PROPOSED WATERBERG PHOTOVOLTAIC PLANT & ASSOCIATED INFRASTRUCTURE LIMPOPO PROVINCE

CONSTRUCTION & OPERATION DRAFT ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE WATERBERG PHOTOVOLTAIC PLANT

Submitted as part of the Draft EIA Report
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

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

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

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.

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

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 public.

Kyoto protocol: The Kyoto Protocol calls for developed countries to reduce their green house gas emissions during the commitment period (2008 - 2012) by 5.2% compared to 1990 levels. Developing countries, like South Africa, do not have a limit on their emissions.

National integrated resource plan: Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is

consistent with reliable electricity supply and environmental, social, and economic policies.

Photovoltaic cell: Semiconductors which absorb solar radiation to produce electricity

Photovoltaic effect: Electricity can be generated using photovoltaic panels (semiconductors) which are comprised of individual photovoltaic cells that absorb solar energy to 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).

Renewable energy feed-in tariff: REFITs are used to promote renewable energy and have been adopted in over 36 countries worldwide. The establishment of the REFIT in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector, and to promote competitiveness between renewable and conventional energies in the medium and long-term. Under the National Energy Regulator Act (Act No. 40 of 2004), the Electricity Regulation Act (Act No. 4 of 2006), and all subsequent relevant amendment acts, the National Energy Regulator of South Africa (NERSA) has the mandate to determine the prices at and conditions under which electricity must be supplied by licence.

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.

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PURPOSE & OBJECTIVES OF THE EMP *CHAPTER 1*

An Environmental Management Plan (EMP) 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 EMP 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 EMP is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP 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 (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site remediation (soil stabilisation, revegetation) and operation.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed Waterberg Photovoltaic Plant), 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. During its lifecycle, projects journey through four distinctive phases. The EMP is accordingly separated into measures dealing with the various project phases.

The EMP has the following objectives:

» To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation, and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the PV plant.

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

- To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- To propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
- To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The mitigation measures identified within the Environmental Impact Assessment process are systematically addressed in the EMP, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Thupela Energy must ensure that the implementation of the project complies with the requirements of any environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development and the implementation of the EMP through its integration into the contract documentation. Since this EMP is part of the EIA process undertaken for the proposed Waterberg Photovoltaic Plant, it is important that this document be read in conjunction with the Scoping Report (July 2010) and EIA Report (November 2010), as well as the Environmental Authorisation (once issued). This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMP for construction and operation activities has been compiled in accordance with Section 34 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project.

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 EMP. 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 EMP 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 EMP 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/off the site.
- Ensuring awareness of any other environmental matters, which are deemed necessary by the ECO.

The EMP is a dynamic document, which must be updated when required. It is considered critical that this draft EMP be updated to include site-specific information and specifications as required. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features.

PROJECT DETAILS *CHAPTER 2*

Thupela Energy is proposing the establishment of a commercial solar energy facility on a site located approximately 24 km north-east of the town of Vaalwater in the Limpopo Province (refer to Figure 1.1). This is to be known as the Waterberg Photovoltaic Plant. From an extensive site identification process undertaken by Thupela Energy, an area which falls within the Modimolle Local Municipality between Vaalwater and Vier-en-Twintig Riviere has been identified for consideration within an Environmental Impact Assessment (EIA) process.

The proposed facility will comprise an array of tracking photovoltaic (PV) panels and ancillary infrastructure to be constructed over an area of approximately 20 ha (and not more than 30 ha) within the broader study area of 50 ha. The facility is proposed to be constructed over a single phase of approximately six - nine months, and will have a maximum generating capacity of up to 5 MW. The facility is intended to be operated as a commercial power generating facility and would include the following infrastructure.

- The **PV panels** will be placed on mounts, which will be sited a certain distance away from each other to allow sufficient room to mitigate shading issues. The electrical output from individual panels will be summed, initially into "strings," then further summed, and changed to AC power using inverters. The panel mounts will be secured into the ground by the use of concrete feet.
- A **switching station** of approximately 4 m x 4 m will be established for the "turn in" to Eskom's existing Mink power line which crosses the site. It has been determined through preliminary discussions with Eskom that this line has capacity to receive the power from the proposed facility. A switching station is a smaller version of a substation and contains a single transformer to step up the generated power into a voltage suitable for the existing power line (i.e. 22 kV in this case).
- An **extraction point** and **low volume water supply pipeline** from an existing on-site borehole will be established for occasional cleaning of the PV panels and for general, limited water use at the kitchen, crèche, and visitors centre.
- **Access roads** within the site will be established for the purposes of construction and limited maintenance activities.
- Workshop, laydown and storage areas
- A visitor's centre, crèche and kitchen/dining utilising a water-less sanitation system[2]

[2] A system of this nature does not utilise water and reduces the waste to approximately 10 % of the original volume through a process of dehydration. This water-less method is preferred due to the proximity of the Melk River which runs east of the site and the rural nature of the site which would render extensive plumbing impractical.

The site proposed for the Waterberg Photovoltaic Plant area falls within the Modimolle Local Municipality, which falls under the Waterberg District Municipality of the Limpopo Province. The plant is proposed on Portion 2 of the Farm Goedgevonden KR 104.

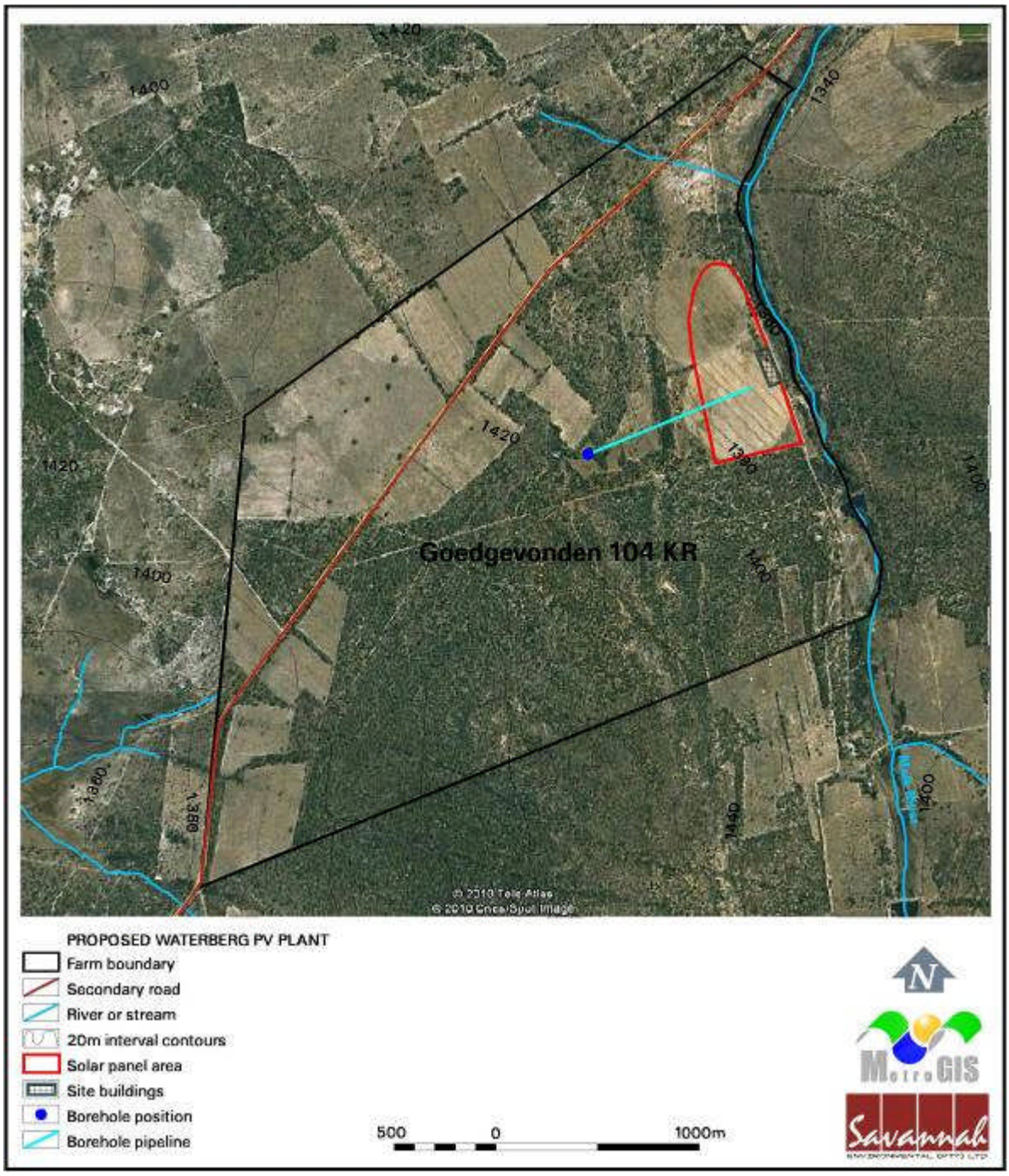

Figure 2.1: Locality map showing the proposed layout

In terms of the findings of the EIA Report, various planning, construction, and operation-related environmental impacts were identified, including:

» Disturbance to sense of place, visual aesthetics

» Soil disturbance and erosion
» Socio-economic impacts
» Road and traffic related impacts

No absolute no go areas have been identified for the proposed photovoltaic plant. In addition, as the facility is located within a previously cultivated area of the property under investigation, no impacts on biodiversity were identified.

