
PROPOSED ALLDAYS SOLAR FACILITY - PHASE 1, LIMPOPO PROVINCE

DEA Ref No: 14/12/16/3/3/2/329

CONSTRUCTION & OPERATION DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

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

DEA Reference No. : 14/12/16/3/3/2/329

Title : Environmental Impact Assessment Process
Draft Environmental Management Programme: Proposed Alldays Photovoltaic (PV)/ Concentrated photovoltaic (CPV) Solar Energy Facility Phase 1 (up to 75MW)on Gotha Farm, Limpopo Province.

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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 programme: An operational plan that organises and coordinates 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.

Photovoltaic cell: Semiconductors which absorb solar radiation to produce electricity

Concentrated photovoltaic cell: lenses or curved mirrors to concentrate a large amount of sunlight onto a small area of solar photovoltaic (PV) cells to generate 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).

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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PROJECT DETAILS

CHAPTER 1

BioTherm Energy (Pty) Ltd is proposing the establishment of a commercial solar energy facility (using either photovoltaic or concentrated photovoltaic technology) for electricity generation of up to 75 MW in export capacity. The facility is proposed on a portion of Farm 102 (Gotha) located approximately 75km west of Musina in the Limpopo Province of South Africa (refer to Figure 1.1).

The purpose of the proposed facility is to sell the electricity to Eskom as part of the Renewable Energy Independent Power Producers (IPP) Procurement Programme. The IPP Procurement Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities by IPPs. Selling of electricity according to the IPP Procurement Programme has the advantage of giving developers long-term stability and predictability, as well as providing the opportunity for the South African Government to introduce renewable energy into the power generation technology mix within the country.

The facility will require an area of more than 20 ha within which the following infrastructure will be established (refer to Figure 1.2).

- » Photovoltaic (**PV**) or Concentrated Photovoltaic (**CPV**) **panels** with an export capacity of up to 75 MW. Panels are proposed to be up to 20m in height (should CPV technology be utilised).
- » A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation. Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV/CPV panels.
- » Cabling between the project's components, to be lain underground where practical.
- » Internal access roads and fencing.
- » Workshop area for maintenance, storage, and offices

The proposed project will be referred to as **Alldays Photovoltaic (PV)/ Concentrated Photovoltaic (CPV) Solar Energy Facility - Phase 1**.

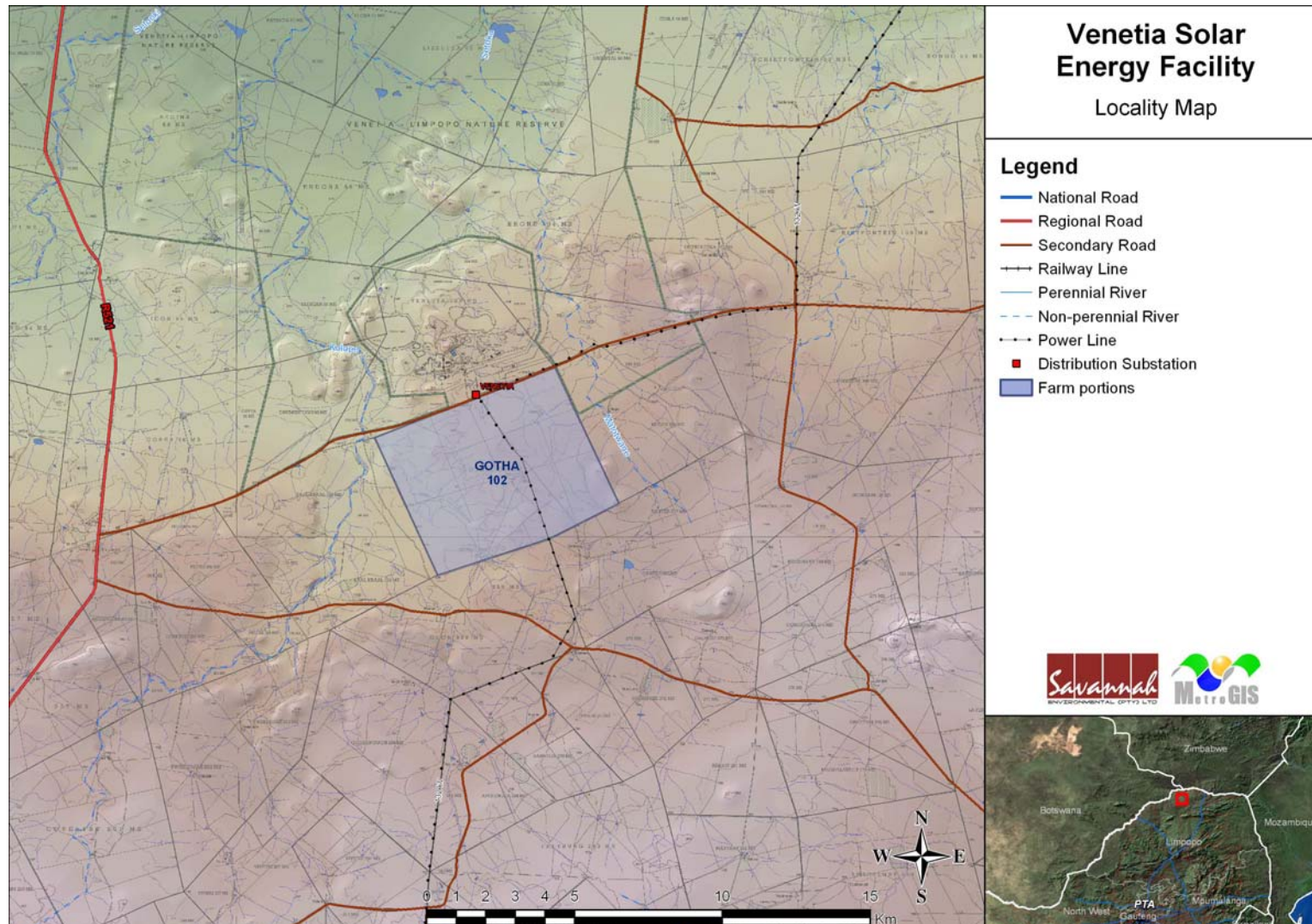


Figure 1.1: Locality map showing the proposed 75 MW PV plant on portion of Farm 102 (Gotha)

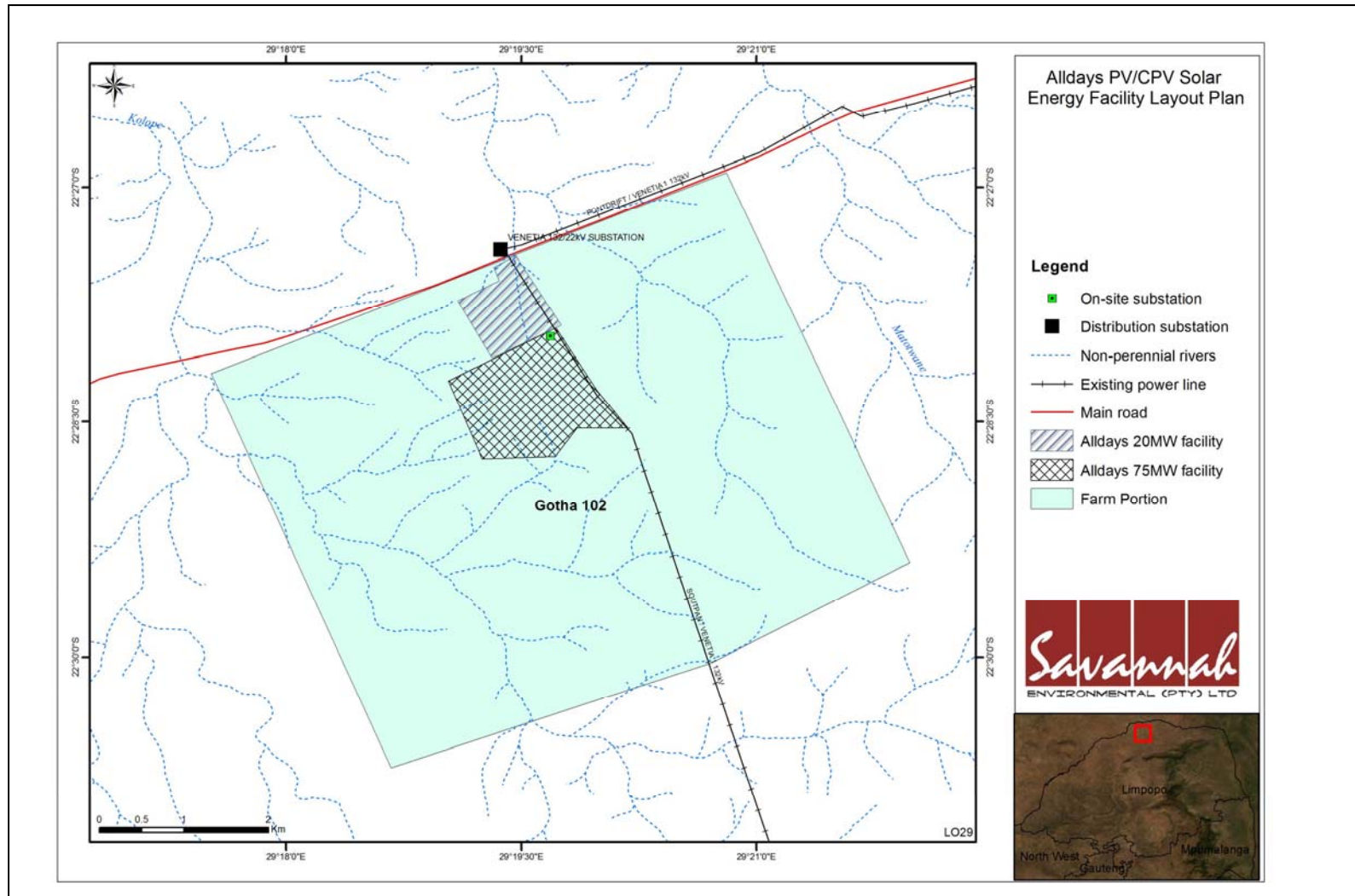


Figure 1.2: Locality map illustrating the location of the assessed development site for the proposed Alldays PV/CPV Plant Phase 1

1.1. Project Location

The Alldays Phase 1 PV/CPV Facility is located on a portion of Farm Gotha 102 which is located in the Musina Local Municipal area (Vhembe District) in the Limpopo Province of South Africa. The farm is situated approximately 75km west of Musina and approximately 35km north-east of Alldays. Access to the site is opposite the entrance to the Venetia Diamond Mine from the existing Bridgewater-Musina gravel road.

1.2. Technology

The proposed facility will either utilise Photovoltaic (PV) technology or Concentrated Photovoltaic (CPV) technology.

1.2.1. Photovoltaic (PV) Technology

Solar energy facilities, such as those using PV panels use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity. The Solar PV facility will comprise of the following components:

Solar energy facilities, such as those using PV panels use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect (see Figure 1.2). This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity. The Solar PV facility will comprise of the following components:

The **Photovoltaic Cell**

Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. Other technologies that can be used include thin film

The **Inverter**

The photovoltaic effect produces electricity in direct current. Therefore an inverter must be used to change it to alternating current.

The **Support Structure**

The PV panels will be attached to a support structure approximately 2 meters off the ground set at an angle so to receive the maximum amount of solar radiation. The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar radiation characteristics.

The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

Figure 1.3: Illustration of a photovoltaic solar facility

Concentrated Photovoltaic (CPV) Technology

Concentrated photovoltaic (CPV) technology uses optics such as lenses to concentrate a large amount of sunlight onto a small area of solar photovoltaic materials to generate electricity.

The Concentrated Photovoltaic Cell

The light energy from the sun is concentrated through lenses onto the individual CPV cells. This serves to increase the efficiency of the CPV panels (i.e. up to 29% efficiency), as compared to conventional PV technology (i.e. 8 % – 18% efficiency) (refer to Figure 1.4).

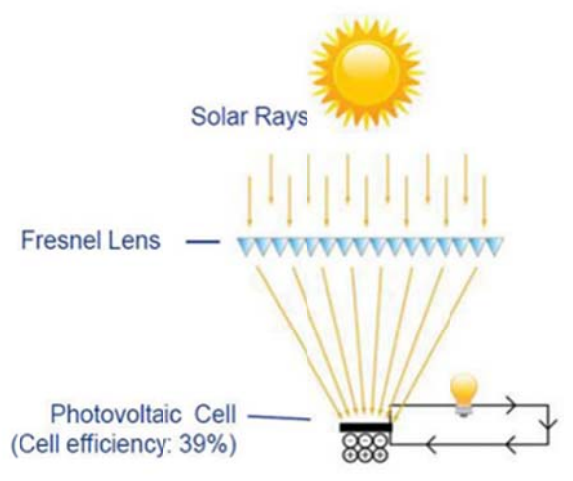


Figure 1.4: The efficiency of the CPV panels is increased through the use of Fresnel Lenses which concentrates the amount of light entering the CPV cells (Source: AmonixTM)

The **Inverter**

An inverter is used to convert the electricity which is produced as direct current into alternating current for the purpose of grid connection. In order to connect a large solar facility to the national grid, numerous inverters will be arranged in several arrays to collect, and convert the produced power.

The **Support Structure**

The CPV Modules will be elevated up to 2m above ground level by a support structure and have a total height of up to 20m. The modules will be able to track the path of the sun during the day, thereby increasing the efficiency of the panels (refer to Figure 1.5).



Figure 1.5: The support structures elevate the panels and allow for dual axis tracking of the sun for increased efficiency (Source: AmonixTM)

Each panel will be approximately 22 m wide and 12.5 m high. As such when the tracking panel is vertical the structure will be a maximum height of approximately 20m.

1.3. Activities and Components associated with the PV/CPV Plant

The main activities/components associated with the Alldays PV plant Phase 1 are detailed in Table 1.1.

Table 1.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the PV/CPV Plant

Main Activity/Project Component	Components of Activity	Details
<i>Planning</i>		
Conduct technical surveys	<ul style="list-style-type: none"> » Geotechnical survey by geotechnical engineer. » Site survey and confirmation of the infrastructure micro-siting footprint. 	<ul style="list-style-type: none"> » Geotechnical survey – a geotechnical survey will be required in order to detail the geology and topography of the study area. The geotechnical study will also consider flood potential, foundation conditions, and the potential for excavations. This study will serve to inform the Engineering, Procurement, and Construction (EPC) Contractors regarding soil conditions, required to specify foundations required for the support structures, and the extent of earthworks and compaction required in the establishment of any internal access roads. » Site survey – this will be required to finalise the design layout of the PV/CPV solar field and other associated infrastructure. The finalisation will need to be confirmed in line with the Environmental Authorisation issued for the facility.
<i>Construction</i>		
Undertake site preparation	<ul style="list-style-type: none"> » Clearance of vegetation at the infrastructure footprints. » Where required, some levelling of the land may occur. » Excavation of trenches for underground cables. 	<ul style="list-style-type: none"> » Site preparation activities will include clearance of vegetation at the footprint of the following infrastructure within the development footprint: <ul style="list-style-type: none"> * Support structure/pedestals for the PV/CPV panels (panel dimensions 2000x1000x50 consisting of up to 80 000 panels. * Switchgear * Transformers * Workshop

Main Activity/Project Component	Components of Activity	Details
		<ul style="list-style-type: none"> * Trenches for the underground cabling. » These activities may require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.
Construction of internal access roads	<ul style="list-style-type: none"> » Construct a 3 to 5 m wide gravel roads around the site. 	<ul style="list-style-type: none"> » The project development site is accessible from the Bridgewater Musina gravel road, south of the Venetia Mine. » Temporary access roads may be required during the construction phase; however these are likely to be single track gravel roads of less than 6 m wide
Construct infrastructure foundations	<ul style="list-style-type: none"> » Mounting structures will either be pile driven, screwed or pre-cast concrete footings 	<ul style="list-style-type: none"> » To be confirmed once the geotechnical study has been completed
Transport of components and equipment to site	<ul style="list-style-type: none"> » Trucks will be used to transport all components to site: <ul style="list-style-type: none"> * The normal civil engineering construction equipment for the civil works (e.g. trucks, graders, compaction equipment, cement mixers, etc.). 	<ul style="list-style-type: none"> * The components will be transported to site (in sections and components), likely from the R572 (partially tarred) or R521 (tarred). The east-west aligned R572, located ~20 km to the north of the proposed site, provides direct access to the Mapungubwe National Park (MNP) as well as the Venetia Limpopo Nature Reserve (VLNR) from Musina and the N1. * In addition, civil engineering construction equipment will be required on site (e.g. excavators, trucks, ready mix cement trucks, etc.) as well as components required for the establishment of the switchgear.
Establishment of PV panels	<ul style="list-style-type: none"> » PV/CPV panels are transported in containers. » The steel structures will be assembled on site. 	<ul style="list-style-type: none"> » A support structure unit will be erected by excavating an area for the foundation.

