

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS: PROPOSED PHOTOVOLTAIC (SOLAR) ENERGY FACILITIES ON DU PLSESSIS DAM FARM NEAR DE AAR, NORTHERN CAPE

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DRAFT LIFE-CYCLE ENVIRONMENTAL MANAGEMENT PROGRAMME

19 September 2013



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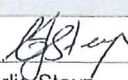

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ABBREVIATIONS

CEMP	Construction Phase Environmental Management Programme
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Reports
EMP	Environmental Management Programme
LEMP	Life-Cycle Environmental Management Programme
NEMA	National Environmental Management Act (No. 107 of 1998)
OHS	Occupational Health and Safety Act (No. 85 of 1998)
OEMP	Operational Phase Environmental Management Programme
SDEMA	Specification Data Environmental Management
SKA	Square Kilometre Array
SPEC EMA	Specification Environmental Management

1 OVERVIEW

This document represents the Life-Cycle Environmental Management Programme (LEMP) for the environmental management of the proposed photovoltaic (PV) solar energy facilities at Du Plessis Dam Farm (Remainder of farm 179), near De Aar in the Northern Cape.

1.1 Purpose of the LEMP

The LEMP has been included in the Environmental Impact Assessment Report (EIAR) in order to provide a link between the impacts identified in the Environmental Impact Assessment (EIA) Process and the actual environmental management on the ground during project implementation and operation. The purpose of this document is to provide for environmental management throughout the following life-cycle stages of the proposed development:

- Planning and design,
- Pre-construction and construction,
- Operation, and
- Decommissioning.

Furthermore, this LEMP aims for alignment and optimisation of environmental management processes with conditions of authorisation that may arise, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

1.2 Legal requirements of Environmental Management Programmes

In terms of the EIA Regulations (Regulation 543 of 18 June 2010) enacted in terms of the National Environmental Management Act (no. 107 of 1998) (NEMA), the proposed project triggers Activity 10, 11 (x and xi) and 18 of Regulation R544 (18 June 2010), Activity 1 and 15 of Regulation R545 (18 June 2010) as well as Activity 4, 14 and 16 of Regulation R546 (18 June 2010). As the proposed project triggers listed activities in terms of Regulation R544, R545 and R546 it is necessary to submit an EIA to the Department of Environmental Affairs (DEA) for Environmental Authorisation (EA). Section 22(l) of the EIA Regulations require that a draft Environmental Management Programme (EMP) is submitted as part of the EIAR.

The contents of the EMP must meet the requirements outlined in Section 24N (2) and (3) of NEMA and Section 33 of the EIA Regulations. The EMP must address the potential environmental impacts of the proposed activity on the environment throughout the project life-cycle including an assessment of the effectiveness of monitoring and management arrangements after implementation. The Department requires that the EMP be submitted together with the EIAR so that it can be considered simultaneously. Table 1 lists the requirements of an EMP as stipulated by Section 33 of the EIA Regulations R543. Table 2 lists the requirements of an EMP as stipulated by Section 24N (2) and (3) of the NEMA.

Table 1: Section 33 of EIA Regulation R543 listing the requirements of an EMP

33.	<i>A draft environmental management programme must comply with section 24N of the Act and include –</i>
(a)	<i>details of –</i>
	<i>(i) the person who prepared the environmental management programme; and</i>
	<i>(ii) the expertise of that person to prepare an environmental management programme;</i>
(b)	<i>information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—</i>
	<i>(i) planning and design;</i>
	<i>(ii) pre-construction and construction activities;</i>
	<i>(iii) operation or undertaking of the activity;</i>
	<i>(iv) rehabilitation of the environment; and</i>
	<i>(v) closure, where relevant.</i>
(c)	<i>a detailed description of the aspects of the activity that are covered by the draft environmental management programme;</i>
(d)	<i>an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);</i>
(e)	<i>proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;</i>
(f)	<i>as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;</i>
(g)	<i>a description of the manner in which it intends to—</i>
	<i>(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</i>
	<i>(ii) remedy the cause of pollution or degradation and migration of pollutants;</i>
	<i>(iii) comply with any prescribed environmental management standards or practices;</i>
	<i>(iv) comply with any applicable provisions of the Act regarding closure, where applicable;</i>
	<i>(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;</i>
(h)	<i>time periods within which the measures contemplated in the environmental management programme must be implemented;</i>
(i)	<i>the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;</i>
(j)	<i>an environmental awareness plan describing the manner in which—</i>
	<i>(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i>
	<i>(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;</i>
(k)	<i>where appropriate, closure plans, including closure objectives.</i>

The legislation hereby aims to ensure that effective environmental management is implemented throughout the life cycle of the project via the translation of EIA management actions into the LEMP.

Mulilo Renewable Energy Pty (Ltd) (Mulilo) therefore has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process, Aurecon has been cognisant of this need, and accordingly the EIA process has been undertaken in terms of NEMA.

The Department of Environmental Affairs & Development Planning (DEA&DP)'s¹ *Guideline for Environmental Management Plans* (2005) aims to inform and guide the preparation and implementation of EMP's. The guideline defines EMPs 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; and that the positive benefits of the project are enhanced”.

Section 24N (2) and (3) of the NEMA listing the requirements of an EMP are given in **Table 1**.

Table 2: Section 24N (2) and (3) of the NEMA listing the requirements of an EMP

<p>24N.(2) <i>the environmental management programme must contain-</i></p> <p>(a) <i>information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of –</i></p> <p>(i) <i>planning and design;</i></p> <p>(ii) <i>pre-construction and construction activities;</i></p> <p>(iii) <i>the operation or undertaking of the activity in question;</i></p> <p>(vi) <i>the rehabilitation of the environment; and</i></p> <p>(vii) <i>closure, where relevant.</i></p> <p>(b) <i>details of –</i></p> <p>(i) <i>the person who prepared the environmental management programme; and</i></p> <p>(ii) <i>the expertise of that person to prepare an environmental management programme</i></p> <p>(c) <i>a detailed description of the aspects of the activity that are covered by the draft environmental management plan;</i></p> <p>(d) <i>information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);</i></p> <p>(e) <i>information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance.</i></p> <p>(f) <i>as far as is reasonable practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and</i></p> <p>(g) <i>a description of the manner in which it intends to-</i></p> <p>(i) <i>modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</i></p> <p>(ii) <i>remedy the cause of pollution or degradation and mitigation of pollutants; and</i></p> <p>(iii) <i>comply with any prescribed environmental management standards or practices.</i></p> <p>(3) <i>the environmental management programme must , where appropriate-</i></p> <p>(a) <i>set out time periods within which the measures contemplated in the environmental management programme must be implemented;</i></p> <p>(b) <i>contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the prospecting area or mining area in question; and</i></p> <p>(c) <i>develop an environmental awareness plan describing the manner in which-</i></p> <p>(i) <i>the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i></p> <p>(ii) <i>risks must be dealt with in order to avoid pollution or the degradation of the environment.</i></p>
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¹ Please note that DEA&DP's guideline is used even though the proposed project is based in the Northern Cape, as DEA has not compiled a guideline on EMPs.

This LEMP aims to meet the EMP requirements as legislated by the NEMA Regulations as well as complying with the DEA&DP guideline document for an Environmental Management Plan². It should however be noted that no guideline or guidance exists in terms of best practice approach to LEMPs. This document should thus be seen in an iterative context allowing for amendments throughout the life-cycle of the project, allowing for adjustments as new information is made available.

1.3 Structure of the LEMP

As discussed above, the LEMP aims to address environmental management throughout the project life-cycle, from planning and design, through construction, to operation and potential decommissioning. The LEMP has been structured to include the following sections:

- Chapter 2: Description of project and alternatives.
- Chapter 3: Discussion summarising environmental management influencing the planning and design of the proposed project.
- Chapter 4: Construction EMP based on identified impacts and mitigation measures from the EIAR.
- Chapter 5: Operational Framework based on identified impacts and mitigation measures from the EIAR.
- Chapter 6: Monitoring programmes.
- Chapter 7: Erosion management plan.
- Chapter 8: Decommissioning Framework providing guidance on key considerations to be considered during decommissioning/closure.
- Chapter 9: Roles and responsibilities.
- Chapter 10: Conclusion.

1.4 Expertise of Environmental Assessment Practitioners

Section 33 of EIA Regulations and Section 24N (2) and (3) of the NEMA requires that an EMP must include the details of the person(s) who prepared the EMP, and the expertise of that person to prepare an EMP. In this regard, the *Curriculum Vitae* of the Environmental Assessment Practitioners who compiled the LEMP are included in **Appendix A**.

² Lochner, P. 2005. *Guideline for Environmental Management Plans*. CSIR Report No ENV-S-C 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

2 BACKGROUND INFORMATION

This section outlines how environmental considerations have informed and been incorporated into the planning and design phases of the proposed PV facilities. Detailed design is usually undertaken as part of the pre-construction phase as it is a costly undertaking which is generally only costed for once all required authorisations have been obtained. Thus, the planning and design phases discussed are limited to those associated with the pre-authorisation phases. Mitigation measures have been recommended for the detailed design phase.

2.1 Project Description

Mulilo proposes to construct a number of PV facilities on Du Plessis Dam Farm. A number of alternatives were investigated in the EIA, however only the preferred alternative is described in this EMP. The preferred alternative is layout alternative 1, which includes three 75MW PV facilities and associated infrastructure. Details on the respective footprints of the proposed PV facilities are provided in Table 3.

Table 3: Footprints, capacities and coordinates of the preferred alternative

Plant	Footprint (ha)	Capacity (MW)	Coordinates (middle point)
PV2	273	75	30°38'11.38" S 24°04'22.75" E
PV3	212	75	30°37'53.03" S 24°03'28.26" E
PV4	374	75	30°37'27.44" S 24°03'31.14" E

Each of the proposed PV facilities would consist of numerous arrays of PV panels and associated support infrastructure. Ancillary infrastructure would include onsite 132kV transmission lines and substations (one substation per PV facility) and a boundary fence around each 75MW facility. It is proposed that the following infrastructure be shared between the PV facilities to lessen the impact on the surrounding environment:

- Central substation: One central 132kV substation and connection to Eskom grid. This central substation will connect the PV facilities with Eskom's De Aar substation via either an existing overhead 132kV Eskom line or the previously authorised 132kV overhead transmission line directly to the offsite De Aar substation.
- Roads: Access road and internal access roads for servicing and maintenance of the site.
- Water supply infrastructure: It is proposed that potable water will be obtained from the Emthanjeni Municipality. Water will be transferred to the site via the municipal pipeline from the nearest municipal supply point and will be contained onsite in a jo-jo tank. However, the Municipality would need to confirm availability of capacity to do so.
- Stormwater infrastructure: Including drainage channels, berms, detention areas and kinetic energy dissipaters.
- Buildings: Buildings would likely include onsite substations, a connection building, control building, guard cabin, an electrical substation and solar resource measuring substation.

Sensitive ecological areas identified on site during the EIA are shown in Figure 1.