The EMP has been developed based on the findings of the EIA, and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

2.1 Activities and Components associated with the Waterberg Photovoltaic Plant

The main activities/components associated with the Waterberg Photovoltaic Plant are detailed in Table 2.1.

Table 2.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity/Project Component	Components of Activity	Details
	Planning	
Conduct technical surveys	» Geotechnical survey by geotechnical engineer: » Site survey and confirmation of the infrastructure micro-siting footprint » Survey of pipe line route	» All surveys are to be undertaken prior to initiating construction.
	Construction	
Upgrade of access roads to the site	» Upgrade external access/haul roads to the site (i.e. gravel track leading to the facility), if required	» The proposed internal access roads will be comprised of gravel tracks or compacted rock-fill with a layer of higher quality surfacing stone on top. Should the latter be required, the strength and durability properties of the rock strata at the proposed site would need to be assessed during the geotechnical surveys. » Existing external access roads will be upgraded in advance of any components being delivered to site (i.e. the gravel track leading to the facility).
Undertake site preparation	» Site establishment of offices/workshop with ablutions and stores, contractors yards » Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the infrastructure footprints (i.e. the visitor's centre, the kitchen/dining facilities, the workshops/storerooms, the crèche, as well as the administrative/security offices) » Shallow excavations for foundations	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.

Main Activity/Project Component	Components of Activity	Details
Construct infrastructure foundations	» A complete interconnected, re-enforced, 'raft' foundation is constructed on which the buildings can sit (final dimensions to be defined by geotechnical survey of the site) » Concrete foundations will be constructed for the 'feet' of the PV panels.	» The raft is positioned typically no more than 30 cm deep into the sand. » Foundation holes for the PV panels will be mechanically excavated to a depth of approximately 30 - 50 cm. The concrete foundation will be poured and will then be left for up to a week to cure. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of small designated concrete batching areas close to the activities.
Transport of components and equipment to site	» Trucks will be used to transport all components to site: * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.). * The components required for the establishment of the switching station (including the inverters) * Components required for the establishment of the switching station (including cabling) * Ready-mix cement trucks for the PV panel foundations/feet	» The individual components are unlikely to be classified as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) by virtue of their limited dimensions (i.e. length and weight). » The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.
Establishment of PV panels	» The electrical output of the PV panels mounts will be summed, initially into "strings," then further summed, and changed to AC power using inverters.	» The PV panels mounts will be sited a certain distance away from each other to allow sufficient room to mitigate shading issues. The panel mounts will be secured into the ground by the use of concrete feet
Construct switching station and ancillary infrastructure	» Switching station » Visitor's Centre	» A temporary construction area is needed for containers, toilets, and equipment.

Main Activity/Project Component	Components of Activity	Details
	» Workshop, storage areas, administrative and security facilities	» Permanent operational buildings include the Visitor's Centre (i.e. 10 m x 20 m), ablution facilities (4 m x 5 m), workshop (6 m x 8 m), storage areas (6 m x 8 m), administrative, and security facilities (6 m x 10 m), kitchen and dining facilities (10 m x 15 m) and a crèche (6 m x 8 m).
Connection of PV panels to the switching station	» The PV panels will be connected to the switching station via underground cabling (where practical)	» The installation of these underground cables will require the excavation of trenches of approximately 30 cm deep within which they can then be laid. The underground cables will be planned to follow the internal access roads, as far as possible.
Connect switching station to the grid	» The generated power that is stepped up in the switching station will then be evacuated to the Mink power line.	» The power line will be isolated along the existing Eskom line, and a new line of approximately 10 m will be connected from the transmission line to the switching station. This will allow for the evacuation of power into the line and extraction of power out of the line in both directions.
Undertake site rehabilitation	» Remove all construction equipment from the site » Rehabilitation of temporarily disturbed areas where practical and reasonable	» On full commissioning of the facility (or a phase thereof), any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
	Operation	
Operation	» PV panels » Associated infrastructure (i.e. Visitor's Centre and kitchen/dining facilities)	» The operational phase is proposed to run for a period of approximately 30 - 50 years. » During this time a full time security, maintenance, supervision, and monitoring teams will be required on site. » The PV plant will be operational during daylight hours only but not under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities. » No energy storage mechanisms (i.e. batteries) which would allow for continued generation at night or on cloudy days are proposed.
Maintenance & Security	» Maintenance during the life cycle of	» The panels will be cleaned during the night whereby large dusters

Main Activity/Project Component	Components of Activity	Details
	the facility would include emergency repairs, routine panel maintenance, and cleaning. » 24 hour security » Kitchen/dining facilities » Visitor's centre	or compressed air would be used. When necessary, the panels would have to be cleaned with water. » Security measures on site would involve infra red cameras and CCTV monitoring, a minimum of three security personnel on site (full-time) and security back-up from a larger armed security organisation. » The canteen facility proposed would be a small facility where food can be prepared for the personnel. » The primary aim of the visitors centre would be educational with the following activities anticipated to take place: » A tour of the site and the opportunity to experience the operation of the facility » An audio visual display focusing on the construction and operation of the facility and solar power and climate change in general » An opportunity to manipulate a solar panel and experience the generation of electricity » Visitors would have the opportunity to buy and/or even make their own souvenirs which use solar power to take with them
Decommissioning		
Site preparation	» Preparation of the site » Mobilisation of construction equipment	» Depending on the economics of the development following the operational period, the plant will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to continue, existing components would be dissembled and replaced with more appropriate technology/ infrastructure available at that time. However, if the decision is made to decommission the facility the following activities will form part of the project scope.
Disassemble panels	» The panels will be disassembled and replaced	» The components of the plant will be disassembled and removed. Thereafter they will be reused and recycled (where possible) or

Main Activity/Project Component	Components of Activity	Details
		disposed of in accordance with regulatory requirements.

STRUCTURE OF THIS EMP *CHAPTER 3*

The first two chapters provide background to the EMP and the proposed project. The chapters which follow consider the:

» Planning and design activities
» Construction activities
» Operation activities
» Decommissioning activities

These chapters set out the procedures necessary for Thupela Energy to achieve environmental compliance. For each of the phases of implementation for the plant project, an over-arching environmental **goal** is stated. 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 environmental management programme table has been established for each environmental objective. The information provided within the EMP table for each objective 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 environmental impact assessment specialist studies

Project component/s	List of project components affecting the objective, i.e.: » PV panels » Access roads » Switching station » Ancillary infrastructure		
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	Description of key indicator(s) that track progress/indicate the		

Indicator	effectiveness of the management plan.
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 EMP tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components and/or layout of the facility).
» Modification to or addition to environmental objectives and targets.
» Relevant legal or other requirements are changed or introduced.
» 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 draft EMP was compiled by:

	Name	**Company**
EMP Compilers:	Tammy Kruger	Savannah Environmental
	Jo-Anne Thomas	Savannah Environmental
Specialists:	Iain Paton – geology, erosion potential	Outeniqua Geotechnical Services cc
	Lourens du Plessis - visual	MetroGIS
	Ingrid Snyman - social	Batho Earth
	Hugo van Zyl – socio-economic	Independent Economic Researchers
	Garry Paterson – agricultural potential	Agricultural Research Council
	Bruce White - roads	Bigen Africa Services
	Johnny van Schalkwyk - heritage	

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

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: PLANNING & DESIGN CHAPTER 4

4.1. Goal for Planning and Design

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

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» 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 sites.
» Enables the photovoltaic plant 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.

4.2. Objectives

OBJECTIVE: Ensure the facility design responds to the identified environmental constraints and opportunities

From the specialist investigations undertaken for the proposed photovoltaic plant development site, no absolute *'no go'* areas were identified. However, in terms of environmental constraints/opportunities the following applies:

» *The visual absorption capacity* of the natural vegetation may allow for the mitigation of potential visual impacts. Similarly, it may be assumed that receptor sites exposed to visual impact may mitigate this impact by planting a vegetation screen similar in form and density to the natural vegetation of the receiving environment. It should be noted, however, that this measure will only be effective if the screen is planted *in close proximity to the receptor*. This means that the visual impact must be screened at the property which is experiencing the impact, rather than at the development site itself.

» The impact of vehicles on the existing gravel roads during construction may result in the further deterioration should the correct remedial and maintenance measures not be applied.

Project component/s	Project components affecting the objective: » PV panels and ancillary infrastructure » Existing gravel access roads
Potential Impact	» Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	» Positioning of panels and » Utilisation of existing gravel access roads
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	**Responsibility**	**Timeframe**
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, as detailed within the EIA report and relevant appendices. These recommendations are to be supplemented by information collected during the pre-construction surveys.	Engineering Design Consultant Thupela Energy	Tender Design & Design Review Stage
Rehabilitation of external access roads to be carefully planned to minimise the impacted area and prevent unnecessary further degradation.	Local roads authorities and Thupela Energy	Design phase
A detailed geotechnical investigation is required for the design phase.	Thupela Energy	Design phase
Compile a comprehensive stormwater management plan for hard surfaces as part of the final design of the project.	Thupela Energy	Design phase
Access roads within the site to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer	Pre-construction and Construction
Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements.	Thupela Energy	Tender Design & Design Review Stage

Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
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.

