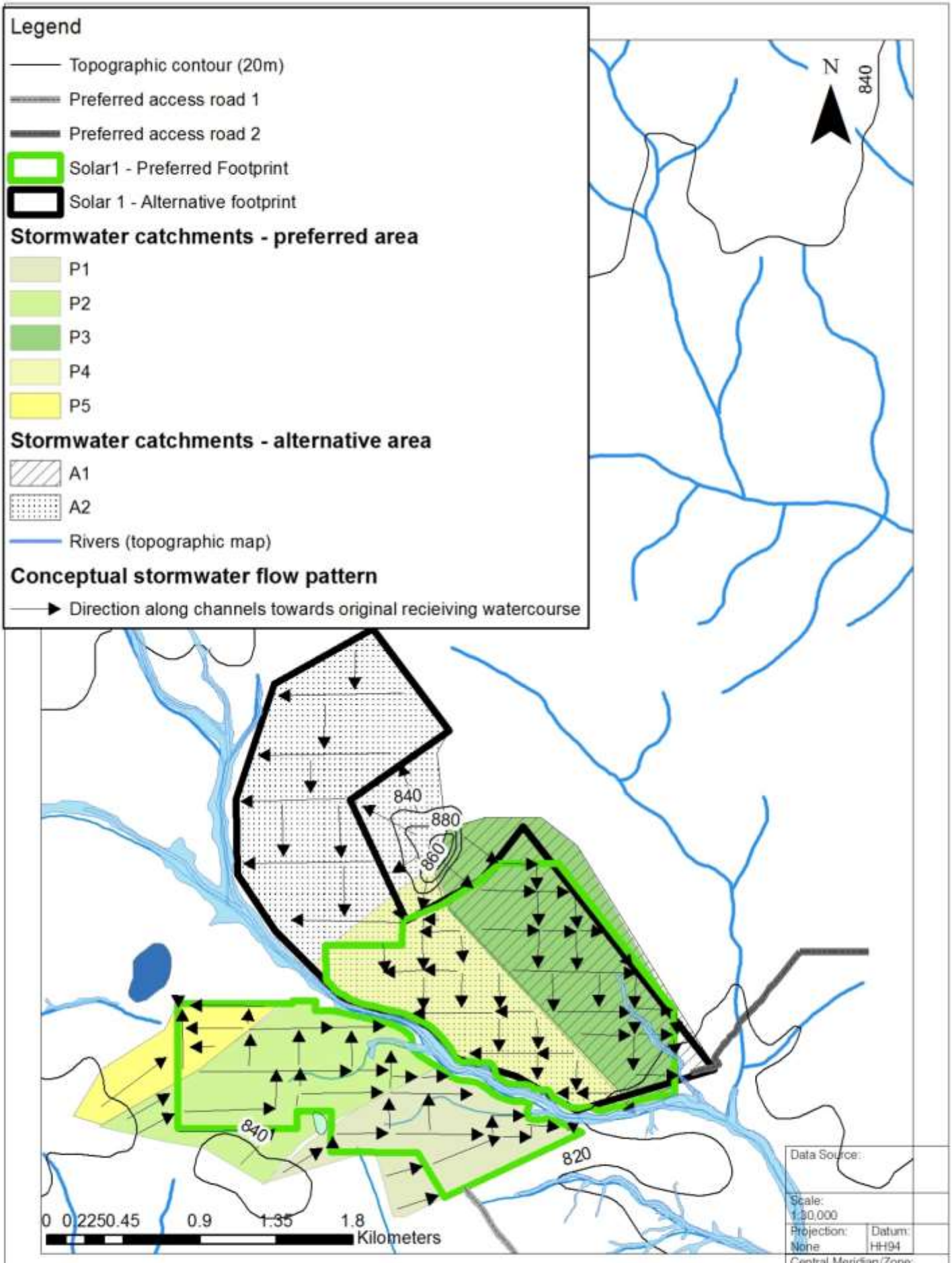
Revision: A Date: 00 00 2011


Legend
Topographic contour (20m)
Preferred access road 1
Preferred access road 2
Solar1 - Preferred Footprint
Solar 1 - Alternative footprint
Stormwater catchments - preferred area
P1
P2
P3
P4
P5
Stormwater catchments - alternative area
A1
A2
Rivers (topographic map)
Conceptual stormwater flow pattern
Direction along channels towards original recieiving watercourse
N
840
840
880
860
840
820
0 0.2250.45 0.9 1.35 1.8
Kilometers
Data Source:
Scale:
1:30,000
Projection:
None
Datum:
HH94
Central Meridian/Zone:
N/A
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AEP Bloemsmond Solar 1 SWMP
Stormwater catchments
Date:
10/10/2015
Compiled by:
MAYE
Project No.
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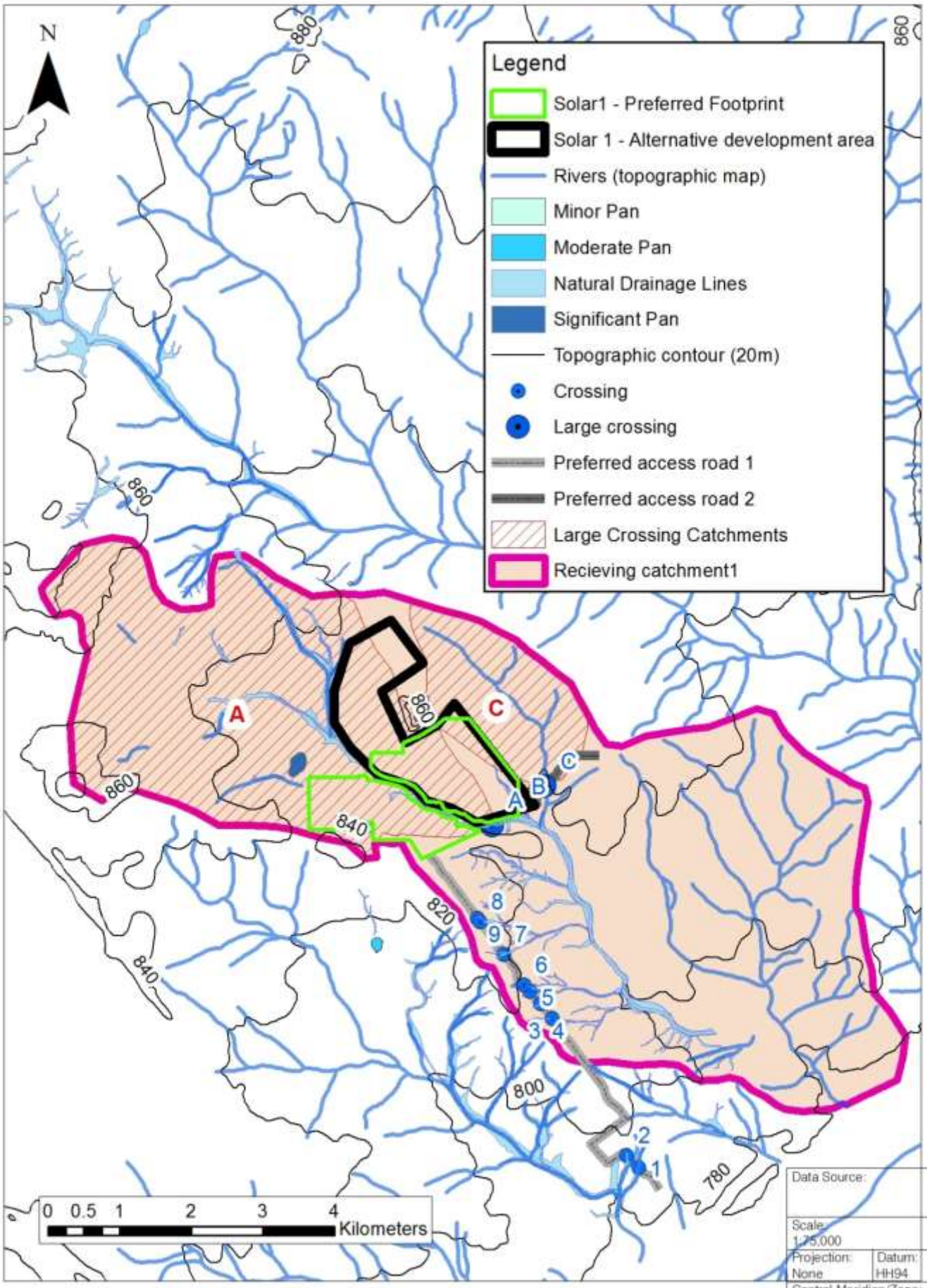
Fig No.
4-2
Path: E:\495722_BloemsWVAA\BGIS\GISPROJ\MXD\SWMP\Solar1_Figure_4-2_SWMP.mxd
Revision: A Date: 00 00 2011



Data Source:	
Scale: 1:25,000	
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Central Meridian/Zone: N/A	
Date: 10/10/2015	Compiled by: MAYE
Project No. 495722	Fig No. 4-3

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AEP Bloemsmond Solar 1 SWMP

River crossing catchments and receiving catchment

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Revision: A Date: 00 00 2011

4.2.4 Storm peaks

Storm peaks were calculated for the catchments shown in Figure 4-2 and Figure 4-3. Peaks were calculated using only one method, the rational method, because the SWMP is currently only conceptual. The rational method is considered conservative, and detailed contour data was not available and thus peaks themselves are currently conceptual. The peaks, along with the input parameters for each peak, are given in

Table 4-1. The peaks are for both pre-development and post-development scenarios because the vegetation, topography and soil conditions will largely be the same, except where the main buildings are placed and this accounts for a negligible portion of the site from a surface area viewpoint.

Note that the wash water was not considered in the storm peaks because solar panel washing is unlikely to be done in the rainy season, and the volumes are very small in comparison to storm volumes. The volume of wash water is approximately 3 l/m^2 per wash for each 1.95 m^2 panel and it is expected that 287,500 panels will be installed (AEP Bloemsmond Solar 1, 2015). Therefore, water per wash will be 1 682 m^3 for the whole site or 840 m^3 for each side. This volume is small compared to rainfall events, and equates to a storm of 0.5 mm rainfall in total over the entire area. Hence, wash water was not considered in the calculations.

Table 4-2 Peak flows for receiving catchments, major crossings and stormwater catchments

C Values for all catchments			0.20	0.22	0.24	0.26	0.33	0.39
Receiving catchments								
Catchment name	**Catchment Area (km^2)**	**Tc (Hours)**	**Stormpeaks (m^3/s)**					
			1:2	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
1.0	41.2	4.3	12.2	21.0	29.1	39.6	61.6	86.7
Major road crossings								
Catchment name	**Catchment Area (km^2)**	**Tc (Hours)**	**Stormpeaks (m^3/s)**					
			1:2	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
C	3.4	2.1	1.8	3.1	4.3	5.9	9.2	12.9
A	14.7	3.1	5.7	9.8	13.5	18.4	28.6	40.3
Stormwater catchments - Preferred development area								
Catchment name	**Catchment Area (km^2)**	**Tc (Minutes)**	**Stormpeaks (m^3/s)**					
			1:2	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
A1	1.1	15.6	2.7	4.6	6.4	8.6	13.5	18.9
A2	2.3	36.1	2.9	5.1	7.0	9.6	14.9	20.9
Stormwater catchments - Alternative development area								
Catchment name	**Catchment Area (km^2)**	**Tc (Minutes)**	**Stormpeaks (m^3/s)**					
			1:2	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
P1	0.6	8.3	1.9	3.3	4.6	6.2	9.7	13.7
P2	0.9	13.4	2.2	3.8	5.2	7.1	11.0	15.5
P3	1.1	14.3	2.7	4.7	6.5	8.8	13.7	19.3
P4	0.8	19.6	1.5	2.6	3.5	4.8	7.5	10.6
P5	0.3	6.9	1.0	1.7	2.4	3.2	5.0	7.0

Also note that a Catchment (P5) naturally drains towards the sensitive pan (Figure 4-2). It is a lesser impact for the water to drain towards this pan as that will ensure that the pan continues to receive its annual runoff and the risk from any potential contaminants in the area can be managed (e.g. with bunds). This conclusion can be confirmed further in detailed design.

It is recommended that these peaks be confirmed with better data and checked against other calculation methods during detailed design. The implications of the stormpeaks calculated, and their impact on the SWMP, are discussed in Section 4.3. In particular, any catchment which contains the buildings may need to be updated as it may include more hard surfaces than currently in place.

4.3 Conceptual design and review

This section should be read in conjunction with the stormwater, wastewater and erosion management plan in Section 5. This section provides detail on why management plans were selected, any alternatives that should be considered, and further steps required to confirm or improve the conceptual plan.

4.3.1 Channels and dissipaters

It is recommended that channels be placed on the upgradient side of any roads to control erosion as well as around any of the dirty areas to ensure that “clean water remains clean.”

Using the conceptual infrastructure layout plans and regional contours, high-level conceptual designs were developed (i.e. typical drain and dissipater types). These were based on the following preliminary conclusions:

- Peak flows for the stormwater catchments were relatively high, and could result in high velocities and present erosion risks;
- Most of the area is under 3% grade, and it is potentially possible to design earth or gravel drains rather than concrete drains because low erosion potential can be engineered at these low flow gradients;
- Even though engineering designs might achieve low velocity flows in the drains, dissipaters are recommended at any outlets to control the transition of water from concentrated channel flow to overland dispersed flow or in-river flow – in addition, it is possible that outlets (e.g. adjacent to road/river crossings) could be locally steep.

Typical generic conceptual designs, based on the above discussions, were compiled as shown in Figure 5-1.

4.3.2 Waste and wastewater management

Landfill and domestic wastewater will be treated offsite, hence, the SWMP only focuses on storage on site.

Domestic waste should be stored out of the rain and wind, and collected regularly as is currently proposed for the development. Conceptual design of the wastewater (sewage) conservancy tank was not within the scope of this report, however, the current conceptual plan was evaluated in terms of the risks to stormwater. Management of the tank is the main risk because the system could fail if the tank is not emptied regularly and overflows. Consequently, a float switch controlled alert system is recommended.

Oil and lubricants in the workshop, and oil from transformers must be bunded (See 4.3.4 for bunding requirements) as per legal requirements and hence, this was recommended without any alternatives.