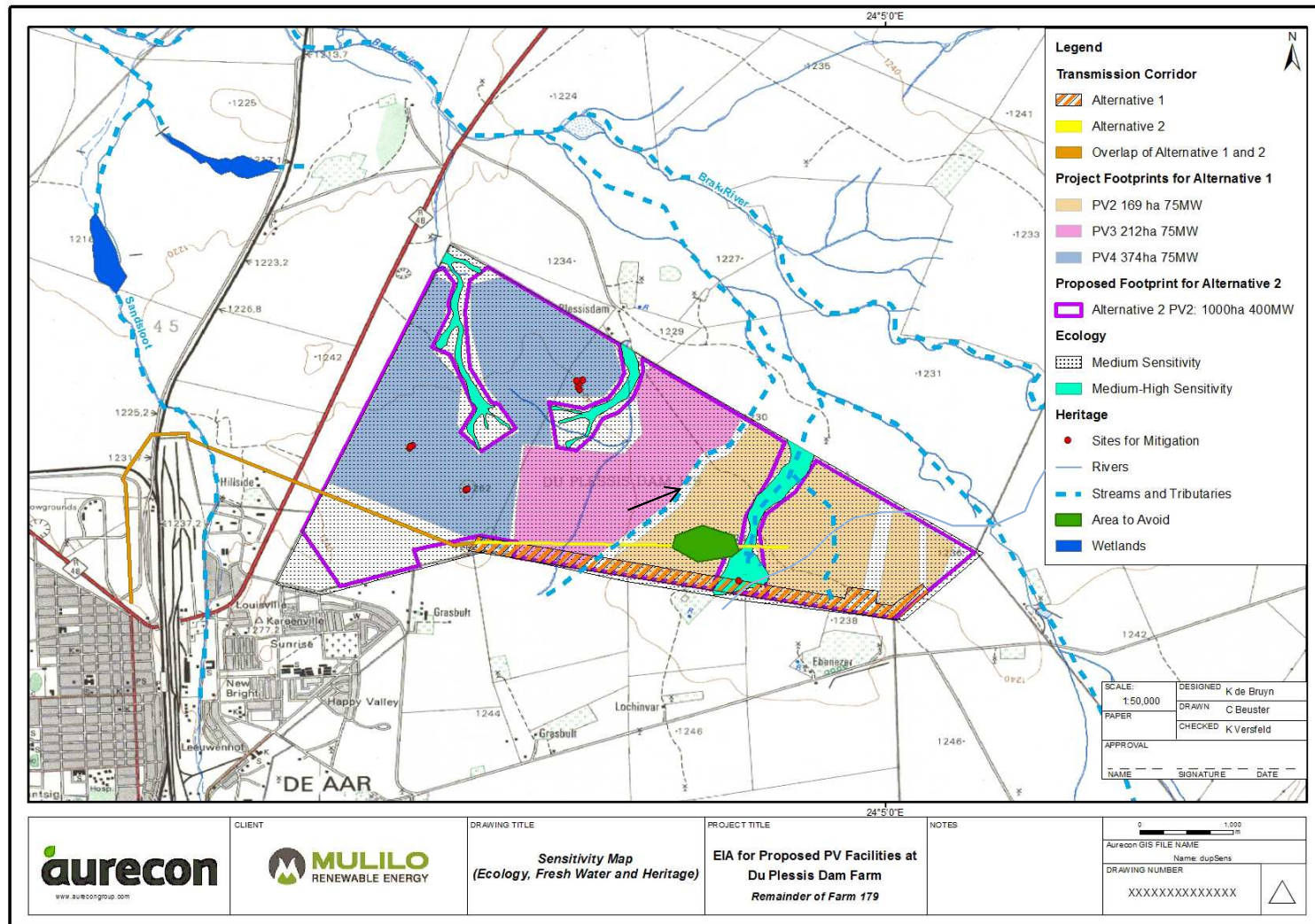


Figure 1: Sensitive ecological areas and the proposed project, including alternative layouts

3 PLANNING AND DESIGN

The design for the proposed development should respond to the identified environmental constraints and opportunities. The following mitigation measures related to the design for the proposed development have been recommended to reduce the environmental impacts.

3.1 Plans, policies, programmes and permits required for the planning and design phase

During the planning and design phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMP. Table 4 below provides a quick reference list of these requirements³.

Table 4: Plans and permits required for the planning and design phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Plant rescue and protection plan	To be compiled and implemented during the planning phase
Flora	Open space management plan	To be compiled in planning phase and implemented during construction and operational phase
Avifauna	Pre-construction monitoring as part of the long term avifauna monitoring programme	In process and Section 6 of this LEMP
Heritage	Fossil collection permit	Heritage specialist
Socio-Economic	Local employment policy and training programme	To be compiled during the planning phase and implemented during construction and operational phase
Surface water	Stormwater management plan	Annexure C of LEMP
Roads	Traffic management plan and transport management plan	To be compiled during the planning phase and implemented during construction and operational phase
Sedimentation and Erosion	Erosion management plan	Section 7 of the LEMP

3.2 Mitigations measures application for the planning and design phase of the project

3.2.1 Botanical

- A plant rescue and protection plan shall be compiled and implemented with the aid of a suitably qualified rehabilitation specialist should it be requested by DEA. It should be noted that the botanical specialist did not identify any threatened, near threatened, declining or rare plant species within Du Plessis Dam Farm. Should it still be required this plan will allow for the maximum transplant of conservation important species from

³ Department: Environmental Affairs, Requirements of EMP, Letter dated 12/08/2013

areas to be transformed should they be identified at a later stage. This plan will be implemented prior to the commencement of the construction phase.

- An open space management plan will be compiled and implemented during the construction and operational phase.
- Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.

3.2.2 Fauna

- Allow small ground level openings, 20-30 cm in height, in the electrical fence to facilitate the movement of small mammals and reptiles through the site.

3.2.3 Avifauna

- Pre-construction monitoring is required as part of the long term avifauna monitoring detailed in Section 6 of this LEMP. The pre-construction monitoring is already being done.
- Implement planning and design mitigation measures for protection of avifauna based on the outcome of the comprehensive bird monitoring programme as per the guidelines provided in Section 6 of this LEMP.
- The length of any above-ground power lines shall be minimised and all new lines should be marked with bird flight diverters.

3.2.4 Heritage

- Prior to construction, a heritage specialist must undertake a final site examination, which will include the historic farmstead and all its related features and artefacts. The historic farmstead site is too significant to be mitigated since an extensive excavation and recording program over several weeks would be required.
- Radiocarbon dating may also be required, but this depends on the preservation of the appropriate organic materials that are needed for the dating process.
- Once the exact lines have been identified for the linear components of the project they should be examined from the desktop then subjected to a walk-down if deemed necessary.
- Where archaeological sites cannot be avoided, mitigation in the form of excavation and collection of artefacts should be carried out.
- The palaeontologist concerned with mitigation work will need a valid fossil collection permit from the South African Heritage Resources Agency (SAHRA) and any material collected would have to be curated in an approved depository (e.g. museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording, fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).

3.2.5 Visual

- Implement good traffic management and keep local people informed of activities.
- Lay-down area(s) should be screened with shade and cloth.
- Site offices, if required, shall be limited to a shingle storey and shall be sited carefully using temporary screen fencing to screen from the wider landscape.

- Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that would blend in with the natural environment (e.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and window frames should reference either the roof or wall colours).
- Minimising the length of any new power lines installed and burying lines wherever possible. If lines cannot be buried, ensure that all new lines are marked with bird flight diverters.

3.2.6 Socio-Economic

- Obtain a list of locally available labour and skills. Preference should be given to local communities for employment opportunities.
- Base recruitment on sound labour practices and with gender equality in mind.

3.2.7 Surface Water

- Design recommendations as set out in the Stormwater Management Plan (Annexure C).
- The area should be sub-divided into smaller sub-catchments (which will distributed the runoff) and have multiple outlets from the site.
- The runoff from the Du Plessis site should in the most part should be directed to the tributary of the Brak River to the north of the site which follows the pre-development flow across the site.
- The runoff from the western side of the site (PV4 Alternative 1) should be directed away from the R48 north towards the Brak River. Should localised drainage within this area be a concern during the design phase, attenuation ponds may be required.
- Cut-off drains should be provided along the outside boundaries of the PV sites that receive overland flow from areas upstream. The cut-off drains will typically be at least 300 mm deep and v-shaped as described above.
- A buffer of 30m should be maintained adjacent to the identified streams for the proposed PV footprint area as well as the substations.
- Most access roads and water pipelines should be planned in areas that will minimise disturbance within no-go areas.

3.2.8 Roads (internal and external)

- A Traffic Management Plan will be compiled and implemented during the construction and operational phase, this plan will include measures to minimize impacts on local commuters.
- A Transportation Plan for the transport of panel components, main assemble cranes and other large pieces of equipment will be compiled.
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled.
- Internal roads should be designed to have minimal impact on the environment.
- Where roads intersect natural, defined drainage lines, suitably sized pipe culverts or drive through causeways should be installed or constructed.
- The gravel roads should have the following: a crowned driving surface, a shoulder area that slopes directly away from the edge of the driving surface, and a ditch.
- Where the roads intersect drainage lines a suitably sized culvert should be used. It is important that ditches and culverts be kept clear from obstructions.

3.2.9 Sedimentation and Erosion

- Refer to the Erosion Management Plan in section 7.

3.2.10 Agricultural land

- A planned phased approach must be adopted as illustrated in Figure 2.
- Allow normal agricultural activities to continue in unaffected areas.

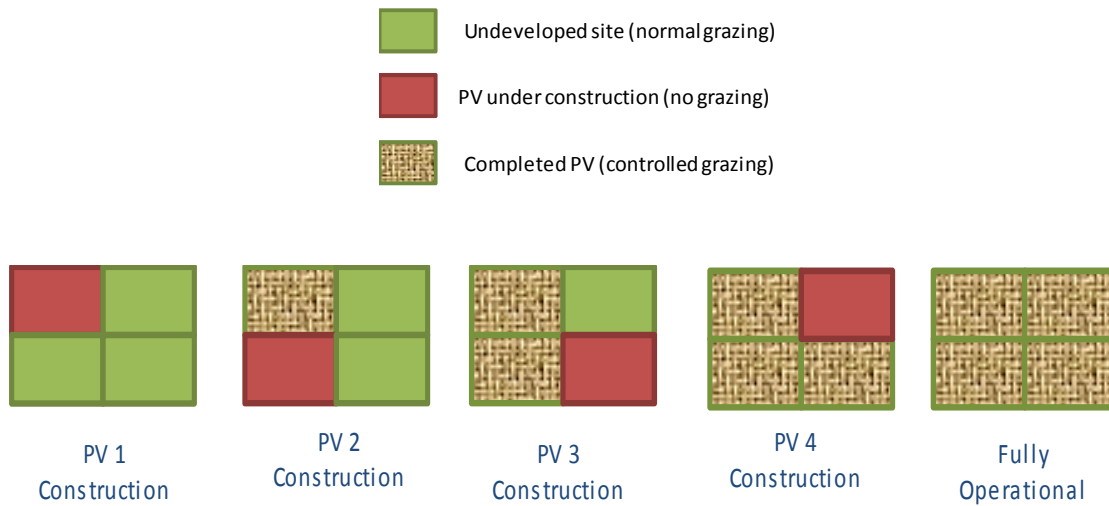


Figure 2: Proposed phased approach and grazing schedule

4 CONSTRUCTION PHASE EMP

The Construction EMP (CEMP) aims to address mitigation measures pertaining to the construction phase as identified during the course of the EIA. This section includes both General Specifications as well as Draft Specification Data, addressing general construction issues and issues that are not addressed by the General Specifications, respectively. It should be noted that the Draft Specification Data should be revised as required post authorisation to ensure that all relevant conditions of the EA have been addressed.