Performance Indicator	» External access roads are not degraded as a result of the construction or operation of the facility. » Visual impacts during the operation phase are mitigated through the effective placement of the facility within the site (i.e. with respect to surrounding vegetation) and using screening.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, and the ECO prior to the commencement of construction.

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: CONSTRUCTION CHAPTER 5

5.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the photovoltaic plant in a way that:

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

5.2. Institutional Arrangements: Roles and Responsibilities for the Construction Phase

As the Proponent, Thupela Energy must ensure that the implementation of the photovoltaic plant complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation. Thupela Energy will retain various key roles and responsibilities during the construction of the photovoltaic plant. These are outlined below.

OBJECTIVE: To establish clear reporting, communication and responsibilities in relation to environmental incident

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environment Representative; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

» Ensure of all specifications and legal constraints specifically concerning the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that Thupela Energy and its Contractor(s) are made aware of all stipulations within the EMP.

» Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully conversant with the Environmental Impact Assessment for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Thupela Energy's On-site Representative) will:
» Be fully knowledgeable with the contents of the Environmental Impact Assessment.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents of the Environmental Management Plan.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Have overall responsibility of the EMP and its implementation.
» Conduct audits to ensure compliance to the EMP.
» Ensure there is communication with the Project Manager, the Environmental Control Officer, 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.

The **Environmental Control Officer** (ECO) will be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specification. Accordingly, the ECO will:

» Be fully knowledgeable with the contents with the Environmental Impact Assessment.
» Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents with the Environmental Management Plan.
» Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
» Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
» Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
» Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address this.
» Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.

» Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
» Ensure that activities on site comply with all relevant environmental legislation.
» Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMP.
» Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
» Ensure that there is communication with the Site Manager regarding the monitoring of the site.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.

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 (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMP.
» 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 EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

5.3. Objectives

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

OBJECTIVE: Site establishment and securing the site

Site establishment is the first activity which is to be undertaken within the construction phase. 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 English, Afrikaans and any other relevant local languages, all to the approval of the Site Manager.

Project component/s	Project components affecting the objective: » PV panels and ancillary infrastructure » Existing gravel access roads substations
Potential Impact	» Hazards to landowners and public » Security of materials
Activities/risk sources	» Open excavations/diggings (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, as agreed with the Environmental Control Officer.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Identify disturbance areas and restrict construction activity to these areas	Environmental Control Officer (ECO)/Contractor	Pre-construction and Construction
Establish the necessary ablution facilities with chemical toilets. Provide adequate sanitary facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Ablution or sanitary facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands or within a horizontal distance	Contractor	During site establishment, construction and

Mitigation: Action/control	Responsibility	Timeframe
of less than 100 m, whichever is applicable		maintenance
Supply adequate numbers of waste collection bins in appropriate locations on the site where construction is being undertaken.	Contractor	Erection: during site establishment Maintenance: for duration of Contract within a particular area

Performance Indicator	» No unnecessary environmental impacts associated with site established » 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 to the EMP » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of non-conformances recorded.

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

Employment opportunities could be created during the construction phase as a large part of the construction activities would entail manual labour such as the erection of the fence, creation of fire breaks, cable laying, and mount installation. Other construction activities would include manual labour associated with the construction of building structures (i.e. visitors centre, crèche, and kitchen). Specialist contractors would be responsible for the installation of the inverters and associated electronics.

In total approximately fifty (50) construction workers would be on site on average, increasing to approximately one hundred and twenty six (126) construction workers during the peak construction period. It is therefore fair to state that at least fifty construction workers could be employed for the average length of the construction period (six months), but that this figure could increase for shorter periods. Additional security personnel would be appointed from the start of the construction process.
The unemployment rate in the study area is approximately 22% and recent studies undertaken by the Waterberg Biosphere Reserve indicate an unemployment rate of the 2008 school leavers in the area as 73%. There are therefore various individuals in the area in search of employment, even if the opportunities are only temporary. As indicated above it is also foreseen that it would be possible to make use of local labour for a large section of the construction activities. Opportunities for SMMEs to be

considered for some of the construction activities also exist. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project. Failure to involve the local population, emerging contractors, and SMMEs during construction could lead to negative attitude formation against the proposed project and the project proponent.

Infrastructural development type projects usually create expectations that numerous job opportunities for the local community members will be generated. This perception is even more so in cases where the implementation and construction is actually taking place in close proximity to rural settlements. Unrealistic expectations concerning job creation should thus be guarded against.

Project component/s	Construction and establishment activities associated with the establishment of the photovoltaic plant, including infrastructure etc.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	Contractors who make use of their own labour thereby reducing the employment and business opportunities for locals.
Mitigation: Target/Objective	Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of the low-skilled workers from the local area where possible. This should also be made a requirement for all contractors.

Mitigation: Action/control	Responsibility	Timeframe
Employment of local community members (e.g. source labour from Boschdraai and Leseding or the immediate environment) should be undertaken where possible.	Thupela Energy, Modimolle Local Municipality & Contractor	Pre-Construction
An equitable process should be promoted whereby locals and previously disadvantaged individuals (women) are taken into account.	Modimolle Local Municipality & Thupela Energy	Pre-Construction
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.	Modimolle Local Municipality, Thupela Energy & Contractor	Pre-Construction
Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses, and SMMEs from the local sector.	Thupela Energy & Contractor	Pre-Construction
A local labour desk should be set-up (if not already established) in the beneficiary communities to co-	Modimolle Local	Pre-Construction

Mitigation: Action/control	Responsibility	Timeframe
ordinate the process of involving local labour.	Municipality & Contractor	
Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.	Thupela Energy	Pre-Construction

Performance Indicator	» Job opportunities, especially of low skilled positions, are primarily awarded to members of local communities. » Locals and previously disadvantaged individuals (women) are taken into account during the hiring process. » SMMEs are awarded with contracts during the construction phase. » Labour, entrepreneurs, businesses, and SMMEs from the local sector are awarded with jobs, based on requirements in the Tender Documentation. » The involvement of local labour is promoted and runs efficiently using a local labour desk in the Boschdraai and Leseding Communities. » Reports are not made from members of the local communities regarding unrealistic employment opportunities.
Monitoring	» ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Address economic inequities within the study area

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector. Education levels in the study area and status of the educational facilities give a clear indication of the unskilled labour force within and surrounding the study area. As a result a large part of the population in the Modimolle Local Municipality and the study area are employed in semi-skilled and unskilled positions (approximately 53%). Detailed skills of the Boschdraai and Leseding residents were not readily available, but based on information sourced concerning the sectors in which most of the adult population in the study area is employed in. Based on the existing occupations, one could conclude that unskilled and semi-skilled labour could, thus, be sourced from the residents of Boschdraai and Leseding, and possibly from the immediate environment.

Project component/s	Semi-skilled and unskilled employment opportunities
Potential Impact	The opportunities and benefits associated with the creation of local employment and business could be maximised as it is anticipated that locals have the necessary skills (semi-skilled and unskilled levels) to be

	employed.
Activity/risk source	Unavailability of locals with the required skills resulting in locals not being employed and labour is sourced from outside the MLM area.
Mitigation: Target/Objective	Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of the low-skilled workers from the local area where possible. Should the necessary skills not be readily available, skills training and capacity building should be undertaken.

Mitigation: Action/control	**Responsibility**	**Timeframe**
A broad-based approach should be followed to identify and involve relevant organisations in identifying people whose skills may correspond with the job specifications.	Thupela Energy	Pre-Construction
In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy and Contractor	Construction Phase

Performance Indicator	» Job opportunities, especially of low skilled positions, are primarily awarded to members of local communities. » Skills training and capacity building initiatives are developed and implemented (possibly in cooperation with similar initiatives undertaken by the Waterberg Biosphere Reserve). » Local SMME's and/or entrepreneurs should be awarded the opportunity to become involved in the tender process.
Monitoring	» Independent ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Enhance capacity building and skills development within the local communities

Capacity building and skills training during the construction phase will range from training labourers in assembly and installation of panel mounts through to more advanced skills, such as electrical wiring. Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other types of construction or electricity generation related projects.

Project component/s	» PV plant and associated infrastructure
Potential Impact	» Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills
Activity/risk source	» Inefficient training or lack of capacity building and skills training
Mitigation:	» Capacity building and skills training during the construction phase to

Target/Objective	range from training labours in assembly and installation of panel mounts through to more advanced skills, such as electrical wiring.

Mitigation: Action/control	Responsibility	Timeframe
In cases for the semi-skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy and Contractors	Pre-Construction and Construction
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Construction
Contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Construction and Operational
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.	Thupela Energy and Contractors	Construction

Performance Indicator	» A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere.
Monitoring	» ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Minimise the impact of the inflow of an outside workforce and job seekers into the study area

It is estimated that an average number of fifty (50) construction workers would be required on site on a daily basis. During peak construction periods this could increase to approximately one hundred (100) workers. No construction workers would be housed on site and no construction camp for accommodation purposes would be built. Due to the size of the construction workforce, the impacts associated with the inflow of temporary workers to the area could result in various negative impacts on the surrounding property owners and possibly on local communities. The negative social impacts associated with the inflow of workers are expected to manifest predominantly during the peak periods of the construction phase of the project. The intensity would depend on whether local labour would be used and the actual percentage of workers that would be from the local labour pool.