4.3.3 Road crossings

Using the conceptual infrastructure layout plans and regional contours, high-level conceptual designs were developed. These were based on the following preliminary conclusions:

- Most crossings are small, and thus the roads are well-placed to generally avoid erosion at crossings;
- Drifts would be the best crossing design from a practical, economic and environmental point of view for the road crossings;
- The catchments of the two larger road crossings (A and C on Figure 4-1) are relatively large, with relatively large peaks of 9 and 29 m^3/s. Conceptually, these are likely to spread widely during flooding, given the flat terrain in the area and the morphology of the rivers. Hence the delineation of floodlines is strongly recommended and this should be done as part of the detailed design stage.
- Note that the preliminary time of concentration (Tc) is 2.1 hours and 3.1 hours for the two larger crossing catchments, and floods last about 3 times as long as the Tc. Consequently, culverts should be considered to allow access during storms, particularly for emergency vehicles. Any decision should be based on:
    - Confirmed Tc values using more detailed contour data;
    - The frequency of floods that would prevent access;
    - Whether alternative access routes are available;
    - The exact location of the main buildings at the site.

Typical conceptual designs, based on the above discussions, were compiled for information purposes and are shown in Figure 5-1.

4.3.4 Erosion and sediment transport

The main erosion risks are drain outlets (Section 4.3.1), road crossings (Section 4.3.3) and stockpiles. Permanent stockpiles should be avoided. However, material excavated during piling of the panels might be significant. In that case, a suitable area should be selected for the stockpile such that it is unlikely to erode and result in sediment transport. Sediment traps and diversion drains should also be designed for the stockpile.

During construction, stockpiles will be necessary. A suitable area should be selected for such stockpiles. Temporary silt fences and diversion drains should also be designed for the stockpile.

4.3.5 Bunding

Requirements for bunding of potential contaminants are specified in detail in the National Norms and Standards for the Storage of Waste (Notice 926 of 29 November 2013, Department of Environmental Affairs, National Environmental Management: Waste Act 2008, Act No.29 of 2008). The specification, which will apply to the site, reads as follows:

"…bunds having a capacity which can contain at least 110% of the maximum contents of the waste storage facility. Where more than one container or tank is stored, the bund must be capable of storing at least 110% of the largest tank or 25% of the total storage capacity, whichever is greater (in the case of drums the tray or bund size must be at least 25% of total storage capacity)."

4.3.6 Monitoring and management

Monitoring and management are key to the success of a SWMP and are included as a key aspect of the SWMP including tasks such as:

- Frequent inspections until the success of the design and any unexpected problems are resolved;
- Review of the plan after a few years to improve, where possible, its practicality, cost-effectiveness or efficacy;
- Alerts that do not rely on a fulltime environmental manager at the site, which might not be feasible including:
    - Automatic alert systems for high flood events and the wastewater conservancy tank (e.g. a float driven switch alert system);
    - Brief, annual training that should not take more than half an hour of time for each staff member;
    - Well placed signs that allow reporting as soon as possible and reduce the likelihood that forgetfulness or confusion will prevent reporting.

5 Stormwater, wastewater and erosion management plan (SWMP)

The SWMP, including waste water management, is summarised in Table 5-1, Table 5-2 and Figure 5-1. Supporting information and discussions of alternatives, where relevant, is provided in Sections 3 and 4.

Table 5-1 Operational SWMP details of AEP Bloemsmond Solar 1

General principle	Specific objective	Ref No.	Focus area	Action*	When	By whom
Keep clean water clean	Keep clean water clean by diverting any clean runoff around any potentially dirty areas. Design for a 1 in 50 year event.	1	The workshop The wastewater conservancy tank Transformers	**Clean water diversions:** Excavate clean water diversion channels to direct clean runoff around dirty areas. Channel to be sized for 1 in 50 year event. Typical design will be trapezoidal earth channel (with rock lining if need be) with 1:2 side slopes.	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
Collect and treat dirty water (waste water management)	Collect and treat discharge water or runoff from any dirty areas. Dirty water should not have the potential to spill into clean water systems more than once every fifty years (where influenced by stormwater)	2	Workshop	**Workshop collection drain with oil and grease trap:** Construct a small concrete drain collecting all water, potentially containing oils and lubricants, from workshop floor and directing it through an oil and grease trap before discharge (or removing to offsite facility). Floor to be sloped such that all water will collect in drains.	Constructed prior to operation	
		3	Workshop	**Clean the oil and grease trap:** the oil and grease trap is to be inspected and, when necessary, cleaned and waste taken to offsite facility	Inspect every 3 months for first 2 years and then revise	
		4	Transformers	**Dispose of transformer oil offsite:** Dispose of any oil removed from transformers during maintenance to a registered facility	Constructed prior to operation	
		5	The sewage conservancy tank	**Transport sewage to municipal works:** Collect sewage in a conservancy tank that will regularly dispose of sewage by collection to municipal sewage treatment plant.	Constructed prior to operation	
	Bund any hazardous substance or pollutant storage areas (including any oils) as per regulations	6	Workshop	**Small trays for workshop chemicals:** Bund any containers with oils and lubricants by placing them in plastic trays that is at least 100% of the volume of the container If all containers are stored together the bund will store at least 110% of the largest container or 25% of the total storage capacity, whichever is greater. Suitability of the bund must be investigated whenever a new substance is added to the bund	During operation: as and when containers are purchased	**Workshop manager** and assurance by **environmental manager**
		7	Transformers	**Transformer bunds:** All transformers will be bunded with bund capacity of at least 110% of the maximum volume of oil in the transformer. Transformers and bund will be protected from rainfall by small covers or roof or housing in containers.	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		8	The sewage conservancy tank	**Sewage conservancy bund:** The sewage conservancy tank will be a closed tank with an automatic alert system.	Constructed prior to operation	
Do not impede surface and subsurface flow along drainage lines	Minimise dirty areas the such that surface and subsurface movement of water along the drainage lines is not impeded	9	The workshop, transformers, waste water conservancy tank	**Diversion channels placed to minimised dirty areas:** Place diversion channels directly beside dirty areas such that dirty areas are minimized in footprint	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
	Ensure any engineered clean stormwater drainage directs water to the naturally receiving drainage line	10	Along roads, the workshop, transformers, waste water conservancy tank	**Drains to follow natural topography:** Ensure outlets drain towards the natural drainage line that would originally have received flow from that area	Constructed prior to operation	

General principle	Specific objective	Ref No.	Focus area	Action*	When	By whom
Control erosion	Prevent erosion in general	11	All areas	**Maintain natural topography:** Do not disturb the natural topography or vegetation between the solar panel installations	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		12	All areas	**No stockpiles if possible:** Do not stockpile (during operation). If spoil from pilings is likely to be significant a good stockpile location must be identified and stormwater protection measures designed when detailed layouts are available.	During operation	Assurance by **environmental manager**
	Minimize erosion in large storm event of 1 in 50 years or greater	13	All drains	**Engineer low velocity drains:** Drains sloped and sized such that velocities do no exceed 1 m/s in a 1 in 50 year event	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		14	Road crossings	**Engineered drifts:** Line all major drifts on road crossings with concrete to protect from traffic damage and high flow velocities (For smaller drifts gravel might suffice). Place a section of rip-rap (larger rocks) underlain by gravel and with gravel on either side to facilitate a smooth flow transition. Detailed modelling and design of road crossings such that erosion is controlled to be a feature of the detailed design.	Constructed prior to operation	
	Dissipate stormwater at all drainage outlets to velocities unlikely to cause erosion in natural soils for a 1 in 50 year storm event	15	All drains	**Dissipaters:** At drain outlets widen the channel and use rip-rap (can be sourced from spoil during construction) or reno matresses to dissipate stormwater flows	Constructed prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		16	Road crossings	**Dissipation at road crossings:** Detailed modelling and design of road crossings including rip-rap (can potentially be sourced from spoil during construction) or reno-matresses.	Constructed prior to operation	
Monitor and manage erosion	Ensure that any chronic erosion is detected and rehabilitated within 6 months	17	PV cell blocks Drains Outlets of all drains All natural drainage lines that cross the access road All natural drainage lines that run through the site	**Inspect and remediate noticeable erosion:** Inspect all focus areas for erosion. If erosion is found, remediate and redesign the drainage in the area. If erosion is found in a natural drainage line, conduct an assessment and determine the cause. Develop a plan to prevent future erosion.	Every 3 months for the first 2 years and annually thereafter	**Environmental manager** or hydrologist/engineer/environmental scientist appointed by the environmental manager
	Ensure that any acute erosion due to large storm events is detected within two weeks.	18		**Inspect and remediate acute erosion:** Inspect all focus areas for erosion. If erosion is found remediate and redesign the drainage in the area. If erosion is found in a natural drainage line conduct and assessment and determine the cause and develop a plan to prevent future erosion.	After a rain event of greater than 65 mm In one day (a 10 year rain event) or when staff notice flood damage.	
		19	Main office	**Install a rain gauge** that can measure greater than 115 mm (100 year, 24 hour event)	Construction prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		20	All	**Set up rain data system:** Build or buy a basic rain program, preferably electronic, that allows site staff to enter rain data from the rain gauge. Ideally the system should alert the environmental manager and site manager when a rainfall event in excess of 65 mm per day is entered.	Design and development prior to operation	**Environmental manager** or hydrologist/engineer/environmental scientist appointed by the environmental manager
		21	Main office	**Record rain data:** Read and record rain gauge daily;		Onsite staff member tasked by the

General principle	Specific objective	Ref No.	Focus area	Action*	When	By whom
						Environmental manager
		22	Main office	**Signs at main office to aid problem reporting:** Ensure that a sign providing the following is posed in the reception area, the control room, on each transformer and in the workshop: The name, telephone number and email address of the environmental manager. The sign should state: "If you notice any leaks or spills or erosion anywhere on the property please phone or email the environmental manager on ……."	Update annually in case of staff change	**Environmental manager**
	Training	23	All	**Training:** Provide a very short briefing to all staff on stormwater management including erosion and leaks that covers at least: • How to identify erosion; • How to identify a leak, including car leaks; • Where to find contact details of the environmental manager in case of leaks or erosion.	Annually	**Environmental manager** or hydrologist/engineer/environmental scientist appointed by the environmental manager
Monitor and manage stormwater system	Include a monitoring system for spills and leaks such that they are detected as soon as possible.	24	All	**Leak inspection:** regularly check for leaks and for any breaches or evidence of spills or any other problems that would indicate that it is not in adherence to this plan. All cars should also be checked for oil leaks during the inspection. Any leaks found should be stopped immediately, the cause of the leak sought, the problem remediated such that no further leaks occur and any contaminated soil or water assessed and remediated.	Every 3 months for the first 2 years and annually thereafter	**Environmental manager** or hydrologist/engineer/environmental scientist appointed by the environmental manager
		25	All	**Data capture, training and signs:** see 19,20,21,22 & 23	Continuous	**Environmental manager** and staff in general
		26	The sewage conservancy tank	**Sewage conservancy tank alert system:** Install a float switch controlled alarm that will be display an alarm in the control room when the conservancy tank has less than 2 weeks of capacity remaining.	Construction prior to operation	Included in detailed designs of **design engineer** and carried out by contractor appointed for construction
		27	Transformers	**Signs at transformers:** Post a sign on transformers stating "If you notice any leaks or spills or erosion anywhere on the property please phone reception on ……and report it"	Construction prior to operation	
General	Do not build infrastructure within the 1:100 year floodline unless properly designed and posing no pollution or erosion risk	28	All	Delineate 1 in 100 year **floodlines** for the rivers flowing through crossing A and C prior to detailed design and construction on major water courses Alter any designs that result in potentially polluting infrastructure (transformers, workshop, conservancy tank) , lying in the floodline mentioned above (currently none are proposed) Design any infrastructure within the floodlines mentioned above to withstand the 1:100 year flood without causing undue pollution or erosion.	Detailed design	**Design engineer** or engineer appointed by the design engineer
	Do not build infrastructure containing potential pollutants in any of the natural drainage lines.	29	All	Ensure that final infrastructure plans **do not** propose **any potentially polluting infrastructure, such as transformers, workshops or conservancy tanks in the natural drainage** lines shown in Figure 3-2 (currently none are proposed)	Detailed design	**Design engineer** or engineer appointed by the design engineer
	Review and improve stormwater management plan regularly.	30	All	**Review and improve** the stormwater plan	Once every 5 years	**Environmental manager** or engineer appointed by the environmental manager

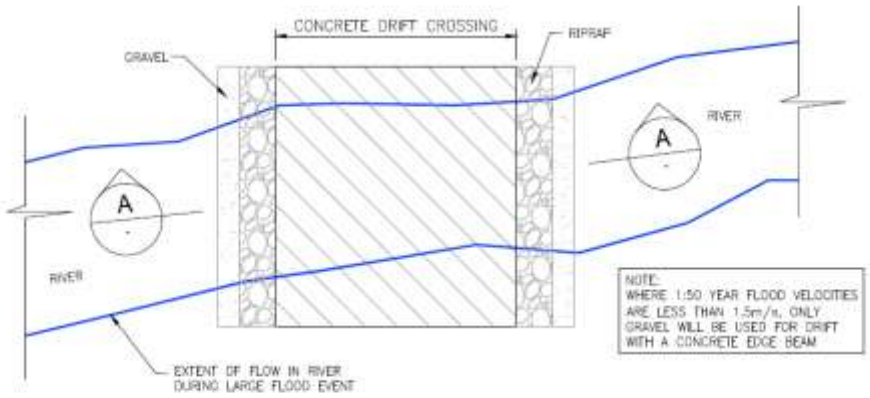
* Plans are conceptual and must be confirmed and fully detailed during detailed design