4.1 Construction EMP General Specifications

The complete General Specifications have been included in **Appendix B** and include the following sections:

- Scope
- Normative References
 - Supporting Specifications
- Definitions
- Requirements
 - Material
 - Material handling, use and storage
 - Hazardous substances
 - Shutter oil and curing compound
 - Bitumen
 - Plant
 - Ablution facilities
 - Solid waste management
 - Contaminated water
 - Site structures
 - Noise control
 - Lights
 - Fuel (petrol and diesel) and oil
 - Workshop, equipment maintenance and storage
 - Dust
 - Methods and procedures
 - Environmental awareness training
 - Construction personnel information posters
 - Site clearance
 - Site division
 - Site demarcation
 - "No go" areas
 - Protection of natural features
 - Protection of flora and fauna
 - Protection of archaeological and paleontological remains
 - Access routes/ haul roads
 - Cement and concrete batching
 - Earthworks
 - Pumping
 - Bitumen
 - Fire control
 - Emergency procedures
 - Community relations
 - Erosion and sedimentation control
 - Aesthetics
 - Recreation
 - Access to site
 - Crane operations
 - Trenching
 - Demolition
 - Drilling and jack hammering
 - Stockpiling
 - Site closure and rehabilitation
 - Temporary re-vegetation of the areas disturbed by construction
 - Temporary site closure
- Compliance with requirements and penalties
 - Compliance
 - Penalties
 - Removal from site and suspension of Works
- Measurement and Payment
 - Basic principles
 - General
 - All requirements of the environmental management specification
 - Work "required by the Specification Data"
 - Billed items
 - Method Statements: Additional work
 - All requirements of the environmental management specification

4.2 Project Specifications

The following section provides the Draft Specification Data which, along with the General Specifications, will be included in all contract documentation associated with the proposed project and will accordingly be binding on the Contractor.

Scope: The general principles contained within this Specification Data: Environmental Management (SDEMA) shall apply to all construction related activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

Interpretations: This Specification contains clauses specifically applicable and related to the environmental requirements for the solar energy facility on Du Plessis Dam Farm, near De Aar, in the Northern Cape.

Where any discrepancy or difference occurs between this SDEMA and the Specification: Environmental Management (Comprehensive), the provision of this Specification shall prevail.

Definitions:

For the purposes of this Specification the following definitions shall be added:

- **Contractor:**
The Contractor must ensure that all of its sub-contractors, employees, etc., are fully aware of the environmental issues detailed in this LEMP. The Contractor shall liaise closely with the SE, Environmental Officer (EO) and the ECO and must ensure that the works on site are conducted in an environmentally sensitive manner and fully in accordance with the requirements of the LEMP, at all times.
- **Developer:**
The developer refers to the holder of the Environmental Authorisation who will be responsible for the following tasks, but not limited to:
 - Ensure that the requirements as set out in this LEMP are adhered to and implemented;
 - Allocate the responsibilities assigned to the ECO to an independent suitably qualified individual prior to the start of construction activities on site; and
 - Provide all principal contractors working on the project with a copy of this CEMPr as part of tender contract documentation to allow the contractors to cost for its requirements within their respective construction contracts.
- **Environmental Control Officer (ECO):**
The Developer shall appoint a suitably qualified ECO to monitor the Contractor's compliance in terms of this LEMP and the conditions contained in the EA. The designation is reserved for a suitably qualified (National Diploma / Degree in Natural Science or an equivalent qualification), independent, environmental manager, with adequate environmental knowledge to understand and implement the LEMP. The duties of the ECO during construction phase will include but are not limited to:

- i) Liaison with the Client, Project Manager or Engineer and DEA;
 - ii) Monitoring of all of the Contractor's activities for compliance with the various environmental requirements contained in the construction Specification;
 - iii) Monitoring of compliance with the EA related to the construction phase as issued by DEA as well as other relevant environmental legislation;
 - iv) Reviewing of the Contractor's environmental Method Statements;
 - v) Ensuring that the requisite remedial action is implemented in the event of non-compliance;
 - vi) Ensuring the proactive and effective implementation and management of environmental protection measures;
 - vii) Ensuring that a register of public complaints is maintained by the Contractor and that any and all public comments or issues are appropriately reported and addressed;
 - viii) Routine recording and reporting of environmental activities on a weekly and monthly basis;
 - ix) Recording and reporting of environmental incidents; and
 - x) Oversee and monitor compliance with and implementation of the construction phase EMP, Operational Phase EMP and Rehabilitation Plan, including compliance with the relevant conditions contained in the EA.
- Responsible persons:
Effective environmental management during the construction phase will be dependent on a number of project personnel. The purpose of this section is to define roles for personnel and to detail their respective responsibilities in the execution of the CEMPr.
 - Site Engineer (SE):
The SE is responsible for ensuring that the contract is carried out to completion on time, in budget and that each Contractor fulfils his obligations in terms of conditions contained in the EA.
 - Working area:
The land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the developer in connection with the Works. The Working Area shall include the site office, construction camp, stockpiles, batching areas, the construction area, all access routes and any additional areas to which the Engineer permits access. The construction footprint must be kept to a minimum.

4.3 Plans, policies, programmes and permits required for the construction phase

During the construction phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMP. Table 5 below provides a quick reference list of these requirements.

Table 5: Plans and permits required for the construction phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Alien invasive management plan	To be compiled and implemented during construction phase
Flora	Re-vegetation and habitat rehabilitation plan	To be compiled and implemented during construction phase
Avifauna	Long term avifauna monitoring programme	Section 6 of this LEMP

4.4 Structure of the CEMP

Each activity identified in the EIA process comprises various aspects, which have associated impacts. These, along with the mitigation measures and performance indicators, are outlined in the table below.

Five main categories have been identified and tabled for the CEMP namely:

- **General**
- **Establishment of the construction camp**
- **Clearing of the site**
- **Construction of the PV panels and associated infrastructures**
- **Removal of the construction related debris, materials or equipment**

The information is summarised in Table 1- 5 below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- Activity: component/ activity of the project for which the impact has been identified.
- Aspect: the aspect of the above activity which will be impacted.
- Impact: the environmental impact identified and to be mitigated.
- Mitigation measure: measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - Objective: desired outcome of mitigation measure.
 - Mechanism: method of achieving the objective.
- Performance indicators: outcomes that will indicate achievement of objective/s.
- Responsibility: party or parties identified for implementation of mitigation measure/s.
- Resources: available resources to aid implementation of mitigation.
- Schedule: timeframe in which identified impact and mitigation measure is anticipated to occur.
- Verification: party or parties identified as responsible for review and assessment of final outcome.

4.5 CEMP Table 1: General

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Communication	Inability to communicate the environmental obligations effectively to responsible parties can result in unnecessary environmental degradation. It can also compromise the health and safety of employees.	Objective: To ensure that the construction activities do not result in avoidable impacts on the environment by anticipating and managing the impacts. Mechanism: 1) The contact details of the key construction team must be available to all relevant parties. 2) All site instructions pertaining to environmental matters issued by the Engineer are to be copied to the ECO. 3) All sub-contractors, employees, suppliers or agents etc. must be fully aware of the environmental management requirements detailed in this CEMP. 4) The Engineer and ECO must be informed immediately should environmental issues arise. 5) A copy of the EIAR, CEMP and EA must be present at the construction site for easy reference to specialist recommendations.	No avoidable environmental impacts occurring due to miscommunication. The ECO is aware of decisions taken by the engineer and contractors.	ECO, Engineer and Contractor.	During the construction phase (from site establishment to contract completion).	ECO and developer
2.	Training of workers	Without proper training the health and safety of workers will be at risk and preventable environmental impacts could occur.	Objective: To provide health and safety training to construction workers to ensure a safe working construction site and to ensure that each employee are aware of the environmental impacts that could occur. Mechanism: 1) Temporary and permanent construction workers must undergo environmental awareness training and health and safety training as part of the induction training.	All employees adhere to the mitigation measures provided in this document. All operators of mechanical equipment are trained properly by the contractor.	Contractor and ECO The Contractor shall supply the ECO with a monthly report indicating the number of employees that will be present on	During the construction phase (from site establishment to contract completion).	DEA and the developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>2) The following aspects need to be covered as a minimum:</p> <ul style="list-style-type: none"> • The prevention of accidental spillage of hazardous chemicals and oil; • Disposal of waste; • The No-Go areas; • Litter control; • Identification of archaeological artefacts and whom to report it to; • The use of fire fighting equipment and Personal Protective Equipment (PPE); and • HIV/AIDS awareness. <p>3) Environmental posters and/ or translators can be used for training purposes.</p> <p>4) Staff operating equipment (such as loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.</p> <p>5) Follow-up training courses must be attended throughout the construction period as deemed necessary by the ECO.</p> <p>1) All new employees that spend more than one day a week on site are to attend the environmental education program within one week of commencement of work.</p>	All workers have attended Environmental awareness training and health and safety training.	site during the following month.		
3.	Protection of fauna, flora and avifauna	Constructing a PV facility may have impacts on the fauna, flora and avifauna.	<p>Objective: To prevent unnecessary disturbance to natural vegetation.</p> <p>Mechanism:</p> <p>1) A rehabilitation plan for the site will be compiled with the aid of a rehabilitation specialist and adhered to.</p> <p>2) Unnecessary impacts on surrounding natural</p>	<p>No animals are injured.</p> <p>No employees enter the no-go areas.</p> <p>No alien vegetation establishment.</p>	ECO, Contractor	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>vegetation must be avoided. The construction impacts must be contained to the footprint of the solar array and other associated infrastructure as well as to the footprint of the tower structures and/or the servitude of the power line.</p> <p>3) Areas outside the construction footprint should be fenced and access to these areas should be limited as much as possible.</p> <p>4) Existing access roads must be used, where possible.</p> <p>5) Service roads in the servitude must be properly maintained to avoid erosion impacts.</p> <p>6) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.</p> <p>7) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.</p> <p>8) Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.</p> <p>9) An on-going alien invasive monitoring programme will be implemented to detect and quantify any aliens that may become established and provide information for the management and monitoring of aliens.</p> <p>10) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum.</p>	<p>Invasive alien vegetation monitoring programme implemented.</p>			