Even if limited numbers of additional outsiders (from other provinces) or foreigners come to the area in search of employment, it is possible that the small number of

outsiders and foreigners already present in the area could come into conflict with the local community members in search of employment. The inflow of jobseekers (foreigners or locals) to the site is thus anticipated to occur and could even materialise prior to the construction phase when people become aware of the proposed project. The majority of negative social impacts associated with the inflow of jobseekers are usually experienced if the jobseekers, especially those not originally from the area, remain in the area for long periods or even after construction has stopped. This could result in added pressure on the existing infrastructure and services and even in an increase in crime levels and conflict between locals and the jobseekers.

Project component/s	» PV plant and associated infrastructure
Potential Impact	» The inflow of outsiders and jobseekers could result in negative impacts on the surrounding property owners and local communities, and could even lead to conflict between the locals and these outsiders.
Activity/risk source	» Outside workforce and jobseekers come into conflict with locals, their presence leads to environmental pollution, and possibility of them remaining in the area after construction has ceased. This would put additional pressure on the existing infrastructure and services.
Mitigation: Target/Objective	» Limit the number of outsiders employed and put pro-active measures in place to deal with possible jobseekers.

Mitigation: Action/control	Responsibility	Timeframe
Local labourers should be employed where possible.	Contractor	Pre-Construction
Local labourers should remain at their existing residences and no workers can be allowed on site during night time. No workers should thus be accommodated on site at night.	Contractor	Construction
Maintain normal working hours.	Contractor	Construction
Before construction commences, representatives from the Modimolle Local Municipality, community leaders, community-based organisations and the surrounding property owners, should be informed of the details of the contractors, size of the workforce and construction schedules.	Thupela Energy	Pre-Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Contractor Environmental Control Officer	Construction
Local community organisations and policing forums / neighbourhood watches must be informed of the presence of the outside workforce.	Thupela Energy	Pre-Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce.	Thupela Energy	Construction

Mitigation: Action/control	Responsibility	Timeframe
Sufficient water and sanitation facilities should be provided for the workers on site during the construction period.	Contractor	Construction
The construction site should be properly managed to avoid any environmental pollution (due to inadequate water and waste infrastructure and services) and littering.	Environmental Control Officer & Contractor	Construction
Informal vending stations should not be allowed on or near the construction site. Construction workers should preferably receive daily meals and beverages to avoid the need for a vending station.	Contractors	Construction
Information distributed as part of the existing HIV/Aids awareness campaigns should again be focused on and communicated to the local workforce.	Thupela Energy & Contractors	Construction
Develop a transparent communication and recruitment process to minimise the influx of jobseekers to the area.	Thupela Energy, local leaders and the Modimolle Local Municipality	Pre-construction
The recruitment process and the use of contractors should be clearly communicated to the local communities.	Thupela Energy	Pre-construction
Maximise the use of local labour and contractors where possible by developing a strategy to involve local labour in the construction process.	Thupela Energy and Contractor	Pre-construction & Construction
The communication strategy should ensure that unrealistic employment expectations are not created.	Thupela Energy	Pre-construction & Construction
A representative of Thupela Energy or its EPC partner could attend community meetings arranged within the various wards to discuss the employment and recruitment process.	Thupela Energy	Pre-construction

Performance Indicator	» Reports are not made from members of the local communities regarding unrealistic employment opportunities. » Sound environmental management of construction site.
Monitoring	» Thupela Energy and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise traffic related impacts

Construction vehicles (e.g. excavators or bulldozers) would be stored on site and movement of these vehicles between the construction site and source areas would be kept to the minimum. A large number of delivery vehicles (large trucks of some being between 20 to 30 tons) would have to access the site for the delivery of the mounts, panels, and electrical equipment. The number of vehicles is estimated at a minimum of 150 trucks and a maximum of 200 trucks for the duration of the construction period which would result in approximately two heavy vehicles per day. The frequency of the trips cannot yet be determined. The construction related vehicles would most probably make use of the tarred Modimolle-Vaalwater Road (R33) and the tarred Vaalwater-Melkrivier Road (R518) and then turn-off onto the Sterkstroom or Vier-en-Twintig-Riviere gravel roads to access the site.

The impact on the safety of other road users, as well as pedestrians (especially children) could materialise near the access road to the farm Boschdraai (from the Sterkstroom gravel road) where approximately 350 individuals reside.

Other social impacts refer to the effect of an increase in heavy traffic on the surface of the gravel roads. It is anticipated that the large number of construction vehicles would have an impact on the gravel roads which could last for a couple of years. If locals from Boschdraai (app. 8 km from the proposed site) and Leseding (app. 25 km from the proposed site) would be employed during the construction period, they would be transported from their existing residences to the site and back on a daily basis. This would result in an additional increase in heavy vehicles (e.g. buses) on the local roads. Concerns in this regard again relate to the safety of other road users and pedestrians, but also to the impact of the increase in traffic on the surfaces of the local roads.

Any access to properties surrounding the proposed site is not expected to be affected during the construction phase. Property owners that have to pass the construction site to access their farms would thus have continuous access to their properties. Noise and dust impacts and possible delays when property owners have to wait to pass heavy vehicles on the local access road would be particularly intrusive to the surrounding property owners of the farms Schoongezicht KR 107 and Sterkstroom KR 103.

Project component/s	» External access road
Potential Impact	» Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents
Activities/risk sources	» Construction vehicle movement

Mitigation: Target/Objective	» Minimise the impact of the increase in heavy vehicles on existing infrastructure, property owners, and road users.

Mitigation: Action/control	Responsibility	Timeframe
Meetings with affected residents should be arranged before construction commences. During these meetings, the contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified. Appropriate management and mitigation measures should be agreed to.	Thupela Energy and Environmental Control Officer	Pre-Construction
Residents of the farms Schoongezicht KR 107 and Sterkstroom KR 103 should be allowed access to their properties at all times.	Contractor	Construction
The movement of construction vehicles through the local area should be limited to off-peak periods (if possible) to minimise adverse impacts on the movement of pedestrians (individuals walking to and from work and schoolchildren) and to a lesser extent on private vehicular traffic.	Contractor	Construction
Signs should be erected at strategic locations throughout the area, warning residents, and visitors about the hazards around the construction site and the presence of heavy vehicles.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	Contractor & Environmental Control Officer	Construction
Construction vehicles should keep to the speed limits.	Contractor & Environmental Control Officer	Construction
The local gravel access roads should be graded during the construction phase (possibly every six months) to limit the degradation of the road surface.	Thupela Energy	Construction

Performance Indicator	» Vehicles keeping to the speed limits, no incidences of speeding are noted. » Vehicles are in good working order and safety standards are implemented » Local residents and road users are aware of vehicle movements and schedules » Property owners (e.g. of the farms Schoongezicht KR 107 and Sterkstroom KR 103) have access to their properties at all times. » No traffic related accidents are experienced. » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).
Monitoring	» The independent appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: To minimise the potential impact on safety and security

Even though no construction workers are expected to be accommodated on site, an inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities. Materials and goods would be stored on site in some type of storage facility for the duration of the construction period, and this in itself can lure criminals to the area. Safety of individuals residing in the area and animals, especially rare game species such as rhinoceros, sable antelope, buffalo, and so forth remain of concern. The negative impacts associated with the inflow of workers could, however, be limited should a local labour force be used. The crime rates are said to be low in the Modimolle Local Municipality area and the proposed project should thus avoid any actions that could increase the risk of criminal activity.

Safety at and around the construction site should be ensured by limiting any fire risks, fencing off the construction area to avoid unauthorised access of especially school children and by employing security personnel. In this regard, the project proponent indicated that it is planned to establish a fire capability on site from the start of the construction phase, which could include a fire fighter and individual man pack sprayers. Permanent security personnel would be on site for the duration of the construction period.

Construction related accidents are also always a concern when construction activities are undertaken. Local doctors and ambulance facilities for accidents would be used and it is anticipated that there would be sufficient capacity for minor emergencies. Major emergencies could be problematic as the nearest hospital is located at Modimolle, but due to the type of activities undertaken, major emergencies are unlikely to occur.

Project component/s	» PV facility and associated infrastructure
Potential Impact	» Outside workers are involved in criminal activities and/or fires occur.
Activities/risk sources	» Safety of individuals and animals are at risk.
Mitigation: Target/Objective	» Employment of local labour should be maximised and strict security measures should be implemented at the construction site.

Mitigation: Action/control	Responsibility	Timeframe
Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the	Contractor	Pre-Construction

Mitigation: Action/control	Responsibility	Timeframe
presence of an outside workforce.		
Screening of workers that apply for work could be useful to lessen perceived negative perceptions about the outside workforce.	Contractor	Pre-Construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	Contractor	Construction
Local community organisations and policing forums must be informed of the presence of the outside workforce.	Thupela Energy	Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce by arranging meetings with local community leaders.	Thupela Energy and Contractor	Pre-Construction and Construction
The property owners surrounding the construction area should be involved during the construction process by communicating the construction schedule and movement of workers with these representatives.	Thupela Energy and Environmental Control Officer	Pre-Construction and Construction
Property owners and their workers, as well as local communities (e.g. Boschdraai due to their location to the site) and their community structures should be motivated to be involved in crime prevention and by reporting crimes.	Thupela Energy	All phases of project
The construction site should be fenced and access to the area controlled.	Thupela Energy and Contractor	All phases of project
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	Thupela Energy and Contractor	Construction
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners	Thupela Energy	Pre-Construction and when required

Performance Indicator	» No criminal activities are reported. » No fires occur. » No incidences are reported between the local communities and the "outside" workforce.
Monitoring	» Thupela Energy, local policing forum and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Noise control

Various construction activities would be taking place during the development of the facility and there exists a risk that some of these activities could have a noise impact on surrounding residents.