Main Activity/Project Component	Components of Activity	Details
		<ul style="list-style-type: none"> » Ready mix cement will be used to stabilise the foundation. Ready-mix cement will be prepared off-site and transported from the closest centre to the development. » A service cage will be erected around the foundation unit to allow for the establishment of the electrical and hydraulic infrastructure). This includes the inverter. » A drive head will be positioned on top of the foundation unit as a connection point for the PV/CPV panel which allows for the dual axis tracking. » The CPV mega module will be lifted via a crane onto the drive head. » The installation of the underground cables between the PV/CPV panels, the transformers, the switchgear, and the new Substation will require the excavation of trenches of approximately 1 m deep within which they can then be laid.
Connection of PV/CPV panels to the substation	<ul style="list-style-type: none"> » The PV panels will be connected to the on-site substation via underground cabling (where practical). 	<ul style="list-style-type: none"> » The installation of these underground cables will require the excavation of trenches of approximately 400 mm – 1000 mm cm deep within which they can then be laid.
Connect substation to the grid	<ul style="list-style-type: none"> » The electricity is proposed to be evacuated into the Venetia substation. 	<ul style="list-style-type: none"> » The electricity generated at the site will run through underground cables through and will connect to Eskom's substation.
Undertake site rehabilitation	<ul style="list-style-type: none"> » Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable. 	<ul style="list-style-type: none"> » Once construction is complete and all construction equipment is removed, the site must be rehabilitated where practical and reasonable. » On full commissioning of the facility any access

Main Activity/Project Component	Components of Activity	Details
		points to the site which are not required during the operational phase must be closed and prepared for rehabilitation.
Operation		
Operation	<ul style="list-style-type: none"> » PV/CPV panels. » Associated infrastructure. 	<ul style="list-style-type: none"> » The PV/CPV panels will convert the light energy from the incoming radiation into electrical energy (i.e. as direct current). » The transformers will change the power to alternating current, where after the electricity will be conveyed to the switchgear, the underground cables and then to the existing Venetia Substation » An estimated 220 000 litres of water per annum would be required for cleaning of the panels, 2 200 litres for offices and workshops and an estimated 1.5 million litres of water would be required for the construction of the plant.
Maintenance & Security	<ul style="list-style-type: none"> » Maintenance during the life cycle of the facility would include emergency repairs, routine panel maintenance, routine maintenance of medium voltage equipment and maintenance of the site. 	<ul style="list-style-type: none"> » Each component within the solar energy facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions, or routine maintenance activities. » As the CPV units use tracking technology the hydraulic oil may need to be supplemented occasionally..
Decommissioning		
Site preparation	<ul style="list-style-type: none"> » Preparation of the site. » Mobilisation of construction equipment. 	<ul style="list-style-type: none"> » 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 may be

Main Activity/Project Component	Components of Activity	Details
		<p>disassembled and replaced with 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.</p>
Disassemble panels	» The panels will be disassembled and removed.	» 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.

1.4. Environmental Process

In terms of the Environmental Impact Assessment (EIA) Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), authorisation is required from the National Department of Environmental Affairs (DEA) (in consultation with the Limpopo Department of Economic Development, Environment and Tourism (LDEDET), for the establishment of the proposed installation. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543 - GNR546, an Environmental Impact Assessment process is required to be undertaken for the construction of the proposed facility. This project has been registered with National DEA under reference number **14/12/16/3/3/2/329**.

Savannah Environmental has been appointed as the independent environmental consultants to undertake the Environmental Impact Assessment to identify and assess any potential environmental impacts. As part of these environmental studies, interested and affected parties (I&APs) have been actively involved through a public involvement process.

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

- » Ecological disturbances
- » Visual Impacts
- » Social Impacts

Potential sensitive areas have been identified through the environmental impact assessment and are listed below. In order to reduce the potential for on-site environmental impacts, these areas should be avoided as far as reasonably possible.

- » The baobab trees within the site are considered to be a significant ecological feature given the role these trees play in the ecology of the area. There is one Baobab tree that was noted. A licence would be required to move the tree. The majority of the site consists of woody vegetation and trees. The removal of the vegetation, if not managed properly, would result in soil erosion. The proposed area is classified as being of medium soil sensitivity.
- » The visual impacts associated with the proposed facility will be largely contained within the broader region itself. However, the proposed facility is located opposite the Venetia Diamond Mine and the surrounding land consists of farm land (grazing for livestock).
- » Impacts on the social environment are expected during both the construction phase and the operational phase of the solar energy facility. Impacts are expected at both

a local and regional scale. Impacts on the social environment as a result of the construction of the solar energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

1.4.1. Site Sensitivity Assessment

The ecological sensitivity map of the BioTherm Venetia Solar Facility is depicted in Figure 1.6. There was little basis on which to differentiate areas of higher sensitivity at the site, and the Mopane Woodland and Mixed Woodland have been classified as being of similar sensitivity. Although the Mixed Woodland is more diverse at a local scale, at a broader scale, the species composition of the two units is similar. The presence of the Baobabs within the development area is seen as significant and the trees have been buffered by 50m, which should be sufficient to maintain the ecological processes associated with these trees. The Baobab trees present are at least several hundred years old and represent an important biological and cultural heritage. Should the development not be able to avoid impacting the trees, mitigation or offset measures may need to be negotiated with the Department of Forestry. Although the Mopane trees are also protected they are not as significant as the Baobab trees and their removal would not be of high significance for this species. In terms of the major risk factors likely to be associated with the development, erosion risk would be high as clearing the woody vegetation from the site would be likely to create a large amount of disturbance and the ground layer is not currently well developed which would leave the soil in the disturbed areas bare and vulnerable to erosion.

The EMP has been developed based on the findings of the Environmental Impact Assessment, 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.

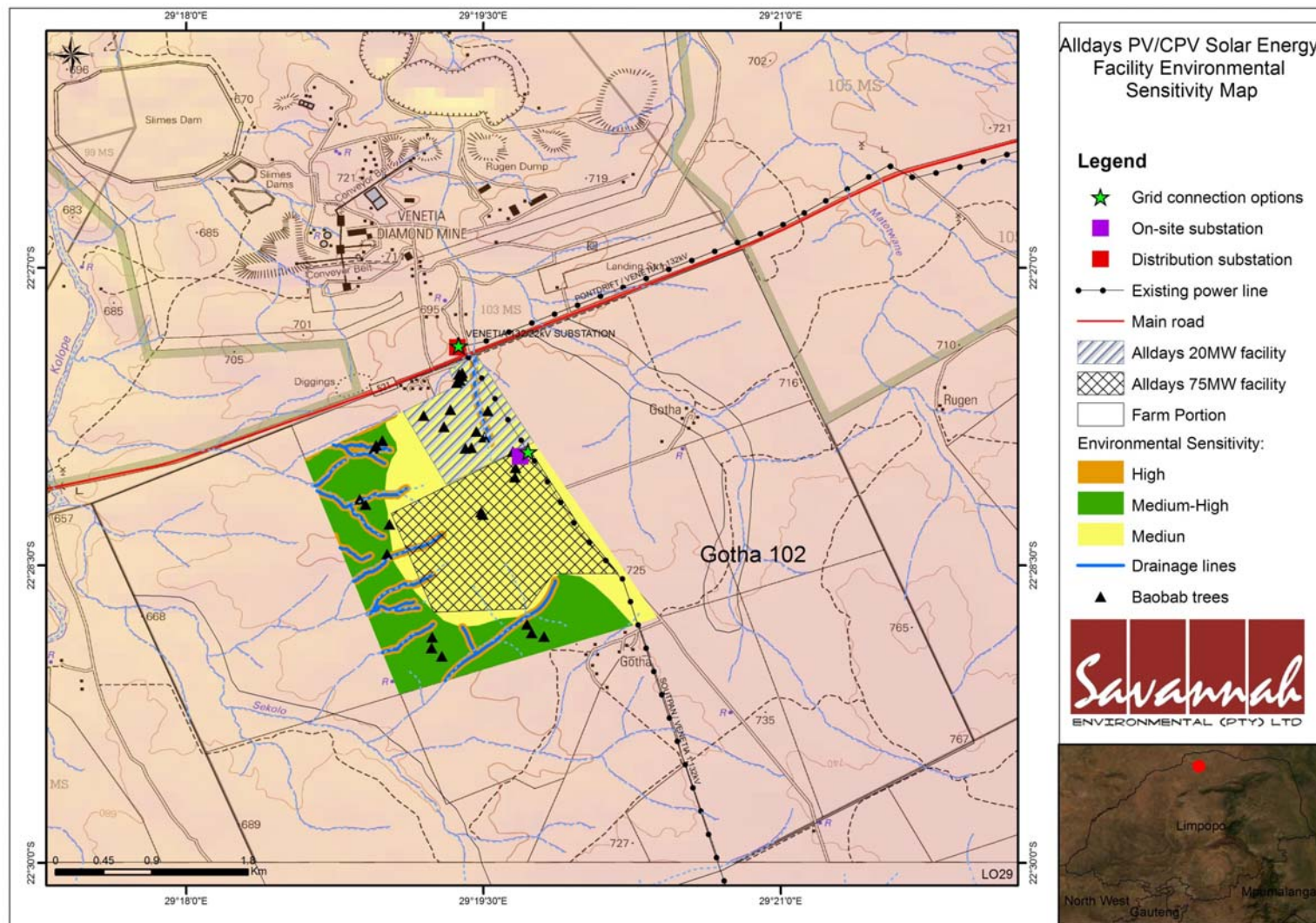


Figure 1.6: Potentially sensitive areas of the study area

PURPOSE & OBJECTIVES OF THE EMP

CHAPTER 2

An Environmental Management Programme (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 PV plant. 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 rehabilitation (soil stabilisation, re-vegetation) and operation.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed Venetia Phase 2), 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, i.e. construction, rehabilitation, operation, and decommissioning. 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.

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 Basic Assessment process.

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

BioTherm Energy (Pty) Ltd 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 Environmental Impact Assessment process undertaken for the proposed Alldays Phase 1, it is important that this document be read in conjunction with the Environmental Impact Assessment, 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 33 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 are given some form of Environmental Awareness Training. This training

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

- » Ensuring awareness of any other environmental matters, which are deemed necessary by the Environmental Control Officer (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 throughout the life-cycle of the facility. This will ensure that the project activities are planned and implemented taking sensitive environmental features into account.

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 BioTherm to achieve environmental compliance. For each of the phases of implementation for the photovoltaic 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/CPV panels » 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
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Indicator	effectiveness of the management Programme.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting.

The objectives and 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:	Umeshree Naicker	Savannah Environmental
	Jo-Anne Thomas	Savannah Environmental
Specialists:	Simon Todd	Simon Todd Consulting
	Iain Paton	Outeniqua Geotechnical Services Cc
	Stephan Gaigher	G&A Heritage
	Tony Barbour	Tony Barbour Consulting
	Johan Claassen	Zone Land Solutions

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 Programmes for other power generation projects throughout South Africa, including numerous renewable energy facilities.

The EAP's from Savannah Environmental who are responsible for this project are:

- » Jo-Anne Thomas - a registered Professional Natural Scientist and holds a Master of Science degree. She has 14 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently

responsible for the project management of EIAs for several renewable energy projects across the country.

- » Umeshree Naicker - the principle author of this report, holds an Honours Bachelor of Science degree in Environmental Science and has 3 years' experience in environmental management.

**MANAGEMENT PROGRAMME FOR THE PV 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 PV/CPV plant in a way that:

- » Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
- » Ensures that the best environmental options are selected for the project, including the power line alignment.
- » Enables the solar facility construction activities to be undertaken without significant disruption to other land uses in the area.

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

4.2. Objectives

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

From the specialist investigations undertaken for the proposed photovoltaic (PV) and concentrated photovoltaic (CPV) plant development site, the sensitive areas for development on the proposed farm portion is indicated on Figure 1.6. Sensitivities within the development footprint include the presence of one baobab tree and minor drainage. Erosion potential has been determined as being high on site and will require management to ensure any impacts are minimised.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> » PV/CPV panels » Access roads » Ancillary infrastructure
Potential Impact	Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	Site layout (Figure 1.6 - Sensitivity Map)
Mitigation:	To ensure that the design of the facility responds to the identified

Target/Objective environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to Biodiversity, as detailed within the Basic Assessment report and relevant appendices.	Engineering Design Consultant, and BioTherm	Design phase
Avoid Baobab trees on site as far as possible. Where not possible to avoid, obtain relevant permits to relocate trees to an appropriate location.	BioTherm Energy	Design phase
A detailed geotechnical investigation is required for the design phase.	BioTherm Energy	Design phase
Compile a final comprehensive stormwater management plan for hard surfaces as part of the final design of the project.	Engineering design consultant	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 Energy	Pre-construction, and construction
Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements.	BioTherm Energy	Tender design, and design review stage

Performance Indicator	<ul style="list-style-type: none"> » Design meets objectives and does not degrade the environment. » Design and layouts respond to the mitigation measures and recommendations in the Basic Assessment report.
Monitoring	Ensure that the design implemented meets the objectives and mitigation measures in the Basic Assessment report through review of the design by the Project Manager, and ECO prior to the commencement of construction.

OBJECTIVE: Minimise storm water runoff (guideline for stormwater management plan)

Management of storm water will be required during the construction and operational phases of the facility. A detailed storm water management plan is required to be compiled as part of the final design to ensure compliance with applicable regulations and to prevent off-site migration of contaminated storm water or increased soil erosion. The section below provides a guideline for the management of storm water on site and will need to be supplemented with the relevant method statements during the construction and operation phases of the facility.

Project Component/s	<ul style="list-style-type: none"> » Storm water management components. » Any hard engineered surfaces (i.e. access roads).
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Potential Impact	» Poor storm water management and alteration of the hydrological regime (i.e. drainage lines).
Activities/Risk Sources	» Construction of the facility (i.e. placement of hard engineered surfaces).
Mitigation: Target/Objective	» Appropriate management of storm water to minimise impacts on the environment.

Mitigation: Action/Control	Responsibility	Timeframe
A Method Statement for the management of storm water which also considers the recommendations below is to be submitted to the ECO.	BioTherm Energy	Pre-construction
Reduce the potential increase in surface flow velocities and the resultant impact on the localised drainage system through increased sedimentation.	BioTherm Energy	Planning and design
Appropriately plan hard-engineered bank erosion protection structures.	BioTherm Energy	Planning and design
Ensure suitable handling of storm water within the site (i.e. separate clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities) through appropriate design of the facility.	BioTherm Energy	Construction and operation
Design measures for stormwater management needed to allow for surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows.	BioTherm Energy	Planning and design

Performance Indicator	» Appropriate storm water management measures included within the facility design. » Sound water quality and quantity management during construction and operation.
Monitoring	» Devise a suitable surface water quality monitoring plan for implementation during construction and operation.

OBJECTIVE: To ensure effective communication mechanisms

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

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

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public to be implemented during both the construction and operational phases of the facility (refer to Appendix A for generic plan in this regard). This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues.	BioTherm Energy	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	BioTherm Energy Contractor	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaison with landowners is to be undertaken prior to the commencement of construction in order to provide sufficient time for them to plan agricultural activities.	BioTherm Energy Contractor	Pre-construction

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

MANAGEMENT PROGRAMME FOR THE SOLAR FACILITY: CONSTRUCTION

CHAPTER 5

5.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the PV/CPV facility 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 of the PV/CPV Plant

As the Proponent, BioTherm Energy must ensure that the implementation of the PV/CPV facility 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. BioTherm will retain various key roles and responsibilities during the construction of the PV facility. 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. Figure 5.1 provides an organogram indicating the organisational structure for the implementation of the EMP.

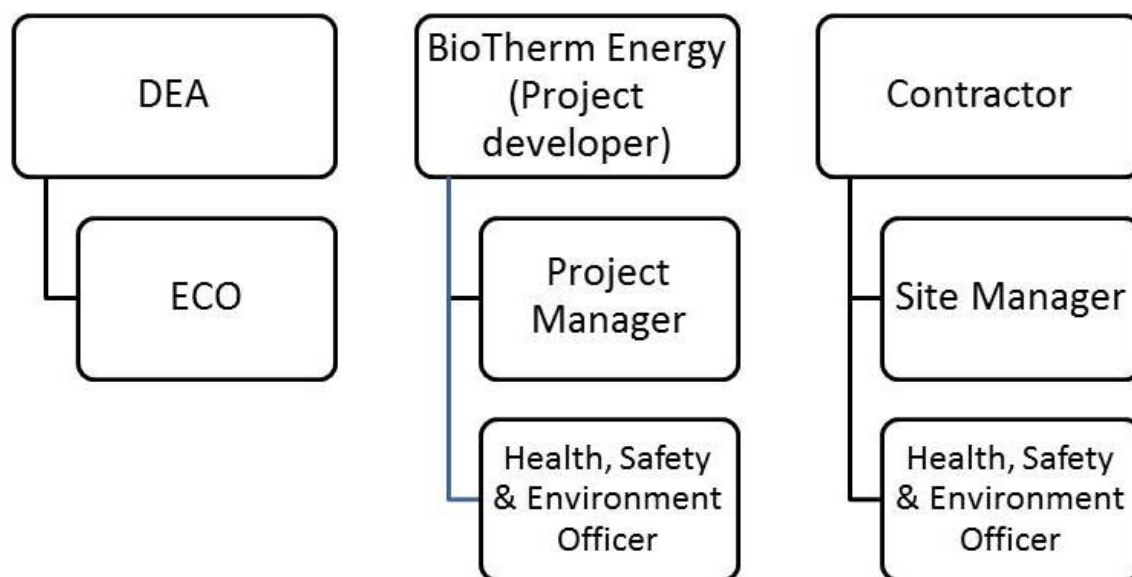


Figure 5.1: Organisational structure for the implementation of the EMP

Specific responsibilities of the Project Manager; Site Manager; 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 with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
- » Ensure that BioTherm 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.