Table 5-2 SWMP details for <u>construction</u> of AEP Bloemsmond Solar 1

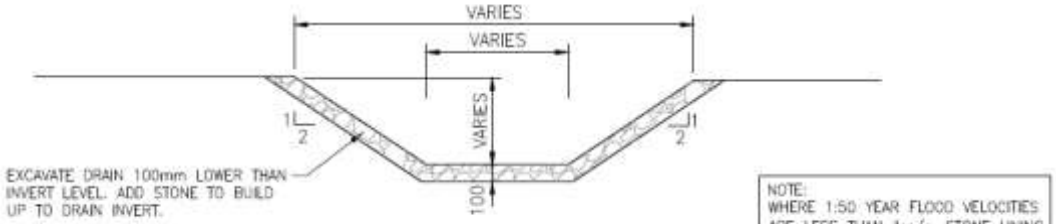
General principle	Specific objective	Ref No.	Focus area	Action*	When	By whom
Keep clean water clean	Keep clean water clean by diverting any clean runoff around any potentially dirty areas. The diversion should be designed for a 1 in 5 year event	1	Stockpiles Laydown areas Any other area likely to generate sediment during a storm event or contain contaminants	**Clean water diversions:** Excavate clean water diversion channel to direct clean runoff around dirty areas. Channel to be sized for 1 in 5 year event. Typical design will be an excavated earth channel or berms.	During site establishment	Construction contractor's **onsite environmental officer/representative**
Collect and treat dirty water	Collect and treat discharge water or runoff from any dirty areas. Dirty water should not have the potential to spill into clean water systems more than once every fifty years (where influenced by stormwater)	2	Stockpiles	**Construct silt fences or berms:** to prevent the sediment transport into rivers.	Before stockpiles are deposited	
		3	Waste	**Dispose of landfill, oils and other contaminants offsite**	Throughout construction	
		4	Sewage	**Supply chemical toilets**	During site establishment	
	Bund any hazardous substance or pollutant storage areas (including any oils) as per regulations	5	General	Construct **temporary bunds for any chemicals** such as oils or fuel stored on sited during construction. Bunds must contain at least 100% of the volume of the container. If all containers are stored together the bund must store at least 110% of the largest container or 25% of the total storage capacity, whichever is greater. Suitability of the material of bund must be investigated whenever a new substance is added to the bund	Throughout construction	
Do not impede surface and subsurface flow along drainage lines	Minimise dirty areas the such that surface and subsurface movement of water along the drainage lines is not impeded	6	Laydown areas Stockpiles	**Minimise laydown areas and stock piles**.	Throughout construction	Construction contractor's **onsite environmental officer/representative**
	Ensure any engineered clean stormwater drainage directs water to the naturally receiving drainage line	7	All drains	Ensure that any temporary **stormwater drains** or diversion berms direct water **towards the drainage line to which it would naturally flow**	Throughout construction	
Control erosion	Prevent erosion in general	8	All	**Maintain natural topography and vegetation:** Do not disturb the natural topography or vegetation where possible	Constructed prior to operation	Construction contractors **onsite environmental officer/representative**
	Minimize erosion in large storm event of 1 in 5 years or greater	9	All drains	**Engineer low velocity temporary drains:** Drains sloped and sized such that velocities do no exceed 1 m/s in a 1 in 5 year event	Throughout construction	
		10	Road crossings	**Engineered temporary drifts:** Build roads and road crossings before other infrastructure.	Early in construction	
	Dissipate stormwater at all drainage outlets to velocities that are unlikely to cause erosion in	11	All drains	**Dissipaters at drain outlets**, where necessary, widen the channel and use rip-rap from construction spoil to dissipate stormwater flows	Constructed prior to operation	

General principle	Specific objective	Ref No.	Focus area	Action*	When	By whom
	for the natural soils for a 1 in 5 year storm event	12	Road crossings	**Dissipation at road crossings:** Build roads and road crossings before other infrastructure.	Constructed prior to operation	
Monitor and manage erosion	Ensure that any erosion is detected and rehabilitated	13	All	**Inspect the site for erosion after rain events.** If erosion is found, remediate and redesign the drainage in the area. If erosion is found in a natural drainage line, conduct an assessment to determine the cause and develop a plan to prevent future erosion.	After rain events	**Contractors environmental officer/representative**
		14		**Install a rain gauge** that can measure greater than 115 mm (100 year, 24 hour event). This rain gauge will also be used during operation.	During site establishment	
		15		**Training:** Provide a very short briefing to all construction staff on stormwater including erosion and leaks that covers at least: • How to identify erosion; • How to identify a leak, including car leaks; Where to find contact details of the environmental officer/representative in case of leaks or erosion.	During site establishment	
Monitor and manage stormwater system	Include a monitoring system for spills and leaks such that they are detected as soon as possible.	16	All	**Leak inspection:** regularly check for leaks and for any breaches or evidence of spills or any other problems not in adherence to this SWMP. All cars should also be checked for oil leaks and any leaks found should be stopped immediately, the cause of the leak identified, the problem remediated such that no further leaks occur and any contaminated soil or water assessed and remediated.	Once every two weeks	**Contractors environmental officer/representative**
General	Review and inspect	17	All	**Inspect the site to ensure adherence to the stormwater management plan**	Once every two months depending on the construction schedule	**Clients environmental representative or Engineer**
	Do not place stockpiles or other potentially polluting construction items within the 1:100 year floodline	18	All	Delineate 1 in 100 year **floodlines** prior to detailed design. **Do not place laydown areas, stockpiles in the 1:100 year floodline** of the larger rivers.	Detailed design and throughout construction	**Design engineer** or engineer appointed by the design engineer
	Do not build infrastructure, except those included in the final operation, in natural drainage lines	19	All	**Do not place laydown areas, stockpiles** or any other materials or equipment **in the natural drainage lines** on Figure 4-1.	Throughout construction	**Design engineer** or engineer appointed by the design engineer
	General	20		Develop a specific **environmental specification for any construction** including, but not limited to, the actions in this stormwater management plan and its principles	Detailed design	**Clients environmental representative or specialist**

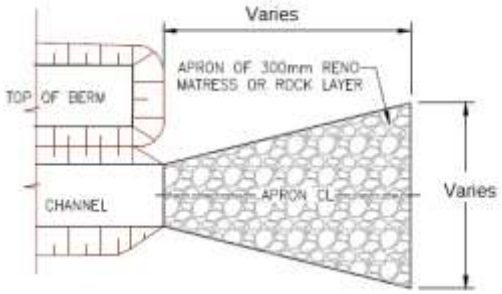
* Plans are conceptual and must be confirmed and fully detailed during detailed design



TYPICAL PLAN OF
DRIFT CROSSING



TYPICAL CROSS SECTION THROUGH
THROUGH DIVERSION CHANNEL



TYPICAL PLAN OF
DISSIPATER AT END OF CHANNEL

srk consulting	**AEP Bloemsmond Solar 1 SWMP** Typical conceptual designs of stormwater infrastructure (to be confirmed in detailed design)	Project No. 495722

Figure 5-1 Typical conceptual designs of stormwater infrastructure

6 Stormwater, wastewater and erosion management plan for alternative options

The plan for the preferred and the alternative development areas will be the same in all respects except for river crossings. However, the differences between the two road options are not significant – Access Road 1 will largely require minor crossings whereas Access Road 2 will require fewer crossings but an additional larger crossing. Hence, from a stormwater management point of view, there is no significant difference between the different options and selection of these should be based on other factors.

7 Conclusions and Recommendations

In conclusion:

- The proposed facility, for the preferred and the alternative option, will have an intrinsically low impact on surface water resources;
- The potential stormwater impacts that do exist can be managed in a practical way;
- The plan is conceptual because no detailed contour data is available and only conceptual infrastructure layouts are available.

It is recommended that:

- The SWMP be developed further during detailed design by:
    - Delineating floodlines for major rivers;
    - Conducting a detailed topographic survey;
    - Developing a stormwater layout and conceptual designs based on the above information and infrastructure layout plan;
    - Developing conceptual designs into detailed designs with sufficient detail to support construction.

The plan will be incorporated into an environmental specification for use during construction. The plan will be incorporated into the operational environmental management of the site;

Prepared by

Xanthe Adams

Engineer

Reviewed by

Bruce Engelsman, Pr. Eng

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

8 References

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Approval Signature:

APPENDIX B:
GRIEVANCE MECHANISM

GRIEVANCE MECHANISM / PROCESS

PURPOSE

This Grievance Mechanism has been developed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The aim of the grievance mechanism is to ensure that grievances or concerns raised by local landowners and or communities are addressed in a manner that:

» Provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting.
» Builds trust as an integral component of broader community relations activities.
» Enables more systematic identification of emerging issues and trends, facilitating corrective action and pre-emptive engagement.

The aim of this Grievance Mechanism is to address grievances in a manner that does not require a potentially costly and time consuming legal process.

PROCEDURE FOR RECEIVING AND RESOLVING GRIEVANCES

» Local landowners, communities and authorities must be informed in writing by the Project Company of the grievance mechanism and the process by which grievances can be brought to the attention of the Project Company through its designated representative.
» A company representative must be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person must 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 must be registered with the contact person who, within 2 working days of receipt of the grievance, must contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting in order to discuss the grievances raised. Unless otherwise agreed, the meeting should be held within 2 weeks of receipt of the grievance.
» The contact person must 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 (once agreed).

- Prior to the meeting being held the contact person must contact the Complainant to discuss and agree on the parties 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 should be chaired by the company representative appointed to address grievances. The Project Company must provide a person to take minutes of and record the meeting/s. Any costs associated with hiring venues must be covered by the Project Company.
- Draft copies of the minutes must 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 must 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 must 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 Project Company 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 Project Company, must identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator must be borne by the Project Company. The Project Company must 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 must be 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 must 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 must be made available to the Complainant and the Project Company 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.

A Complaint is closed out when no further action can be or needs to be taken. Closure status will be classified in the Complaints Register as follows:

» Resolved. Complaints where a resolution has been agreed and implemented and the Complainant has signed the Confirmation Form.
» Unresolved. Complaints where it has not been possible to reach an agreed resolution and the case has been authorised for close out by the Appeals Committee.
» Abandoned. Complaints where the Complainant is not contactable after one month following receipt of a Complaint and efforts to trace his or her whereabouts have been unsuccessful.

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 C:
REHABILITATION PLAN

REVEGETATION AND REHABILITATION PLAN

1. PURPOSE

The purpose of the rehabilitation plan is to ensure that areas cleared or impacted during construction activities of the proposed Solar Facility are rehabilitated with a plant cover that reduces the risk or erosion from these areas as well as restores some ecosystem function. The purpose of the rehabilitation plan for the site can be summarised as follows:

» Achieve long-term stabilisation of all disturbed areas to minimise erosion potential.
» Re-vegetate all disturbed areas with suitable local plant species.
» Minimise visual impact of disturbed areas.
» Ensure that disturbed areas are safe for future uses.

This rehabilitation plan should be closely aligned with other site-specific plans, including the erosion management plan, soil management plan, alien plant management plan, and plant rescue and protection plan. Prior to commencement of construction, a detailed rehabilitation plan and Method Statement for the site should be compiled with the aid of a rehabilitation specialist.

2. RELEVANT ASPECTS OF THE SITE

The site occurs within a semi-arid environment and a fundamentally different approach to rehabilitation efforts in such areas is required as compared to traditional rehabilitation approaches within more mesic areas. In addition, the site is within an extensive natural ecosystem of high biodiversity value and the use of any rehabilitation techniques which rely on agricultural techniques such as the application of fertilizer and the planting of annual grasses or other alien species are not appropriate. The major implication of the semi-arid nature of the site is that active rehabilitation outside of the wet season may lead to very poor results on account of dry conditions and low rainfall which is likely to characterize the dry season.

3. REHABILITATION METHODS

» Immediately after replacing topsoils in disturbed areas, the soil surface must be revegetated with a suitable plant cover.
» It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover. However, simply applying this topsoil to a well prepared rehabilitation site does not result in the same species richness and diversity as the surrounding areas. In some areas the natural regeneration of the

vegetation may be poor and the application of seed to enhance vegetation recovery may be required.

» Where possible, seed should be collected from plants present at the site during plant rescue oprerations. Indigenous seeds may also be harvested for purposes of re-vegetation in areas that are free of alien or invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites.
» Seed collection should be undertaken by a suitably qualified specialist who is familiar with the various seed types associated with the plant species and rehabilitation in the area.
» 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. The collection of unripe seeds will reduce the percentage germination thereby reducing the effectiveness of the rehabilitation efforts. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.
» Seed can be sown onto the soil, but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch. Additional organic material may be added to the soil mix, if required, to assist with water retention during the early stages of seedling establishment.
» It should be ensured that the seed mix is as diverse as possible in the first season. After the first season, when pioneer plant communities have successfully established, attempts should be made to re-sow and replant the area with more perennial and woody species. It is a process that will require several follow-ups.
» Planting is dependent on species involved. Planting of species recommended for rehabilitation should be carried out as far as is practicable to coincide with the onset of the first significant rains. In general however, planting should commence as soon as possible after construction is completed in order to minimise the potential for erosion.
» The final vegetation cover should resemble the original (non-encroached and indigenous) vegetation composition and structure as far as practicably possible.
» Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible. Re-vegetation of disturbed surfaces must occur immediately after construction activities are completed.
» Once revegetated, areas should be protected to prevent trampling and erosion.
» No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated.
» Where rehabilitation sites are located within actively grazed areas, they should be fenced.
» Fencing should be removed once a sound vegetative cover has been achieved.
» Any runnels, erosion channels or wash aways developing after revegetation should be backfilled and consolidated and the areas restored to a proper stable condition.

4. 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 rehabilitated areas. During the construction phase, the EO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project company will need 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
» Re-emergence of alien and invasive plant species. If noted, remedial action must be taken immediately.

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 rehabilitation specialist, 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).

As rehabilitation success, monitoring and follow-up actions are important to achieve the desired cover and soil protection, the following monitoring protocol is recommended:

» re-vegetated areas should be monitored every 4 months for the first 12 months following construction;
» re-vegetated areas showing inadequate surface coverage (less than 20% within 12 months after re-vegetation) should be prepared and re-vegetated; and
» any areas showing erosion, should be re-contoured and seeded with indigenous grasses or other locally occurring species which grow quickly.

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 an acceptable plant cover is achieved (excluding alien plant species or weeds). Additional seeding or planting may be necessary to achieve acceptable plant cover. Hand seeding may have to be considered as an option in this case.

Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging alien plant species should continue until the decommissioning phase has been completed.

APPENDIX D:
WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN

1. PURPOSE

A Waste Management Plan (WMP) plays a key role in achieving sustainable waste management. This purpose of this plan is to ensure that effective procedures are implemented for the handling, storage, transportation and disposal of waste that is generated from the activities on site. The plan prescribes measures for the collection, temporary storage and safe disposal of the waste streams associated with the project and includes provisions for the recovery, re-use and recycling of waste.

This WMP has been compiled as part of the project Environmental Management Programme (EMPr) and includes waste stream information available at the time of compilation. Construction practices and operations must be measured and analysed in order to determine the efficacy of the plan and whether further revision of the plan is required. This plan should be further updated should further detail regarding waste quantities and categorisation become available, during the construction and/or operational stages.

2. RELEVANT ASPECTS OF THE SITE

Waste generated on site, originates from various sources including:

- Contaminated water, soil and vegetation due to hydrocarbon spills.
- Hydrocarbon waste from vehicle, equipment and machinery parts (oil cans, filters, rags etc), and servicing.
- Recycable waste in the form of paper, glass, steel, aluminium, wood/ wood pallets, plastic (PET bottles, PVC, LDPE), Cardboard and rockwool.Organic waste from food waste and alien vegetation removal.
- Sewage from portable toilets and septic tanks.
- Inert waste from excess rock and soil from site clearence and trenching works.