Project component/s	» Construction of infrastructure » Movement of vehicles » Activities of construction crews
Potential Impact	» Increased noise levels at potentially sensitive receptors
Activity/risk source	» Any noisy construction activities
Mitigation: Target/Objective	» Minimise the generation of a disturbing or nuisance noises, where possible » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with Noise Control Regulations

Mitigation: Action/control	Responsibility	Timeframe
Establish a line of communication and notify all stakeholders and potentially sensitive receptors of the means of registering any issues, complaints, or comments.	Environmental Control Officer	All phases of project
Ensure that all construction equipment is maintained and fitted with the required noise abatement equipment.	Environmental Control Officer	Weekly inspection
Where possible, construction work should be undertaken during normal working hours (06h00 – 18h00), from Monday to Saturday. If agreements can be reached (in writing) with the surrounding (within a 1,000m distance) potentially sensitive receptors, these working hours can be extended.	Contractor	As required

Performance Indicator	» No noise complaints are registered.
Monitoring	» N/A

OBJECTIVE: Management of dust and emissions to air

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the main and internal access roads.

Project component/s	Construction and establishment activities associated with the establishment of the photovoltaic plan and associated infrastructure.
Potential Impact	» Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment.
Activities/risk sources	» Clearing of vegetation and topsoil » Excavation, grading, scraping » Transport of materials, equipment and components on internal access roads » Re-entrainment of deposited dust by vehicle movements » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces » Fuel burning vehicle engines
Mitigation: Target/Objective	» To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase

Mitigation: Action/control	Responsibility	Timeframe
Roads must be maintained to a manner that will ensure that dust from road or vehicle sources is not visibly excessive. Ensure that damage to roads is repaired on completion of construction phase.	Contractor	Site establishment; Construction
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins.	Contractor	Duration of contract
Speed of construction vehicles must be restricted, as defined by the ECO.	Contractor ECO	Duration of contract
Disturbed areas must be re-vegetated as soon as	Contractor	Completion of

Mitigation: Action/control	Responsibility	Timeframe
practicable once construction is completed in an area.		Construction
Construction vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem must be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor	Duration of contract

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods: » Visual daily inspections of dust generation by construction activities throughout the construction phase. » Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » A complaints register must be maintained, in which any complaints from residents/the community will be logged. Complaints will be investigated and, where appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMP.

OBJECTIVE: Control the establishment and spread of alien invasive plants

Project Component/s	» Any infrastructure or activity that will result in disturbance
Potential Impact	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activities/Risk Sources	» Construction, environmental management
Mitigation: Target/Objective	» There is a target of no alien plants within project control area during the construction and operation phases

Mitigation: Action/Control	Responsibility	Timeframe
Avoid creating conditions in which alien plants may become established:	Contractor	Construction and operational

Mitigation: Action/Control	Responsibility	Timeframe
» Rehabilitate disturbed areas as quickly as possible » Do not import soil from areas with alien plants		phase
Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act)	Contractor	Construction and operational phase
Immediately control any alien plants that become established using registered control methods	Contractor	Construction & operational phase

Performance Indicator	» For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	» Ongoing monitoring of area by ECO during construction » Ongoing monitoring of area by environmental manager during operation » Annual audit of project area and immediate surroundings by qualified botanist » If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants » The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area » The environmental manager should be responsible for driving this process » Reporting frequency depends on legal compliance framework

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

The vegetation in the study area may be at risk of fire. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

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

Mitigation: Action/control	Responsibility	Timeframe
Establish fire breaks	Contractor	Pre-Construction
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Thupela Energy and Contractor	Duration of construction
Provide adequate fire fighting equipment onsite.	Thupela Energy & Contractor	Duration of construction
Provide fire-fighting training to selected construction staff.	Contractor	Duration of construction
Compensate farmers / community members at full market related replacement cost for any proven losses, such as livestock, damage to infrastructure etc for losses associated with fires resulting from negligence or non-compliance.	Contractor	As required

Performance Indicator	» Designated areas for fires identified on site at the outset of the construction phase. » Fire fighting equipment and training provided before the construction phase commences.
Monitoring	» Appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Control runoff and soil erosion & degradation

The soil resource on the site needs to be conserved as far as possible to minimise the cumulative impact on the local environment. A set of strictly adhered to mitigation measures are required to effectively limit the impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below.

Project component/s	» PV panels » Access roads » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads, / areas) » All other infrastructure
Potential Impact	» Degradation of soil » Degradation of local geology » Soil erosion
Activities/risk sources	» Water and wind erosion of cleared and excavated areas » Excavation, mixing, dumping, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Site preparation and earthworks » Foundations or plant equipment installation

	» Mobile construction equipment movement on site
Mitigation: Target/Objective	» Minimise degradation of rock and soil by construction activity » Conserve topsoil by stockpiling and re-using in disturbance areas » Minimise erosion of soil from site during construction » Minimise deposition of soil into drainage lines

Mitigation: Action/control	Responsibility	Timeframe
Identify disturbance areas and restrict construction activity to these areas	Environmental Control Officer/Contractor	Pre-construction and Construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer/ Environmental Control Officer	Pre-construction and Construction
Erosion features must be immediately stabilised with appropriate erosion control measures, if they develop	Contractor	Construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. Limit the height of stockpiles as far as possible to reduce compaction.	Contractor	During site establishment and any activity related to earthworks as well as the duration of construction
Rehabilitate any disturbed areas immediately after construction in that area is complete in order to stabilise landscapes.	Contractor	Post-construction
Any stockpiles must be protected against wind and water erosion (e.g. surrounded by shade cloth fences or damped down on a regular basis).	Contractor	Duration of contract
Erosion control measures: Run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets, or temporary mulching over denuded areas.	Contractor/ Environmental Control Officer	Erection: Before construction Maintenance: Duration of contract
Vehicular traffic must be controlled during construction, confining access and roadways, where possible, to proposed or existing road alignments.	Contractor	Duration of contract
As far as possible, access to the facility construction site should be restricted to a single access point.	Contractor	Duration of contract
Internal access roads should be kept to a minimum. Use existing roads wherever possible.	Contractor	During site establishment
Movement of vehicles on-site is to be on approved and formalised access roads only, which shall be adequately maintained throughout construction.	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Where temporary tracks are required these are to be ripped and rehabilitated as soon use of the track in an area is no longer required.		

Performance Indicator	» Acceptable level of soil erosion around site, as approved by Environmental Control Officer » Acceptable level of increased siltation in drainage lines, as approved by Environmental Control Officer » Acceptable level of soil degradation, as approved by Environmental Control Officer » Acceptable state of excavations, as approved by Environmental Control Officer » No activity in restricted areas
Monitoring	» Ongoing monitoring of area by Environmental Control Officer » during construction » Weekly inspections of the site by Environmental Control Officer » An incident reporting system will record non-conformances

OBJECTIVE: Protection of sites of heritage value / fossil resources

No heritage/archaeological sites have been identified on the site. However, it is possible that sites will be uncovered during excavation activities associated with construction. If at any stage during the construction phase any semblance of a fossil is observed, it would be vital to stop the work immediately and report this occurrence to the South African Heritage Resources Association and/or a professional palaeontologist as soon as possible so that appropriate mitigation measures can be implemented. Generally fossils can be removed quickly and would therefore not delay or hinder construction operations.

Project component/s	» PV panels » Access roads » All other infrastructure
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed » Disturbance to fossil resources
Activity/risk source	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site
Mitigation: Target/Objective	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
If a heritage object is found, work in that area must be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	Thupela Energy /Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Zero disturbance outside of designated work areas. » All heritage items located are dealt with as per the legislative guidelines. » A record is kept of all instances of accidental disturbance of heritage material, as well as post construction review of impacts on landscape context.
Monitoring	» Supervision of all clearing and earthworks by the Environmental Control Officer throughout construction phase

OBJECTIVE: Minimisation of visual impacts associated with construction

The construction phase of a project is potentially the phase that causes the most disturbances. During this time there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

Project component/s	» PV panels » Access roads » All other infrastructure
Potential Impact	» Temporary visual intrusion
Activity/risk source	» Transportation of components to the site » Construction activities on-site » The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation
Mitigation: Target/Objective	» Minimise contrast with surrounding environment and visibility of the construction activities to people in the area

Mitigation: Action/control	Responsibility	Timeframe
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	Contractor	Duration of contract
The activities and movement of construction workers and construction site vehicles will be restricted to the immediate construction site.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Limit access to the construction sites along existing access roads.	Contractor	Construction
The general appearance of construction activities, and construction equipment camps, will be maintained by means of the timely removal of rubble and disused construction materials.	Contractor	Construction
Clearance of vegetation within the development footprint will be minimised in order to minimise long-term visual disturbance, and rehabilitation efforts undertaken.	Contractor	Duration of contract
Implement an environmentally responsive planning approach to roads to limit cut and fill requirements.	Thupela Energy Contractor	Pre-construction Construction
Rehabilitate all disturbed areas, including cut and fill slopes to acceptable visual standards.	Contractor	Post-construction

Performance Indicator	» No complaints regarding visual intrusion associated with construction activities
Monitoring	» Ensure that mitigation measures are implemented during construction to minimise visual impacts on surrounding communities » An incident reporting system will be used to record non-conformances to the EMP

OBJECTIVE: 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, 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 (i.e. the photovoltaic plant and ancillary infrastructure).