5.2.1. Site Manager

The **Site Manager** (BioTherm 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.

5.2.2. Safety, Health and Environment Representative

The **Safety, Health and Environment Representative** (SHE officer) will:

- » Develop and compile environmental policies and procedures.
- » Direct and liaise with the Environmental Control Officer (ECO) regarding monitoring and reporting on the environmental performance of the construction phase.
- » Conduct internal environmental audits and co-ordinate external environmental audits.
- » Liaise with statutory bodies on environmental performance and other issues as required.

5.2.3. Environmental Control Officer

An independent **Environmental Control Officer** (ECO) must be appointed by BioTherm Energy prior to the commencement of any authorised activities. The ECO will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMP and the conditions of the Environmental Authorisation. 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.
- » Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.

As a general mitigation strategy, the Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter weekly site compliance inspections would probably be sufficient, decreasing in frequency as construction proceeds, provided that compliance with the EMP is maintained. However, in the absence of the ECO there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

5.2.4. 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 the goal detailed in Section 5.1 above, 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	» PV/CPV panels and ancillary infrastructure
Potential Impact	» Hazards to landowners and public » Security of materials
Activities/risk sources	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 ECO.	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

Mitigation: Action/control	Responsibility	Timeframe
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: duration of contract
Identify disturbance areas and restrict construction activity to these areas.	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: 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 of less than 100 m, whichever is applicable.	Contractor	During site establishment, construction and 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
All unattended open excavations shall be adequately demarcated and/or fenced). Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor	Erection: during site establishment Maintenance: for duration of contract

Performance Indicator	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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: Limit impact on protected tree species (As part of the rescue and protection of vegetation)

A number of protected species occur at the site, including Marula and Baobab trees. The Baobab trees are of particular significance as these trees are keystone species which provide key resources for birds, bats and mammals. The Baobab is a nationally protected species under the Forests Act and a permit is required to impact on these species. At least four Baobab trees were recorded within the proposed development area and should preferably not be destroyed for the construction of the PV/CPV facility. Only one Baobab tree appears to be affected by the development footprint. The dense tree cover at the site generally restricts visibility to less than 100 m and so although the development area was thoroughly searched for Baobab trees, it is plausible but unlikely that there may be one or two additional trees that were not observed. The affected Baobab tree/s would have to be relocated in accordance with the requirements of the environmental authorities. Mitigation measures will therefore need to be implemented during the construction phase to ensure protection of the natural vegetation on site.

Project component/s	All components which require vegetation clearing
Potential Impact	Loss of individuals of protected tree species
Activities/risk sources	Construction & site clearing activities
Mitigation: Target/Objective	Limit the loss of protected tree species No overall loss through planting replacement trees

Mitigation: Action/control	Responsibility	Timeframe
Minimise loss of protected trees through adjustment of the final layout as far as possible	BioTherm Energy ECO	Design & Construction
Conduct plant sweeps in the final development footprint for any species suitable for search and rescue	BioTherm Energy ECO	Pre-construction
Plant replacement trees in the area	BioTherm Energy ECO	Construction/ rehabilitation

Performance Indicator	» Survival of relocated trees
Monitoring	» Document survival of relocated trees

OBJECTIVE: Objective: Limit faunal impacts

Four listed terrestrial mammals may occur at the site, i.e. the Honey Badger (Endangered), Leopard (Near Threatened), Brown Hyaena (Near Threatened) and Black-footed cat (Vulnerable). Given the preponderance of game farming in the area, predators may be tolerated to a greater degree than in livestock farming areas and so it is possible that all of the listed species may occur in the area. As no listed reptile species are likely to occur at the site and given the small extent of the development, the impact on reptiles is likely to be local in extent and of a generally low significance. Given that there are no pans, rivers or permanent water sources within the proposed development area, the impact on amphibians is likely to be local in nature and of low magnitude. The development is likely to result in some habitat loss for resident bird species, which is to some extent mitigated by the proximity of the site to the tar road and the mine.

Project component/s	All components which create disturbance during construction, as well as security fencing and transmission lines
Potential Impact	<ul style="list-style-type: none"> » Loss of habitat and landscape connectivity for terrestrial fauna. » Negative impacts on avifauna.
Activities/risk sources	<ul style="list-style-type: none"> » Habitat transformation during construction; » site fencing, » presence of construction and operation personnel.
Mitigation: Target/Objective	Low faunal impact during construction and operation.

Mitigation: Action/control	Responsibility	Timeframe
Environmental induction for all staff	Contractor ECO	Construction
Ensure bird-friendly design of power line infrastructure	BioTherm Energy	Design Construction
Use low UV lighting at night to avoid attracting insects.	BioTherm Energy	Design Construction
ECO must be on duty during the site clearing.	ECO	Construction
Permeable fencing should be erected at strategic places.	BioTherm Energy Contractor	Design Construction

Performance Indicator	<ul style="list-style-type: none"> » Limited mortality of fauna during construction » Limited mortality of avifauna during operation
Monitoring	<ul style="list-style-type: none"> » Monitoring for compliance during the construction phase » Monitoring for avifaunal impacts by searching under transmission infrastructure for dead birds

- » Records of all incidents and mitigation measures implemented at sites where repeated impacts occur.

OBJECTIVE: Limit damage to drainage lines

Minor drainage areas are likely to be directly affected by the proposed development. Indirect impacts are also possible as a result of erosion and associated sedimentation. Appropriate management is required to minimise potential impacts.

Project component/s	» Any infrastructure or activity that will result in disturbance to drainage lines
Potential Impact	» Damage to drainage lines by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil or vegetation). The focus should be on the functioning of the watercourse as a natural system.
Activity/risk source	<ul style="list-style-type: none"> » Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities » Dumping or damage by construction equipment outside of demarcated construction areas.
Mitigation: Target/Objective	» No unauthorised changes or damage to drainage lines or watercourses within project area.

Mitigation: Action/control	Responsibility	Timeframe
Where drainage lines are required to be crossed by access roads and/or underground cables, or impacted by other infrastructure, the relevant permits (or water use licences) must be applied for from the DWA	BioTherm Energy, Contractor, ECO	Construction, Operation
Ensure that power line towers are constructed at least 32 m from the drainage lines (i.e. span the drainage lines)	BioTherm Energy, Contractor, ECO	Construction, Operation
The construction impacts must be contained to the footprint of the infrastructure.	Contractor, ECO	Construction, Operation
Rehabilitate any disturbed areas as soon as possible after construction is completed in an area	Contractor, ECO	Construction, Operation
Develop and implement an appropriate stormwater management plan for all infrastructure	BioTherm Energy, Contractor, ECO	Construction, Operation
Infrastructure (including culverts and/or bridges) should not be placed within drainage line channels but should span them completely.	BioTherm Energy, Contractor, ECO	Construction, Operation

Mitigation: Action/control	Responsibility	Timeframe
Make use of existing access roads. If extra tracks are needed to conduct any activities on site, ensure that they are not in contravention of any environmental legislation or the EMP.	BioTherm Energy, Contractor, ECO	Construction, Operation

Performance Indicator	» No unauthorised impacts on water quality, water quantity, drainage lines/vegetation, natural status of watercourses
Monitoring	<ul style="list-style-type: none"> » Habitat loss in watercourses should be monitored before and after construction. » The presence and development of erosion features downstream of any construction through drainage lines must be monitored.

OBJECTIVE: Limit disturbance of site during construction

Project component/s	<ul style="list-style-type: none"> » PV or CPV arrays and their support structures; » access and maintenance roads; » buildings
Potential Impact	Loss of plant cover leading to erosion as well as loss of faunal habitat
Activities/risk sources	Construction & site clearing activities
Mitigation: Target/Objective	Maintain a ground layer to protect the site from erosion and reduce faunal impacts.

Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing.	Contractor ECO	Construction
Clear woody vegetation with least possible impact to ground layer, or re-establish ground layer after clearing	Contractor ECO	Construction
The extent of clearing and disturbance to the natural vegetation must be kept to a minimum so that impact on flora and habitats is restricted.	Contractor	Site establishment & duration of contract
Construction activities must be restricted to demarcated areas so that impact on flora and sensitive habitats is restricted.	Contractor	Site establishment & duration of contract
Unnecessary impacts on surrounding natural vegetation must be avoided, e.g. driving around in the veld. Use demarcated access roads only.	Contractor	Site establishment & duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Ensure erosion control structures are in place in areas of water movement	Contractor ECO	Construction

Performance Indicator	<ul style="list-style-type: none"> » Zero disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation » Loss of natural vegetation equivalent to the exact footprint of the proposed project
Monitoring	<ul style="list-style-type: none"> » Document pre- and post- construction cover of the ground layer after the rainy season » Document erosion problems and the control measures implemented

OBJECTIVE: Minimise storm water runoff and subsequent alteration of the local hydrological regime (Storm water Management Plan)

Management of stormwater will be required during the construction and operational phases of the facility. A stormwater management plan is required to ensure compliance with applicable regulations and to prevent off-site migration of contaminated storm water or increased soil erosion. The section below provides a guideline for the management of stormwater on site and will need to be supplemented with the relevant method statements during construction and operation phases of the facility.

Project Component/s	<ul style="list-style-type: none"> » Storm water management components » Any hard engineered surfaces (i.e. access roads and building foundations).
Potential Impact	<ul style="list-style-type: none"> » Poor storm water management and alteration of the hydrological regime. » Risk of river system erosion and downstream sedimentation.
Activities/Risk Sources	<ul style="list-style-type: none"> » Construction of the facility (i.e. placement of hard engineered surfaces). » Construction of water abstraction infrastructure.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Appropriate management of storm water to minimise impacts on the environment.

Mitigation: Action/control	Responsibility	Timeframe
A Method Statement for the management of storm water which also considers the recommendations below is to be submitted to the ECO.	Contractor	Construction and operation
Reduce the potential increase in surface flow velocities and the resultant impact on the localised drainage system through increased sedimentation.	BioTherm Energy	Planning and design

Mitigation: Action/control	Responsibility	Timeframe
Suitable handling of storm water within the site (i.e. clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities).	BioTherm Energy	Construction and operation
Design measures for storm water management need to allow for surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows	BioTherm Energy	Construction and operation

Performance Indicator	» Sound water quality and quantity management
Monitoring	» Surface water quality monitoring plan.

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 solar energy facility and associated infrastructure.
Potential Impact	<ul style="list-style-type: none"> » 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 NO₂, CO and SO₂) from vehicles and construction equipment.
Activities/risk sources	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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; duration of 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	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable once construction is completed in an area.	Contractor	At completion of construction phase
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	<ul style="list-style-type: none"> » No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures on roads implemented for all heavy vehicles that require such measures during the construction phase commences. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	<ul style="list-style-type: none"> » Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods: <ul style="list-style-type: none"> * 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 Project 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: Minimise the establishment and spread of alien invasive plants (Invasive Plant Management Plan) and manage indigenous invasive plants

On-going alien and invasive plant monitoring and removal should be undertaken on all areas of natural vegetation within the project lease area on an annual basis. The section below provides a guideline for the Invasive Plant Management Plan and should be implemented together with consideration of the principles contained in the Department of Water Affairs: Working for Water Programme (refer to Appendix B).

Project Component/s	» Any infrastructure or activity that will result in disturbance to natural areas.
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, and no additional thickening of indigenous invasive shrubs.

Mitigation: Action/Control	Responsibility	Timeframe
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum. » Rehabilitate disturbed areas as quickly as possible. » Do not import soil from areas with alien plants. » Remove all alien plants from areas adjacent to or on frequently traversed access routes to prevent dispersal of regenerative material onto site	Contractor	Construction and operation
Establish an on-going 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 and Biodiversity Act).	Contractor	Construction and operation
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction and operation
DWA approved methodology should be employed for all invasive clearing operations. No bulldozing or removal by any machinery except chainsaws is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. All stems must be cut as close to ground level as possible, using loppers or chainsaws (depending on size). No herbicide spraying should be undertaken anywhere, due to the extensive collateral damage. All cut branches should be	Contractor	Construction and operation

Mitigation: Action/Control	Responsibility	Timeframe
stacked into a pyramid (cut end up) and left to dry – where rodents will eat the available seed under the pile, reducing seed germination. Should this method not be feasible due to volumes of biomass, all cut branches shall be shredded. Shredded material of cut branches that do not contain any seed or other regenerative material can be kept for rehabilitation. Annual follow ups are required in all areas that have been previously cleared (to be undertaken in the growing season). Small seedlings may be hand pulled.		

Performance Indicator	» For each invasive or alien species: number of plants and aerial cover of plants within project area and immediate surroundings is significantly reduced and alien species are absent from site.
Monitoring	» On-going monitoring of area by ECO during construction. » 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 and used in optimising the control programme. » The environmental manager should be responsible for driving this process. » Reporting frequency depends on legal compliance framework.

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

The soil on site may be impacted in terms of:

- » Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern in areas that are underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion).
- » Uncontrolled run-off relating to the construction activity (excessive wetting, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation along natural drainage lines or catchment areas.
- » Degradation of the natural soil profile due to excavation, removal of topsoil, stockpiling, wetting, compaction, pollution and other construction activities may affect soil forming processes and associated agricultural potential.

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

Project Component/s	<ul style="list-style-type: none"> » PV/CPV arrays and foundations to support them. » Substation. » Access roads. » Underground cabling. » Storage and maintenance facilities and foundations to support them. » Overhead power line linking the facility to the electricity grid.
Potential Impact	<ul style="list-style-type: none"> » Soil degradation including erosion, dust and siltation.
Activities/Risk Sources	<ul style="list-style-type: none"> » Earthworks & activity on site. » Rainfall and concentrated discharge causing water erosion of disturbed areas. » Wind - erosion of disturbed areas.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Minimise soil degradation (removal, excavation, mixing, wetting, compaction, pollution, etc.). » Minimise erosion. » Minimise sediment transport downstream (siltation). » Minimise dust pollution.

Mitigation: Action/Control	Responsibility	Timeframe
Identify areas of high erosion risk (drainage lines, existing problem areas). Only special works to be undertaken in these areas to be authorised by ECO and Engineer's representative (ER)	ECO/ER	At design stage. Site establishment Duration of construction
Identify construction areas for general construction work and restrict construction activity to these areas.	ECO/ER/Contractor	At design stage and during construction
Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling)	ECO/ER/Contractor	During construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary degradation of soil. Special attention to be given to roads that cross drainage lines and roads on steep slopes (to prevent unnecessary cutting and filling operations).	ECO/ER/Contractor	At design stage and during construction
Dust control on construction site through wetting or covering of cleared areas.	Contractor	Daily during construction
Minimise removal of vegetation which aids soil	ECO/Contractor	Continuously during

Mitigation: Action/Control	Responsibility	Timeframe
stability.		construction
Rehabilitate disturbance areas as soon as an area is vacated.	Contractor	Continuously during and after construction
Soil conservation - stockpile topsoil for re-use in rehabilitation phase. Protect stockpile from erosion. Topsoil should be stockpiled below 1 m height and for as short a period as possible to ensure survival of the soil seed bank and other soil-borne organisms.	Contractor	Continuously during construction
Erosion control measures- run-off control and attenuation on slopes (sand bags, logs), silt fences, stormwater channels and catch-pits, shade nets, soil binding, geofabrics, hydroseeding or mulching over cleared areas.	Contractor/ECO	Erection: Before construction Maintenance: Duration of contract
Where access roads cross natural drainage lines, culverts must be designed to allow free flow. Regular maintenance must be carried out.	ECO/ER/Contractor	Before construction and maintenance over duration of contract
Control depth of excavations and stability of cut faces/sidewalls.	ECO/ER/Contractor	Before construction and maintenance over duration of contract
Identify areas of high erosion risk (drainage lines/watercourses, existing problem areas). Only special works to be undertaken in these areas to be authorised by ECO and Engineer's representative (ER).	ECO/ER	At design stage.

Performance Indicator	<ul style="list-style-type: none"> » Only authorised activity outside construction areas. » No activity in no-go areas. » Acceptable level of activity within construction areas, as determined by ECO. » Acceptable level of soil erosion around site, as determined by ECO. » Acceptable level of sedimentation along drainage lines, as determined by ECO. » Acceptable level of soil degradation, as determined by ECO. » Acceptable state of excavations, as determined by ER & ECO.
Monitoring	<ul style="list-style-type: none"> » Monthly inspections of the site by the ECO. » Monthly inspections of sediment control devices by the ECO. » Monthly inspections of surroundings, including drainage lines by the ECO. » Immediate reporting of ineffective sediment control systems by the ECO. » An incident reporting system will record non-conformances.