3. LEGISLATIVE REQUIREMENTS

Waste in South Africa is currently governed by means of a number of pieces of legislation, including:

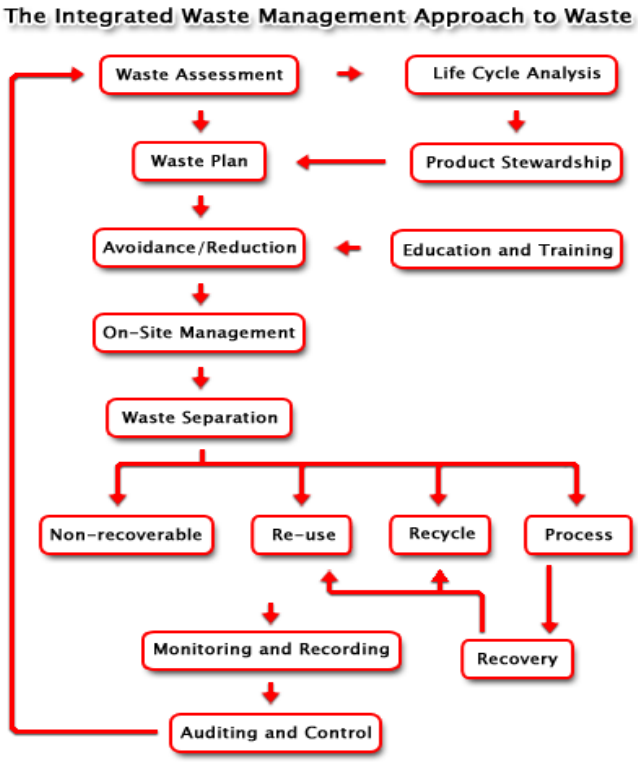
- National Environmental Management: Waste Act (NEM:WA), 2008 (Act 59 of 2008)
- National Environmental Management: Waste Amendment Act, 2014 (Act 26 of 2014)
- The South African Constitution (Act 108 of 1996)
- Hazardous Substances Act (Act 5 of 1973)

» Health Act (Act 63 of 1977)
» Environment Conservation Act (Act 73 of 1989)
» Occupational Health and Safety Act (Act 85 of 1993)
» National Water Act (Act 36 of 1998)
» The National Environmental Management Act (Act 107 of 1998)
» Municipal Structures Act (Act 117 of 1998)
» Municipal Systems Act (Act 32 of 2000)
» Mineral and Petroleum Resources Development Act (Act 28 of 2002)
» Air Quality Act (Act 39 of 2004)

Storage of waste must be undertaken in accordance with the National Norms and Standards for the Storage of Waste published in GN926.

4. WASTE MANAGEMENT PRINCIPLES

An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.



Source: http://www.enviroserv.co.za/pages/content.asp?SectionId=496

It is important to ensure that waste is managed with the following objectives in mind during all phases of the project:

» Reducing volumes of waste is a priority;

» If reduction is not feasible, the maximum amount of waste is to be recycled; and
» Waste that cannot be recycled is to be disposed of in the most environmentally responsible manner as possible.

4.1. Construction phase

A plan for the management of waste during construction waste is detailed below. As previously stated, construction practices must be measured and analysed in order to determine the efficacy of the plan and whether further revision of the plan is required. A Method Statement detailing specific waste management practices during construction should be prepared by the Contractor prior to the commencement of construction.

4.1.1. Waste Assessment / Inventory

» The Environmental Officer must develop, implement and maintain a waste inventory reflecting all waste generated during construction for both general and hazardous waste streams.
» Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.
» Once a waste inventory has been established, targets for recovery of waste (minimisation, re-use, recycling) should be set.
» The Environmental Officer must conduct waste classification and rating in terms of SANS 10288 and Government Notice 634 published under the NEM: WA.

4.1.2. Waste collection, handling and storage

» Each subcontractor must implement their own waste recycling system, i.e. separate bins for food waste, plastics, paper, wood, glass cardboard, metals, etc.
» Septic tanks and portable toilets must be monitored and maintained daily. Below ground storage of septic tanks must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from driving around the area.
» Waste collection bins and hazardous waste containers must be provided by the principal contractor and placed at various areas around site for the storage of organic, recyclable and hazardous waste.
» A dedicated waste area must be established on site for the storage of all waste streams, before removal from site.
» Signage/ colour coding must be used to differentiate disposal areas for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.).

- Hazardous waste must be stored within a bunded area constructed according to SABS requirements. The volume of waste stored in the bunds must not exceed 110% of the bund capacity.
- The location of all temporary waste storage areas must aim to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.
- Waste storage shall be in accordance with all Regulations and best-practice guidelines and under no circumstances may waste be burnt on site.
- A dedicated waste management team must be appointed by the principal contractors' EO, whom will be responsible for ensuring the continuous sorting of waste and maintenance of the area. The waste management team must be trained in all areas of waste management and monitored by the EO.
- All waste removed from site must be done so by a registered/ licensed subcontractor, whom must supply information regarding how waste recycling/ disposal will be achieved. The registered subcontractor must provide waste manifests for all removals at least once a month.

4.1.3. Management of waste storage areas

- The position of all waste storage areas must be located away from water courses and ensure minimal degradation to the environment. The main waste storage area must have a suitable storm water system separating clean and dirty storm water.
- Collection bins placed around site and at subcontractors' camps must be maintained and emptied on a regular basis by the principal contractor.
- Inspections and maintenance of the main waste storage area must be undertaken daily. Skips and storage containers must be clearly marked or colour coded and well-maintained, not allowing access to vermin or other rodents. Shade cloth should ideally be used to ensure avifauna does not have access to waste.
- Waste must be stored in designated containers and not on the ground.
- Inspections and maintenance of bunds must be undertaken daily. Bunds must be inspected for leaks or cracks in the foundation and walls.
- It is assumed that any rainwater collected inside the bund is contaminated and must be removed and stored as hazardous waste, and not released into the environment. If any leaks occur in the bund, these must be removed immediately.

4.1.4. Disposal

- Waste generated on site must be removed on a regular basis, as determined by the Environmental Officer. This frequency may change during construction depending on waste volumes generated at different stages of the construction process.

» Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor.

4.1.5. Record keeping

The success of the waste management plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan.

» Documentation (waste manifest, certificate of issue or safe disposal) must be kept detailing the quantity, nature, and fate of any regulated waste for audit purposes.
» Waste management must form part of the monthly reporting requirements in terms of volumes generated, types, storage and final disposal.

4.1.6. Training

Training and awareness regarding waste management shall be provided to all employees and contractors as part of the toolbox talks or on-site awareness sessions

5. Operational phase

It is expected that the operational phase will result in the production of general waste consisting mostly of cardboard, paper, plastic, tins, metals and a variety of synthetic compounds. Limited hazardous wastes (grease, oils) may also be generated. All waste generated will be required to be temporarily stored at the facility in appropriate sealed containers prior to disposal at a permitted landfill site.

The following waste management principles apply during the operational phase:

» The Environmental Manager must develop, implement and maintain a waste inventory reflecting all waste generated during construction for both general and hazardous waste streams.
» Adequate waste collection bins at site must be supplied. Separate bins should be provided for general and hazardous waste.
» Recyclable waste must be removed from the waste stream and stored separately.
» All waste must be stored in appropriate temporary storage containers (separated between different construction wastes, and contaminated or wet

waste) at each construction area prior to being taken to the construction camp for final sorting (if required) and further temporary storage. Waste storage shall be in accordance with all best-practice guidelines and under no circumstances may waste be burnt on site.

» Waste generated on site must be removed on a regular basis throughout the operational phase.
» Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor.

6. Monitoring of Waste Management Activities

Records must be kept of the volumes/ mass of the different waste streams that are collected from the site throughout the life of the project. The appointed waste contractor is to provide monthly reports to the operator containing the following information:

» Monthly volumes/ mass of the different waste streams collected;
» Monthly volumes/ mass of the waste that is disposed of at a landfill site;
» Monthly volumes/ mass of the waste that is recycled;
» Data illustrating progress compared to previous months.

This report will aid in monitoring the progress and relevance of the waste management procedures that are in place. If it is found that the implemented procedures are not as effective as required, this WMP is to be reviewed and amended accordingly.

APPENDIX E:
SOIL MANAGEMENT PLAN

SOIL MANAGEMENT PLAN

1. PURPOSE

Some of the most significant impacts on soil properties occur as a result of activities associated with construction. Construction activity can have adverse impacts on soil in a number of ways by:

- Covering soil with impermeable materials, effectively sealing it and resulting in significant detrimental impacts on soils' physical, chemical and biological properties, including drainage characteristics.
- Contaminating soil as a result of accidental spillage or the use of chemicals.
- over-compacting soil through the use of heavy machinery or the storage of construction materials.
- Reducing soil quality, for example by mixing topsoil with subsoil.
- Wasting soil by mixing it with construction waste or contaminated materials, which then have to be treated before reuse or even disposed of at landfill as a last resort.

Careful management of topsoil and subsoil is an important aspect of sustainable use of materials that are being stripped. Without a proper Soil Resource Plan there is the risk of losing, damaging or contaminating valuable soil resources. The purpose of this Soil Management Plan is to outline principles for soil management to ensure the integrity of the resource during and post-construction. This plan should be read together with the Emergency Response Plan in order to minimise the risk of contamination of soils.

2. SOIL HORIZONS

Topsoil

The top-most soil layer (0-25 cm) in undisturbed areas. This soil layer is important as it contains nutrients, organic material, seeds, communities of micro-organisms, fungi and soil fauna. All the contents of the topsoil layer are necessary for soil processes such as nutrient cycling, and support growth of new plants. The biologically active upper layer of soil is fundamental in the development of soils and the sustainability of the entire ecosystem. Fungi, algae, cyanobacteria and non-vascular plants form a 'living crust' on the soil surface that influences the retention of resources (principally nutrients and water), as well as reducing the potential for soil erosion.

In general, the greatest concentration of seeds (i.e. up to 90% of the seedbank) is found in the top 5-10 cm of topsoil. Soil nutrients and other biological elements also have a higher concentration in the top 5 – 10 cm of soil, but can occur up to 25 cm.

Subsoil

Soil generally deeper than 25 cm. The subsoil contains lower levels of nutrients, but the soil texture is still suitable for plant growth.

Overburden

All the soil below the subsoil layer, generally characterised by a fine soil texture which is sometimes high in clay and salt content which makes plant growth difficult. Such soils comprise a sterile growth medium, devoid of nutrients, and depending on the clay content, are of high salinity and often phytotoxic. Even shallow-lying overburden soils are largely depleted of nutrients. These soils constitute an unsuitable medium for the establishment of plants.

3. PRINCIPLES FOR SOIL MANAGEMENT

3.1. The correct handling of topsoil

» Before beginning work on site, topsoil should be stripped from all areas that will be disturbed by construction activities. Appropriate equipment must be used and appropriate work practices must be implemented for soil stripping as mishandling soil can have an adverse effect on its properties.
» Topsoil should be stripped in the driest condition possible.
» Topsoil must be retained on site in order to be used in site rehabilitation. The correct handling of the topsoil layer is in most cases the key to rehabilitation success.
» It is important that the correct depth of topsoil is excavated in order to ensure good plant growth. If excavation is too shallow, then an important growth medium for new seedlings could be lost. If excavation is too deep, this could lead to the dilution of the seed and nutrient rich topsoil with deeper sterile soil.
» Topsoil and subsoil layers must never be mixed. The mixture of topsoil with the deeper sterile soil hinders the germination of seeds which are buried too deep in the soil layer. Mixture of soil layers also leads to the dilution of nutrient levels which are at highest concentration within the topsoil, resulting in lower levels of nutrients available for new seedlings.
» To enable soil to be reused on site at a later stage, it needs to be stored in temporary stockpiles to minimise any damage or loss of function. Stockpiles should not be higher than 2m. Alternatively topsoil berms can be created on the site boundaries. There are a number of important considerations when creating stockpiles - including soil erosion, pollution to watercourses and the risk of flooding. These will be affected by the size, height and method of forming stockpiles, and how they are protected and maintained.
» Topsoil must stored separately from other soil in heaps until construction in an area is complete.

» The duration of topsoil storage should be minimsed as far as possible. Storing topsoil for long periods leads to seed bank depletion following germination during storage, and anoxic conditions develop inside large stockpile heaps.
» All stockpiles must be positioned away from drainage lines.
» Sediment fencing should be erected downslope of all stockpiles to intercept any sediment and upslope runoff should be diverted away from stockpiles.

3.2. Stripping of Subsoil

The following protocols must be followed when stripping subsoil:

» On many sites subsoil will not need to be stripped but merely protected from damage. However, on other sites it might need to be temporarily removed. Where subsoil is required to be stripped, this should be undertaken before commencement of construction from all areas that are to be disturbed by construction activities or driven over by vehicles.
» Subsoil stripping depths depend on the correct identification of the sub-soil types on an ad-hoc basis, where no formal survey data exists.
» Subsoil should be stripped in the driest condition possible.
» To enable soil to be reused on site at a later stage, it needs to be stored in temporary stockpiles to minimise any damage or loss of function. There are a number of important considerations when creating stockpiles - including soil erosion, pollution to watercourses and the risk of flooding. These will be affected by the size, height and method of forming stockpiles, and how they are protected and maintained.
» All stockpiles must be positioned away from drainage lines.
» Sediment fencing should be erected downslope of all stockpiles to intercept any sediment and upslope runoff should be diverted away from stockpiles.

APPENDIX F:
ALIEN INVASIVE MANAGEMENT PLAN

ALIEN PLANT MANAGEMENT PLAN

1. PURPOSE

Invasive alien species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Plant Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Solar Facility. The broad objectives of the plan include the following:

» Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment.
» Develop and implement a monitoring and eradication programme for alien and invasive species.
» Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

2. RELEVANT ASPECTS OF THE SITE

According to the national vegetation map (Mucina & Rutherford 2006), there are three vegetation types within the boundaries of the site but only two within the area likely to be affected by the development. An additional two vegetation types are common in the wider area, but do not occur in the vicinity of the affected area. In terms of the conservation status of the various vegetation types of the area, only Lower Gariep Alluvial Vegetation is of concern and is listed as Endangered. This vegetation type is however associated with the alluvium along the Orange River and would not be impacted by the current development which would be some distance from the river itself.

Within the area affected by the proposed development, the two vegetation types that occur are Kalahari Karroid Shrubland and Bushmanland Arid Grassland. Both Kalahari Karroid Shrubland and Bushmanland Arid Grassland are classified as Least Threatened and have been little impacted by transformation and more 99% of their original extent is still intact. Both are considered Hardly Protected within formal conservation areas. Mucina & Rutherford (2006), list 6 endemic species for Bushmanland Arid Grassland, while no vegetation-type endemic species are known from Kalahari Karroid Shrubland. The biogeographically important and endemic species known from these vegetation types tend to be widespread within the vegetation type itself and local-level impacts are not likely to be of significance for any of these vegetation types or species concerned. Bushmanland Arid Grassland is widely distributed and represents one of the most extensive vegetation types in South Africa. Kalahari Karroid Shrubland is less extensive, but represents a transitional vegetation type between the northern Nama Karoo and Kalahari (Savannah) vegetation types.