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>11) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.</p> <p>12) Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.</p> <p>13) Minimising the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds.</p> <p>14) Comply with the bird monitoring scheme in Section 6 of this LEMP.</p>				
4.	Stormwater runoff, erosion, and pollution of surface water and groundwater resources.	Contamination of stormwater runoff can impact on the surface and groundwater resources. The mismanagement of stormwater can furthermore result in erosion.	<p>Objective: Prevent stormwater from eroding the land and becoming contaminated.</p> <p>Mechanism:</p> <p>1) Straw barriers should be installed in drainage paths to act as a check dam, i.e. to reduce velocity, and as a sediment trap during construction. Suspended solids carried by overland flow will be intercepted. These are erosion barriers placed at intervals of 25-50 m apart in the drainage paths which will intercept suspended solids from entering the natural drainage paths.</p> <p>2) Packed stone (also known as rip-rap) must be placed as liners for channel spines. These comprise packed stones with an average diameter of 100mm, packed in the channels as lining material to control flow velocities and hence erosion.</p>	<p>Stormwater not contaminated by construction activities.</p> <p>Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop.</p> <p>Freshwater ecosystems are not unduly disturbed by construction activities within the drainage channels.</p>	ECO and contractor ECO to inspect soils for erosion at regular intervals.	After site clearing has taken place up to the end of the construction phase.	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>3) Earth cut-off channels at boundaries of the facility. These will assist in directing flow away from the site and reduce the possibility of flooding from runoff origination from outside the site.</p> <p>4) Provide erosion protection at channel outfalls and positions of high flow concentration. These comprise packed stones with an average diameter of 200 mm, packed in the drainage path to control flow velocities and hence erosion.</p> <p>5) Comply with regulations as set out in the storm water management plan to be implemented during construction.</p> <p>6) A buffer of 30m should be maintained adjacent to the identified streams for the proposed PV footprint area as well as the substations.</p> <p>7) There should be minimal use of machinery within the drainage channels and disturbance within this area should be kept to a minimum.</p> <p>8) Invasive alien plant growth within the disturbed areas should be monitored and managed.</p> <p>9) Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines.</p> <p>10) Construction activities for the proposed infrastructure that will need to take place within the river channels and riparian zone (i.e. linear development components – roads, transmission lines and water pipeline) should</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>transect the streams at right angles and be limited as far as possible to ensure minimum disturbance of this area.</p> <p>11) Minimise duration and extent of construction activities in the river – construction should also preferably take place in the low flow season.</p> <p>12) Clearing of debris, sediment and hard rubble associated with the construction activities should be undertaken post construction to ensure that flow within the drainage channels are not impeded or diverted.</p> <p>13) Rehabilitate disturbed stream bed and banks and re-vegetate with suitable indigenous vegetation.</p> <p>14) All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.</p> <p>15) Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.</p> <p>16) Contaminated runoff from the construction site(s) should be prevented from entering the rivers. All materials on the construction sites should be properly stored and contained.</p> <p>17) Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100m away from the river systems/ freshwater features and regularly serviced.</p> <p>18) The laydown area should be cleaned and rehabilitated after construction is complete.</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
5.	Visual impact	The proposed site is visible to the public and a construction site might have a negative visual impact on the sense of place, which is characterised by vast open plains.	<p>Objective: To protect the sense of place.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Top soil should be scraped off, conserved and used for rehabilitation. The remainder could be used for site development, and any surplus disposed of in a manner that appears natural. The top 50 - 100mm of naturally occurring substrate should be separated and then spread over finished levels. 2) The laydown area should be screened with shade cloth and dust prevention mitigations needs to be implemented during use to prevent wind-blown dust. 3) Site offices and structures should be limited to single-storey and they should be sited carefully to reduce visual intrusion. Colours should reflect shades of the surrounding vegetation and/or the ground. Roofs should be grey and non-reflective. Door and window frame colour should reference either the roof or wall colours. 4) Litter is to be regarded as a serious offence and no contaminants are to be allowed to enter the environment by any means. 5) Road construction and management must take run-off into consideration in order to prevent soil erosion. 6) The developer will be required to ensure that the footprint areas of all impact sites utilised in the construction phase, are rehabilitated and restored as near as possible to previous natural vegetation during that phase, and not in the operational phase. 7) The fencing should be grey in colour and 	No complaints from the public.	ECO, Engineer and Contractor	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			located as close as possible around the PV site. If possible, natural waterways and drainage lines indicated as sensitive should not be fenced in.				
6.	Impacts on local economy (employment) and social conditions	The activity might impact on the economy (local shops, restaurants, and Guest Houses, etc.)	<p>Objective: To ensure on-going sustainability of the local tourism / hospitality industry.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) It is recommended that the local employment policy, as stated by the proponent, be implemented, audited and accompanied by a training programme. The policy must be based on a 'local's first' policy, specifically for low skilled jobs and should aim to recruit at least 20% of the jobs from the local community. This should also apply to all contracting firms. 2) A local procurement policy should be adopted by the applicant to maximise the benefit to the local economy. 3) Implement a policy of "no employment at the gate" to prevent loitering. 4) The site should be secured. 5) A comprehensive employee induction programme would cover land access protocols and fire management. This was addressed in the LEMP. 6) A comprehensive employee induction programme would address issues such as HIV/ AIDS and Tuberculosis, as well as alcohol and substance abuse. The induction should also address a code of behaviour for employees that would align with community values. 	Contribute to local community upliftment	Contractor, ECO, Engineer	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
8.	Traffic	Increased volume of traffic both on and off site	<p>Objective: To ensure that increased traffic volume is managed efficiently to minimise associated impacts.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Comply with the traffic management plan and the transportation plan. 2) Ensure that all drivers are aware of the "No-Go" areas, permissible roads, and where the offloading area is. 3) Impose speed limits on the construction site. 4) Manage site access to prevent congestion of vehicles and trucks. 5) Access of all construction and material delivery vehicles should be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure. 6) Roads not to be used shall be marked with a "NO ENTRY for construction vehicles" sign. 7) Access roads are to be kept litter free. 8) Transportation of materials must be done by the least amount of trips to prevent the construction vehicles from congesting the main roads leading to De Aar. 9) The contractor must ensure that there is ample space to off load the materials to prevent truck being delayed and interrupting the traffic flow. 	Traffic is orderly, free flowing and controlled.	Contractor and Engineer	During the construction phase (from site establishment to contract completion)	ECO
9.	Dust	Dust generated from the stripped surfaces, construction demolition,	<p>Objective: To avoid nuisance impacts caused by dust as far as possible.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The Contractor shall take all reasonable measures to minimise the generation of dust 	No complaints received from public and or site staff.	Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		excavations and stockpiled materials can become a nuisance to neighbouring landowners.	<p>as a result of construction activities to the satisfaction of the ECO and Engineer.</p> <ol style="list-style-type: none"> 2) Water sprays to be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. 3) Ensure travel distance between clearing area and topsoil piles to be at a minimum. 4) Ensure exposed areas remain moist through regular water spraying during dry, windy periods. 5) Reshape all disturbed areas to their natural contours. 6) Cover disturbed areas with previously collected topsoil and replant native species. 7) Minimise the time that stripped areas are exposed. 8) Protect open soils against wind erosion. 9) Put in place procedures for effective cleaning of vehicles and inspection. 10) Material loads must be covered properly during transport and storage thereof. 11) The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of both natural and manufactured materials. 				
10.	Noise	The increase in traffic and operation of equipment may result in noise becoming a nuisance.	<p>Objective: To ensure that the construction phase are compliant to noise regulations.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas. 	No complaints received from public and or site staff.	Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>2) Stationary noisy equipment such as compressors and pumps should be encapsulated in acoustic covers, screens or sheds where possible. Portable acoustic shields should be used in the case where noisy equipment is not stationary (i.e. angle grinders, chipping hammers).</p> <p>3) Vehicles should avoid unnecessary use of the reverse gear to minimise annoyance caused by reverse sirens. Consideration of alternative safety measures may be necessary when taking such a measure.</p> <p>4) All diesel powered equipment must be regularly maintained and kept at a high level of maintenance. This must particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for maintenance.</p> <p>5) Truck traffic should be routed away from noise sensitive areas, where possible.</p> <p>6) Noisy operations should be combined so that they occur where possible at the same time.</p> <p>7) Instruction of employees on low-noise work methods, for example, the handling of structural steel and the use radiotelephony rather than shouting for communication.</p> <p>8) Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.</p> <p>9) Construction activities are to be contained to reasonable hours during the day and early evening.</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>10) Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning.</p> <p>11) With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents and owners on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.</p>				
11.	Impact on archaeological, cultural and historic sites	Heritage resources can be impacted on during the site clearance, earthworks and the constructing of the PV panels.	<p>Objective: To ensure that no heritage resources as identified in the Heritage Impact Assessment report are disturbed and or destroyed.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The development should avoid the historic farmstead and all its related features and artefacts. The historic farmstead site is too significant to be mitigated since an extensive excavation and recording program over several weeks would be required. 2) For PV4 [part of Layout Alternative 1 (PV2-PV4)] the archaeological mitigation in the form of excavation, sampling and analysis should be carried out for the LSA sites that will be impacted. 3) Once the exact lines have been identified for the linear components of the project they should be examined from the desktop then subjected to a walk-down if deemed necessary. Where archaeological sites cannot be avoided, mitigation in the form of excavation and collection of artefacts should 	No heritage resources are disturbed and SAHRA was contacted in the event of uncovering an archaeological artefact.	ECO and contractor	During the construction phase (from site establishment to contract completion).	

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>be carried out.</p> <p>4) If any human remains are encountered during the development they should be cordoned off and protected from further harm until they can be inspected and removed by an archaeologist under a permit issued for that purpose.</p> <p>5) All mitigation-worthy archaeological sites that are avoided by the development and are not mitigated should be protected from incidental damage (for example from vehicles driving over them or through the establishment of power line access tracks).</p> <p>6) Any dense subsurface concentrations of artefacts found during excavations should be protected <i>in situ</i> and immediately reported to an archaeologist for assessment.</p> <p>7) Any areas of the landscape that are not to be developed should be protected so as to minimise unnecessary landscape scarring.</p> <p>8) The ECO must be informed if archaeological resources are found on the surface or exposed by fresh excavations during construction activities.</p> <p>9) Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.</p> <p>10) No-Go areas identified by the Heritage Specialist must be demarcated and all site personal must be informed thereof.</p>				