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

Project component/s	Construction and establishment activities associated with the establishment of the solar facility, including infrastructure etc.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activity/risk source	The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	BioTherm, in discussions with the Musina Local Municipality, should aim to employ a minimum of 80% of the low-skilled workers from the local area. This should also be made a requirement for all contractors. BioTherm should also develop a database of local BEE service providers

Mitigation: Action/control	Responsibility	Timeframe
Employment and business policy document that sets out local employment targets to be in place before construction phase commences.	BioTherm & contractors	Pre-construction
As far as possible, ensure that the majority of low-skilled workers are sourced from the local area.	BioTherm & contractors	Construction
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that the local employment target is met.	BioTherm Energy Contractors	Pre-construction Construction
Skills audit to be undertaken to determine training and skills development requirements;	BioTherm Energy	Pre-construction
Develop a database of local BEE service providers and ensure that they are informed of tenders and job opportunities;	BioTherm Energy	Pre-construction
Identify potential opportunities for local businesses	BioTherm Energy	Pre-construction

Performance Indicator	<ul style="list-style-type: none"> » Employment and business policy document that sets out local employment and targets completed before construction phase commences. » Majority of semi and unskilled labour locally sourced. » Database of potential local BEE services providers in place before construction phase commences. » Skills audit to determine need for training and skills development programme undertaken within 1 month of commencement of
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	construction phase.
Monitoring	» BioTherm and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

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

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

Mitigation: Action/control	Responsibility	Timeframe
Attempt to ensure that the majority of the low-skilled workers are sourced from the local area. This should be included in the tender documents. Construction workers should be recruited from the local area.	BioTherm Energy contractors	Construction
Identify local contractors who are qualified to undertake the required work.	BioTherm Energy	Pre-construction
Develop a Code of Conduct to cover the activities of the construction workers housed on the site.	BioTherm Energy	Pre-construction
Ensure that construction workers attend a brief session before they commence activities. The aim of the briefing session is to inform them of the rules and regulations governing activities on the site as set out in the Code of Conduct.	BioTherm Energy and contractors	Pre-construction
Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	BioTherm Energy contractors	Pre-construction
Ensure that construction workers who are found guilty of breaching the Code of Conduct are dismissed. All dismissals must be in accordance with South African labour legislation.	Contractors	Construction
Provide opportunities for workers to go home over weekends. The cost of transporting workers home	Contractors	Construction

Mitigation: Action/control	Responsibility	Timeframe
over weekends and back to the site should be borne by the contractors.		
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	Contactors	Construction

Performance Indicator	<ul style="list-style-type: none"> » Employment policy and tender documents that sets out local employment and targets completed before construction phase commences. » Majority of semi and unskilled labour locally sourced. » Local construction workers employed have proof that they have lived in the area for five years or longer. » Tender documents for contractors include recommendations for construction camp. » Code of Conduct drafted before commencement of construction phase. » Briefing session with construction workers held at outset of construction phase.
Monitoring	<ul style="list-style-type: none"> » BioTherm and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

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

The natural vegetation in the study area is known to 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 solar facility, including infrastructure etc.
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.
Activity/risk source	The presence of construction workers and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed	BioTherm Energy and contractors	Construction

Mitigation: Action/control	Responsibility	Timeframe
except in designated areas.		
Provide adequate fire fighting equipment on-site.	BioTherm Energy and contractors	Construction
Provide fire-fighting training to selected construction staff.	BioTherm Energy and contractors	Construction
Compensate farmers / community members at full market related replacement cost for any losses, such as livestock, damage to infrastructure etc.	Contractors	Compensate Farmers within 1 month of claim being verified
Join Fire Protection Agency	BioTherm Energy	Pre-construction

Performance Indicator	<ul style="list-style-type: none"> » 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. » Compensation claims settled within 1 month of claim being verified.
Monitoring	<ul style="list-style-type: none"> » BioTherm and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: To avoid and or minimise the potential impacts of safety, noise and dust and damage to roads caused by construction vehicles during the construction phase.

Project component/s	Construction and establishment activities associated with the establishment of the solar facility, including infrastructure etc.
Potential Impact	<ul style="list-style-type: none"> » Heavy vehicles can generate noise and dust impacts. » Movement of heavy vehicles can damage roads.
Activity/risk source	The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads.
Mitigation: Target/Objective	To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and minimise damage to roads.

Mitigation: Action/control	Responsibility	Timeframe
Implement dust suppression measures for heavy vehicles such as wetting roads or applying appropriate dust suppressants on a regular basis, and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Contractors	Construction
Ensure that all vehicles are road-worthy; drivers are qualified and are made aware of the potential	Contractors	Construction

Mitigation: Action/control	Responsibility	Timeframe
noise, dust and safety issues.		
Ensure that drivers adhere to speed limits. Vehicles should be fitted with recorders to record when vehicles exceed the speed limit.	Contractors	Construction
Ensure that damage to roads is repaired before completion of construction phase.	Contractors	Construction

Performance Indicator	<ul style="list-style-type: none"> » Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase commences. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » All heavy vehicles equipped with speed monitors before they are used in the construction phase. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring	<ul style="list-style-type: none"> » BioTherm and/or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

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

Project component/s	Construction phase activities associated with the establishment of the solar facility and associated infrastructure.
Potential Impact	The footprint of the solar energy plant and associated infrastructure will result in a loss of land that will impact on farming activities on the site.
Activity/risk source	The footprint taken up by the solar energy plant and associated infrastructure.
Mitigation: Target/Objective	To minimise the loss of land taken up by the PV facility and associated infrastructure and to enable farming activities to continue where possible, specifically grazing.

Mitigation: Action/control	Responsibility	Timeframe
Minimise the footprint of the solar facility and the associated infrastructure as far as possible.	Contractor BioTherm Energy	Pre-construction Site establishment Construction
Rehabilitate disturbed areas on completion construction activities within an area. Details of the rehabilitation programme should be contained in the EMP	ECO Contractors	Construction

Performance	» Footprint of solar facility included in the Construction Phase EMP.
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Indicator	» Meeting/s held with farmers during construction phase.
Monitoring	» ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: To minimise the potential impact on safety and security

Criminals could 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. The negative impacts associated with the inflow of workers could, however, be limited should a local labour force be used.

Project component/s	» Solar facility. » Associated infrastructure.
Potential Impact	Outside workers are involved in criminal activities.
Activities/risk sources	» Safety of individuals and animals are at risk. » Theft of construction material.
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 presence of an outside workforce.	Contractor	Pre-construction Construction
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 members and property owners should be informed of the presence of the outside workforce, the construction schedule, and movement of workers.	BioTherm Energy	Construction
Property owners, their workers, as well as local communities should be motivated to be involved in crime prevention by reporting crimes to the appropriate authorities.	BioTherm Energy, and local communities	All phases of project
The construction site should be fenced and access to the area controlled.	BioTherm Energy, and contractor	All phases of project
Workers should preferably not be accommodated on site. Should this, however, be considered, the	BioTherm Energy & EPC Partner	Construction

Mitigation: Action/control	Responsibility	Timeframe
developer should be obliged to consult the neighbouring property owners in this regard and to address their concerns.		

Performance Indicator	» No criminal activities and theft are reported to be linked with the construction force.
Monitoring	» Project proponent, and appointed ECO must monitor indicators listed above to ensure that they have been implemented.

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

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

The components for the proposed facility will be transported to site by road. The study site is accessible via an existing secondary gravel road off the R380. The total number of vehicles that are estimated during the construction phase is approximately 100-150, although this could change depending on the final transport plan devised by the EPC partner during the final design phase of the facility.

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

Project Component/s	» Delivery of any component required within the construction phase.
Potential Impact	<ul style="list-style-type: none"> » Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals. » Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.
Activities/Risk	» Construction vehicle movement.

Sources	<ul style="list-style-type: none"> » Speeding on local roads. » Degradation of local road conditions. » Site preparation and earthworks. » Foundations or plant equipment installation. » Transportation of ready-mix concrete from off-site batching plant to the site. » Mobile construction equipment movement on-site. » Power line and substation construction activities.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Minimise impact of traffic associated with the construction of the facility on local traffic volume, existing infrastructure, property owners, animals, and road users. » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction » To ensure all vehicles are roadworthy and all materials/ equipment are transported appropriately and within any imposed permit/licence conditions

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

Mitigation: Action/Control	Responsibility	Timeframe
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	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 of the contractor must be ensured.	Contractor	Duration of contract
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract
Signs must be placed along construction roads to identify speed limits, travel restrictions and other standard traffic control information.	Contractor	Duration of contract

Performance Indicator	<ul style="list-style-type: none"> » Vehicles keeping to the speed limits. » Vehicles are in good working order and safety standards are implemented. » Local residents and road users are aware of vehicle movements and schedules. » No construction traffic related accidents are experienced. » Local road conditions and road surfaces are up to standard. » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).
Monitoring	<ul style="list-style-type: none"> » Developer and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE: Minimising the impact on heritage resources

NO heritage sites were recorded on the proposed development site during the EIA process. The construction of the PV/CPV array could however impact on unidentified sites of heritage importance (e.g. artefacts, graves, etc.) which may be unearthed during the construction phase.

The proposed site lies outside of the southern boundary of the buffer zone for the Mapungubwe WHS and Cultural Landscape. The possible impact on this landscape type should however be avoided.

Project component/s	PV /CPV Array, power lines, roads and construction camps
Potential Impact	<ul style="list-style-type: none"> » Heritage objects or artefacts found on site are inappropriately managed or destroyed » Disturbance to fossil resources
Activity/risk source	<ul style="list-style-type: none"> » Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
Monitoring of any excavation activities during the construction phase of the project.	Heritage specialist or ECO (with appropriate training)	During excavations associated with the construction phase
Obtain relevant permits if sites are unearthed during the construction phase.	Contractor Heritage specialist	Construction
Mapungubwe WHS management should be informed of the development and any changes in the buffer zone should be re-evaluated.	Environmental Manager	Continuous

Performance Indicator	No destruction of heritage, archaeological or cultural sites of importance
Monitoring	Monitoring by specialist or ECO during excavation phase

OBJECTIVE: Mitigate the possible visual impact associated with the construction phase

Project component/s	PV /CPV Array, power lines, roads and construction camps
Potential Impact	» Visual impact of general construction activities and associated impacts.
Activity/risk source	» Potential impact on sensitive receptors within 1 km of the facility.
Mitigation: Target/Objective	» Minimal visual intrusion by construction activities and general acceptance and compliance with Environmental Specifications.

Mitigation: Action/control	Responsibility	Timeframe
Keep disturbed areas to a minimum.	BioTherm Energy / contractor	Throughout construction
Identify suitable areas within the construction site for fuel storage, temporary workshops, eating areas, ablution facilities and washing areas.	BioTherm Energy / contractor	Throughout construction
Maintain the dense natural vegetated buffer is also in existence.	BioTherm Energy / contractor	Throughout construction

Performance Indicator	» Construction site is confined to the demarcated areas identified on the Development Plan
Monitoring	» Monitoring to be undertaken by an appointed Environmental Control Officer who will enforce compliance with the Environmental Specifications.

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

The construction phase of the PV/CPV facility 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 will probably consist of some construction and general solid waste. A guideline for integrated management of construction waste is included as Appendix D of this EMP.

Project component/s	» Storage and handling of chemicals, and waste. » Maintenance of vehicles and planning of vehicle service areas.
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Pollution of the surrounding environment through inappropriate waste

	<p>management practices.</p> <ul style="list-style-type: none"> » Litter or contamination of the site or water through poor waste management practices. » Pollution of water and soil resources. » Oil, fuel and other hydrocarbon pollution.
Activity/risk source	<ul style="list-style-type: none"> » PV panel construction activities. » Building construction activities. » Packaging and other construction wastes. » Hydrocarbon use and storage. » Spoil material from site preparation. » Poor maintenance of vehicles and poor control over service areas.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » 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. » Adequate maintenance and control over service areas

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement an emergency preparedness plan during the construction phase.	Contractor	Duration of Contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is 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 authorities should be notified as per the notification of emergencies/incidents, as per the requirements of NEMA.	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
Routine servicing and maintenance of vehicles must not take place on-site outside of designated areas (except for emergencies). 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	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
and on a sealed surface. The bunded area must be provided with a tap-off system through which spillages and leakages that might occur will be removed without any spillage outside the bunded area.		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 complied with.	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	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
operational state at all times.		
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction
Maintenance of service areas, regular clean-up	Construction team and engineer	Duration of contract

Performance Indicator	<ul style="list-style-type: none"> » Implement an effective monitoring system to detect any leakage or spillage of all hazardous substances. » 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. » Assessment number and extent of spillages on a regular basis.
Monitoring	<ul style="list-style-type: none"> » 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. » An incident reporting system will be used to record non-conformances to the EMP. » Monitor construction and service sites.

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 Basic Assessment 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.
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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 Contractors contracts.	BioTherm Energy	Tender process
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-contractors	Duration of contract
Cooking/meals must take place in a designated area; no firewood or kindling may be gathered from the site or surrounds.	Contractor, and sub-contractors	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-contractors	Duration of contract
No one other than the ECO or personnel authorised by said individual may disturb flora or fauna outside of the demarcated construction area/s.	Contractor, and sub-contractors	Duration of contract
Contractors must ensure that all workers are informed at the outset of the construction phase about the consequences of stock theft and trespassing on adjacent farms.	Contractor, and sub-contractors	Construction
Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	BioTherm Energy Contractor	Pre-construction

Performance Indicator	<ul style="list-style-type: none"> » Compliance with specified conditions of Environmental Authorisation, (once issued), EIA report, and the 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	<ul style="list-style-type: none"> » 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.

Very specific areas to be addressed in the method statement: before, during and post construction include:

- » Site Establishment plan (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and to be established etc. Including a site camp plan indicating all of these).
- » Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- » Soil management/stockpiling and erosion control.
- » Excavations and backfilling procedure and processes.

- » Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions as applicable).
- » Stipulate the storm water management procedures recommended in the storm water management plan.
- » Ablution facilities (placement, maintenance, management and servicing).
- » Solid Waste Management:
 - * Description of the waste storage facilities (on site and accumulative).
 - * Placement of waste stored (on site and accumulative).
 - * Management and collection of waste process.
 - * Recycle, re-use and removal process and procedure.
- » Liquid waste management:
 - * The design, establish, maintain and operate suitable procedures for pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
 - * Stipulate grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) that needs to be disposed of, link into an existing facilities where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into wetlands or natural watercourses.
- » Dust and noise pollution:
 - * Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels (construction activities generating output levels of 85 dB(A) near human settlement, are to be confined to working hours (06h00 - 18h00) Mondays to Fridays).
 - * Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- » Hazardous substance storage (ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
 - * List of all potentially hazardous substances to be used.
 - * Appropriate handling, storage and disposal procedures.
 - * Prevention plan of accidental contamination of soil at storage and handling areas.
 - * All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- » Fire prevention and management measures on site.

- » Fauna and flora protection process on and off site (i.e.: removal to reintroduction or replanting, if necessary).
- » Rehabilitation and re-vegetation process.
- » Incident and accident reporting protocol.
- » General administration (and stipulating that all documentation and licences must be on site at all times).
- » Designate access road and the protocol on while roads are in use.
- » Requirements of gate control protocols.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Project Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

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

5.5. Awareness and Competence: Construction Phase of the PV/CPV 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 and employees 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 to be 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.

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

5.5.1. Environmental Awareness Training

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

5.5.2. Induction Training

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

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

5.5.3. *Toolbox Talks*

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

5.6. Monitoring Programme: Construction Phase of the PV/CPV 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, BioTherm 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 to the ECO.

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 ECO will ensure compliance with the EMP, and to conduct monitoring activities. The ECO must have the appropriate experience and qualifications to undertake the necessary

tasks. The ECO must report any non-compliance or where corrective action is necessary to the Site Manager and/or any other monitoring body stipulated by the regulating authorities. The following reports will be applicable:

5.6.1. Non-Conformance Reports

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

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

5.6.2. Monitoring Reports

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

5.6.3. Final Audit Report

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

MANAGEMENT PROGRAMME FOR THE SOLAR FACILITY: CHAPTER 6
REHABILITATION OF DISTURBED AREAS

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 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 operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area (principles on rehabilitation included in soil management plan and in plant search and rescue plan).