3. LEGISLATIVE CONTEXT

Conservation of Agricultural Resources Act (Act No. 43 of 1983)

In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA), all declared aliens must be effectively controlled. Landowners are legally responsible for the control of invasive alien plants on their properties. In terms of this Act, 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:

» Category 1: Prohibited and must be controlled.
» Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.
» Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

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. Indigenous invasive species that need to be controlled include: *Acacia mellifera* subsp. *mellifera,* and *Rhigozum trichotomum.* Alien invasives that must be controlled and eradicated to prevent degradation include *Nicotianan glauca, Prosopis glandulosa, Salsola kali.* Weeds and potentially invasive species on and around the site that need to be monitored and managed include: *Melia azedarach, Tribulus terrestris, Alternanthera pungens.*

National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this Act and the regulations, any species designated under Section 70 cannot be propagated, grown, bought or sold without a permit. Below is an explanation of the three categories:

» Category 1a: Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
» Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

» Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Cat 2 plants to exist in riparian zones.
» Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

Plants listed under the categories above are detailed within Notice 1 of the Alien and Invasive Species published in GNR599 of 01 August 2014. 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.

It is important to note that alien species that are regulated in terms of the CARA as weeds and invader plants are exempted from NEMBA. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEMBA.

4. ALIEN PLANT MANAGEMENT PRINCIPLES

4.1. Prevention and early eradication

A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas.

Monitoring plans should be developed which are designed to identify Invasive Alien Plant Species shortly after they arrive in the project area. Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When new Invasive Alien Plant Species are recorded on site, an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

4.2. Containment and control

If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Separate plans of control actions should be developed for each location and/or each species. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The key is to ensure that no invasions get out of control. Effective containment and control will ensure that the least energy and resources are required to

maintain this status over the long-term. This will also be an indicator that natural systems are impacted to the smallest degree possible.

4.3. 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. The lighter infested areas should be cleared first to prevent the build-up of seed banks. Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently. Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses. All clearing actions should be monitored and documented to keep records of which areas are due for follow-up clearing.

i. Clearing Methods

Different species require different clearing methods such as manual, chemical or biological methods or a combination of both. Care should however be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.

Fire should not be used for alien control or vegetation management 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/

» **Mechanical control**

This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive, and could cause severe soil disturbance and erosion.

» **Chemical 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 resprout. 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.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning 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 should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring 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 Regulations and guidelines should be followed:

- Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.
- Pesticide Management Policy for South Africa published in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) – GNR 1120 of 2010.
- South African Bureau of Standards, Standard SANS 10206 (2010)

According to Government Notice No. 13424 dated 26 July 1992, it is an offence to "*acquire, dispose, sell or use an agricultural or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or on such a container*".

Contractors using herbicides need to have a valid Pest Control Operators License (limited weeds controller) according to the Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). This is regulated by the Department of Agriculture, forestry and Fisheries (DAFF).

» **Biological control**

Biological weed control consists in the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plants reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilised. All of these outcomes will help to reduce the spread of the species.

To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), DAFF can be contacted.

4.4. General management practices

The following general management practices should be encouraged or strived for:

- Establish an ongoing monitoring programme for construction phase to detect and quantify any alien species that may become established and identify the problem species.
- Alien vegetation regrowth on areas disturbed by construction must be immediately controlled once recorded throughout the entire site during construction and operation.
- Care must be taken to avoid the introduction of alien invasive plant species to the site. 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.
- Cleared areas that have become invaded by alien species 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.
- The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control until late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.
- Alien management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- Some alien species are best individually pulled by hand and in the case of Opuntia removed from the site.
- Regular vegetation control to reduce plant biomass within the site should be conducted. This should be timed so as to coincide with the critical growth phases of the most important alien species on site. This will significantly reduce the cost of alien management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.

- » No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used
- » During operation, surveys for alien species should be conducted regularly. It is recommended that this be undertaken every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared using appropriate means.

4.5. Monitoring

In order to monitor the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide and assessment of the magnitude of alien invasion on site as well as an assessment of the success of the management programme.

In general, the following principles apply for monitoring:

- » Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.
- » Simple records must be kept of daily operations, e.g. area/location cleared, labour units and, if ever used, the amount of herbicide used.
- » It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

The following monitoring should be implemented to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Preconstruction & monthly thereafter
Document alien plant distribution	Alien plant distribution map within priority areas	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

Operation Phase

Monitoring Action	Indicator	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	Biannually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

APPENDIX G:
TRAFFIC MANAGEMENT AND TRANSPORTATION PLAN

AEP BLOEMSMOND SOLAR 1 PV FACILITY

NORTHERN CAPE

TRANSPORT IMPACT ASSESSMENT

September 2015

Issue

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SYNOPSIS :

Conduct a revised Transport Impact Assessment for the AEP Bloemsmond Solar 1 PV Facility in the Northern Cape close to Upington, pertaining to all relevant traffic and transportation engineering aspects.

KEY WORDS :

Transport Impact Assessment

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882

Verification	Capacity	Name	Signature	Date
By Author	Senior Traffic & Transportation Engineer	Iris Wink		09/9/15
Checked by	Technical Director	Duncan Murphy		7-9-2015
Authorised by	Technical Director	Duncan Murphy		7-9-2015

AEP Bloemsmond Solar 1 PV Facility

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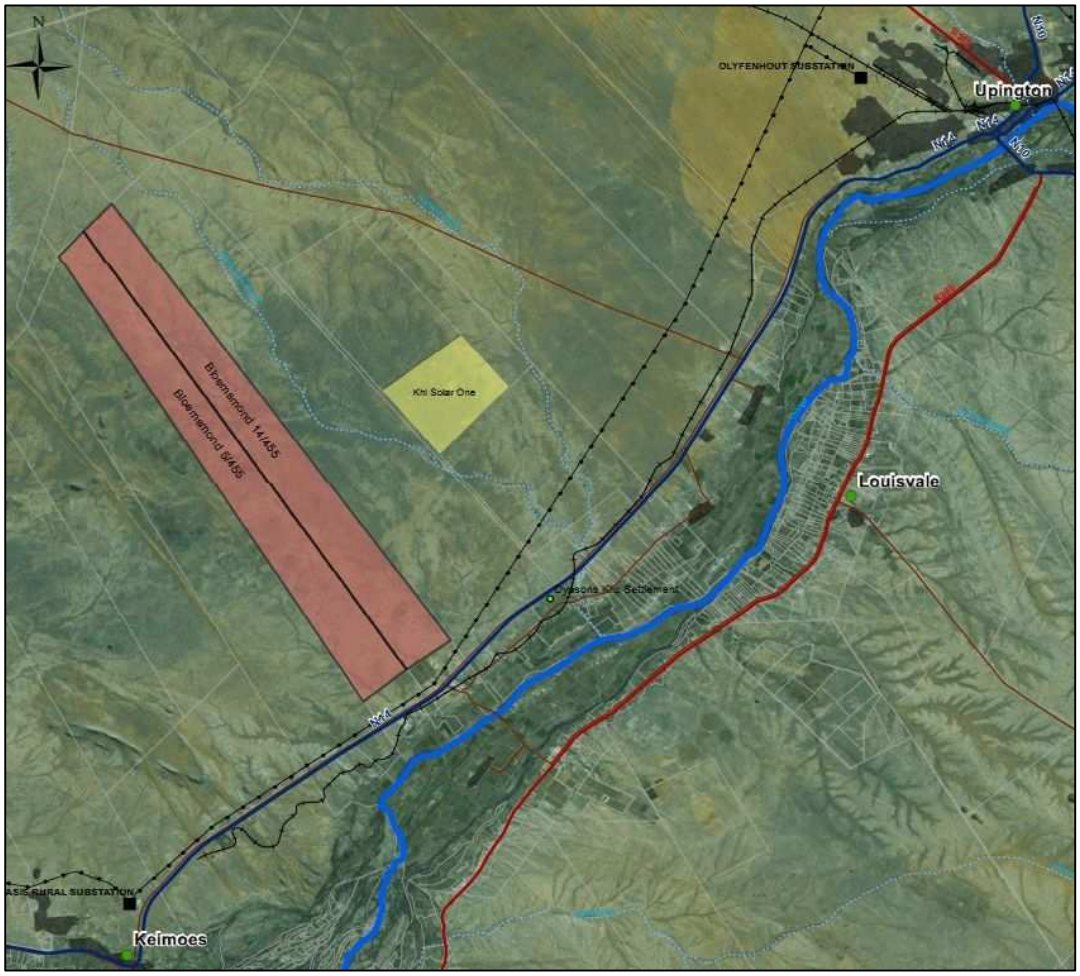
1 INTRODUCTION & SCOPE OF WORK

Atlantic Energy Partners (Pty) Ltd (AEP) appointed Jeffares & Green to conduct a Transport Impact Assessment (TIA) for the proposed solar farm on Bloemsmond Farm 455 in the Northern Cape.

The site is located on the National Road N14 approximately 30km from Upington in a south-western direction and approximately 16km north-east of Keimoes.

The report deals with the items as listed below and focuses on the surrounding road network in the vicinity of the site.

- Extent of the traffic study and study area,
- The proposed development,
- Trip generation for the solar farm during construction and operation,
- Traffic impact on external road network,
- Accessibility and circulation requirements,
- National and local haulage routes between port of entry/manufacturer and site,
- Assessment of internal roads and site access,
- Assessment of freight requirements and permitting needed for any abnormal loads and
- Traffic accommodation during construction.

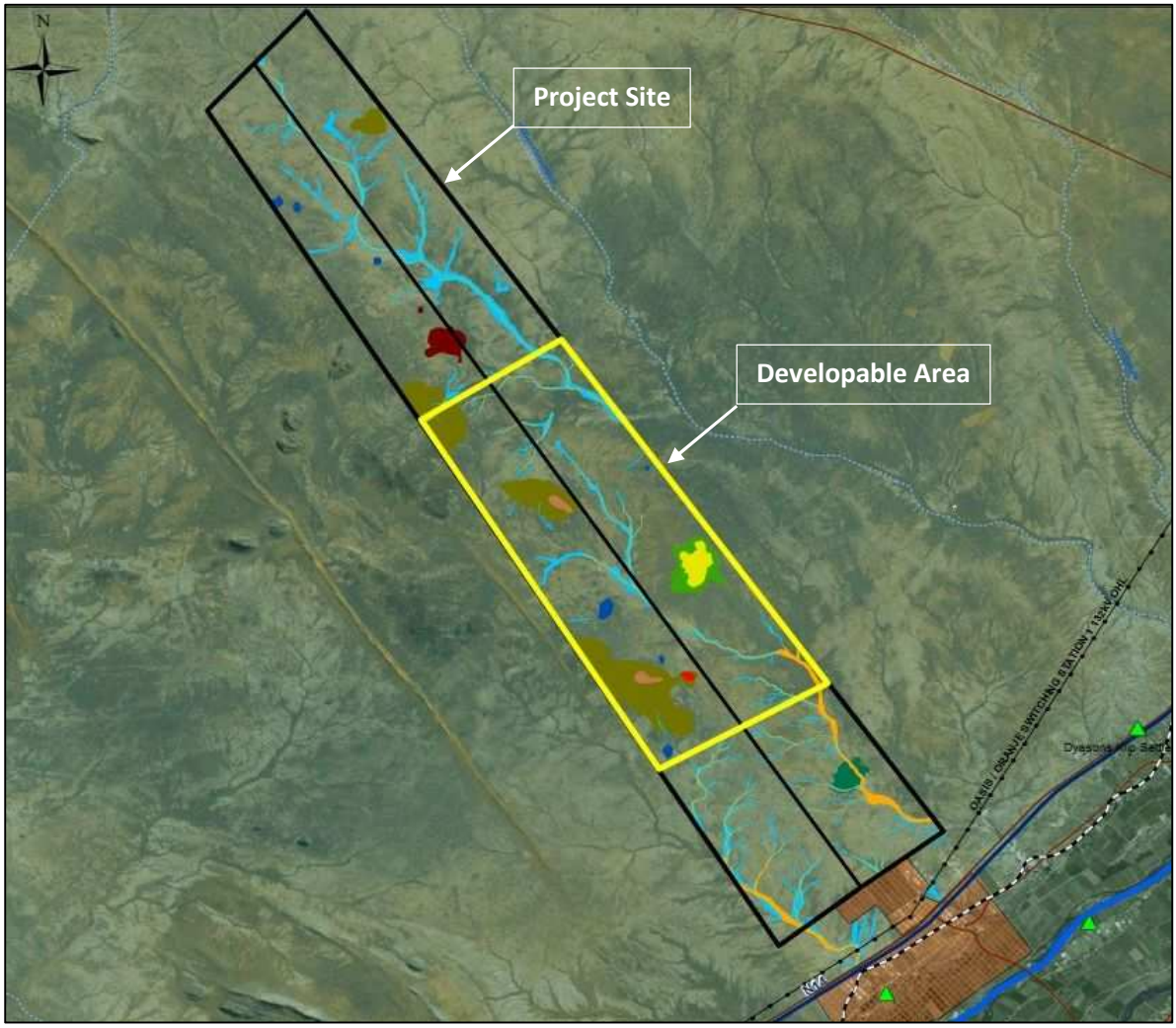


2 THE SITE

2.1 General

It is proposed to develop the AEP Bloemsmond Solar 1 PV Facility on a site located on Portion 5 and Portion 14 of Farm Bloemsmond 455. The developable area is shown in Figure 1 below and will comprise of approximately 225ha in extent.

Figure 1 Aerial View of Site



The site is located approximately 30km south-west of Upington and 16km north-east of Keimoes within the Kai !Garib Local Municipality in the Northern Cape. A second PV Facility will be located on the same farm (Bloemsmond 455), called the AEP Bloemsmond Solar 2 PV Facility, which will be addressed in a separate report.

The solar facility will have a maximum total capacity of 75MW and will consist of the following elements:

- Photovoltaic (PV) solar panels,
- Mounting structures to support the PV Panels,

- On-site inverters and substation,
- New 132kV power line between substation and Eskom grid connection point,
- Underground cabling,
- Temporary laydown areas and
- Internal access roads and fencing.

It is furthermore assumed that a small office block and ablution facilities will be provided on site for permanent staff as well as a temporary site office during the construction phase.