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
12.	Impact on municipal services	The proposed activity will require municipal services in terms of sewage, waste removal, and provision of water.	<p>Objective: To ensure that the Emthanjeni Municipality will be able to accommodate the proposed activity without jeopardising the security of services provided.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Ensure that service level agreements are in place prior to the commencement of the construction phase. 	Services can be provided for the proposed activity.	The Developer and Engineer	Prior to the commencement of the construction phase.	ECO
13.	Hazardous substances	Impact on soil and water.	<p>Objective: Secure safety, to avoid soil and water contamination</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Procedures detailed in the Materials Safety Data Sheets (MSDS) shall be followed in the event of an emergency situation. 2) Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Engineer. 3) An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage shall be compiled and implemented. This shall include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems. 4) Shutter oil and curing compound shall be stored and dispensed within a bunded area, and not located closer than 32 m from river banks / water courses / drainage lines. 5) Hazardous wastes e.g. mixed cement shall only be disposed at landfill sites registered 	<p>Correct handling, use and storage of materials, including hazardous materials. MSDS are available for all hazardous substances stored on site.</p> <p>Appropriate hazardous waste spill kits are available on site.</p>	Contractor monitored by the ECO	During Construction Phase (from site establishment to Contract Completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>for hazardous wastes.</p> <p>6) All waste hazardous materials must be carefully stored as advised by the ECO, and then disposed of at a licensed landfill site.</p> <p>7) All necessary precaution measures shall be taken to prevent soil or surface water pollution from hazardous materials used during construction.</p> <p>8) No hazardous waste may be buried or burned under any circumstances.</p> <p>9) The Material Safety Data Sheet (MSDS) for any hazardous materials must be kept on site at all times.</p> <p>10) The contractor must ensure that the employees are informed on how to responsibly dispose of any containers containing hazardous substances.</p> <p>11) All major spills of any materials, chemicals, fuels or other potentially hazardous or pollutant substances must be cleaned immediately and the cause of the spill investigated.</p> <p>12) Preventative measures must be identified and submitted to the ECO.</p>				
14.	Solid waste management	The incorrect management of solid waste can result in the pollution of soil, groundwater and the general environment. Windblown litter can also contribute	<p>Objective: To avoid soil and water contamination as well as windblown litter.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Provide adequate waste bins. 2) Set up system for regular waste removal to an approved facility. 3) Minimise waste by sorting wastes into recyclable and non-recyclable wastes (an independent contractor can be appointed to conduct this recycling if practical). 	<p>No complaints from public.</p> <p>No windblown litter.</p> <p>No contamination of soil and or water.</p> <p>No deceased animals due to windblown litter</p>	Contractor, ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		to a negative visual impact. Windblown litter consumed by grazing animals can result in fatality.	<ol style="list-style-type: none"> 4) No waste may be buried or burned under any circumstances. 5) An approved waste disposal contractor must be employed to remove and recycle waste oil, if practical. 6) A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site. 7) Littering by the employees shall not be allowed under any circumstances. 8) The ECO shall monitor the neatness of the work sites as well as the Contractor campsite. 9) Skip waste containers should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly to prevent vermin and odours. 10) A certificate of disposal by shall be obtained the Contractor and kept on file, if relevant. 	<p>consumed.</p> <p>Certificate of disposal at approved waste site are available.</p> <p>MSDS are available for all hazardous substances stored on site.</p> <p>Appropriate hazardous waste spill kits are available on site.</p>			

4.6 CEMP Table 2: Establishment of the construction camp

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Demarcate the construction camp	Without properly demarcating the site, the surrounding vegetation might be impacted on through trampling, compaction of the soil etc. Windblown	<p>Objective: Prevent construction activities from impacting on surrounding vegetation.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The ECO and Engineer shall be advised of the area that the Contractor intends using for the Construction Camp. 2) All Construction Camps are to be fenced off in such a manner that unlawful entry is 	Temporary or permanent fencing in place.	Contractor	Prior to the commencement of site clearance.	ECO, Engineer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		litter might also become problematic	<p>prevented.</p> <p>3) Any windblown litter must be removed on a regular basis.</p> <p>4) Signage shall be placed at all access points in compliance with all applicable occupational health and safety requirements.</p>				
2.	Stockpiling of equipment and materials	Storing materials wrongly can result in water and soil contamination, dust and or erosion.	<p>Objective: Ensure that all materials and equipment stored do not cause environmental degradation.</p> <p>Mechanism:</p> <p>1) The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of materials.</p> <p>2) All construction equipment must be stored within this construction camp.</p> <p>3) Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected.</p> <p>4) Impervious surfaces must be provided where necessary.</p>	No public complaints	Contractor and ECO	During Construction Phase (from site establishment to Contract Completion).	ECO, Engineer
3.	Storage and handling of materials	The incorrect storage and handling of materials pose a risk of environmental contamination and could jeopardise the safety of public/site staff.	<p>Objective: To ensure that materials are handled and stored in a manner that environmental contamination and safety hazards are limited.</p> <p>Mechanism:</p> <p>1) Educate employees regarding specification requirements of the materials they handle.</p> <p>2) Secure materials during transport.</p> <p>3) Identify appropriate storage areas for stockpiling of materials, storage of hydrocarbons and storage of hazardous substances and ensure that these areas are</p>	<p>Correct handling, use and storage of materials, including hazardous materials.</p> <p>No incidents of environmental contamination.</p> <p>No accidents or incidents related to the handling of materials.</p>	Contractor monitored by the ECO	During Construction Phase (from site establishment to Contract Completion).	ECO, Engineer, Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>appropriately prepared for their purpose.</p> <p>4) Storage of materials must take into consideration the prevailing wind directions to reduce windblown dust.</p> <p>5) Prevent and limit spillage of hazardous substances or substances with the potential to cause contamination of the environment.</p> <p>6) Develop emergency protocols for dealing with spillages particularly where these pose a pollution risk or involve hazardous substances.</p> <p>7) All oil changes must take place within a designated area on an impervious surface such as a concrete slab.</p> <p>8) Contaminated runoff from the construction site should be prevented from entering freshwater systems.</p> <p>9) Containers that contained toxic or harmful materials shall not be rinsed and re-used.</p> <p>10) Such containers shall not be stored or disposed on site. These containers shall be destroyed to prevent re-use and disposed in accordance with the manufacturer's instructions at a permitted waste disposal facility.</p> <p>11) Proper storage facilities which are bunded for the storage of oils, paints, grease, fuels, chemicals, and any hazardous materials to be used must be provided to prevent the soil and groundwater contamination.</p> <p>12) The wall of the bunded area shall be of earth or concrete, and shall be designed to be liquid tight and to withstand a full hydrostatic head of water. The volumetric capacity of the bunded area will be a minimum of 110%</p>	No public complaints.			

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>of the volume of the largest tank. Should more than one tank be enclosed in the bunded area, then the capacity should be calculated on the volume of all the tanks stored within the bunded area.</p> <p>13) All fuel storage area must be roofed to avoid creation of dirty stormwater.</p> <p>14) Storage areas containing hazardous substances / materials must be clearly signposted.</p> <p>15) The concrete batching plant must be contained within a bunded area.</p> <p>16) Concrete mixing must only take place within designated areas.</p> <p>17) Ready mixed concrete must be utilised where possible.</p> <p>18) No stockpiling shall occur outside of the working area or within drainage channels.</p>				
4.	Ablution facility, recess area	The lack of adequate ablution facilities and recess areas can compromise the health of site staff and result in environmental degradation.	<p>Objective: To minimise the potential environmental impacts associated with an influx of site staff.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The contractor shall establish a sufficient recess area within the construction camp. 2) The recess area should include a food preparation area with adequate washing facilities and bins. 3) The Contractor and Engineer shall ensure that the recess area and ablution facilities are positioned so as to limit visual intrusion on neighbours or the greater environment. 4) No littering may take place. 5) A sufficient number of chemical toilets shall be provided by the Contractor in the 	Adequate ablution facilities are in place.	Contractor, Engineer and ECO	Prior to construction.	ECO, Engineer, Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>construction camp area and at appropriate locations approved by the Engineer.</p> <p>6) Temporary/ portable toilets shall not be located within 100m of the drainage channels located on site or along the road reserve.</p> <p>7) The ratio of ablution facilities for workers should not be less than that required by the Construction Regulations of 2003 of the Occupational Health and Safety Act.</p> <p>8) All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.</p>				

4.7 CEMP Table 3: Clearing of the site

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Demarcating the site to be cleared	Without properly demarcating the area to be cleared of vegetation might result in unnecessary vegetation removal. The surrounding vegetation might also be impacted on through trampling, compaction of the soil and clearing etc.	<p>Objective: To keep the area to be cleared of vegetation to a minimum and avoid unnecessary impacts to surrounding vegetation.</p> <p>Mechanism:</p> <p>1) The site must be clearly demarcated with fencing or orange construction barrier to keep clearing activities to a minimum.</p> <p>2) No site staff is to be allowed in the area outside of the demarcated area to prevent trampling of surrounding vegetation.</p>	Only the area required for the construction of the PV site are cleared	Contractor and ECO	Prior to construction	ECO
2.	No-Go areas No-Go areas are	Without No-Go areas the free	Objective: Manage on site biophysical	Comprehensive record, including	Engineer and	During Construction	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
	those areas which have been designated by specialists as sensitive environments which need to be conserved.	moving of site staff could result in impacts to the sensitive areas.	<p>components to ensure ecological health.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) All areas outside of the designated construction footprint shall be declared a “No-Go” area. 2) No equipment shall be allowed outside the site and defined access routes, or within “no-go” areas, unless expressly permitted by the Engineer. 3) The ECO and Engineer must establish a penalty system to manage any non-compliance. 4) The ECO must keep record of any non-compliance. 	photographic record, of compliance available.	ECO	Phase (from site establishment to Contract Completion).	
3.	Removal of vegetation	By not limiting the removal of vegetation to a minimum can result in the destruction or loss of sensitive areas which could include indigenous vegetation, fauna, aquatic ecosystems or heritage resources.	<p>Objective: To ensure that disturbance to sensitive areas or artefacts is minimised and minimise the extent of areas cleared</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) The entire site shall not be cleared at one time but shall be cleared as required. 2) The top 300mm of the soil layer shall be stockpiled for rehabilitation purposes. The topsoil stockpiles need to be protected against erosion, contamination and the establishment of alien vegetation. 3) Topsoil shall be stored in areas demarcated by the ECO and Engineer and stockpiles shall not exceed 2m in height. 4) If heavy rains are expected activities should be put on hold to reduce the risk of erosion. 5) Wind screening should be undertaken to 	<p>Limited extent of vegetation destroyed during construction activities.</p> <p>No topsoil contaminated.</p>	Contractor and ECO	During the start of the construction period.	ECO

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		<p>prevent soil loss from the site.</p> <p>6) Rehabilitation of completed sections with appropriate local indigenous vegetation shall start immediately and bare soil shall be covered by straw as protection against wind while vegetation re-establishes (or as required by the rehabilitation specialist).</p> <p>7) Soil remaining after construction and rehabilitation activities has been completed, shall be dispersed evenly, as a very thin layer of soil.</p> <p>8) Once construction is complete, disturbed areas shall be rehabilitated and maintained with appropriate local indigenous vegetation.</p>				

4.8 CEMP Table 4: Construction of the PV panels and associated infrastructures

ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	<p>Excavations for foundation structures and potential pipeline</p> <p>In order to anchor the PV panels excavations will be required which might impact on the environment.</p> <p>A pipeline might be required depending on the source of water opted for. In order to construct the pipeline excavations will be required which</p>	<p>Objective: To limit the impact to the environment caused by excavations.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Any surplus materials from excavations that cannot be used on site during the construction phase must be disposed of in an environmentally sound manner. 2) Materials may be used in local construction activities. 3) The ECO must be informed if historical artefacts are found on the surface or exposed by excavations. 4) Trenches shall be appropriately demarcated and regularly monitored during operations to 	No heaps of materials left on site after the construction phase.	Contractor, ECO	During Construction Phase (from site establishment to Contract Completion)	ECO

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		might impact on the environment	ensure that pedestrian (and vehicular) access to these areas is strictly prohibited.				
2.	Construction of transmission lines	Transmission lines might result in negative environmental impacts	<p>Objective: To construct the transmission lines whilst limiting environmental impacts</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Demarcate the area proposed for transmission line construction in order to prevent site staff from damaging nearby vegetation. 2) All new powerlines should be adequately insulated and marked with bird flight diverters along their entire length. 	<p>No damage to vegetation adjacent to area proposed for transmission line construction.</p> <p>No significance changes are recorded in the number, distribution or breeding behaviour of priority avifauna species (bird monitoring programme).</p>	Contractor	During Construction Phase	ECO

4.9 CEMP Table 5: Removal of construction related debris, materials or equipment

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Removal of equipment, materials and any temporary structures	If the construction camp is not decommissioned it can result in environmental degradation.	<p>Objective: To rehabilitate the impacted area to an acceptable state as close to the original state.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) All construction related structures are to be removed from site. 2) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc., and these shall be cleaned up. 3) All hardened surfaces within the construction 	The area impacted by the construction activities are rehabilitated and pose no threats to the environment.	Contractor, Engineer and ECO	After the construction phase, before the operational phase can commence.	