Project Component/s	» Area and linear infrastructure.
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion and increased runoff, and the requirement for on-going management intervention.
Activity/Risk Source	<ul style="list-style-type: none"> » Temporary construction areas. » Temporary access roads/tracks. » Power line servitudes. » Other disturbed areas/footprints.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » 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.	Contractor	Following execution of the works
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
The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up.	Contractor	Following completion of construction activities in an area
All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area shall be top soiled and re-vegetated.	Contractor	Following completion of construction activities in an area
Temporary roads must be closed and access across these blocked. Compacted surfaces of temporary roads must be ripped to facilitate their rehabilitation.	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
A rehabilitation plan that specifies the rehabilitation process should be compiled and should be approved by the ECO.	BioTherm Energy, Contractor and ECO	Pre-construction
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 to be determined by a botanist as applicable.	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.	BioTherm Energy in consultation with rehabilitation specialist	Post-rehabilitation
Erosion control measures should be used in sensitive areas such as steep slopes, hills, and drainage lines as necessary.	BioTherm Energy in consultation with rehabilitation specialist	Post-rehabilitation
On-going invasive and alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	BioTherm in consultation with rehabilitation	Post-rehabilitation

Mitigation: Action/Control	Responsibility	Timeframe
	specialist	

Performance Indicator	<ul style="list-style-type: none"> » All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised where practicable or required after construction and temporally utilised areas. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Completed site free of erosion and alien invasive plants.
Monitoring	<ul style="list-style-type: none"> » On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented during the operational lifespan of the facility. » On-going alien plant monitoring and removal should be undertaken on an annual basis.

MANAGEMENT PROGRAMME FOR THE SOLAR FACILITY: OPERATION

CHAPTER 7

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the PV/CPV 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 PV/CPV facility in a way that:

- » Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
- » Ensures 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: 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 Power Station Manager, and Environmental Manager for the operation phase of this project are detailed below.

The **Power Station Manager** will:

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

The **Environmental Manager** will:

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

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	<ul style="list-style-type: none"> » PV/CPV facility. » All disturbed areas.
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	<ul style="list-style-type: none"> » Foundations. » Other disturbed areas.
Mitigation: Target/Objective	Ensure and encourage site rehabilitation of disturbed areas.

Mitigation: Action/control	Responsibility	Timeframe
Fire breaks should be established and maintained, where appropriate.	BioTherm Energy	Operation
Maintenance of erosion control measures.	BioTherm Energy	Operation
Implementation of a storm water management plan.	BioTherm Energy	Operation
Appoint an environmental manager during operation whose duty it will be to minimise impacts on	BioTherm Energy	Operation

Mitigation: Action/control	Responsibility	Timeframe
surrounding sensitive habitats.		

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

OBJECTIVE: Protection of vegetation and faunal habitats

Project component/s	<ul style="list-style-type: none"> » Solar array » Access roads » Substation linking the facility to the electricity grid » Underground cabling » Power line
Potential Impact	» Disturbance of vegetation outside of areas affected by solar energy facility components
Activity/risk source	» Maintenance of solar energy facility and associated infrastructure
Mitigation: Target/Objective	» Minimisation of impacts on vegetation in the area surrounding the solar energy facility infrastructure

Mitigation: Action/control	Responsibility	Timeframe
Limit maintenance activities to facility footprint	BioTherm Energy	Operational Life of the Facility
Only utilise existing roads	BioTherm Energy	Operational Life of the Facility
Alien invasive management to be implemented during operation of the facility. The management strategy must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	BioTherm Energy	Operational Life of the Facility

Performance Indicator	» Minimal impacts on vegetation outside of facility footprint
Monitoring	<ul style="list-style-type: none"> » On-going monitoring of area by environmental manager. » 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

	<p>plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants.</p> <ul style="list-style-type: none"> » The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area and used in optimising the control programme. » The environmental manager should be responsible for driving this process. » Reporting frequency depends on legal compliance framework..
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OBJECTIVE: Minimise soil degradation and erosion (Erosion management Plan)

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

Project component/s	<ul style="list-style-type: none"> » Solar array » Access roads » Power line
Potential Impact	<ul style="list-style-type: none"> » Accelerated soil erosion » Increased deposition of soil into drainage systems » Increased run-off over the site » Dust pollution
Activities/risk sources	<ul style="list-style-type: none"> » Operation and maintenance activities » Stormwater runoff from hard surfaces and panel area » Wind erosion of disturbed areas
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To minimise size of disturbance areas » To minimise soil degradation due to erosion » To minimise deposition of soil into drainage lines » To minimise the loss of topsoil » To minimise dust pollution

Mitigation: Action/control	Responsibility	Timeframe
Ensure appropriate maintenance of access roads.	BioTherm Energy	Operation & maintenance
Dust control on construction site: Wetting or covering of cleared areas.	BioTherm Energy	Operation & maintenance
Minimise impacts on vegetation which aids soil stability.	BioTherm Energy	Operation & maintenance
Maintain erosion control measures implemented.	BioTherm Energy	Operation &

Mitigation: Action/control	Responsibility	Timeframe
		maintenance
A Stormwater Management Plan to be implemented during operation of the facility	BioTherm Energy	Operation & maintenance
Develop and implement an erosion management system for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this system is to prevent and reduce risk of any potential erosion.	BioTherm Energy	Operation & maintenance

Performance Indicator	» Minimal soil erosion and siltation around site which is attributable to the facility
Monitoring	» Monitoring of erosion management measures on an on-going basis

OBJECTIVE: Mitigate the possible visual impact associated with the operational phase

The sensitive receptors in the *foreground* and *middle ground* of the generated viewshed represents the Venetia access road, the Venetia mine and a secondary road south of the proposed project site. The latter road does not serve as a mobility route but only to provide access to adjacent farms. It is therefore not likely that many observers will travel along this route. Farmsteads and associated farm buildings are scattered throughout the landscape on the respective farms. Any new activity should take these structures into account.

The Venetia mine is considered to be the major receptor in the area as the mine is situated on a slightly higher elevation than its surrounding. The sensitivity of the receptor is however to be questioned as the activity of mining is already in contrast to the majority of land uses in the area. The mine is also a private facility, only accessible to employees and workers on the premises.

Project component/s	Photovoltaic 'string' of panels or CPV plant with tower structure and infrastructure such as a security building, workshop and offices.
Potential Impact	Potential visual intrusion in the area and damage to the natural environment.
Activity/risk source	Potential impact on sensitive receptors within 1 km of the site.
Mitigation: Target/Objective	A facility that fits in with the landscape, that is well maintained and managed.

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the	BioTherm / operator	Throughout operational

facility as a whole (i.e. the PV panels, buildings and associated infrastructure, roads and natural environment).		phase
Maintain access roads to prevent scouring and erosion, especially after rains.	BioTherm / operator	Throughout operational phase

Performance Indicator	<ul style="list-style-type: none"> » Well maintained facility that has a small footprint on the environment. Natural processes continuing to occur unhindered. » All actions to be measured against the Operational Phase Environmental Management Programme.
Monitoring	<ul style="list-style-type: none"> » Environmental manager to undertake on-going monitoring after construction has been completed to ensure compliance with mitigation measures.

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

Project component/s	Day to day operational activities associated with the PV/CPV facility, including maintenance etc.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised
Activity/risk source	The operational phase of the PV facility will create approximately 20-25 full time employment opportunities.
Mitigation: Target/Objective	In the medium to long term employ as many locals as possible to fill the full time employment opportunities.

Mitigation: Action/control	Responsibility	Timeframe
The workforce of 20-25 permanent staff is likely to be based in Musina. BioTherm Energy should commit to implementing a 5-year training and skills development and training programme. The initial local content target is 30%; however, after 5 years the objective is to have all the employment opportunities taken up by locals.	BioTherm Energy / operator	Prior to commencement of operation
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	BioTherm Energy / operator	Prior to commencement of operation

Performance Indicator	<ul style="list-style-type: none"> » 5 year training and skills development programme developed and designed before construction phase completed. » Potential locals identified before construction phase completed.
Monitoring	<ul style="list-style-type: none"> » BioTherm must monitor indicators listed above to ensure that they

have been met for the operational phase.

OBJECTIVE: Appropriate handling and storage of chemicals and hazardous substances for the substation.

The operational phase of the PV facility may involve handling and management for appropriate handling and storage of chemicals and hazardous substances for the substation for the substation.

Project component/s	Storage and handling of chemicals, and waste.
Potential Impact	<ul style="list-style-type: none"> » Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Pollution of the surrounding environment through inappropriate waste management practices. » Oil, fuel and other hydrocarbon pollution.
Activity/risk source	<ul style="list-style-type: none"> » Hydrocarbon use and storage. » Maintenance of the substation.
Mitigation: Target/Objective	<ul style="list-style-type: none"> » 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 the substation 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. » Adequate maintenance and control over service areas

Mitigation: Action/control	Responsibility	Timeframe
Implement an emergency preparedness plan during the operation and maintenance phase.	BioTherm Energy	Operation
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	BioTherm / operator	Operation
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.	BioTherm / operator	Operation
In the event of a major spill or leak of contaminants, the relevant authorities should be notified as per the notification of emergencies/incidents, as per the	BioTherm / operator	Operation

Mitigation: Action/control	Responsibility	Timeframe
requirements of NEMA.		
All stored fuels to be maintained within a bunded area and on a sealed surface.	BioTherm / operator	Operation
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.	BioTherm / operator	Operation
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be complied with.	BioTherm / operator	Operation
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	BioTherm / operator	Operation
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.	BioTherm / operator	Operation
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.	BioTherm / Operator	Operation

Performance Indicator	<ul style="list-style-type: none"> » 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. » Assessment number and extent of spillages on a regular basis.
Monitoring	<ul style="list-style-type: none"> » Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout operational phase.

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

**MANAGEMENT PROGRAMME FOR THE SOLAR FACILITY:
 DECOMMISSIONING**

CHAPTER 8

The infrastructure which will be utilised for the proposed PV/CPV facility is expected to have a lifespan of up to 20 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the infrastructure with more appropriate technology/infrastructure available at that time.

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

8.1. Site Preparation

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

8.2 Disassemble and Replace Existing Infrastructure

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

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

Decommissioning of the solar facility would result in job losses and this could impact negatively on those employed at the facility.

Project component/s	Decommissioning phase of the PV facility.
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 (20-25) is relatively small. Decommissioning is also similar to the construction phase in that it will also create temporary employment opportunities..
Activity/risk source	Decommissioning of the PV/CPV facility
Mitigation:	To avoid and or minimise the potential social impacts associated with

Target/Objective	decommissioning phase of the PV/CPV facility.
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Mitigation: Action/control	Responsibility	Timeframe
Retrenchments should comply with South African Labour legislation of the day	BioTherm	When PV/CPV facility is decommissioned

Performance Indicator	» South African Labour legislation relevant at the time
Monitoring	» BioTherm and Department of Labour

**ON-GOING UPDATE OF THE
ENVIRONMENTAL MANAGEMENT PLAN**

CHAPTER 9

The EMP is a dynamic document, which must be updated when required. It is considered critical that this EMP be updated to include any additional site-specific information and specifications following the final walk-through survey by specialists just prior to the commencement of construction. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

**APPENDIX A:
GRIEVANCE MECHANISM FOR PUBLIC COMPLAINTS
AND ISSUES**

GRIEVANCE MECHANISM / PROCESS

AIM

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

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

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

2

Proposed generic grievance process

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

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

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

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

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

**APPENDIX B:
DEPARTMENT OF WATER AFFAIRS: WORKING FOR
WATER PROGRAMME PRINCIPLES FOR INVASIVE
PLANT SPECIES**

METHODS FOR ALIEN SPECIES REMOVAL

The sections below are taken from the Department of water Affairs: Working for Water Programme, whose guidelines and policies on alien plant species removal should be adhered to.

In general the use of herbicide by is strongly discouraged – unless for direct stump applications in areas at least 30 m from any type of wetland. This is due to the potential for herbicide and related compounds to be distributed into the wetland areas and thus damaging indigenous vegetation all along the watercourses and beyond.

Any control programme for alien vegetation must include the following 3 phases:

- Initial control: drastic reduction of existing population
- Follow-up control: control of seedlings, root suckers, and coppice growth
- Maintenance control: sustain low alien plant numbers with annual control

2.1. Mechanical Clearing

2.1.1. ADULT PLANTS AND SAPLINGS

2.1.1.1. Felling

Consider as first option where possible, but see section 3 regarding kill standing – although this is only mandatory in pristine or near-natural environments, kill standing may have to be considered where the tree to be felled on the project area is very large or tilted and by falling it could significantly damage the surrounding habitat or other structures.

Where trees are to be felled and removed, the stem/trunk shall be cut as close to the ground as possible but not higher than 150mm, using chainsaws, bow saws, brush cutters or cane knives. Where felling is to be followed by herbicide treatment the cut shall either be made by means of a saw, so as to produce a clean, flat and generally horizontal surface or in the case of suitably small, thin barked species, the stem shall be cut with a lopper. A slasher or kapmes should preferably not be used because of the diagonal cut that is produced. This minimises the herbicide absorption and the “sharp sticks” are a Health and Safety risk.

In the case of larger trees, they shall, where possible, be felled to fall uphill in order to reduce breakage and minimise the danger to workmen.

Felled material and other dead material (brush and logs) shall not be allowed to block or impede water courses and must be removed from all water courses, either 30 m away from the river or out of the flood line itself.

Felled material (thicker than 7 cm) shall be debranched and cross cut in manageable logs of not longer than 2,4 m or in lengths as directed and then stacked in windrows (brush lines) with the contour or moved to or from identified locations as directed by Project Management.

The logs and brush shall be stacked separately, at least 3 m apart. Windrows shall be with gaps of 2 m every 15 m and be as narrow as possible but not wider than 3 m. Where windrows are impractical heap stacking may be allowed after approval by the Project Manager. Heaps shall be spaced at a minimum distance of 20 m with a maximum ground cover of 16 m² in other words heaps of maximum 4 X 4 m.

Windrows must be a minimum of 10 meters away from any indigenous forest (10 or more closely spaced indigenous trees). On a slope nothing should be packed below the indigenous forest, because burning of the windrows will cause damaged to the indigenous forest by burning up into it.

2.1.1.2. Ring barking

Where ring barking is directed, the Contractor shall remove all bark (including the inner bark or phloem) from ground level to 50 cm up or such lesser distance as may be specified. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.

Bush knives or hatchets should be used for debarking. Herbicide can be applied to the exposed bark except in the case of Wattle spp. In the case of smaller trees and saplings with soft, thin skinned bark (especially *Acacia* and *Hakea* species.) the stem shall be beaten with the back of a hatchet and the bark peeled off.

2.1.1.3. Frilling

Where frilling is directed, the Contractor shall, at a height of approximately 50 cm, using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to affect the cuts around the entire stem and apply herbicide into the cuts.



The Frilling Method

2.1.1.4. Bark Stripping

Where bark stripping is specified all bark shall be stripped from the trunk between ground level and 1 m above ground level.

2.1.2. SEEDLINGS

2.1.2.1. Manual clearing

Where seedlings are relatively sparse, less than 1 m high and soil suitably soft or where specified in the Project Specification (where seedlings are growing in sensitive areas where chemicals cannot be used due to the risk of contamination or effect on adjacent plant populations or for any other reason), seedlings shall be removed by hand pulling which shall be so carried out as to ensure the removal of the roots. Hand pulled plants shall be left hanging on other vegetation or deposited in a pile to reduce the possibility of re-growth.

Where seedlings are dense or are too well established to be removed by hand and the Project Management has not directed hand pulling or herbicide treatment of the undisturbed plants, the seedlings shall be cut using a lopper or brush cutter (written approval must be obtained) and the stems then treated with herbicide.

It is anticipated that after initial clearing, every year there will be a multitude of seedlings of alien species emerging. Cleared sites will thus have to be constantly monitored, and as soon as a seedling can be identified as alien invasive species, these must be pulled out by hand.

2.2. Chemical Treatment

2.2.1. Foliar spray

(Not recommended due to potential distribution of poison beyond target plants and thus killing of indigenous species)

Where foliar spray has been specified, the spray shall be applied as to the leaves of the whole plant to the point of drip-off. Spraying shall not be done when the leaves are wet or in windy conditions. The herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label. Where the same herbicide is use for different methods e.g. foliar and cut-stump, different colour dyes must be used to identify the different herbicide mix ratios.

Spraying shall be done using a back-pack spraying system with a solid cone nozzle which allows for consistent, thorough application of the herbicide (e.g. Spraying systems TG 0,5 (or as indicated in the herbicide policy).

2.2.2. Cut-stump treatment



Where stumps are to be treated with herbicide the herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label, this shall be applied as soon as possible but not later than 15 minutes after felling, stripping or frilling. In the case of felled stumps all sawdust shall first be brushed off the cut surface.

A knapsack or handheld pressurised spray can, with a narrow angle solid cone nozzle or adjustable nozzle set to a solid spray, should be used. The pressure should be as low as possible to avoid the herbicide from bouncing off the sprayed surface and to minimise contamination; attention must be paid to achieving an even coverage only on the outer rim (Cambium area).

2.2.3. Basal bark application

(Only after written approval has been obtained, due to environmental damage caused by diesel)

Where directed and after written approval, herbicide shall be applied directly to the basal bark of trees. The herbicide shall be applied by knapsack sprayer as a coarse, low

pressure spray, using a narrow angle solid cone nozzle, all around the basal stem or trunk of the plant, from the ground up to the height as specified on the herbicide label, as well as to any exposed roots. The area to be treated shall be thoroughly wetted by the herbicide. Attention shall be paid to ensuring adequate application taking note of the condition and age of the bark.