2.2 Site Access and Internal Roads

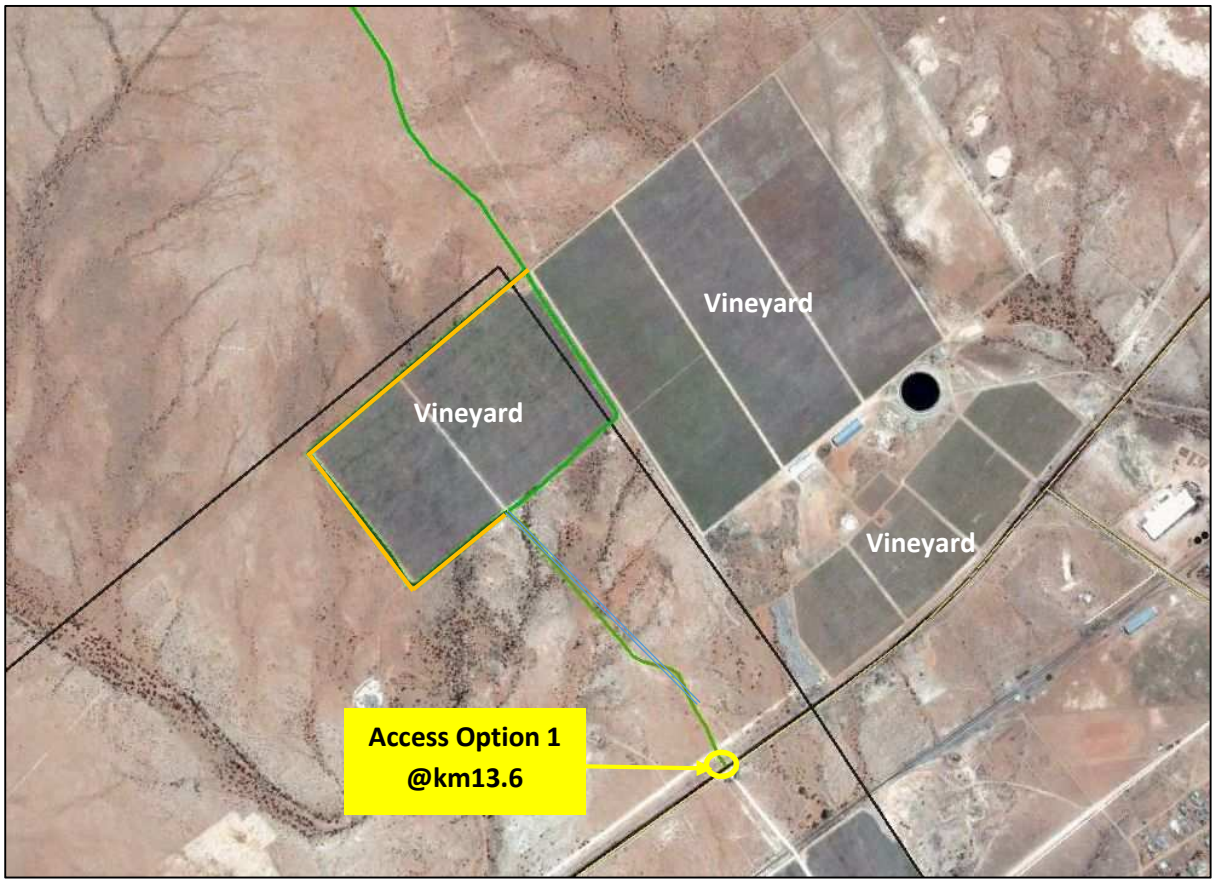
Two access options will be discussed in this study:

2.2.1 Access Option 1

This access option is located at km13.6 on National Road N14, which has been confirmed as an acceptable access location by SANRAL. The N14 is classified as a Class 1 Expressway and passes the site to the South. This road is a single carriageway with one lane per direction running in an east-west direction.

The access point would be located directly opposite an existing farm access as shown in the aerial picture below. Sight distances at this access point are good.

Figure 2 Aerial View of Access Option 1



The following picture shows the existing gravel farm road at the access point, which will need to be upgraded to cater for the construction vehicles navigating the road to the laydown areas on site. Generally, the road width at the access point needs to be a minimum of 6m and the access roads on site a minimum of 5m. The radius at the access point from the N14 needs to be large enough to allow for all construction vehicles to turn safely onto the site. The access point shall be surfaced with black top and the internal access roads on site can be gravel.

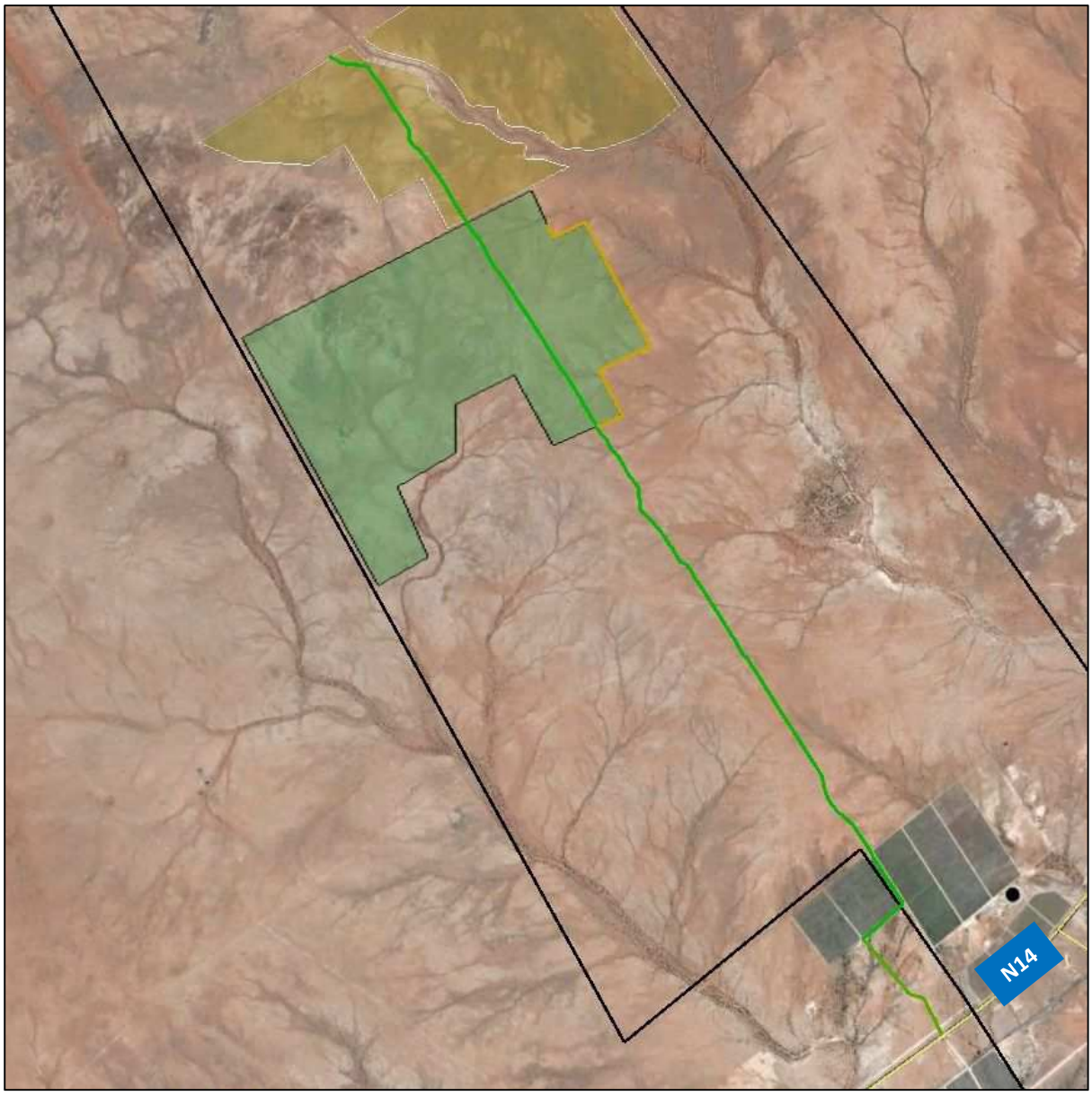
Picture 1 Existing Access Point - Access Option 1

As shown in the previous Figure 2, the access road, which is shown in light-green, will pass through vineyards. The largest of the three vineyards belongs to another owner, who requested that dust pollution of his vines be prevented. It is hence suggested to consider one of the following mitigations:

- Guide the access road around the smaller vineyard to the west of the largest vineyard as shown in orange in Figure 2, which will result in an additional length of approximately 800m gravel road to be constructed or
- Consider upgrading the access road to black top for the section passing along and through the vineyards. This option will require a bitumen surfaced road of approximately 650m in length from the access point on the N14.

The total length of the proposed access road is shown in green in the following Figure 3 and largely follows existing gravel roads. The exact location and design of the internal access road needs to be established at detailed design stage. Existing structures and services such as drainage structures and pipelines will need to be evaluated if impacting on the access road.

Figure 3 Access Road for Option 1



2.2.2 Access Option 2

Currently the detailed design of the access road for the adjacent Dyasonsklip Solarfarm is underway. The alignment of the access road for the Dyasonsklip Solar PV Project has been agreed upon and is shown in light blue in the following Figure 4.

As an alternative access option, it is proposed to utilise this access road and construct a new connection to the Bloemsmond site as shown in dark blue.

This option is deemed feasible as construction of the Bloemsmond Solarfarm will only take place after construction of the Dyasonsklip Solarfarm and hence no conflict of construction vehicles occurs. During operation, the number of trips for the respective sites will be low.

Figure 4 Aerial View of Access Option 2

The existing access point on the N14 is shown in Picture 2 below and will be upgraded to SANRAL standards as part of the Dyasonsklip Solarfarm Project. Sight distances at this access point are good.

Picture 2 Existing Access Point on N14 – Access Option 2

2.2.3 Preferred Access Option

Provided that a consent agreement with the Dyasonsklip Site is in place for shared use of their access road and taking into account cost implications of constructing the access road and the matter of protecting the vineyards (as mentioned under 2.2.1), it is recommended to choose Access Option 2 as the preferred access road. It furthermore makes sense from an access management point of view that neighbouring solarfarms share an access point to limit the number of accesses along the N14 (provided that construction phases are at different times).

2.3 Access Control

For both the above access options, access control will be provided via boom and gatehouse. It is planned to have security staff on site at the access booms during construction and implement an electronic number plate reader once the solarfarm is in operation.

Access Option 1

The boom needs to be placed far enough away from the N14 to ensure trucks can stop in front of the boom without impeding on general traffic along the N14. It is therefore recommended to allow for at least 25m stacking distance between the boom and the road edge of the N14.

Access Option 2

The boom needs to be placed far enough away from the turn-off from the access road of Dyasonsklip Solarfarm to prevent obstructing vehicles for Dyasonsklip. As above, the stacking distance from the turn-off to Bloemsmond Farm and the boom should be a minimum of 25m.

3 FREIGHT REQUIREMENTS & TRIP GENERATION

3.1 General Freight Requirements

Abnormal permits are required for vehicles exceeding the following permissible maximum dimensions on road freight transport in terms of the Road Safety Act (Act No. 29 of 1989):

- Length: 22m for an interlink, 18.5m for truck and trailer and 13.5m for a single unit truck
- Width: 2.6m
- Height: 4.3m measured from the ground. Possible height of load – 2.7m.
- Weight: Gross vehicle mass of 56t resulting in a payload of around 30t
- Axle unit limitations: 18t for dual and 24t for triple-axle units.
- Axle load limitation: 7.7t on front axle and 9t on single or rear axles.

Any dimension / mass outside the above will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorising for the conveyance of said load. A permit is required for each Province that the load has to transit.

Escort vehicles will be required to accompany the abnormal load vehicle.

It is expected that the transformer for the Bloemsmond Solar 1 PV Facility will be transported by an abnormal vehicle and hence permitting needs to be in place before transporting the transformer to site. The fee for the permit will be dictated by the actual vehicle configuration.

In addition to the vehicle limitation, further factors need to be taken into account, such as height clearances and load bearings of road infrastructure along the routes. This will be discussed further in Chapter 4.

3.2 Solar Components

The following components and materials will be transported to the site:

- Solar panels (PV panels and frames)
- Inverter and electrical equipment for the substation
- Cabling and further electrical elements
- Building material (such as gravel, concrete aggregates, cement)
- Transformer
- Vehicles transporting workers from surrounding areas to site
- Drilling machines and other construction machinery

It is anticipated that the following vehicles will access the site during construction:

- Conventional trucks within the freight limitations to transport building material to the site.
- 40ft container trucks transporting solar panels and frames as well as the inverter, which are within the freight limitations.
- Bakkie type vehicles transporting workers from surrounding areas to site.
- Drilling machines and other required construction machinery being transported by conventional trucks or via self-drive to site.
- The transformer will be transported as an abnormal load as discussed under 3.2.

3.3 Trip Generation

During Construction

The current traffic volumes on the N14 in the vicinity of the site are at about 3 000 vehicles per day (Average Daily Traffic – ADT) according to the SANRAL Yearbook and hence a maximum hourly traffic flow of around 200 vehicles per hour can be anticipated for this section of road.

From experience on other projects of similar nature, the number of heavy vehicles per 7MW installation is estimated to range between 300 and 400 trips depending on the site conditions and requirements. For the 75MW, the total trips can therefore be estimated to be between 3 000 and 4 000 heavy vehicle trips, which will be made over a 12 month construction period.

Choosing the worst case scenario of 4 000 heavy vehicles over a 12 months period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 15. Taking into account that the number of vehicle trips during peak hour traffic in a rural environment can roughly be estimated at around 20-40% of the average daily traffic, the resulting vehicle trips for the construction phase are approximately 3-6 trips. The impact on general traffic on the N14 is therefore deemed nominal.

During Operation

During operation approximately, 7 to 15 full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network.

4 HAULAGE ROUTES

A visual, Google Earth review and desktop assessment was undertaken to identify possible haulage routes for the respective components to be transported to site. It is understood that all components will be transported via road from either the manufacturing centre within South Africa or the port of entry.

4.1 General Assumptions

The following assumptions are made when establishing the suitable haulage routes:

- The largest component of the project is a single 80MVA transformer with a payload of 70t. According to the Eskom Specifications for Power Transformers, the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000mm, total maximum width 4 300mm and total maximum length 10 500mm.
- Maximum vertical height clearances along the routes is 5.2m for abnormal loads.
- The imported elements will be transported from the most feasible port of entry, which is deemed to be Saldanha Port in the Western Cape.
- The elements manufactured within South Africa will be transported from their respective manufacturing centres, which is assumed to be in the greater Johannesburg area for the transformer, inverter and the support structures and in Pinetown (KwaZulu Natal) for the PV modules.
- All haulage trips will occur mainly on surfaced national and provincial roads.
- Material for the construction of internal access roads will be as far as possible sourced locally.

4.2 Route from Saldanha Port to Site

The two possible ports of entry to receive the imported parts are Saldanha and Port Elizabeth. As the distance from Port Elizabeth to the site via road is approximately 940km and from Saldanha to the site approximately 763km via the N7 and R27 (shown in purple in the following Figure 5) and approximately 880km via the N7 and N14 (shown in orange in Figure 5), the preferred port of entry is Saldanha.