Project component/s	» Gravel Roads D973, D2416, and D2747
Potential Impact	» Risk of accidents » Contribute to the prevailing sub-standard road conditions » Deterioration of road conditions (both surfaced and gravel road) due to the load frequency and the current condition of the gravel roads
Activity/risk source	» Transportation of project components to site » Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on-site » If the present conditions are left untreated the road will be unsafe for

	the transportation of people and materials
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 minimse impacts on road surfaces » To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions » The roads need immediate remedial measure to repair and improve their riding conditions » Furthermore a maintenance programme needs to be implemented to mitigate the recurrence of these conditions

Mitigation: Action/control	**Responsibility**	**Timeframe**
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved access routes within the site must be allowed.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Times for arrival and departure of heavy vehicles must be co-ordinated to minimise congestion.	Contractor	Duration of contract
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of 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).	Contractor	Duration of contract
Appropriate maintenance of all vehicles must be ensured.	Contractor	Duration of contract
All vehicles 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
Improve road drainage, blade roads to remove corrugation, add gravel wearing course. Implement maintenance programme for period of construction	Part local user/roads authorities and Thupela Energy	Pre-Construction and construction

Performance Indicator	» No traffic incidents involving Thupela Energy personnel or appointed contractors » Appropriate signage in place

	» No complaints resulting from road surface deterioration or driver negligence associated with construction of the photovoltaic plant
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 EMP

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

The construction phase of the photovoltaic plant may 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 and will include general solid waste, hazardous waste and liquid waste.

Project component/s	Storage and handling of chemicals, hazardous substances and waste
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 » Pollution of the surrounding environment through inappropriate waste management practices » Litter or contamination of the site or water through poor waste management practices » Pollution of water and soil resources
Activity/risk source	» PV panel construction activities » Building construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	» Ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons » Ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons » Comply with waste management guidelines » Minimise production of waste » Ensure appropriate waste handling, storage and disposal » Avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
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 made, 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
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 must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Soil contaminated/ polluted as a result of a major spill must be removed from the site and disposed of at a licensed hazardous waste disposal facility. Soils contaminated/ polluted through minor spills can be treated on site provided they are contained and have not penetrated the soil surface.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site outside of designated areas (except for emergencies or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
All stored fuels to be maintained within a bunded area and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor ECO	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with 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 contractors must provide specific detailed waste management method statements to deal with all waste streams.	Contractor	Pre-construction
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract
Where 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.	Contractor	Duration of contract
No waste may be buried or burnt on site	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	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction

Performance Indicator	» No 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. Complaints will be investigated

	and, if appropriate, acted upon » Observation and supervision of waste management practices throughout construction phase » Waste collection to 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 EMP

OBJECTIVE: 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 EMP, as well as the requirements of all relevant environmental legislation.

Project component/s	» All components and activities occurring during the construction phase
Potential Impact	» Pollution/contamination of the environment » Disturbance to the environment
Activity/risk source	» Contractors are not aware of the requirements of the EMP, 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 EMP and the Environmental Authorisation (once issued) will be included in all tender documentation and Contractors contracts.	Thupela Energy	Tender process
An Environmental Control Officer must be permanently on site throughout the cable laying, and foundation construction periods, and at other times should visit the site at least once a week.	Thupela Energy	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting will be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Cooking/meals must take place in a designated area; no firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	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 (and sub-contractor/s)	Duration of contract
No one other than the Environmental Control Officer or personnel authorised by said individual may disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract
Contractors appointed by Thupela Energy must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor (and sub-contractor/s)	Construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne by the contractor	Contractor (and sub-contractor/s)	Construction

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, (once issued), EIA report and EMP » No complaints regarding contractor behaviour or habits » 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 EMP

5.4. Detailing Method Statements

OBJECTIVE: Ensure all construction activities/practices/procedures are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMP.

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 EMP 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 (and ECO).

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:

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

The Contractor may not commence the activity covered by the Method Statement until it has been approved, 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.

5.5. Awareness and Competence: Construction Phase of the Waterberg Photovoltaic Plant

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

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. 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 EMP 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 EMP 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.
- Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed necessary by the ECO.
- Ensuring that appropriate communication tools are used to outline the environmental "do's" and "don'ts" (as per the environmental awareness training course) to employees.
- Records must be kept of those that have completed the relevant training.
- Refresher sessions must be held to ensure the contractor's staff are aware of their environmental obligations.

5.6. Monitoring Programme: Construction Phase of the Waterberg Photovoltaic Plant

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

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

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

The Environmental Control Officer will ensure compliance with the EMP, and will conduct monitoring activities. The Environmental Control Officer must have the appropriate experience and qualifications to undertake the necessary tasks. The Environmental Control Officer will report non-compliances to the Site Manager and/or any other monitoring body stipulated by the regulating authorities.

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: REHABILITATION OF DISTURBED AREAS

CHAPTER 6

6.1. 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

6.2. Objectives

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

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

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

Project component/s	» Photovoltaic plant » Access roads (i.e. those not required for operation and maintenance)
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 access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» Ensure and encourage site rehabilitation of disturbed areas » 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 must be removed from site as soon as practically possible after construction is complete.	Contractor	Following execution of the works

Mitigation: Action/control	Responsibility	Timeframe
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
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
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use of native/indigenous plant species removed from disturbance areas in the rehabilitation phase.	Contractor in consultation with rehabilitation specialist	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.	Thupela Energy in consultation with rehabilitation specialist	Post-rehabilitation
Ongoing alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Thupela Energy in consultation with rehabilitation specialist	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 » 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 » On-going alien plant monitoring and removal should be undertaken on an annual basis

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: OPERATION CHAPTER 7

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the photovoltaic plant 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 photovoltaic plant in a way that:

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

7.2. Objectives

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

OBJECTIVE: Maintenance of rehabilitated areas

In order to ensure the long-term environmental integrity of the site following construction, maintenance the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established. Fire breaks should be established, where appropriate, to limit both incoming and outgoing veld fires.

Project component/s	» Photovoltaic plant (i.e. including access roads and ancillary buildings)
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	» Foundations » Access roads » Other disturbed areas
Mitigation: Target/Objective	» Ensure and encourage site rehabilitation of disturbed areas

Mitigation: Action/control	Responsibility	Timeframe
Fire breaks should be established, where appropriate.	Thupela Energy	Duration of contract
Appoint an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats.	Thupela Energy	Operation

Performance Indicator	» Successful rehabilitation of disturbed areas
Monitoring	» On-going alien plant monitoring and removal should be undertaken on an annual basis

OBJECTIVE: Minimisation of visual impacts

The placement of the photovoltaic plant and its associated structures will have a visual impact on the natural scenic resources of this region. The natural and relatively unspoiled views surrounding the PV plant will be transformed for the entire operational lifespan (approximately 30 years) of the plant. The area potentially affected by the proposed development is generally seen as having a high scenic value and the proposed PV plant is expected to form a noticeable contrast within this predominantly natural and agricultural region.

There are not many options as to the mitigation of the visual impact of the facility. Although the functional design of the structures cannot be changed in order to reduce visual impacts, it is proposed that the standard height of the units be set at 3 – 4 m and that a 6 m height should only be used on exception where absolutely necessary. This will reduce the facility's visual intrusion and increase the vegetations' ability to mask the facility. Receptor sites exposed to visual impact may mitigate this impact by planting a vegetation screen similar in form and density to the natural vegetation of the receiving environment. This measure will only be effective if the screen is planted *in close proximity to the receptor*. This means that the visual impact must be screened at the property which is experiencing the impact, rather than at the development site itself. It is recommended that the visual screen be planned and specified by a planning professional in order to maximise the screening benefit. In addition, it is imperative that the species of plants utilised be ecologically appropriate for the natural environment.

Project component/s	» Photovoltaic plant (i.e. including associated buildings)
Potential Impact	» The viewing of the photovoltaic plant by observers on or near the site
Activity/risk	The viewing of the above mentioned by observers on or near the site

source	
Mitigation: Target/Objective	» Minimise potential for visual impact » Minimise contrast with surrounding environment and visibility of the PV panels and infrastructure associated with the facility to humans » The containment of night lighting in order to eliminate the risk of additional night-time visual impacts.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that proper planning is undertaken regarding the placement of lighting structures, should they be deemed necessary	Thupela Energy	Construction, Operation and maintenance
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.	Thupela Energy	Erection and maintenance
Maintain the general appearance of the facility in an aesthetically pleasing way.	Thupela Energy	Operation and maintenance
Undertake regular maintenance of light fixtures.	Thupela Energy	Operation and maintenance
Limit access to the photovoltaic plant site, and along existing access roads.	Thupela Energy	Operation and maintenance
Avoid the unnecessary removal of vegetation (during both construction and operational phases) along existing access roads.	Thupela Energy	Operation and maintenance

Performance Indicator	» Minimised visual intrusion on surrounding areas » The effective containment of the light
Monitoring	» The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE: Appropriate handling and management of hazardous substances and waste

The operation of the photovoltaic plant may involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and liquid waste.