	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>camp area should be ripped and rehabilitated.</p> <p>4) Surfaces are to be checked for waste products from activities such as concreting and cleared in a manner approved by the Engineer.</p> <p>5) All rubble is to be removed from the site to an approved disposal site as approved by the Engineer.</p> <p>6) Burying of rubble on site is prohibited.</p> <p>7) Temporary fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Engineer.</p> <p>8) All residual stockpiles must be removed or spread into a thin even layer over the disturbed area.</p> <p>9) The Contractor must repair any damage that the construction works has caused to neighbouring properties.</p> <p>10) Rehabilitate and re-vegetate cleared areas with indigenous plant species.</p>				

4.10 Temporary site closure

If the site is closed for a period exceeding one week, the contractor, in consultation with the Engineer shall carry out the following checklist procedure.

Hazardous materials stores

- Outlet secure/ locked
- Bund empty (where applicable)
- Fire extinguishers serviced and accessible
- Secure area from accidental damage e.g. vehicle collision
- Emergency and contact details displayed
- Adequate ventilation

Safety

- All trenches and manholes secured
- Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1193)
- Emergency and Management contact details displayed
- Stockpiles wedged/ secured

Erosion

- Wind and dust mitigation in place
- Slopes and stockpiles at stable angle

Water contamination and pollution

- Cement/bitumen and materials stores secured
- Toilets empty and secured
- Refuse bins empty and secured
- Structures vulnerable to high winds secure.

4.11 Penalties

Penalties will be issued for the transgressions listed below. Penalties may be issued per incident at the discretion of the Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications. The Engineer will inform the Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract. A penalty register shall be kept and shall be made available to the DEA on request.

Penalties for the activities detailed below, will be imposed by the Engineer on the Contractor:

- a) Any employees, vehicles, plant, or item related to the Contractor's R10 000 operations operating within the designated boundaries of a "no-go" area.
- b) Any mechanised excavation equipment related to the Contractor's R10 000 operations operating within the designated boundaries of a "no-go" area

abutting the two streams.

c)	Any vehicle driving in excess of designated speed limits.	R 1 000
d)	Persistent and un-repaired oil leaks from machinery.	R 3 000
e)	Persistent failure to monitor and empty drip trays timeously.	R 1 000
f)	Litter on site associated with construction activities.	R 1 000
g)	Deliberate lighting of illegal fires on site.	R 5 000
h)	Employees not making use of the site ablution facilities.	R 2 000
i)	Failure to implement specified noise controls	R 2 000
j)	Failure to empty waste bins on a regular basis.	R 1 000
k)	Inadequate dust control.	R 5 000
l)	A spillage, pollution, fire resulting from negligence on the part of the Contractor.	R10 000
m)	Any act, that in the reasonable opinion of the Engineer, constitutes a deliberate contravention of the requirements of these Specifications	R 5 000

For each subsequent similar offence the penalty shall be doubled in value to a maximum value of R 50 000.

4.12 Amendments to CEMP & Registers

Amendments to the CEMP must be submitted to and approved by the DEA before the changes are commenced with.

Furthermore, copies of the attendance registers for all environmental awareness training, complaints registers, penalty registers and method statements must be kept and made available to the DEA on request.

5 OPERATIONAL FRAMEWORK EMP

This section contains the Operational Framework EMP. It is important to note that this Framework OEMP has been compiled prior to authorisation of the proposed project and will be updated to include the conditions of the EA that will be issued by DEA as part of the EA.

The information is summarised in tabular format below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

Definitions:

The following components are identified/ described:

- Activity: component / activity of the project for which the impact has been identified;
- Aspect: the aspect of the above activity which will be impacted;
- Impact: the environmental impact identified and to be mitigated;
- Mitigation measure: measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - Objective: desired outcome of mitigation measure,
 - Mechanism: method of achieving the objective;
- Performance indicators: outcomes that will indicate achievement of objective/s;
- Responsibility: party or parties identified for implementation of mitigation measure/s;
- Resources: available resources to aid implementation of mitigation;
- Schedule: timeframe in which identified impact and mitigation measure is anticipated to occur; and
- Verification: party or parties identified as responsible for review and assessment of final outcome.

5.1 OEMP Table 1

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Environmental management documentation and procedures	No framework within which to locate the management of the operational phase. No procedures against which to assess environmental performance during the operational phase and thus no measure of compliance.	Objective: To ensure that the operation of the solar energy facility does not result in avoidable impacts on the environment, and that any impacts that do occur are anticipated and managed. Mechanism: 1) Appoint a suitably qualified ECO to monitor compliance (either independent or in-house) and conduct the environmental audit. 2) Audit the compliance with the requirements of the environmental specification contained within the OEMP.	Environmental impacts effectively monitored and managed during the operational phase. Comprehensive record of compliance and remedial actions available to Mulilo and the authorities	The Developer	Twice in the 1 st three years and then once every five years	The Developer
2.	Environmental management of the operational phase	Positive impacts on socio-economic environment during operation	Objective: To ensure that the operation of the solar energy facility maximises positive impacts on the socio-economic environment. Mechanism: 2) Train local people for operation and maintenance of facility. 3) Employ local labour for the operational phase, where possible, and particularly for day to day operations and maintenance.	Consult annual skills and training records, employment records and proof of staff residency in the area prior to employment.	The Developer	During Operational Phase (full lifetime) when the need arise to employ people.	DEA The Developer
3.	Protection of fauna, flora and avifauna	Constructing a PV facility may have impacts on the vegetation. The site will be cleared of all vegetation and this area could become prone to alien species.	Objective: To prevent unnecessary disturbance to natural vegetation. Mechanism: 1) The rehabilitation plan for the site should be implemented and adhered to during the operational phase. 2) An on-going monitoring programme should be implemented to detect and quantify any	No animals are injured. No employees enter the no-go areas. No alien vegetation establishment.	The Developer	During the construction phase (from site establishment to contract completion).	The Developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			<p>aliens that may become established and provide information</p> <p>3) Minimizing noise and disturbance associated with maintenance activities at the plant once it becomes operational for the management of aliens.</p> <p>4) The small ground level openings in the electrical fence, 20-30 cm in height, should be kept clear to allow for small mammals and reptiles to move through the site.</p> <p>5) Minimising the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds.</p> <p>6) New aboveground lines should be fitted with bird flight diverters and marked along their entire length. High risk areas identified during the avifauna monitoring assessment shall be fitted at all times with bird flight diverters. .</p>	Invasive alien vegetation monitoring programme implemented.			
4.	Stormwater runoff, erosion, and pollution of surface water and groundwater resources.	Contamination of stormwater runoff can impact on the surface and groundwater resources. The mismanagement of stormwater can furthermore result in erosion.	<p>Objective: Prevent stormwater from eroding the land and becoming contaminated.</p> <p>Mechanism:</p> <p>1) Disturbed areas should be monitored and kept free of invasive alien plant growth.</p> <p>2) Storm water runoff from the constructed areas should be monitored to ensure that eroded areas do not develop, particularly within the drainage channels.</p> <p>3) Should soil chemistry be affected (this is likely to be an increase in salinity), the nature of the washing mixture could be changed, or acceptable waste treatment employed;</p>	<p>Stormwater not contaminated by construction activities.</p> <p>Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop.</p> <p>Freshwater ecosystems are not unduly disturbed by construction activities</p>	Contractor	After site clearing has taken place up to the end of the construction phase.	Developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			4) Install composting toilets that does not require water, septic tanks or soak-aways; 5) Disturbed areas within the riparian zones and stream beds should be rehabilitated as soon as possible after construction has been completed and revegetated with suitable indigenous vegetation.	within the drainage channels.			
5.	Visual impact	The proposed site is visible to the public and a construction site might have a negative visual impact on the sense of place.	Objective: To protect the sense of place. Mechanism: 1) All lighting is to be kept to a minimum, within the requirements of safety and efficiency. 2) Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, should be used. 3) No naked light sources are to be directly visible from a distance. Only reflected light should be visible from outside the site. 4) Any necessary aircraft warning lights are to be installed as per the relevant authority requirements. 5) External lighting must use down-lighters shielded in such a way as to minimise light spillage and pollution beyond the extent of the area that needs to be lit. 6) Security and perimeter lighting must also be shielded so that no light falls outside the area needing to be lit. Unnecessarily tall light poles are to be avoided.	No complaints from the public.	Engineer and Contractor	During the construction phase (from site establishment to contract completion).	Developer
6.	Impacts on local economy (employment) and social conditions	The activity might impact on the economy (local shops, restaurants, and Guest Houses,	Objective: To ensure on-going sustainability of the local tourism / hospitality industry. Mechanism: 1) It is recommended that the local employment policy as stated by the proponent is	Contribute to local community upliftment	Contractor, Engineer	During the construction phase (from site establishment to contract	Developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		etc.)	<p>implemented, audited and accompanied by a training programme. The policy must be based on a 'local's first' policy, specifically for low skilled jobs and should aim to recruit at least 20% of the jobs from the local community. This should also apply to all contracting firms.</p> <p>2) It is recommended that the developer adopts a local procurement policy which would maximise the benefit to the local economy and minimise leakage.</p>			completion).	

6 MONITORING PROGRAMMES

6.1 Avifaunal Monitoring Programme

The primary aims of monitoring work would be to:

- Determine the densities of birds resident within the impact area of the solar power plant before construction of the plant, and afterwards, once the plant, or phases of the plant, become operational.
- Register and as far as possible document the circumstances surrounding all avian mortalities associated with the ancillary infrastructure of the solar plant for at least six months after the plant becomes operational.
- Register and as far as possible document the circumstances surrounding all other avian interactions with the solar arrays of the solar power plant for at least six months after the plant becomes operational.