In the case of multi-stemmed plants, each stem shall be treated.

2.3. Kill Standing vs. Felling

This section is to further explain the National Circular 18 of 2002 under the same heading.

As this National Circular contains a policy clause on the operational approach all WfW projects need to align their operations accordingly as a matter of urgency. The policy should be interpreted as follows (National policy in *Italic* font with interpretation in normal font):

All trees must be killed standing (i.e. NOT felled), except when the following applies: (where cut stump operations are underway on a property this will be allowed to be finished if negotiations for the property has already been concluded and written into the landowner's agreement, negotiations on new areas should thus be adapted accordingly as no further cut stump operations will be allowed except as indicated below):

- *Danger to lives & property and the tree must be removed* (it is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *All alien clearing within two tree lengths of roads, buildings, power lines etc* (fences should be added to the possibilities. It is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *Specific requirement of a partnership to fell* (this will be when the Programme and what it stands for will directly benefit from an operation other than frilling e.g. secondary industry operations, if this is not the case then the landowner must contribute to the price difference due to a change in the preferred operational method)
- *Where required to remove trees for specific flood-control measures* (no frilling should take place within the riparian zone that is the 1:20 year flood level or closer than 30 metres from the natural bank of a river. Trees in these areas should be removed.)
- *Where frilling is not a practical method due to tree growth form, treatment efficacy* (It is the responsibility of Project Management to assess this. If these exceptions

influence the workload then the person collecting the data for contract generation should be informed of such exceptions)

- *Where the frilling of trees increases the fire danger in the area* (where such a scenario is suspected Project Management should liaise with the landowner and also get the opinion of a reputable person, these findings should be recorded in writing and added to the landowner's agreement)

In most cases the resistance towards frilling are based on the aesthetics of the area after the operation. The most economical and effective method of eradicating invasive alien vegetation within the Programme's guidelines should remain the prime objective of efforts. It is the obligation and responsibility of people in all spheres of management to maximise the effect and efficiency of any eradication programme.

2.4. Species-specific clearing methods

Various herbicides have been registered for the control of alien invasive species. The first option though should always be felling the species as low as possible, followed by localised stump treatment and the remaining only as last-resort alternatives or where the alien is a vicious multi-stemmed scrambler, such as the bramble.

Chemicals do not only come at a cost, but will require proper storage, management, and handling. For operation details refer to the Working for Water Operational Standards spreadsheet provided separately.

Information for each invasive alien species as encountered on the project area, as well as alien invasive species that are highly likely to become established after initial clearing, is listed below.

OBJECTIVE: Optimise Operational Standards for Clearing of Invasive Alien Plants

The Contractor must take all reasonable measures to ensure the efficient use of manpower, operational equipment and chemicals for the systematic eradication of alien invasives on site.

Project component/s	Project components affecting the objective: <ul style="list-style-type: none"> » solar energy turbines » access roads » substation » power line
Potential Impact	<ul style="list-style-type: none"> » Hazards to landowners, workers and public » Security of materials » Substantially increased damage to adjacent sensitive vegetation and wetland areas
Activities/risk sources	<ul style="list-style-type: none"> » Operation of equipment » Use of herbicides » Use of fire » Distribution of regenerative material of invasive alien plants
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure effective systematic removal of invasive alien plants » To prevent additional spreading of invasive alien plants » To maintain low numbers and eventually eradicate unwanted species from the project area » To prevent any spillage of chemicals into the surrounding environment » To prevent and reverse damage to wetlands/pans caused by invasive alien plants » To protect members of the public/landowners/residents
Timeframe	<ul style="list-style-type: none"> » Training required: training schedule and training opportunities identified and started within three months of commencement of clearing

	<ul style="list-style-type: none"> » Initial control involving planning and drastic reduction of existing population: during site establishment and construction phase » Follow-up control: control of seedlings, root suckers and coppice growth: during construction and operational phase » Maintenance control: sustain low alien plant numbers with annual control: during operational and decommissioning phase 	
Abbreviations	<ul style="list-style-type: none"> » Working for Water Programme (WfW) » Health and Safety (H&S) 	
Responsibility	RESPONSIBLE PERSON OR UNIT	
	PROJECT MANAGER	PM
	CONTRACTOR/COMMUNITY WORKER	C
	ENVIRONMENTAL CONTROL OFFICER / COMMUNITY LIASION OFFICER	ECO
	TRAINING UNIT	TU
	PLANNING UNIT	PU

Mitigation: Action/control	Responsibility
1. PROJECT OPERATIONAL PLANNING	
1.1. Creation of detailed map of the area: Provides an overview of the project and it must indicate the following:	
<ul style="list-style-type: none"> • Project boundaries 	PU
<ul style="list-style-type: none"> • Area/s where workers are sourced from 	PM
<ul style="list-style-type: none"> • Other features relevant to project wetlands, invasive thickets, grazing areas, cultivated areas 	PM, PU

Mitigation: Action/control	Responsibility
<ul style="list-style-type: none"> Clearly indicate areas that need to be cleared and divide into different Management Units according to location and most prevalent invasive 	PM, PU
1.2. Strategic plan and safety	
<ul style="list-style-type: none"> Project Management to create an Area Strategic Plan / Method Statement for clearing alien invasive vegetation 	ECO, PM
<ul style="list-style-type: none"> Project Management to be familiar with the Area Strategic Plan 	ECO, PM
<ul style="list-style-type: none"> Evidence of Rules & Regulations given and explained to Contractor or Community Workers (this should include the Operating Standards) 	PM, C
<ul style="list-style-type: none"> Emerging and potential weeds reported through agreed communication lines, ecologist can be consulted for proper identification 	PM
<ul style="list-style-type: none"> A copy of the emergency plan and telephone numbers must be on site, workers must demonstrate knowledge thereof 	PM
1.3. Management Unit Clearing Plan (MUCP)	
<ul style="list-style-type: none"> It must be up to date 	PU, PM
<ul style="list-style-type: none"> A clearing strategy must be evident and supported by the planned priorities 	PU, PM
<ul style="list-style-type: none"> Project Managers must be able to show actual work done vs. planned work, supported by fixed point photographs 	PM

2. TOOLS AND EQUIPMENT	
2.1. Hand tools in good condition and used correctly	
<ul style="list-style-type: none"> Hand tools(e.g. lopper, pruning saw etc.) must be best suited to the work and the size of plants being cleared 	PM, C
<ul style="list-style-type: none"> The tools must have correct and properly secured handles and must be in safe working order 	C
<ul style="list-style-type: none"> A sharpening stone/file, with a hand grip, must be on site 	C
<ul style="list-style-type: none"> Gloves and goggles must be worn when sharpening tools 	C
<ul style="list-style-type: none"> The tools must be used in the correct manner; clearing must be done using the correct techniques 	C, PM
<ul style="list-style-type: none"> Safe working distances of at least two (2) tool-reach lengths apart must be maintained 	C, PM
2.2. Chainsaws good condition and used correctly	
<ul style="list-style-type: none"> Operators have received certified training in chainsaw operation, felling, cross-cutting and de-branching techniques and have been assessed for competence every six months. For training opportunities contact the regional WfW or otherwise qualified entity 	PM, TU
<ul style="list-style-type: none"> The chainsaws must be best suited to the clearing work and timber size 	PM, C
<ul style="list-style-type: none"> There must be a service maintenance schedule for all chainsaws Services (daily, weekly) are done and recorded 	PM, C
<ul style="list-style-type: none"> Safety and operational features must be in good order as per standard checklist 	PM, C
<ul style="list-style-type: none"> Chainsaw work is planned and executed for safe and efficient production 	PM, C
<ul style="list-style-type: none"> Correct felling / clearing techniques are applied 	PM, C
<ul style="list-style-type: none"> Correct cross-cutting and de-branching techniques are applied. 	PM, C

<ul style="list-style-type: none"> • Correct re-fuelling procedures are followed to prevent spillages 	C
<ul style="list-style-type: none"> • Chain sharpening is correctly done with the correct tools at each refueling 	C
2.3. In-field fuel site	
<ul style="list-style-type: none"> • A cleared area, at least six (6) metres from rest areas, demarcated with hazard tape must be used to store fuel 	C
<ul style="list-style-type: none"> • Fuel and oil containers at the in-field fuel site must be stored on an absorbent drip-mat or drip-tray 	C
<ul style="list-style-type: none"> • A 2 kg dry chemical powder (DCP) fire extinguisher must be at least 3m distant from the fuel site and easily visible 	C
3. STORES, WORKSHOPS AND OFFICES	
3.1. Stores, workshops and offices	
<ul style="list-style-type: none"> • Buildings and containers must be secure and provide safe storage space for equipment and/or supplies 	PM
<ul style="list-style-type: none"> • The office / stores area must show a high standard of housekeeping (A place for everything, everything in its place) 	PM
3.2. Herbicide stores	
<ul style="list-style-type: none"> • The building / container must meet the Herbicide Policy standards 	PM
<ul style="list-style-type: none"> • A Material Safety Data Sheet and Label must be in the store for each stock category of herbicide stored. (Each product.) 	PM
<ul style="list-style-type: none"> • Herbicides must be issued with reference to the WIMS contract number 	PM
<ul style="list-style-type: none"> • There must be stock control of empty containers. 	

<ul style="list-style-type: none"> • Empty containers must be stored until removal by a registered recycling company 	ECO
<ul style="list-style-type: none"> • Excess, undiluted herbicide must be returned to the stores and noted on the stock sheet. Excess, diluted herbicide must be stored in a UV-resistant container and allocated to another treatment within 2 days or returned to a suitable container in the stores 	ECO, C
<ul style="list-style-type: none"> • Burning of empty containers by Project staff or Contractor is prohibited 	PM, C
3.3. Fuel and flammable liquids stores	
<ul style="list-style-type: none"> • The building / container must be suitable for the liquids stored in them 	ECO
<ul style="list-style-type: none"> • Quantities limited to allowed maximum per class where proper storage facilities are not available: <ul style="list-style-type: none"> ○ Class I – 45L (petrol, thinners) ○ Class II – 270L (diesel, lube oils) 	
<ul style="list-style-type: none"> ○ Class I – 45L (petrol, thinners) 	PM
<ul style="list-style-type: none"> ○ Class II – 270L (diesel, lube oils) 	PM
<ul style="list-style-type: none"> • Proper housekeeping and handling procedures must be evident 	PM
<ul style="list-style-type: none"> • Adequate measures to deal with spillage and contamination e.g. spill kit 	PM
<ul style="list-style-type: none"> • Correct signage and fire-fighting equipment e.g. dry chemical powder fire extinguisher of at least 2.25kg 	PM
3.4. Storage at contractor stores / houses: Where contractors cannot make use of proper dedicated stores, the following standards apply:	
<ul style="list-style-type: none"> • All equipment, supplies, herbicides, fuel and oils must be safely and securely stored with controlled access, in a suitable lockable building, container or a lockable trailer 	C
<ul style="list-style-type: none"> • A 1kg dry chemical powder (DCP) fire extinguisher must be available outside the store / container 	C

<ul style="list-style-type: none"> PM to annually verify and keep record of inspection of compliance regarding storing facilities at contractors store / house 	PM
4. HERBICIDES	
4.1. General	
<ul style="list-style-type: none"> Workers must be specifically allocated and trained to work with herbicides and demonstrate knowledge of the risk of working with the selected chemicals and how to avoid that risk 	TU, PM
<ul style="list-style-type: none"> Only registered herbicides as detailed in the WfW herbicide policy or on the product label may be used 	PM
<ul style="list-style-type: none"> A Material Safety Data Sheet (MSDS) and Label must be in the field for each product used 	PM, C
<ul style="list-style-type: none"> Written approval must be obtained via the approved communication channels from the National Office to use an unregistered herbicide for a particular specie or situation 	PM, ECO
<ul style="list-style-type: none"> Mix water must be clean & clear (not muddy) 	C, PM
<ul style="list-style-type: none"> Spray mix adjuvants (e.g. wetters, buffers etc.) must be used according to label instructions 	PM, C
<ul style="list-style-type: none"> In the absence of a built-in colourant a suitable dye must be used in applications 	PM, C
<ul style="list-style-type: none"> Contractors and applicators must demonstrate an understanding of why herbicide applications should not be done in unsuitable weather conditions; e.g. foliar application in windy conditions 	C
<ul style="list-style-type: none"> Quality check records must show that application methods are monitored for targeting, rates and spray drift 	C, PM
<ul style="list-style-type: none"> Where there is a risk of herbicide applicators entering water, knapsacks should be filled only half full 	C, PM
<ul style="list-style-type: none"> PM must submit a Herbicide-used sheet for every completed contract, information must be captured 	PM, PU

• Herbicide applicators must demonstrate an understanding of spot spray patterns	C
• For cut-stump / frill / ring-barking, coverage must be even and spraying must be monitored to limit excessive run-off	C
4.2. Equipment	
• Equipment must be properly maintained according to regular scheduled services	C
• Equipment must not leak. Faulty equipment must be serviced or decommissioned	C
• Equipment appropriate to the application method and treatment must be used.	PM, C
• When using knapsack sprayers the following apply:	
o Knapsack sprayers must be fitted with pressure regulators set to the correct pressure (1bar / 100Kpa) or fitted with a constant flow valve	PM, C
o Knapsack sprayers must be fitted with the correct nozzle in good condition, appropriate for the application method used (e.g. TG1; FL5VS; TFVS2 or equivalent)	PM, C
• Lances must be secured to prevent damage when transporting.	C
• Washing of equipment must take place in a designated area, using the triple-rinse method	C
4.3. Safe storage and handling in-field	
• In a designated, shaded demarcated area	C
o Away from rest / eating areas	C
o At least 20m from any water body	C
o Away from crops, gardens etc.	C

o Floor area covered suitable absorbent material	C
o Bucket & spade must be available in case of spills	C
o Clean water, washing bucket, soap & towel must be available for persons handling the herbicide & equipment	C
• Mixing containers must be UV resistant and leak proof	C
• Mixing containers must be clearly labeled, showing the brand name and concentration of the contents	C
• Refilling, mixing, washing and rinsing should only be done within the demarcated area	C
• Empty product containers must be triple-rinsed and punctured before it is returned to the store	C
• Rinsed water must be recycled for subsequent mixes	C
• Contractors must have proper records of daily herbicide mixtures and issues and actual herbicide use in the contracting teams on-site	C
5. SAFETY	
5.1. Hazard Identification and Risk Assessments (HIRA)	
• The HIRA process to be developed, recorded and available at the project / area and knowledge demonstrated by everyone.	PM,C
• Site Emergency Evacuation Plan must be drafted and communicated to all personnel.	PM,C
• Where relevant, hazards in the working area must be taped off. e.g. trenches, holes, hang-ups etc.	C
• The Written Safe Work Procedures Manual must be available, understood and adhered to by all working staff.	PM, C

5.2. First Aid kit	
<ul style="list-style-type: none"> • A first aid kit, fully stocked according to the standard stock list, must be easily accessible at all work sites, and regularly inspected by the PM. 	PM, C
<ul style="list-style-type: none"> • All first aid treatment and usage of stock must be recorded in the dressing book kept on site / regional office. 	C, PM
<ul style="list-style-type: none"> • The First Aid kit must be under control of a trained First Aider with a current valid certificate 	C, PM
<ul style="list-style-type: none"> • There must be an alternative trained First Aider of opposite gender in the team 	C
<ul style="list-style-type: none"> • A list of emergency numbers must be kept in the first aid box e.g. ambulance, doctor, hospital, fire brigade, poison info centre 	C, PM
<ul style="list-style-type: none"> • A copy of the competency certificate of the first-aider must be kept on-site in the H&S file. 	C, PM
5.3. Personal Protective Equipment and Clothing (PPE)	
<ul style="list-style-type: none"> • PPE must meet the minimum prescribed standards of quality (EU or SABS). 	C, PM
<ul style="list-style-type: none"> • PPE must be replaced when it becomes ineffective through wear & tear. 	C, PM
<ul style="list-style-type: none"> • PPE must be provided with due consideration to the hazard exposure as well as the PPE requirements as per occupation 	C, PM
<ul style="list-style-type: none"> • A record must be kept of all PPE issued to contractors and workers, and signed for by them, with the acknowledgement to wear the PPE. 	PM, C
<ul style="list-style-type: none"> • Project must conform to acceptable H&S Guidelines 	PM, C
5.4. Substance abuse	
<ul style="list-style-type: none"> • The use of any mind altering substances is not allowed on-site (e.g. alcohol, dagga). 	PM, C