The Port of Saldanha Bay is South Africa's largest natural anchorage and port with the deepest water. It lies approximately 60 nautical miles northwest of Cape Town and accepts vessels of up to 21.5m draught and is a common user port (Iron Ore Terminal).

4.2.1 Preferred Route to Site

The preferred route will be the shortest route to the site shown in pink below and haulage vehicles will travel via the R27, R399 and N7 to site passing Veldrift, Piketberg, Vanrynsdorp, Calvinia, Kenhardt and Keimoes on their way. All roads along this route are tarred and either have black top or gravel shoulders and are single carriageways with one lane per direction.

Figure 5 Overview of Haulage Routes

4.2.2 Alternative Routes

As an alternative, the route as shown in orange in Figure 5 above can be chosen. This route remains the same as the preferred route until Vanrynsdorp, but from here it differs by remaining on the N7 until Springbok, where a turn-off will be made onto the N14 towards Upington. This route is approximately 120 km longer than the preferred route.

Should both above mentioned routes not be available for whatever reason, vehicles may travel from Port Elizabeth.

4.2.3 Summary

On both the routes discussed under 4.2.1 and 4.2.2, there are several passes, bridges and other road structures, which the haulage vehicles will pass over, but none of the goods transported from Saldanha will require abnormal loads and there are no limitations for normal heavy vehicles using these routes.

According to feedback from SANRAL, the current planning for road construction projects on the N7 is that construction will be taking place south of the Hopefield intersection, which will

not affect this project. The other projects on the N7 north of the same intersection will all be completed by 2017. Besides the daily Routine Road Maintenance, nothing is planned at this point in time.

Various projects on the N14 from Springbok to Upington were recently completed and currently nothing is envisaged for this section.

Various projects on the R27 from the WC/NC border to Upington were also recently completed and the current planning is for one project, which may be under construction at the Calvinia/Brandvlei intersection (approximately 20km from Calvinia) in 2017. However, this project will only be confirmed at a later stage.

4.3 Route for Components manufactured within South Africa

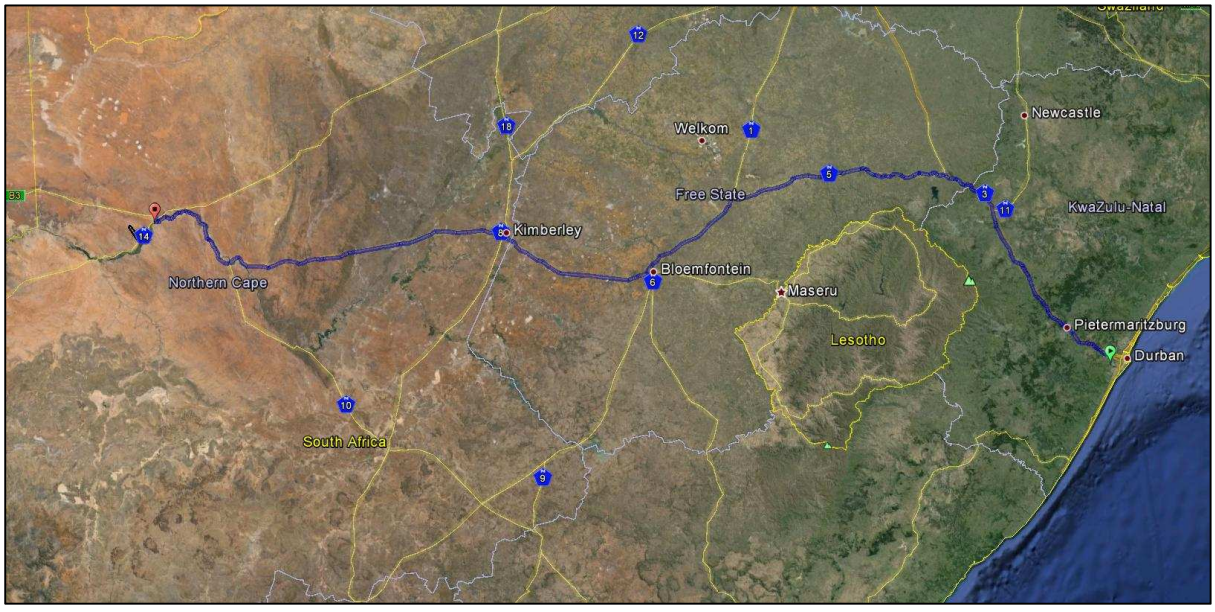
As mentioned before, it is anticipated that elements manufactured within South Africa will be transported to the site from the Johannesburg and Pinetown/Durban areas.

It is furthermore understood that the transformer, which will be transported with an abnormal load vehicle, will be transported from the Johannesburg area and hence it needs to be ensured that the route from the manufacturer to the site doesn't have load limitations for abnormal vehicles. At this stage, only a high-level assessment can be conducted as no information of the exact location of the manufacturer is known and all road structures (such as bridges and culverts) need to be confirmed for their load bearing by SANRAL or the respective Roads Authority.

4.3.1 Route from Pinetown / Durban to Site

It is assumed that the PV panels will be manufactured in the Pinetown area close to Durban and transported to site via road. These elements are normal loads and no road limitations will occur along the route, which is shown in Figure 6 below. Haulage vehicles will mainly travel on national and provincial roads and the total distance is approximately 1 200km.

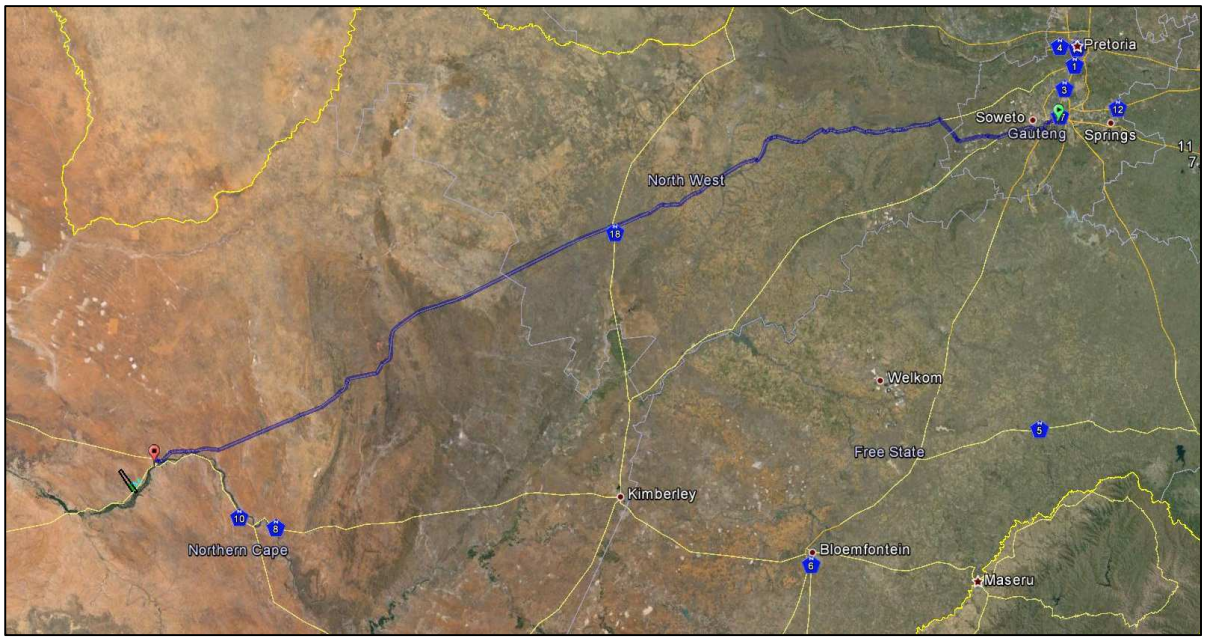
Figure 6 Route Pinetown to Site



4.3.2 Route from Johannesburg Area to Site – Normal Loads

It is assumed that the inverter and support structure will be manufactured in the Johannesburg area and transported to site via road. The general route distance is around 795km and no road limitations are expected on this route for normal loads vehicles as it will mainly follow national and provincial roads. The haulage route is shown in Figure 7 below.

Figure 7 Route from Johannesburg Area to Site for Normal Loads



4.3.3 Route from Johannesburg Area to Site – Abnormal Load

As mentioned previously, it is understood that the 80MVA transformer will be manufactured locally in South Africa and be transported from the Johannesburg area to site. As the transformer will be transported with an abnormal load vehicle, the route planning needs a more detailed investigation of the feasible routes taking into account any limitations due to existing road structures. Furthermore, a load of abnormal dimensions may cause an obstruction and danger to other traffic and therefore the transformer needs to be transported as far as possible on roads that are wide enough for general traffic to pass.

It is expected that the transformer can be transported to site via the same route used for normal loads as shown in Figure 7.

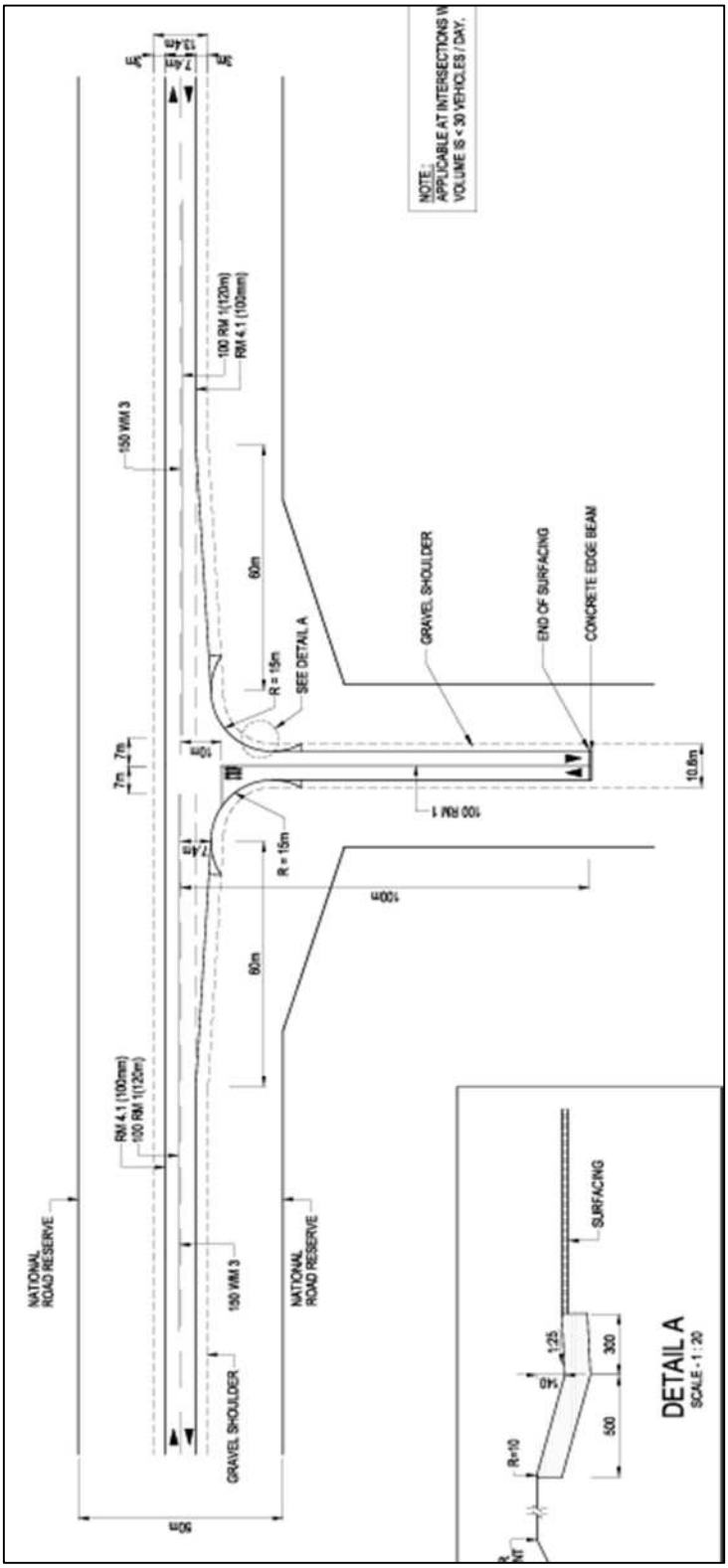
There are several bridges and culverts along this route, which need to be confirmed for load bearing and height clearances. There will be several turns along the way and a couple of small towns to pass through, such as Delareyville and Vryburg. According to the desktop study, all turning movements along the route are manageable for the abnormal vehicle.

There are a number of alternative routes, which can be investigated if the above route or sections of the route should not be available for whatever reason.

5 TRAFFIC ACCOMMODATION DURING CONSTRUCTION

If Access Option 1 is chosen, the access point from the N14 may be upgraded to SANRAL standards as shown in the following example.