Bird density and activity monitoring should focus on rare and/or endemic, potentially disturbance or collision prone species, which occur with some regularity in the area. Ultimately, the study should provide much needed quantitative information on the effects of the solar power plant on the distribution and abundance of birds, and the actual risk it poses to the local avifauna, and serve to inform and improve mitigation measures to reduce this risk.

6.1.1 Monitoring protocols: Avian densities before and after

A set of at least 10 walk-transect routes, each of at least 20 minutes in duration or 750 m in length, should be established in areas representative of all the avian habitats present within and around the periphery of the Du Plessis PV site. Each of these should be walked at least once every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the PV plant is commissioned. The transects should be walked after 06h00 and before 09h00 in summer, and after 07h00 and before 12h00 in winter, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison.

6.1.2 Monitoring protocols: collisions and fouling

The area within 5 m on either side of any new lengths of power line, should be checked regularly for bird casualties (Anderson *et al.* 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates. All suspected mortality incidents should be comprehensively documented, detailing the apparent cause of death, precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labeled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each bird should be contained in a suitably-sized cardboard box, and the local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre.

These post-construction surveys should also include detailing (location, extent, size, number) of all bird products (e.g. faeces, pellets, nest structures etc) found on and around the solar panels.

6.1.3 Results of first monitoring iteration

Seventeen walk transects were established within ($n = 9$) and outside ($n = 5$) of the proposed development area (Fig. 4), and surveys of small terrestrial bird densities were measured along each of these transect lines as per the stipulated protocols (Table 4, Appendix 2). In combination with the data obtained in two further site visits, these initial density estimates will establish a baseline against which to estimate the numbers of Karoo endemic passerines displaced by the development, and to monitor the effect of the built and operational PV plants on the density and community structure of surrounding passerine populations. Other results of the first monitoring iteration are integrated into this EIA report.

7 EROSION MANAGEMENT PLAN

7.1 Soil Erosion Monitoring

Soil erosion will need to be monitored visually by the appointed Environmental Control Officer (ECO):

- It is recommended that areas around roads, stockpiles and PV panels are visually monitored during audits.
- A photographic record of the on-site conditions will also aid in the identification of erosion problems.
- Signs of rill and gully erosion should be remediated as soon as possible. Typical remediation techniques are provided below.

7.2 Soil Erosion Mitigation Measures

- Clearing activities should be kept to a minimum and must only be undertaken during agreed working times, as well as permitted weather conditions. If heavy rains are expected clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- The further unnecessary removal of groundcover vegetation from slopes must be prevented, especially on steep slopes. Following the clearing of an area, the surfaces of all exposed slopes must be roughened to retain water and increase infiltration (especially important during the wet season). Any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures or vegetated. A fascine structure usually consists of natural wood material and is used for the strengthening earthen structures or embankments.
- If a cleared area is not going to be built on immediately, the top layer (nominally 150 mm) of soil should be removed and stockpiled in a designated area approved by the ECO. Vegetation shall be stripped in a sequential manner as the work proceeds so as to reduce the time that stripped areas are exposed to the elements. Top-soiling and re-vegetation shall start immediately after the completion of an activity and at an agreed distance behind any particular work front.
- It is highly recommended that existing farm roads are used as much as possible, while the additional creation of access roads should be kept to a minimum.
- Storm water control and wind screening should be undertaken to prevent soil loss from the site. All embankments shall be protected by a cut off drain to prevent water from running down the face of the embankment, resulting in soil erosion. Typical erosion control measures such as the installation of silt fences, hay bales, EcoLogs™ and Bio Jute™ are recommended if erosion problems are noted during construction and operation phases.

7.3 Groundwater and Soil Contamination Mitigation Measures

Every precaution must be taken to ensure that chemicals and hazardous substances do not contaminate the soil or groundwater on site. For this purpose the Contractor must:

- Ensure that the mixing /decanting of all chemicals and hazardous materials should take place on a tray or impermeable surface.
- Dispose of any generated waste at a registered landfill site.
- Ensure all storage tanks are designed and managed in order to prevent pollution of drains, groundwater and soils.
- Construct separate storm water collection areas and interceptors at storage tanks, and other associated potential pollution activities.
- Ensure the control of fuels and chemicals in order to prevent spillage and potential ground leaching. Adequate spillage containment measures shall be implemented, such as cut off drains, etc. Fuel and chemical storage containers shall be set on a concrete plinth. The containment capacity shall be equal to the full amount of material stored, plus 10%.
- Appoint appropriate contractors to remove any residue from spillages from site. Handling, storage and disposal of excess or containers of potentially hazardous materials shall be in accordance with the requirements of pertinent Regulations and Acts (e.g. Hazardous Substances Act, Number 15 of 1973; National Water Act, Number 36 of 1998).
- Ensure that used oils/lubricants are not disposed of on/near the site, and that contractors purchasing these materials understand the liability under which they must operate. The ECO will be responsible for reporting the storage/use of any other potentially harmful materials to the relevant authority.
- Ensure that potentially harmful materials are properly stored in a dry, secure environment, with concrete or sealed flooring. The ECO will ensure that materials storage facilities are cleaned/ maintained on a regular basis, and that leaking containers are disposed of in a manner that allows no spillage onto the bare soil or surface water. The management of such storage facilities and means of securing them shall be agreed upon.
- Site staff shall not be permitted to use any stream, river, other open water body or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing or for any other construction or related activities. Municipal water or another source approved by the ECO should rather be used for all activities such as washing of equipment, dust suppression, concrete mixing and compacting.

7.4 Stockpile Management

- Stockpiles should be situated in an area that should not obstruct the natural water pathways on site.
- Topsoil stockpiles will be kept separate from other stockpiles, shall not be compacted, and shall not exceed 2m in height.
- If exposed to windy conditions or heavy rain, stockpiles should be protected by re-vegetation using an indigenous grass seed mix or cloth, depending on the duration of the project. The construction of a berm consisting of sand bags, or a low brick wall, can be placed around the base of the stockpile for retention purposes.
- Stockpiles should be weeded regularly to ensure they are kept free of alien vegetation, and shall be kept free of any contaminants whatsoever, including paints, building rubble, cement, chemicals, oil, etc.

- Subsoil and topsoil stockpiles will be moved to areas of final utilisation as soon as possible to avoid unnecessary erosion.
- Stockpiles not utilized within three months of the initial stripping process (or prior to the onset of seasonal rains) will be seeded with appropriate grass seed mixes, including indigenous grasses to further avoid possible erosion.

7.5 Land Rehabilitation

- All rubble is to be removed from the site to an approved landfill site as per the construction phase requirements. No remaining rubble is to be buried on site.
- The site is to be free of litter, and surfaces are to be checked and cleared of waste products resulting from activities such as concreting or asphaltting.
- After construction the land will need to be rehabilitated, which includes a re-vegetation plan. It is recommended that more palatable species are planted to enable the faster stocking initiation.

8 DECOMMISSIONING

The Power Purchase Agreement for the Du Plessis dam PV facility is only valid for a period of 20 years after which the plant would most likely be decommissioned and the site rehabilitated. Should the PV plant be decommissioned, materials and infrastructure that could not be recycled would need to be disposed of at an approved landfill site. Infrastructure should be removed and disturbed areas rehabilitated in accordance to the specifications of a suitably qualified rehabilitation specialist during decommissioning.

Since the proposed PV plant comprises of inert materials (mostly concrete), the residual risks associated with decommissioning would be negligible. Should the need arise to decommission the PV plant a decision would need to be made as to whether the infrastructure would be removed or left *in situ*. Roads which are no longer required after decommissioning should be scarified and the areas rehabilitated with the assistance of a rehabilitation specialist.

Materials will be recycled where appropriate, and any hazardous substances shall be removed and disposed of in terms of the requirements of the relevant legislation (e.g. Hazardous Substances Act, No. 15 of 1973) and SANS specifications.

A detailed decommissioning plan will be developed approximately 24 months before closure of the facilities. The construction phase EMP could be used as a guideline to facilitate the detailed decommission phase EMP. Mitigation measures below are only provisional mitigation measures.

- All PV structures, associated structures and fencing should be removed and recycled.
- Internal roads should be ripped and then rehabilitated.
- All impacted footprint areas should be rehabilitated and restored to indigenous, endemic vegetation.

9 CONCLUSION

In conclusion it should be noted that the LEMP should be regarded as a living document and changes should be made to the LEMP as required by project evolution, while retaining the underlying principles and objectives on which the document is based.

The compilation of the LEMP has incorporated impacts and mitigation measures from the EIAR as well as incorporating principles of best practice in terms of environmental management. By identifying the potential impacts, mitigation measures, performance indicators, responsibilities, available resources, potential schedule and verification responsibility, the LEMP has provided a platform on which both the construction phase and the operational phase EMPs can be founded. The LEMP has ensured that the individual EMPs will be able to incorporate mitigation measures based on the project in its entirety as opposed to phase-specific measures.

APPENDIX A
CURRICULUM VITAE OF ENVIRONMENTAL
ASSESSMENT PRACTITIONERS

See Annexure C of the EIA Report

ANNEXURE B

STORMWATER MANAGEMENT PLAN

See Annexure E of the EIA Report

APPENDIX C
CONSTRUCTION EMP GENERAL SPECIFICATIONS
(COMPREHENSIVE)

SPECIFICATION EM : ENVIRONMENTAL MANAGEMENT (COMPREHENSIVE)

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SPECIFICATION EM : ENVIRONMENTAL MANAGEMENT (COMPREHENSIVE)

1. SCOPE

This Specification covers the requirements for controlling the impact of construction activities on the environment. It contains clauses that are generally applicable to the undertaking of civil engineering works in areas where it is necessary to impose pro-active controls on the extent to which the construction activities impact on the environment.

Interpretations and variations of this Specification are set out in the Specification Data.

2. NORMATIVE REFERENCES

2.1 Supporting specifications

Where this Specification is required for a project the following specifications shall, inter alia, form part of the Contract Document.

- a) Specification Data;
- b) SANS 1200 Series of Standardized Specifications;
 - i) SANS 1200 A or SANS 1200 AA, as applicable;
- c) Specification AO,
- d) Construction Regulations, 2003, and
- e) Standards listed in Appendix A.¹

3. DEFINITIONS

For the purposes of this Specification the definitions and abbreviations given in the applicable specifications listed in 2.1 and the following definitions shall apply:

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.

Potentially hazardous Substance : A substance that, in the reasonable opinion of the Engineer, can have a deleterious effect on the environment.

Method Statement : A written submission by the Contractor to the Engineer in response to the Specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting the Method Statement, in such detail that the Engineer is enabled to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.

¹ See Appendix A

The Method Statement shall cover applicable details with regard to:

construction procedures,
materials and equipment to be used,
transportation of equipment/materials to and from site,
movement of equipment/material on site,
storage of materials on site,
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,
areas of non-compliance with the Specifications, and
any other information deemed necessary by the Engineer.