<ul style="list-style-type: none"> Persons in the WfW programme must demonstrate knowledge of the potential dangers and the workplace policy of drug use 	ECO, PM, C
5.5. Extreme Weather Conditions	
<ul style="list-style-type: none"> Demonstrate knowledge that no work in / near / on water bodies may take place during rain or lightning. 	PM,C
<ul style="list-style-type: none"> No felling or spray application of herbicides may take place during high wind conditions 	PM,C
<ul style="list-style-type: none"> The contractor should be informed of any adverse weather conditions 	PM
6. METHOD OF WORK	
6.1. Appropriate clearing methods applied	
<ul style="list-style-type: none"> A process of appropriate clearing method selection must be followed and recorded - use the species guide provided 	PM
<ul style="list-style-type: none"> Handling / processing of cleared material must be kept to a minimum, but due to a potential fire hazard and the allelopathic effect of leaf litter, cleared material must not be left on site. A specific area must be designated to stack and process material to make maximum use of wood for community members, whilst regenerative material must be destroyed by controlled burning. 	PM, C
<ul style="list-style-type: none"> A copy of the Treatment Methods table must be available in the Project Office 	PM
<ul style="list-style-type: none"> No frilling / ring barking is allowed within two (2) tree lengths of roads, fences, telephone and power lines, infrastructure (e.g. buildings) or in the riparian zone of a river 	PM
6.2. Follow-up done timeously	
<ul style="list-style-type: none"> An up-to-date follow-up plan must be used to ensure treatment is done on time 	PM

<ul style="list-style-type: none"> For foliar treatment there must be sufficient newly-growing foliage and plants must not exceed hip height 	PM, C
<ul style="list-style-type: none"> When follow-up operations are not done at the most cost-efficient stage, there must be specific reasons on record including cost/person day variations between planned and actual follow-up to be recorded 	PM
6.3. Efficient team operation	
<ul style="list-style-type: none"> Operational planning for the specific site must be evident. Different tasks must be coordinated in an efficient manner for optimum productivity. If possible, every management unit mapped should have its own team allocated. 	PM, C
<ul style="list-style-type: none"> Tool use and tasks must be in line with the site-specific requirements 	C
<ul style="list-style-type: none"> Daily or weekly production tasks must be set and actual production must be measured and recorded 	C
6.4. Work methods conform to WfW standards	
<ul style="list-style-type: none"> Record of inspection of method, quantity and quality according to the contract. 	PM, C
<ul style="list-style-type: none"> All invasive alien species treated within the contract boundaries 	PM, C
7. ENVIRONMENTAL AWARENESS	
7.1. Site clean and free of litter and waste	
<ul style="list-style-type: none"> There must be no litter from clearing activities on work sites, at any time and there must be a litter bag on site at the demarcated gathering area, cleared or removed daily and disposed of in an acceptable manner. 	C

<ul style="list-style-type: none"> Existing litter not cleared in light of possible health risks, that may be associated with certain waste, reported to PM and disposal solution with relevant authority found 	PM, C
<ul style="list-style-type: none"> Project Manager and contractors to demonstrate knowledge that soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site. 	PM, C
<ul style="list-style-type: none"> When loose waste material is transported on vehicles, it must be adequately tied down / covered and contained. 	PM, C
7.2. Sanitation	
<ul style="list-style-type: none"> As far as practically possible, provide formal sanitation (chemical or water-born). Where this is not possible, a spade and toilet paper must be easily accessible on every site. 	C
<ul style="list-style-type: none"> Human waste and used toilet paper must be buried at least 20 m distant from any watercourses or bodies and at least 50 cm deep. 	C
<ul style="list-style-type: none"> In sensitive areas (urban sites, wetlands) a portable toilet must be provided on site and the waste removed and disposed of in an acceptable manner. 	C
<ul style="list-style-type: none"> Clean water and soap must be provided and used for hand washing. 	C
<ul style="list-style-type: none"> The workers should be informed of personal hygiene and demonstrate its practice 	C, PM
<ul style="list-style-type: none"> Where relevant, sufficient toilets per gender need to be available 	C, PM
7.3. Access routes	
<ul style="list-style-type: none"> Existing access routes must be used. Where new access routes or paths are required, these must be planned and made in co-operation with the landowner / manager and marked with hazard tape 	PM, C
7.4. Indigenous plants and animals	
<ul style="list-style-type: none"> Indigenous plants should not be damaged where possible and animals must not be harmed. 	C

<ul style="list-style-type: none"> • Alien trees with bird nests must be killed standing where possible. Site records must be kept. 	PM, C
<ul style="list-style-type: none"> • Collection of plant parts of alien plants for medicinal or other purposes, may only take place with the appropriate permission. Collection records must be kept. 	C
<ul style="list-style-type: none"> • Identify and protect indigenous plants and animals, especially: 	
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Red list data species (none recorded) 	C
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Protected plants (see species of conservation concern) 	C
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Sensitive communities (wetlands only, no other recorded on project area) 	C
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Wetlands 	C
<ul style="list-style-type: none"> • No species of animal may be poached, snared, hunted, captured or willfully harmed, damaged or destroyed. Snares must be reported to land owners, PM or conservation authorities and removed immediately. 	C
<ul style="list-style-type: none"> • Snakes and other reptiles that may be encountered on the treatment area must not be killed. 	C
<ul style="list-style-type: none"> • Anthills and/or termite nests that occur must not be disturbed. 	C
<ul style="list-style-type: none"> • Keep the relevant managers informed of dangerous or problem animals. Record sightings and encounters. 	PM, C
<ul style="list-style-type: none"> • Keep food and rubbish out of reach of scavengers, e.g. apes and birds. 	C
<p>7.5. Invasive alien plant identification (IAP)</p>	
<ul style="list-style-type: none"> • Alien invasive plants including aquatic alien plants must be identified, where required expert assistance must be used. 	PM, C
<ul style="list-style-type: none"> • The relevant species to be removed must be pointed out to contractors and workers on site. 	PM

<ul style="list-style-type: none"> • Damage to indigenous / desirable vegetation must be minimised. 	C
7.6. Alien invasive dispersal	
<ul style="list-style-type: none"> • Where cleared material must be moved from the site, measures must be taken to prevent dispersal of reproductive material (e.g. seeds, cuttings). 	PM, C
<ul style="list-style-type: none"> • Chipped plant material must be free of seed if used off-site (e.g. mulch). 	PM, C
<ul style="list-style-type: none"> • Plants which have been removed must not be transported across or near to rivers or dams in which the species is absent. 	PM, C
<ul style="list-style-type: none"> • Removed plants must not be stacked on top of indigenous flora. 	PM, C
<ul style="list-style-type: none"> • Method and specifications chosen with due consideration of impact on the site, natural vegetation & regeneration. 	PM
<ul style="list-style-type: none"> • Methods used must ensure that weeds are not distributed by the contractor and employees 	PM, C
7.7. Site stabilisation / anti-erosion / rehabilitation measures	
<ul style="list-style-type: none"> • Stack larger cut logs along the contour and below knee height with 2 m gaps at 10 to 15 m intervals for access, escape, animal movement and to reduce run-off and soil movement where there is an enhanced erosion risk along stream banks or steeper slopes 	PM, C
<ul style="list-style-type: none"> • Preserve indigenous plant cover and adapt treatment methods to allow indigenous plants to colonize the site. 	PM, C
<ul style="list-style-type: none"> • Identify sites requiring additional stabilisation structures / measures / re-vegetation and obtain expert advice & planning to implement. 	PM
<ul style="list-style-type: none"> • Take precautionary measures to protect stabilising plants (planted & natural) during follow-up spraying. 	C

7.8. Site stabilisation / anti-erosion / rehabilitation records	
<ul style="list-style-type: none"> Sites must be mapped and a unique Treatment Area number must be assigned. Comprehensive planting / maintenance records must be kept; including dates, species and number of plants and follow-up care. 	PM
<ul style="list-style-type: none"> A record of input costs must be kept, including: materials, plants, seeds, person-days etc. 	PM
8. FIRE FIGHTING AND PROTECTION	
8.1. Fire Precautions on work sites	
<ul style="list-style-type: none"> Smoking allowed in safe indicated areas, designated by the contractor / manager / landowner. 	PM, C
<ul style="list-style-type: none"> No fires are allowed on work sites. 	PM, C
<ul style="list-style-type: none"> Site specific reaction / evacuation rules must be applied in the case of wild fires. 	C
<ul style="list-style-type: none"> Basic appropriate fire-fighting equipment must be available at each work site; a minimum of five fire beaters and one filled knapsack fire-fighting pump, or alternative suitable equipment. 	PM, C
<ul style="list-style-type: none"> Where fuels and machines are used on site, a 2 kg dry chemical powder fire extinguisher in working condition must be available. 	PM, C
<ul style="list-style-type: none"> Fire Fighting & Extinguishing Equipment inspected and recorded. 	PM
8.2. Fire Protection	
<ul style="list-style-type: none"> The project must be a member of the Fire protection Association (FPA) and attend meetings where applicable 	ECO, PM
<ul style="list-style-type: none"> In FPA areas, the project must be on their communication network. 	ECO, PM

<ul style="list-style-type: none"> Fieldwork may not take place during red days or extreme danger rating days. (Contact Working on Fire office) 	ECO, PM
9. TRAINING	
9.1. Induction	
<ul style="list-style-type: none"> All new workers must receive orientation before starting work. 	PM
9.2. Compulsory functional training	
<ul style="list-style-type: none"> All training, including refresher courses, is compulsory. 	TU, PM
<ul style="list-style-type: none"> All training must be provided to workers and contractors within three months of commencement of work 	TU, PM
<ul style="list-style-type: none"> Project Managers must hold a valid training certificate, on file, for all the training courses required in their project. Alternatively, arrangement must be made with the WfW Programme or suitably qualified units to provide such training 	PM
<ul style="list-style-type: none"> Training must be in line with the latest WfW Training Policy 	TU, PM
<ul style="list-style-type: none"> Area / Project Managers must pass an Environmental Pest Control Course and apply for PCO Registration with the National Dept. Agric - Registrar. 	TU
<ul style="list-style-type: none"> Contractors - Limited Pest Control course. 	TU
<ul style="list-style-type: none"> Herbicide Applicators – WfW Herbicide Applicators course. 	TU
<ul style="list-style-type: none"> Other workers – Herbicide Awareness training. 	TU
<ul style="list-style-type: none"> Chain saw operators - chainsaw handling and maintenance, felling, cross-cutting and de-branching techniques. 	TU

<ul style="list-style-type: none"> Copies of all herbicide training certificates received and Pest Control Licenses must be available with the PM and contractor on-site. 	PM, C
9.3. Training Plan & Profiles	
<ul style="list-style-type: none"> The Training Annual Plan of Operations must be displayed. 	PM
<ul style="list-style-type: none"> The plan must be based on the WFW training matrix and policy. 	TU, PM
9.4. Training Records	
<ul style="list-style-type: none"> All training capture sheets, attendance registers, evaluation forms, and certificates must be filed in the Regional Training Manager’s office or Area office. 	TU, PM
<ul style="list-style-type: none"> All Department of Labour monitoring sheets, correspondence, financial records and training schedules must be filed in the Regional Training Manager’s office or Area office. 	TU
9.5. Accreditation	
<ul style="list-style-type: none"> All training must be aligned to unit standards, where possible. 	TU
<ul style="list-style-type: none"> All training must be provided by accredited training providers, where possible. 	TU
Performance Indicator	<ul style="list-style-type: none"> » Project area is consistently cleared of invasive alien vegetation » Remnants of alien vegetation removed from where they were cleared to make way for the proposed development and rehabilitation of natural vegetation surrounding the development » No indication of further degradation and/or pollution of the areas surrounding the development » No members of staff/ public/ landowners injured
Monitoring	<ul style="list-style-type: none"> » Regular visual inspection of cleared areas for signs of resprouting, alien plant seedling emergence, new alien species invasions » An incident reporting system will be used to record non-conformances to the EMP.

- » Public complaints register must be developed and maintained on site.
- » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager.
- » ECO to address any infringements with responsible contractors as soon as these are recorded.

**APPENDIX C:
EROSION MANAGEMENT PLAN**

PRINCIPLES FOR EROSION MANAGEMENT

1. Purpose

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

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

2. Legislation and Standards

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

Relevant legislation:

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

3. Areas with a high soil erodability potential

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

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

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

4. Precautionary management activities to avoid erosion

In the assessment process the ECO and the contractor must assess all:

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

5. Monitoring

7.1. General Erosion

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

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

In the assessment process, the ECO and the contractor must assess all:

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

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

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

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

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

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

7.2. Stormwater Management

The ECO is responsible to monitor the site and the activities to ensure that no unnatural soil degradation is taking place.

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

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

In the assessment process the ECO and the contractor must assess all:

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

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

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

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

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

6. Rehabilitation

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

6.1. General Erosion Management

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

6.1.1. Equipment

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

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

6.1.2. Methods to prevent accelerated erosion

The following practises should be considered and adhered to:

- » Ensure steep slopes are stabilised.
- » Ensure that steep slopes are not stripped of vegetation and left to dry out and become water repellent (which will cause increased runoff and a decreased infiltration rate) increasing the erosion potential.
- » Ensure that all water on site (rain water or water wastage from the construction process) does not result in any surface flow (increase velocity and capacity of water) as a result of the poor drainage systems.
- » Ensure that pooling of water on site is avoided, as the site and the general area consists of dispersive soils, pooling will cause an increase of infiltration on one area, causing the subsurface to begin eroding.
- » Ensure that heavy machinery does not compact those areas which are not intended to be compacted (i.e. areas intended to be managed), as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. where compaction does occur, the areas should be ripped.
- » Ensure that compacted areas have adequate drainage systems to avoid pooling and surface flow.
- » Prevent the concentration or flow of surface water or stormwater down cut or fill slopes, or along pipeline routes or roads, and ensure measures to prevent erosion are in place prior to construction.
- » Ensure that stormwater and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that surface flows are managed prior to being discharged back into a natural watercourse to support the maintenance of natural

base flows within the ecological systems and prevent erosion, i.e. hydrological regime (water quantity and quality) is maintained.

- » Ensure siltation and sedimentation through the use of the erosion equipment mentioned structures.
- » Ensure that all stormwater control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local ground watertable in low quantities (to reduce runoff but prevent subsurface erosion).
- » Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
- » Ensure that vegetation clearing is conducted in parallel with the construction progress across the site to minimise erosion and/or run-off.
- » Ensure that large tracts of bare soil which would cause dust pollution in high winds, or have high erosion susceptibility and increase sedimentation in the lower portions of the catchment are controlled through temporary surface covering.
- » Ensure no diversion of water flows in catchment occurs.
- » Ensure that dust control measures are implemented, but prevent over-wetting/saturating the area (to cause pooling) and run-off (that may cause erosion and sedimentation).
- » Watercourse (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing watercourses.

6.1.3. Mitigation for previously degraded areas

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

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

6.2. Methodologies

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

- » Topsoil covered with a geotextile or hessian material and a grass seed mixture (see Rehabilitation Specifications).

- » Logging or stepping following the contours of the slope, to reduce surface runoff.
- » Earth or rock-pack cut-off berms.
- » Packed branches to roughen the surface and promote infiltration.
- » Benches (sand bags).
- » Stabilisation of near vertical slopes (1:1 – 1:2), if created during construction, will be required to utilise hard structures that have a natural look. The following methods may be considered:
 - Gabions (preferred method with geotextile material).
 - Retaining walls.
 - Stone pitching.
- » The slopes of all stream diversions must be protected. The following methods may be considered:
 - Reno mattresses (preferred method), ensure that the reno mattresses are buried deep into the subsurface, to avoid undercutting from the water.
 - Coarse rock (undersize rip-rap)
 - Sandbags.
 - Stone packing with geotextile
- » Where feasible use rubber dams as stream diversions when establishing water course crossings. Although (and considering that these are non-perennial watercourses) the recommendation is to construct watercourse crossings during dry periods (or no flow periods), where possible.
- » Any concentration of natural water flow caused by road works or hardstands areas will be treated as follows:
 - if water flow is sub-critical, nothing is required
 - if water flow is supercritical, the outlets will be provided with protection (either gabions or stone pitching – depending on the flows) to release water subcritical back into the watercourse at a low velocity.

6.3. Engineering Specifications

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

Requirements for project design:

- » Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
- » The location, area/extent (m²/ha) and specifications of all temporary and permanent water management structures or stabilisation methods.
- » A resident Engineer to be responsible for ensuring implementation of the erosion control measures on site during the construction period.
- » The Developer holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.

- » Concrete lined drains placed adjacent to road to transfer the water to the existing water courses.
- » Frequent gravel drains hydroseeded placed on permanent roadway edges.
- » At the point where stormwater is discharged, energy dissipaters to be constructed to reduce the flow rate of run-off.
- » All cut and fill banks will be seeded with an approved seed mix (as per the rehabilitation specifications) to ensure bank stabilisation and the elimination of potential erosion. Reno mattresses may be used to ensure that the area remains stable.

6.4. Rehabilitation Specifications

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

6.5. Post- and during construction rehabilitation activities

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

7. Rehabilitation steps to mitigate the eroded area

- » Stockpiled topsoil must be spread over disturbed areas (150 – 200mm thick) just prior to planting/seeding.
- » Rip and scarify along the contours of the newly spread topsoil prior to watering and seeding.
- » Organic fertilizers or compost shall be used if site conditions require it and can be applied as part of hydro-seeding applications.
- » Seed should be sown into weed-free topsoil that has been stockpiled (i.e. original topsoil from the site).