Project component/s	» PV facility and buildings associated with the facility
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk	» Kitchen and dining facilities

source	» Visitor's Centre » Crèche » PV panels
Mitigation: Target/Objective	» To comply with waste management guidelines » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	Thupela Energy	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Thupela Energy	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.	Thupela Energy	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 will be cleaned up according to specified standards regarding bioremediation.	Thupela Energy	Operation and maintenance
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	Thupela Energy /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.	Thupela Energy	Operation
It must be ensured that volumes of any hazardous waste stored on site do not exceed $30m^3$. Should this volume be exceeded, a waste license will be required to be obtained.	Thupela Energy	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Contractor	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Thupela Energy	Operation
Hazardous waste must be disposed of at an	Contractor	Operation

Mitigation: Action/control	Responsibility	Timeframe
appropriately licensed landfill.		
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Thupela Energy	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 on request » 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. All appropriate waste disposal certificates accompany the monthly reports.

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

Approximately ninety (90) individuals could be employed with approximately forty (40) people on site at any given time, apart from the security personnel. One shift would be undertaken per day, but the security personnel would cover three shifts per day. A team of around thirty (30) panel operators will be on site from just pre-dawn to just pre-dusk every day. They will work in teams, with a supervisor, turning panel mounts. The canteen that would serve basic food and beverages to the workers would be run by approximately two (2) individuals.

Night maintenance would predominantly consist of panel cleaning. This will principally be done without water, either with big dusters or compressed air. Occasionally dirt would have to be removed with water cleaning. A small team (i.e. 2 to 3 individuals) will work across the site cleaning one panel each at a time.

Therefore, long-term direct job opportunities for locals exist. Secondary employment opportunities for locals would refer to the security personnel and catering services. The farm Boschdraai hosts two villages with a total of 350 residents or approximately 50

families. Those falling within the working age category and who are currently unemployed (especially young unemployed school leavers), could thus secure permanent employment at the PV facility. There would also be a further opportunity for individuals from Leseding and the entire MLM area to be employed.

Project component/s	» Operation of the photovoltaic plant and associated infrastructure (i.e. kitchen and dining facilities, crèche, visitor's centre, administration and security offices, and workshops.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/risk sources	» Locals are not employed where the local skills exist.
Mitigation: Target/Objective	» Maximise the appointment of local employees.

Mitigation: Action/control	Responsibility	Timeframe
Employees should be sourced from Ward 3 and Ward 1 of the MLM, and then from the wider area.	Thupela Energy	Operation
Consider training and capacity building programmes to lessen the skills disparity	Thupela Energy	Construction and Operation
The skill requirements should be communicated to the local community leaders and community based organisations	Thupela Energy	Construction and Operation
Make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers	Thupela Energy	Construction and Operation
An equitable process whereby minorities and previously disadvantaged individuals (women) are taken into account should be implemented.	Thupela Energy	Construction and Operation

Performance Indicator	» An employee list should be drawn up indicating the percentage of locals employed. » A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower skilled working levels to higher skilled and possibly management levels.
Monitoring	» Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Address economic inequities within the study area

Economic inequities refers to the degree to which employment opportunities created by the proposed project match the actual job skills present in the local communities or the unemployed sector. The following positions would be available:

» General Manager: 1
» Production supervisor: 1
» Technical manager (overseeing the technical aspects of the site, mostly high power electrical skills): 1
» Technical assistants: 2
» Security personnel: 18
» Mount and panel operators (unskilled labourers): 57
» Cooks: 2 and cleaning and administrative personnel: 2

The majority of skills therefore required for the operation and management of the facility fall within the unskilled to semi-skilled category. Some highly skilled personnel would also be required.

Through training and skills development, the proposed project would provide employees from the local community with transferable skills and could thus result in the overall improvement of the quality of life of those involved.

The visitors centre in itself, which would have a strong educational focus, would assist in local capacity building as it would:
» Assist with the social upliftment of local communities through site visits and educational tours undertaken by local school children and/or tourists; and
» Assist in creating awareness concerning renewable energy sources in general.

Project component/s	» PV plants and associated infrastructure
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business could be maximised as it is anticipated that locals have the necessary skills to be employed
Activity/risk source	» Unavailability of locals with the required skills resulting in locals not being employed and employees be sourced from outside the MLM area
Mitigation: Target/Objective	» Thupela Energy, in discussions with the Modimolle Local Municipality, should aim to employ a maximum number of employees from the local area where possible. Should the necessary skills not be readily available, skills training and capacity building should be undertaken

Mitigation: Action/control	Responsibility	Timeframe
A broad-based approach should be followed to identify and involve relevant community based organisations and/or local recruitment agencies which could assist the main contractor in identifying people whose skills may correspond with the job specifications.	Thupela Energy	Pre-operation and operation
In cases for the middle to lower skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Thupela Energy	Pre-operation and operation
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Operation
As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Operation

Performance Indicator	» Job opportunities are primarily awarded to members of local communities. » Skills training and capacity building initiatives are developed and implemented (possibly in cooperation with similar initiatives undertaken by the Waterberg Biosphere Reserve). » Local SMME's and/or entrepreneurs should be awarded the opportunity to become involved in the tender process for operational activities (e.g. catering / security)
Monitoring	» Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Enhance capacity building and skills development within the local communities

During the operational phase, further individually tailor-made training programmes would be embarked upon which would be undertaken in association with accredited training operators. Employees will be given paid leave to attend, and attendance will be seen as part of their work, and thus compulsory.

Should employees leave the facility in search of work elsewhere in the field they would be equipped with portable skills. With the cooperation of accredited training facilities, Thupela Energy would facilitate the process whereby they assist employees in finding work elsewhere (if required).

Capacity building and skills training would thus have the greatest impact if the skills would be transferable to other type of construction or electricity generation related projects.

The visitor's centre would have a strong educational and awareness creation focus. Exposure to large numbers of schoolchildren would also enhance the capacity building initiatives of the facility.

Project component/s	Capacity building and skills training undertaken during the operational phase.
Potential Impact	Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills
Activity/risk source	Inefficient training or lack of capacity building and skills training
Mitigation: Target/Objective	Capacity building and skills training should be continuously undertaken during the operational phase of the project.

Mitigation: Action/control	Responsibility	Timeframe
Capacity building initiatives could link in with the planned capacity building and skills training initiatives to be undertaken as part of the Waterberg Biosphere Reserve's outreach programmes.	Thupela Energy	Operation
As part of Thupela Energy's social responsibility it could consider contributing funds for the initiation phase of the Waterberg Biosphere Reserve's Skills Training Facilitation Project.	Thupela Energy	Operation
The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the operational phase.	Thupela Energy and Contractors	Operation
The project proponent should invest in improving the quality of life of employees and their families through the provision of capacity building and skills training programmes	Thupela Energy	Operation
School excursions to the visitors centre should be arranged between the project proponent and local school representatives	Thupela Energy	Operation

Performance Indicator	» A Skills Development Plan should be developed. This plan should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere. » For each employee a career path should be developed to put mechanisms in place which allows employees to progress from lower

	skilled working levels to higher skilled and possibly management levels. » School children should be invited to visit the visitors centre on a regular basis.
Monitoring	» Thupela Energy should be able to demonstrate that the above indicators are implemented.

OBJECTIVE: Promote local procurement

Apart from the technical components it is expected that some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. This aspect, however, would be dependent on the outcome of the tender process. The impact of the project on the procurement of local businesses and previously Historically Disadvantaged South Africans (HDSAs) can therefore not be determined at this stage. It is, however recommended that the project proponent commits itself to involving locals (HDSAs and SMMEs) in the procurement of capital goods, consumables and services, if these are locally available. Local procurement could result in indirect economic spin-offs and benefits such as increased income, and expansion of other local economic sectors.

Project component/s	» Local procurement of goods, materials, and services could occur.
Potential Impact	» Potential positive economic spin-offs, increased income, and expansion of other local economic sectors.
Activity/risk source	» No procurement of local goods, materials, and services due to unavailability of those in the area.
Mitigation: Target/Objective	» Maximise the use of local goods, materials, and services.

Mitigation: Action/control	Responsibility	Timeframe
Where possible, local sourcing of materials to assist in providing more economic and employment opportunities for the local people	Thupela Energy	Operation

Performance Indicator	» Local procurement of goods, materials, and services do take place.
Monitoring	» Thupela Energy should be able to demonstrate that they have aimed to achieve the above indicators as far as possible.

OBJECTIVE: Minimise the potential impact on surrounding landowners

This aspect refers to the possible impact of the photovoltaic plant and associated activities undertaken on site on the following:

» The daily living and movement patterns of the surrounding property owners
» Surrounding land-uses
» Guest farms, guest houses, and accommodation facilities.