Figure 8 Example of Typical T-Junction on Class 2 Roads

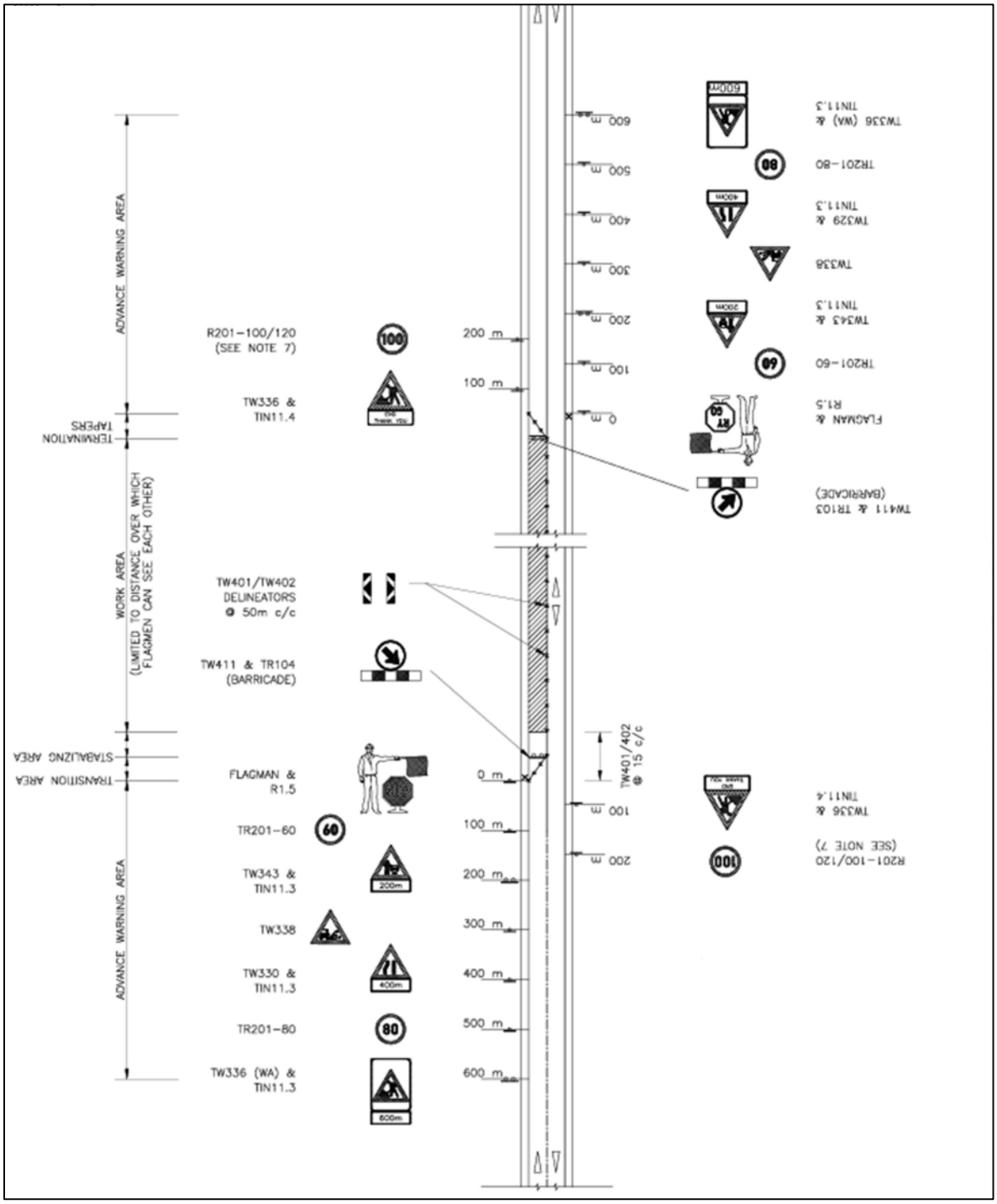


Source: SANRAL Typical Drawings – September 2014

Figure 9 shows a typical layout for Traffic Accommodation for two-way roads as per WCG Standard Plans by the Department of Transport and Public Works (March 2015).

All temporary road signage and markings needs to be in line with the South African Road Traffic Signs Manual.

Figure 9 Typical Traffic Accommodation



Source: Western Cape Government – Standard Plans – Index No. WCS/15/1/D1

6 CONCLUSION & RECOMMENDATIONS

The aim of this study was to investigate all traffic and transportation related matters pertaining to the proposed Bloemsmond Solar 1 PV Facility close to Upington in the Northern Cape. The following conclusions and recommendations are made:

The Site

- It is proposed to develop the AEP Bloemsmond Solar 1 PV Facility on a site located on Portion 5 and Portion 14 of Farm Bloemsmond 455. The developable area will comprise of approximately 225ha in extent.
- The site is located approximately 30km south-west of Upington and 16km north-east of Keimoes within the Kai !Garib Local Municipality in the Northern Cape.
- The solar facility will have a maximum total capacity of 75MW and will consist of the following elements:
  - Photovoltaic (PV) solar panels,
  - Mounting structures to support the PV Panels,
  - On-site inverters and substation,
  - New 132kV power line between substation and Eskom grid connection point,
  - Underground cabling,
  - Temporary laydown areas and
  - Internal access roads and fencing and
  - Small office block and ablution facilities for permanent staff as well as a temporary site office during the construction phase.

Access

- Two access options were discussed in this report:

  Access Option 1
  - Location at km13.6 on the N14 opposite an existing farm access.
  - Sight distances are good.
  - The existing gravel road needs to be upgraded to cater for construction vehicles (recommended road width minimum 6m)
  - Access point shall be surfaced with black top.
  - Due to dust pollution when construction vehicles pass the vineyards on site, it is recommended to either surface the sections along and through the vineyards with black top or guide the access road around one of the vineyards as shown in Chapter 2.

  Access Option 2
  - Utilise the access road currently being designed for the neighbouring Dyasonsklip Solarfarm (at approximately km16.65 on the N14) and construct a new connecting access road to the Bloemsmond site as shown in Chapter 2.
  - The Dyasonsklip and Bloemsmond Solarfarms will not be constructed at the same time and hence no conflict between construction vehicles will occur.
  - Vehicle trips during operations are low for both sites.

- Provided that a consent agreement with the Dyasonsklip Site can be obtained for shared use of their access road, it is recommended to choose Access Option 2 as the Preferred Access Option.
- For both access options, access control would be provided with boom and gatehouse. It is planned to have security staff on site at the access booms during construction and implement an electronic number plate reader once the solarfarm is in operation.
- For Access Option 1, it is recommended to position the access control a minimum of 25m from the N14. For Access Option 2, it is recommended to position the access control at least 25m from the turn-off from the access road leading to the Dyasonsklip Solarfarm.

Freight Requirements & Trip Generation

- It is expected that the transformer for the Bloemsmond Solar 1 PV Facility will be transported by an abnormal vehicle and hence permitting needs to be in place before transporting the transformer to site. The fee for the permit will be dictated by the actual vehicle configuration.
- In addition to the vehicle limitation, further factors need to be taken into account, such as height clearances and load bearings of road infrastructure along the routes.
- It is anticipated that the following vehicles will access the site during construction:
  - Conventional trucks within the freight limitations to transport building material to the site.
  - 40ft container trucks transporting solar panels and frames as well as the inverter, which are within the freight limitations.
  - Bakkie type vehicles transporting workers from surrounding areas to site.
  - Drilling machines and other required construction machinery being transported by conventional trucks or via self-drive to site.
  - The transformer will be transported with an abnormal load vehicle.
- During construction, the total trips are estimated to be between 3 000 and 4 000 heavy vehicle trips, which will be made over a 12 month construction period.
- Choosing the worst case scenario of 4 000 heavy vehicles over a 12 months period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 15. Taking into account that the number of vehicle trips during peak hour traffic in a rural environment can roughly be estimated at around 20-40% of the average daily traffic, the resulting vehicle trips for the construction phase are approximately 3-6 trips. The impact on general traffic on the N14 is therefore deemed nominal.
- During operation approximately, 7 to 15 full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network.

Haulage Routes

<u>Route from Saldanha Port to Site</u>

- The preferred route will be the shortest route to the site and haulage vehicles will travel via the R27, R399 and N7 to site passing Veldrift, Piketberg, Vanrynsdorp, Calvinia, Kenhardt and Keimoes on their way. All roads along this route are tarred and either have black top or gravel shoulders and are single carriageways with one lane per direction.
- An alternative route remains the same as the preferred route until Vanrynsdorp, but from here it differs by remaining on the N7 until Springbok, where a turn-off will be made onto the N14 towards Upington. This route is approximately 120 km longer than the preferred route.

- Should both above mentioned routes not be available for whatever reason, vehicles may travel from Port Elizabeth.
- According to SANRAL, no road construction projects are currently in planning for the time period when construction vehicles will travel from Saldanha Port to site.

Route for Components manufactured within South Africa

- It is assumed that the PV panels will be manufactured in the Pinetown area close to Durban and transported to site via road. These elements are normal loads and no road limitations will occur along the route. Haulage vehicles will mainly travel on national and provincial roads and the total distance is approximately 1 200km.
- It is assumed that the inverter and support structure will be manufactured in the Johannesburg area and transported to site via road. The general route distance is around 795km and no road limitations are expected on this route for normal loads vehicles as it will mainly follow national and provincial roads.
- It is expected that the transformer can be transported to site via the same route used for normal loads. There are several bridges and culverts along this route, which need to be confirmed for load bearing and height clearances. There will be several turns along the way and a couple of small towns to pass through, such as Delareyville and Vryburg. According to the desktop study, all turning movements along the route are manageable for the abnormal vehicle. There are a number of alternative routes, which can be investigated if the above route or sections of the route should not be available for whatever reason.

Traffic Accommodation during Construction

- For Access Option 1, the access point from the N14 needs to be designed to SANRAL standards for a T-Junction on Class 2 Roads.
- During construction of the access point, temporary road signage and markings shall be in place in accordance with the WCG Standard Plans by the Department of Transport and Public Works.

From a traffic engineering perspective, the proposed Bloemsmond Solar 1 PV Facility is supported, provided that the recommendations above are adhered to.

APPENDIX H:
EROSION MANAGEMENT PLAN

PRINCIPLES FOR EROSION MANAGEMENT

1. PURPOSE

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, this erosion management plan and the revegetation and rehabilitation plan are closely linked to one another and should not operate independently, but should rather be seen as complementary activities within the broader environmental management of the site and should therefore be managed together.

This 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 soil erosion and sediment control, which enables the contractor to identify areas where erosion can occur and be accelerated by construction related activities.
- An outline of general methods to monitor, manage and rehabilitate erosion, ensuring that all erosion resulting from all phases of the development is addressed.

2. RELEVANT ASPECTS OF THE SITE

The generalised soil patterns for the area are Sandy AR2 soils and LP2 soils that have limited pedological development, where AR2 is the more abundant of the two. AR2 soil patterns occur on the northern part of the site and may be described as red and yellow, sandy well drained soils with high base status. The other soil pattern that can be found in the southern part of the site is LP2 which are soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. Lime is generally found in large parts or in most of the surrounding landscape.

The soils are highly susceptible to wind erosion and are classified under category 1a in the northern most part where pure sands are strongly dominant, 1b towards the middle of the site where pure sands are dominant and 1d near the N14 where pure sands are present.

3. EROSION AND SEDIMENT CONTROL PRINCIPLES

The goals of erosion control during and after construction at the site should be to:

» Protect the land surface from erosion;

» Intercept and safely direct run-off water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment; and
» Progressively revegetate or stabilise disturbed areas.

These goals can be achieved by applying the management practices outlined in the following sections.

3.1. On-Site Erosion Management

General factors to consider regarding erosion risk at the site includes the following:

» Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional summer thunder storms can also cause significant soil loss. Therefore precautions to prevent erosion should be present throughout the year.
- Soils loss will be greater on steeper slopes. Ensure that steep slopes are not devegetated and subsequently become hydrophobic (i.e. have increased runoff and a decreased infiltration rate) increasing the erosion potential.
» Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilisation. Therefore the gap between construction activities and rehabilitation should be minimised. Phased construction and progressive rehabilitation are therefore important elements of the erosion control strategy.
» The extent of disturbance will influence the risk and consequences of erosion. Therefore site clearing should be restricted to areas required for construction purposes only. As far as possible, large areas should not be cleared at a one time, especially in areas where the risk of erosion is higher.
» Roads should be planned and constructed in a manner which minimises their erosion potential. Roads should therefore follow the contour as far as possible. Roads parallel to the slope direction should be avoided as far as possible.
» Where necessary, new roads constructed should include water diversion structures present with energy dissipation features present to slow and disperse the water into the receiving area.
» Roads and other disturbed areas should be regularly monitored for erosion. Any erosion problems recorded should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Compacted areas should have adequate drainage systems to avoid pooling and surface flow. Heavy machinery should not compact those areas which are not intended to be compacted 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.

» All bare areas should be revegetated with appropriate locally occurring species, to bind the soil and limit erosion potential.
» Silt fences should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.
» Gabions and other stabilisation features should be used on steep slopes and other areas vulnerable to erosion to minimise erosion risk as far as possible.
» Activity at the site after large rainfall events when the soils are wet and erosion risk is increased should be reduced.
» Topsoil should be removed and stored separately during construction activities, and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
» Regular monitoring of the site for erosion problems during construction (ongoing) and operation (at least twice annually) is recommended, particularly after large summer thunderstorms have been experienced.

3.1.1. Erosion control mechanisms

The contractor may use the following mechanisms to combat erosion when necessary:

- Reno mattresses
- Slope attenuation
- Hessian material
- Shade catch nets
- Gabion baskets
- Silt fences
- Storm water channels and catch pits
- Soil bindings
- Geofabrics
- Hydro-seeding and/or re-vegetating
- Mulching over cleared areas
- Boulders and size varied rocks
- Tilling

3.2. Engineering Specifications

A detailed Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers and this should include erosion control measures. Requirements for project design include:

- 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 must be indicated within the Stormwater Management Plan.
- An onsite Engineer or Environmental Officer 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.

3.3. Monitoring

The site must be monitored continuously during construction and operation in order to determine any indications of erosion. If any erosion features are recorded as a result of the activities on site the Environmental Officer (during construction) or Environmental Manager (during operation) must:

» Assess the significance of the situation.
» Take photographs of the soil degradation.
» Determine the cause of the soil erosion.
» Inform the contractor/operator that rehabilitation must take place and that the contractor/operator is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor/operator is taking action to stop the erosion and assist them where needed.
» Report and monitor the progress of the rehabilitation weekly and record all the findings in a site register.
» All actions with regards to the incidents must be reported on a monthly compliance report which will be submitted to the Competent Authority (during construction) and kept on file for consideration during the annual audits (during construction and operation).

The Contractor/ Developer (in consultation with an appropriate specialist) must:

» Select a system/mechanism to treat the erosion.
» Design and implement the appropriate system/mechanism
» Monitor the area to ensure that the system functions like it should. If the system fails, the method must be adapt or adjust to ensure the accelerated erosion is controlled.
» Continue monitoring until the area has been stabilised.

4. 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 compliance 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.

5. REFERENCES

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APPENDIX I:
OPEN SPACE MANAGEMENT PLAN

OPEN SPACE MANAGEMENT PLAN

The following elements are considered part of the Open Space Management Plan. The principles contained within the Alien Invasive Management Plan should also be considered to form part of the Open Space Management Plan.

Access Control:

» Access to the facility should be strictly controlled.
» All visitors and contractors should be required to sign-in.
» Signage at the entrance should indicate that disturbance to fauna and flora is strictly prohibited.

Prohibited Activities:

The following activities should not be permitted by anyone except the landowner or his representatives:

» No fires within the site.
» No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
» No driving off of demarcated roads.
» No interfering with livestock.

Fire Risk Management:

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

» Lightning strikes
» Personnel within the facility
» Infrastructure such as transmission lines

The National Veld and Forest Fires Act places responsibility on the landowner to ensure that the appropriate equipment as well as trained personnel are available to combat fires. Therefore, the management of the facility should ensure that they have suitable equipment as well as trained personnel available to assist in the event of fire.

Firebreaks

Extensive firebreaks are not recommended as a fire-risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management should be implemented around vulnerable or sensitive elements of the facility such as substations or other high-risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is recommended that

firebreaks are created by mowing and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substation, a strip of vegetation 5-10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However if alien species colonise these areas, more regular clearing should be implemented.