- » Indigenous plants (e.g. grass species such as *Cynodon dactylon*, *Eragrostis curvula*) shall be used to rehabilitate disturbed areas.
- » Applying the seed through hydromulching (hydro-seeding) is advantageous (or organic mulching after seeding).
- » Watering is essential and rehabilitation should ideally occur during the wet season.
- » The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.

7.1. 'Watering' to avoid erosion

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

7.2. Seeding

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

7.3. Steep slopes

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

7.4. Maintenance and duration

- » Rehabilitation will occur during construction, as areas for plant rehabilitation become available.
- » The rehabilitation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
- » The rehabilitation phase (including post seeding maintenance) should be at least 6 months (depending on time of seeding and rainfall) to ensure establishment of plants with a minimum 80% cover achieved (excluding alien plant species).
- » If the plants have not established and the 80% is not achieved within the specified maintenance period, maintenance of these areas shall continue until at least 80% cover is achieved (excluding alien plant species).
- » Additional seeding may be necessary to achieve 80% cover.
- » Any plants that die during the maintenance period must be replaced.
- » Succession of natural plant species should be encouraged.

8. Conclusion

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

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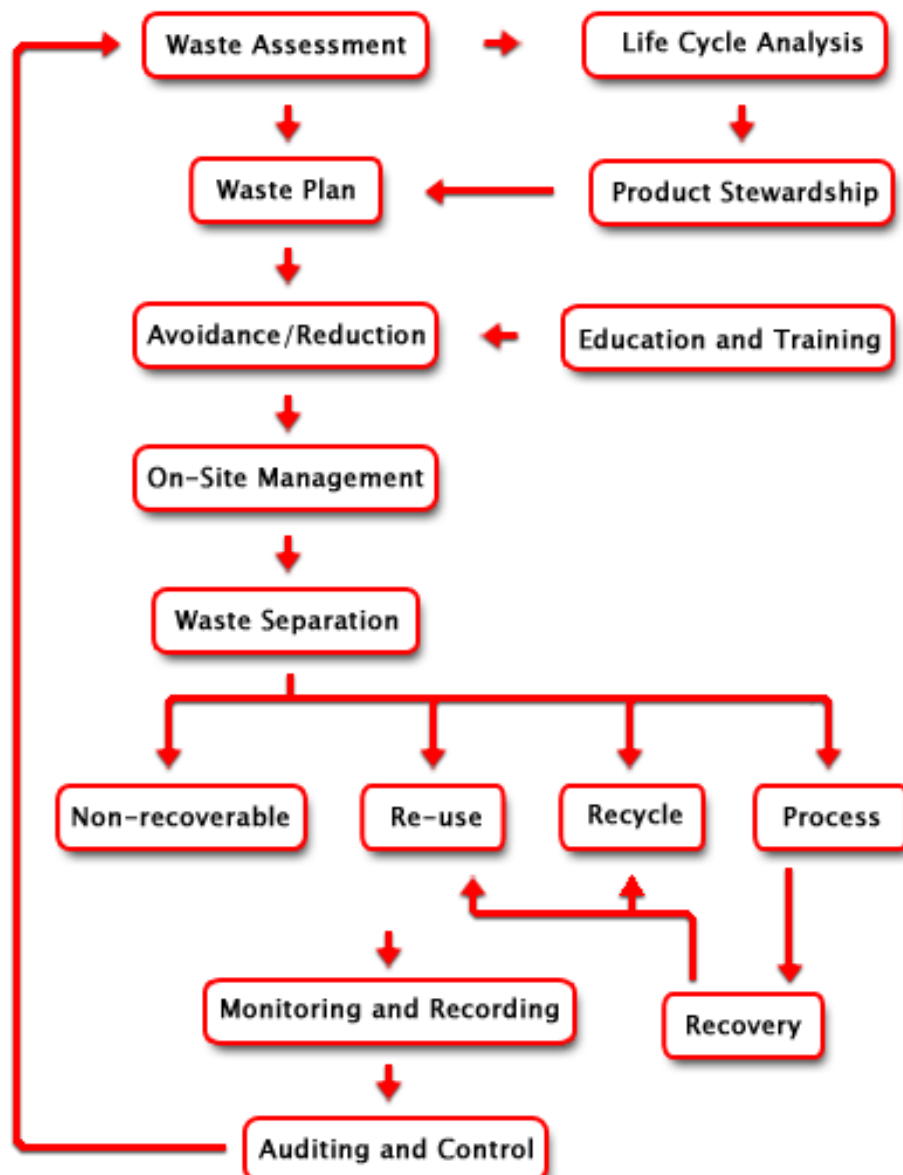
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**APPENDIX D:
GUIDELINES FOR INTEGRATED MANAGEMENT OF
CONSTRUCTION WASTE**

GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

Waste is broadly defined by the Department of Water Affairs in 1994 as: 'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity'. An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.

The Integrated Waste Management Approach to Waste



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

1. Waste Assessment

A detailed waste assessment is necessary to understand the waste types and volumes being produced. In order to achieve this, construction practices must be measured and analysed.

2. Waste Plan

A waste plan must be developed to provide appropriate solutions for managing the entire waste stream on site. The objective of the plan should be to reduce the volumes of waste to disposal and thereby to reduce the cost of management of the waste stream without compromising environmental standards. The plan should include recovery, re-use and recycle recommendations.

Construction Waste Management is the practice of reducing the actual waste that goes to the landfill site. Waste reduction is best met by recycling, and construction wastes offer several opportunities in this regard. In fact, 80% of the wastes found in construction waste piles are recyclable in some form or another. Wood, concrete, bricks, metals, glass and even paint offer several options for recycling.

There are three basic steps for construction waste management, i.e. Reduce, Reuse, and Recycle. **Reduce** is the prevention of the waste from arising and optimising material usage. Waste avoidance and waste reduction can be achieved through improved education and training - by improving efficiencies and by making staff environmentally aware.

Reuse is using existing materials instead of throwing these away. Reusing does not mean that it needs to be reused on the same construction site. Selling or donating waste materials to a third party is one option of construction waste management.

Recycle is somewhat limited since it only allows for those items that can be used on-site. The most important step for recycling of construction waste is on-site separation. Initially, this will take additional effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

3. What to Recycle

Before recycling construction waste, identify who will accept it. This is important in designating type of waste to separate, and in making arrangements for drop-off or delivery of materials. Materials that can be recycled include:

- » Cardboard and Paper
- » Wood

- » Metals
- » Plastics
- » Glass
- » Paints, Stains, Solvents and Sealants
- » Oil

4. Materials Separation

Successful recycling requires good clean uniform collections of single waste types. This is most effectively achieved by separating the waste streams close to source rather than at the landfill site. Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

Some materials will require bins or storage that protect these from rain. Other bins may be locked to prevent tampering.

5. Recycling and Waste Minimisation Guidelines

- » *Wood*
 - * Optimise building dimensions to correspond to standard wood dimensions in order to reduce the need for cutting.
 - * Store wood on level blocking under cover to minimize warping, twisting and waste.
- » *Metals*
 - * During construction, separate metals for recycling, including copper piping, wire, aluminium, iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.
- » *Cardboard and Paper*
 - * Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
 - * As far as possible, use recyclable packaging.
 - * Separate cardboard waste, bundle, and store in a dry place.
 - * Minimise the number of blueprints and reproductions necessary during the design and construction process.
- » *Plastic*
 - * Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
 - * As far as possible, use recyclable packaging.

Since more than 60 different types of plastic resins exist, the Plastics Federation of South Africa has adopted a voluntary number coding system for each category of plastics to aid in their sorting by material type for recycling (Bruyns et al, 2002). The most common resin types are itemised in Table 1.

Table 1: Identification System for Plastic

Id Number	Plastic Resin Type
1	PET (polyethylene terephthalate)
2	HDPE (high-density polyethylene)
3	PVC (polyvinyl chloride) or V (vinyl)
4	LDPE (low-density polyethylene)
5	PP (polypropylene)
6	PS (polystyrene)
7	Other (laminates, etc.)

» *Paints, Stains, Solvents and Sealants*

* Unused materials should be taken to a hazardous waste collection facility.

6. On-site Management

Good supervision of the waste management programme on site is critical to success. Management of the entire on-site program is critical to ensure smooth operations.

7. Auditing and Control

The success of the waste plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Finally, good record keeping and control, becomes a continuous waste assessment process, allowing the waste plan to be improved and adjusted as required.

8. Useful contacts:

<http://www.transpaco.co.za/page5.htm>

Transpaco, a manufacturing and distribution company operating extensively in the plastics and packaging industries, conducts plastic reclamation and recycling.

<http://www.jclenterprises.co.za/>

JCL Enterprises for plastic sales of quality recycled plastic materials as well as the recycling of plastic.

<http://www.rosefoundation.org.za/>

The Rose Foundation specialises in the collection and recycling of used motor (engine) oil.

Information Sources:

<http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines>

<http://www.enviroserv.co.za/pages/Content.asp?SectionID=587>

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

Programme for the Implementation of the National Waste Management Strategy. DEAT, May 2000

Residential Construction Waste Management Demonstration and Evaluation. Prepared for U.S. Environmental Protection Agency by NAHB Research Center, May 2, 1995

**APPENDIX E: SPECIFICATIONS FOR
EARTHWORKS (ENVIRONMENTAL MEASURES)**

Standard Specifications for Earthworks: Environmental measures

Topsoil

Prior to construction, the topsoil areas to be disturbed should be stripped to a depth to be confirmed by the engineer and set aside for spreading to all areas to be reinstated after the construction. Temporary topsoil stock piles must be covered with net or shade cloth to protect them.

Once all grades have been finalised and prepared, topsoil should be spread evenly to all areas to be re-vegetated.

Erosion and sedimentation control

1. During construction the Contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
2. A Method statement shall be developed and submitted to the Engineer to deal with erosion issues prior to bulk earthworks operations commencing.
3. Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted and the areas restored to a proper condition.
4. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. The method of stabilisation shall determine in consultation with the ECO. Consideration and provision shall be made for the following methods (or combination):
 - a) Brush cut packing
 - b) Mulch or chip cover
 - c) Straw stabilising
 - d) Watering
 - e) Planting/sodding
 - f) Hand seed-sowing
 - g) Hydroseeding
 - h) Soil binders and anti erosion compounds
 - i) Mechanical cover or packing structures
 - i. Gabions & mattresses
 - ii. Geofabric
 - iii. Hessian cover
 - iv. Armourflex
 - v. Log/ pole fencing
 - vi. Retaining walls
5. Traffic and movement over stabilised areas shall be restricted and controlled and damage to stabilised areas shall be repaired and maintained to the satisfaction of the ECO.
6. Anti-erosion compounds shall consist of all organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be of such a quality that indigenous seeds may germinate and not prohibit growth.

Blasting

1. A current and valid authorisation shall be obtained from the relevant authorities and copied to the Engineer prior to any blasting activity.
2. A Method Statement shall be required for any blasting related activities.
3. All Laws and Regulations applicable to blasting activities shall be adhered to at all times.
4. A qualified and registered blaster shall supervise all blasting and rock splitting operations at all times.
5. The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area.)
6. The Contractor shall allow for good quality vibration monitoring equipment and record keeping on site at all times during blasting operations.
7. The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on site.
8. The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting / drilling shall be repaired at the Contractor's expense to the satisfaction of the Engineer.
9. The Contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given.
10. The contractor shall use blast mats for cover material during blasting. Topsoil may not be used as blast cover.
11. During demolition the Contractor shall ensure, where possible that trees in the area are not damaged.
12. Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a Method Statement to be approved by the Engineer, shall be required in this regard.
13. At least one week prior to blasting, the relevant occupants/owners of surrounding land shall be notified by the Contractor and any concerns addressed. Buildings within the potential damaging zone of the blast shall be surveyed preferably with the owner present and any cracks or latent defects pointed out and recorded either using photographs or video. Failing to do so shall render the Contractor fully liable for any claim of whatsoever nature, which may arise. The Contractor shall indemnify the Employer in this regard.

Borrow pits and quarries

1. All borrow pit sites shall be clearly indicated on plan.
2. Prior to the onset of any quarrying or borrow pit activities the Contractor shall establish from the Engineer whether authorisation has been obtained, both in terms of the Minerals and Petroleum Resources Development Act 28 of 2002 (via the compilation of an Environmental Management Programme Report) and in terms of the National Environmental Management Act (via the Environmental Impact Assessment process). No excavation or blasting activities shall commence before the necessary authorizations are in place.
3. Borrow pits to be used must be approved by the engineer and shall at all times be operated according to the regulations promulgated in terms of the Minerals Act (No 50 of

1991): Mine Health and Safety Act (NO 29 of 1996) and Noise and Nuisance Regulations of the Environment Conservation Act (No 73 of 1989).

4. Only a single lane access for construction vehicles shall be provided at borrow pit and quarry sites. New access roads require approval by the Engineer.
5. Stormwater and groundwater controls shall be implemented.
6. Machinery, fuels and hazardous materials vulnerable to flooding shall be stored out of flood risk areas.
7. Vehicles leaving borrow pits shall not deposit/shed mud, sand and debris onto any public road.
8. All loads shall be covered with a tarpaulin or similar to prevent dangers and nuisance to other road users.
9. Borrow pits shall be fenced to prevent unauthorized persons and vehicles from entering the area. Fences shall also be stock and game proof.
10. Rehabilitation and re-vegetation of borrow pits sites shall be according to a method statement to be approved by the ECO.
11. The contractor shall ensure that blasted faces of the pit shall be shape-blasted to the approval of the Site Manager.
12. Where required, dust and fly-rock prevention methods shall be detailed in a Method Statement to be approved by the Site Manager.
13. During the rehabilitation of borrow pits, the slope or the borrow pit shall be graded to blend with the natural terrain and be stabilized to prevent erosion.

Drilling and jackhammering

1. The Contractor shall submit a Method Statement detailing his proposals to prevent pollution during drilling operations. This shall be approved by the Site Manager prior to the onset of any drilling operations.
2. The Contractor shall take all reasonable measures to limit dust generation as a result of drilling operations.
3. Noise and dust nuisances shall comply with the applicable standards.
4. The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.
5. All affected parties shall be informed at least one week prior to the onset of the proposed drilling/jackhammering operations, and their concerns addressed.
6. Drill coring with water or coolant lubricants shall require a Method Statement approved by the Site Manager.
7. Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the Contractor to the satisfaction of the Site Manager.

Earthworks

1. The excavations on site shall be done in accordance with SABS 1200 D or DB, as applicable.
2. Prior to Earthworks (including site clearance) starting on site, a search and rescue operation shall be undertaken as per the requirements set out in the EMP.

2. All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities.
3. Defined access routes to and from the area of operations as well as around the area of operation shall be detailed in a Method Statement for approval by the Site Manager.
4. No equipment associated with the activity shall be allowed outside of these areas unless expressly permitted by the Site Manager.
5. Mechanical methods of rock breaking, including Montabert type breakers, jackhammers, have noise and dust impacts that shall be addressed.
6. Residents shall be notified at least one week prior to these activities commencing, and their concerns addressed.
7. Chemical breaking shall require a Method Statement approved by the Site Manager.

Trenching

1. Trenching for services shall be undertaken in accordance with the engineering specifications (SABS 1200DE) with the environmental amplifications contain herein, where applicable.
2. Trenching shall be kept to a minimum through the use of single trenches for multiple service provision.
3. The planning and selection of trench routes shall be undertaken in liaison with the Engineer and cognisance shall be given to minimising the potential for soil erosion.
4. Trench routes with permitted working areas shall be clearly defined and marked with painted stakes prior to excavation.
5. The stripping and separation of topsoil shall occur as stipulated by the Engineer. Soil shall be stockpiled for use as backfilling as directed by the engineer.
6. Trench lengths shall be kept as short as practically possible before backfilling and compacting.
7. Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an area approved by the engineer.
8. Immediately after backfilling, trenches and associated disturbed working areas shall be planted with a suitable plant species and regularly watered. Where there is a particularly high erosion risk, a fabric such as Geojute (biodegradable) shall be used in addition to planting.

Dust

1. The Contractors shall be solely responsible for the control of dust arising from the Contractor's operations and for any costs against the Employer for damages resulting from dust.
2. The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Site Manager.
3. Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible.

4. Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present.
5. During high wind conditions the Site Manager will evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level.
6. Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the Site Manager.
7. Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas.
8. Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. dampening with water, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, clipping etc.)
9. Straw stabilisation shall be applied at a rate of one bale/ 10m² and harrowed into the top 100mm of top material for all completed earthworks.

Imported materials

1. Imported materials shall be free of weeds, litter and contaminants.
2. Sources of imported material shall be listed and approved by the Engineer or the Engineer's representative (ER) on Site.
3. The Contractor shall provide samples to the ER for approval.
4. Stockpile areas shall be approved by the ER before any stockpiling commences.