Only one of the neighbouring property owners (Vier-en-Twintig-Riviere KR 102/2) is currently operating a formal privately owned guest farm. The PV facility is not in close proximity to the dwellings on this property. Kudu Lodge is on the farm Goedgevonden KR 104 and therefore does not qualify as neighbouring property. The property owners consulted, however, indicated that various "lodges" are planned on the different properties. It thus seems as if there is a move to extend their existing tourism facilities to cater for national and international tourists.

Once operational, the impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (e.g. the increase in traffic to and from site). It is not anticipated that any activities undertaken as part of the operation and maintenance of the photovoltaic plant would negatively affect the surrounding property owners' daily living patterns. They would thus be able to continue their game or cattle farming practices without interference from the facility.

Furthermore, it is *not* anticipated that the presence and visual impact of the photovoltaic plant, even though it could affect the visitor's sense of place, would result in less visitors coming to the area. The negative impact on the surrounding property owners with regards to the operation and management of their farms as "guest farms" with accommodation facilities is thus rated as moderate and expected to be responsive to mitigation.

Project component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners.
Potential Impact	» Possible impact on game and cattle farming practices, as well as on the operation of guest accommodation facilities
Activity/risk source	» Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents. Visual impact of facility
Mitigation: Target/Objective	» Effective management of the facility » Mitigation of visual impact as far as possible

Mitigation: Action/control	Responsibility	Timeframe
Effective management of the facility and visitor's centre to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services, and limiting any increase in noise levels (due to visitors) and so forth	Thupela Energy	Operation

Performance Indicator	» Tourism related facilities are functioning normally without interference from facility's activities » No environmental pollution occur (waste, water and sanitation related) » No noise pollution occur
Monitoring	» Thupela Energy should be able to demonstrate that facility is well managed without environmental pollution

OBJECTIVE: Minimise the potential impact on traffic patterns

The traffic impacts associated with the operation of the facility refers to the transportation of workers to and from the site, deliveries to the canteen, as well as to the visitors coming to the visitors centre. It has been estimated that approximately seven vehicles would be travelling to and from the site per day.

As it is anticipated that local labour would be used, and that the forty daily employees would be transported from Boschdraai/Leseding/Vaalwater to the site and back. At this stage it is planned to use one or two buses for this purpose.

These trips could result in limited intermittent noise and dust pollution, as well as safety risks associated with speeding on the local gravel roads. The Sea Para School on the gravel road has been closed but should this facility open again speeding should be intensely mitigated in this area.

Deliveries to the canteen would generate one additional trip every two to three days. The above trips and this increase in traffic are not seen to result in severe negative impacts. The main impact in this regard would rather be the trips undertaken to the visitors centre. At this stage the number and frequency of such trips cannot be finalised although it is anticipated that it would be one bus at a time. It can thus only be concluded that the additional traffic in this regard would have an intermittent and limited negative impact on the surrounding property owners and road users.

Impact on access to properties is not expected to be affected during the operational phase. The road leading to the site (turn off from Naauwpoort /Vier-en-Twintig Riviere /

Olievenfontein Road) would still be available to the property owners of the farm Sterkstroom KR 103 and Schoongezigt KR 107 to use to access the respective farms.

Project component/s	» Transportation of workers to and from site on a daily basis
Potential Impact	» Impact of increase in vehicles on road surfaces, and possible increased risk in accidents
Activity/risk source	» Vehicle movement impacting on daily living and movement patterns of residents in the area, and especially the surrounding property owners
Mitigation: Target/Objective	» Minimise the impact of the increase traffic on existing infrastructure, property owners and road users

Mitigation: Action/control	Responsibility	Timeframe
Speeding on the local roads should be avoided for safety reasons and for dust creation.	Thupela Energy	Operation
The access road to the site could be upgraded to accommodate additional traffic volumes, as well as to create some safe viewing areas where passing motorists could stop to view the facility to limit the risk of accidents	Thupela Energy	Operation
Signage along the local roads should be put up to direct visitors to the facility to limit the risk of accidents	Thupela Energy	Operation

Performance Indicator	» Vehicles keeping to the speed limits » Vehicles are in good working order and safety standards are implemented » No increase in traffic related accidents are experienced. » Complaints of residents are not received (e.g. concerning the speeding of vehicles associated with the operation of the facility).
Monitoring	» Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

OBJECTIVE: Minimise the potential impact on safety and security

It is not anticipated that the proposed facility would result in severe safety and security impacts. Should children or other individuals gain unauthorised access to the site it could, however, create safety risks. The site should thus be properly fenced and access controlled and managed by security guards to avoid such a situation. Security

personnel will be based on-site on a permanent basis which would assist in mitigating the possible impact.

Regarding the concerns of property owners concerning illegal poaching of game on the surrounding properties remain an issue which is difficult to mitigate. An inflow of people to an area creates an opportunity for criminal elements.

The fire fighting services in the district and Modimolle Local Municipality is currently understaffed and there is a need for additional personnel in the Vaalwater area. As the proposed facility could increase the risk of fires, it would be useful if attention could be given to the provision of some kind of fire fighting and emergency services on site to attend to any possible emergencies in the study area. The applicant has indicated their willingness to have some form of fire fighting capacity in the area that would be available for fire fighting in the wider area. The details and practical operations would thus be finalised as part of the final planning phases and operational aspects.

Project component/s	» PV plant
Potential Impact	» Increased safety and security risks due to presence of facility
Activity/risk source	» Insufficient fencing of the site and perceptions of increased criminal activity in the area. Increased risk of fires and operational accidents.
Mitigation: Target/Objective	» Minimise the safety and security risks

Mitigation: Action/control	Responsibility	Timeframe
The site should be properly fenced.	Thupela Energy	Operation
Fire fighting and emergency services should be available on site.	Thupela Energy	Operation
Schoolchildren visiting the visitors centre should be supervised at all times to avoid accidents.	Thupela Energy	Operation
Normal operational safety guidelines should be adhered to.	Thupela Energy	Operation
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	Thupela Energy & security personnel	Operation
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners.	Thupela Energy & surrounding property owners	Operation

Performance Indicator	» The site is properly fenced. » Security personnel are on site on a continuous basis. » Fire fighting equipment and vehicles are available on site » A fire emergency plan is put in place

	» Fire breaks are in place » Normal operational safety guidelines are implemented
Monitoring	» Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

OBJECTIVE: Minimise the potential for noise pollution

Due to the rural characteristics of the area, existing noise levels are anticipated to be low. Noise generating sources could relate to:

» The number of workers that would be on site on a daily basis
» The influx of visitors to the proposed development
» Vehicle movement
» Maintenance to be undertaken at night, especially due to the even lower ambient noise levels experienced at night
» Some instances where lawn mowers could be used to mow the grass between the panels instead of being the responsibility of the sheep grazing in between the panels

Dwellings in close proximity to the area are limited and the closest sensitive receptors are on the surrounding farms which in some cases could be approximately 1 km or further away from the facility. From a social observation it is perceived that there could be limited intermittent noise impact on Kudu Lodge on the farm Goedgevonden KR 104 and possibly on the other farms surrounding the property. This noise impact could be irritating, but is not anticipated to be socially disruptive.

Project component/s	» Possible noise pollution
Potential Impact	» Possible noise pollution due to operations at site
Activity/risk source	» Increase in ambient noise impacting on daily living patterns of surrounding residents
Mitigation: Target/Objective	» Limit noise pollution

Mitigation: Action/control	Responsibility	Timeframe
Employees should understand that excessive noise could be problematic and should thus attend to this issue in a sensitive manner.	Thupela Energy	Operation
The use of lawnmowers should be kept to the minimum.	Thupela Energy	Operation
Schoolchildren should be supervised at all times to try to keep noise levels to a minimum.	Thupela Energy	Operation

Performance Indicator	» No increase in noise is experienced by surrounding property owners. » No complaints concerning the noise levels on site are received from surrounding property owners.
Monitoring	Thupela Energy must monitor indicators listed above and should be able to demonstrate that the mitigation measures are implemented.

MANAGEMENT PLAN FOR THE PHOTOVOLTAIC PLANT: DECOMMISSIONING CHAPTER 8

Depending on the economics of the development following the operational period, the plant will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to continue, existing components would be dissembled and replaced with more appropriate technology/ infrastructure available at that time. However, if the decision is made to decommission the facility the following activities will form part of the project scope.

8.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

8.2 Disassemble and Replace Existing PV Panels

The components of the plant will be disassembled and removed. Thereafter they will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.

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

Project component/s	» Decommissioning phase of the photovoltaic plant.
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 etc. However, the number of people affected (~30) 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 photovoltaic plant.
Mitigation: Target/Objective	» To avoid and or minimise the potential social impacts associated with decommissioning phase of the photovoltaic plant.

Mitigation: Action/control	Responsibility	Timeframe
Thupela Energy should ensure that retrenchment packages are provided for all staff that stand to lose their jobs when the facility is decommissioned	Thupela Energy	At decommissioning.

Mitigation: Action/control	Responsibility	Timeframe
Retrenchments should comply with South African Labour legislation of the day.		
Thupela Energy should establish an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 25-30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.	Thupela Energy	At decommissioning.

Performance Indicator	South African Labour legislation at the relevant time.
Monitoring	Retrenchments should comply with South African Labour legislation of the day.