- Reasonable** : Unless the context indicates otherwise, reasonable in the opinion of the Engineer after he has consulted with a person, not an employee of the Employer, suitably experienced in "environmental implementation plans" and "environmental management plans" (both as defined in Act No 107,1998).
- Solid waste** : All solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).
- Contaminated water** : Water contaminated by the Contractor's activities, e.g. concrete water and runoff from plant/ personnel wash areas.
- Topmaterial** : The top 150 mm of soil (topsoil) and root material of cleared vegetation.

4. REQUIREMENTS

4.1 Materials

4.1.1 Materials handling, use and storage

The Contractor shall ensure that any delivery drivers are informed of all procedures and restrictions (including "no go" areas) required to comply with the Specifications. The Contractor shall ensure that these delivery drivers are supervised during off loading, by someone with an adequate understanding of the requirements of the Specifications.

Materials shall be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to sand, stone chips, fine vegetation, refuse, paper and cement, shall have appropriate cover to prevent them spilling from the vehicle during transit. The Contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.

4.1.2 Hazardous substances

Procedures detailed in the Material Safety Data Sheets (MSDSs) shall be followed in the event of an emergency situation.

Petroleum, chemicals, harmful and hazardous waste shall be stored in an enclosed and banded area. This area shall be subject to the approval of the Engineer. The waste shall be disposed of at a hazardous waste disposal site as approved by the Engineer.

4.1.2.1 Shutter oil and curing compound

Shutter oil and curing compound pose a risk of causing water and soil contamination and accordingly are regarded as potential hazardous substances. The Contractor shall ensure that shutter oil and curing compound containers in use are stored within the fuel bund. The remaining containers shall be inspected regularly to ensure that no leakage occurs. When shutter oil or curing compound is dispensed, the proper dispensing equipment shall be used, and the storage container shall not be tipped in order to dispense the oil/compound. The dispensing mechanism of the shutter oil/curing compound storage container shall be stored in a waterproof container when not in use.

Shutter oil and curing shall be used in moderation and shall be applied under controlled conditions using appropriate equipment. The Contractor shall take all reasonable precautions to prevent accidental and incidental spillage during the application of these compounds.

In the event of a shutter oil or curing compound spill, the source of the spillage shall be isolated, and the spillage contained. The Contractor shall clean up the spill, either by removing the contaminated soil or by the application of absorbent material in the event of a larger spill. Treatment and remediation of the spill area shall be undertaken to the reasonable satisfaction of the Engineer.

4.1.2.2 Bitumen

The Engineer shall be advised of the area that the Contractor intends using for the storage of bitumen drums/ products. The storage area shall have a smooth impermeable (concrete or 250 µm plastic covered in sand) floor. The floor shall be banded and sloped towards a sump to contain any spillages of substances. The bund shall be inspected and emptied daily, and serviced when necessary. The bund shall be closely monitored during rain events to ensure that it does not overflow.

4.2 Plant

4.2.1 Ablution facilities

The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are properly stored and removed from Site. Discharge of waste from toilets into the environment and burial of waste is strictly prohibited.

Washing, whether of the person or of personal effects and acts of excretion and urination are strictly prohibited other than at the facilities provided.

4.2.2 Solid waste management

The Contractor shall provide sufficient bins with lids on Site to store the solid waste produced on a daily basis. Solid, non-hazardous waste shall be disposed of in the bins provided and no on-site burying, dumping or burning of any waste materials, vegetation, litter or refuse shall occur. Bins shall not be allowed to become overfull and shall be emptied a minimum of once daily. The waste may be temporarily stored on Site in a central waste area that is weatherproof and scavenger-proof, and which the Engineer has approved.

All solid waste shall be disposed of off site at an approved landfill site. The Contractor shall supply the Engineer with a certificate of disposal.

4.2.3 Contaminated water

The Contractor shall set up a contaminated water management system, which shall include collection facilities to be used to prevent pollution, as well as suitable methods of disposal of contaminated water. The Contractor shall prevent the discharge of water contaminated with any pollutants, such as soaps, detergent, cements, concrete, lime, chemicals, glues, solvents, paints and fuels, into the environment.

The Contractor shall notify the Engineer immediately of any pollution incidents on Site. The Engineer's approval is required prior to the discharge of contaminated water to the Municipal sewer system.

4.2.4 Site structures

All site establishment components (as well as equipment) shall be positioned to limit visual intrusion on neighbours and the size of area disturbed. The type and colour of roofing and cladding materials to the Contractor's temporary structures shall be selected to reduce reflection.

4.2.5 Noise control

The applicable regulations framed under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), and the provisions of SANS 1200 A Subclause 4.1 regarding "built-up areas" shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas.

Appropriate directional and intensity settings are to be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant such that the noise level in inhabited areas and dwellings adjacent to the work areas will not increase by more than 7 dB(A)Leq 60 above residual background sound levels. Similarly in habituated areas adjacent to access roads maximum noise levels shall not exceed 60 dB(A)Leq 60 and maximum sound pressure level of 70 dB(A).

Where excess noise generation is unavoidable, the Contractor shall, by means of barriers, effectively isolate the source of any such noise in order to comply with the said regulations. The Contractor shall restrict any of his operations that may result in undue noise disturbance to those communities and dwellings abutting the Site to the hours of 08:00 to 17:00 on weekdays and Saturdays. No work will be permitted on Sundays unless otherwise agreed to with the Engineer.

No amplified music shall be allowed on Site. The use of radios, tape recorders, compact disc players, television sets etc shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor shall not use sound amplification equipment on Site unless in emergency situations.

4.2.6 Lights

The Contractor shall ensure that any lighting installed on the site for his activities does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding community or other users of the area.

4.2.7 Fuel (petrol and diesel) and oil

Unless otherwise specified in the Specification Data, fuel may be stored on site in an area approved by the Engineer. The Contractor shall ensure that all liquid fuels (petrol and diesel) are stored in tanks with lids, which are kept firmly shut or in bowsers. The tanks/bowsers shall be situated on a smooth impermeable surface (concrete or 250 µm plastic) with an earth bund (plastic must have a 5 cm layer of sand on top to prevent damage and perishing). The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be 130% of the total capacity of all the storage tanks/ bowsers. The bunded area shall be covered to protect it from rain. Provision shall be made for refuelling at the fuel storage area, by protecting the soil with 250 µm plastic covered with a minimum of a 5 cm layer of sand.

If fuel is dispensed from 200 litre drums, only empty externally clean drums may be stored on the bare ground. All empty externally dirty drums shall be stored on an area where the ground has been protected. The proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage drum shall be stored in a waterproof container when not in use.

The Contractor shall prevent unauthorised access into the fuel storage area. No smoking shall be allowed within the vicinity of the fuel storage area. The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.

Where reasonably practical, plant shall be refuelled at the fuel storage area or at the workshop as applicable. If it is not reasonably practical then the surface under the refuelling area shall be protected against pollution to the reasonable satisfaction of the Engineer prior to any refuelling activities. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill. The Contractor shall obtain the Engineer's prior approval for any refuelling or maintenance activities.

4.2.8 Workshop, equipment maintenance and storage

Leaking equipment shall be repaired immediately or removed from the Site. Where practical, all maintenance of equipment and vehicles on Site shall be performed off Site or in the workshop. If it is necessary to do maintenance outside of the workshop area, the Contractor shall obtain the approval of the Engineer prior to commencing activities. The Contractor shall ensure that in his workshop and other plant maintenance facilities, including those areas where, after obtaining the Engineer's approval, the Contractor carries out emergency plant maintenance, there is no contamination of the soil or vegetation. The workshop shall have a smooth impermeable (concrete or 250 µm plastic covered with sand) floor. The floor shall be bunded and sloped towards an oil trap or sump to contain any spillages of substances (e.g. oil).

When servicing equipment on site, drip trays shall be used to collect the waste oil and other lubricants. Drip trays shall also be provided in construction areas for stationary plant (such as compressors) and for "parked" plant (such as scrapers, loaders, vehicles). Drip trays shall be inspected and emptied daily. Drip trays shall be closely monitored during rain events to ensure that they do not overflow. Where practical, the Contractor shall ensure that equipment is covered so that rainwater is excluded from the drip trays.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only. All washing shall be undertaken off Site or in the workshop. The use of detergents for washing shall be restricted to low phosphate and nitrate containing, low sudsing-type detergents.

4.2.9 Dust

The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer. The Contractor's dust management planning shall, as a minimum, take cognisance of the following:

- Schedule of spraying water on unpaved roads paying due attention to control of runoff.
- Speed limits for vehicles on unpaved roads and minimisation of haul distances.
- Measures to ensure that material loads are properly covered during transportation.
- Schedule for wheel cleaning and measures to clean up public roads that may be soiled by construction vehicles.
- Minimisation of the areas disturbed at any one time and protection of exposed soil against wind erosion, e.g. by dampening with water or covering with straw
- Location and treatment of material stockpiles taking into consideration prevailing wind directions and location of sensitive receptors.
- Controlled blasting techniques to minimise dust and fly rock during blasting.
- Adherence to the dust loads and protective gear stipulated in the Occupational Health and Safety Act.
- Reporting mechanism and action plan in case of excessive wind and dust conditions.

During summer, a water tanker shall be permanently available for the control of dust generation, and the Contractor shall ensure that the sprays do not generate excess run off. During winter, provision shall be made for a tanker, as required by the Engineer.

During high wind conditions, the Contractor shall comply with the Engineer's instructions regarding dust-dampening measures. The Engineer may request the temporary cessation of all construction activities where wind speeds are unacceptably high, and until such time as wind speeds return to acceptable levels.

As required by the Specification Data, the Contractors shall develop and implement a programme for the monitoring of dust fallout in areas where dust generation may be expected.

4.3 Methods and procedures

4.3.1 Method Statements

Any Method Statement required by this Specification, the Specification Data or the Engineer shall be produced within such reasonable time as is required by this Specification, the Specification Data or the Engineer. The Contractor shall not commence the activity until the Method Statement has been approved. Except in the case of emergency activities, the Contractor shall allow a period of two weeks for approval of the Method Statement by the Engineer. Such approval shall not unreasonably be withheld.

Method Statements in respect of environment management that shall be provided by the Contractor within 14 days of receipt of the letter of acceptance and prior to the activity covered by the Method Statement being undertaken, include:

- 1) Location and structure of the fuel storage site, including the type and volume of storage container and the design and capacity of the bund.

- 2) Solid waste (refuse) control and removal of waste from the Site, including the number, type and location of rubbish bins, the manner and frequency with which the waste will be removed from site and the disposal site.
- 3) Contaminated water management system, including an indication of the source and volume of contaminated water and how this would be disposed of.
- 4) Dust control, including methods to prevent dust generation and methods to reduce dust where its generation is unavoidable.
- 5) Location and layout of the construction camp in the form of a plan showing offices, stores for fuels and explosives, vehicle parking, access point, equipment cleaning areas and staff toilet placement.
- 6) Location of proposed site access routes and proposed traffic safety measures.
- 7) Emergency procedures for fire, and accidental leaks and spillages of hazardous materials.
- 8) Location, layout and preparation of cement/ concrete batching facilities including the methods employed for the mixing of concrete and the management of runoff water from such areas. An indication shall be given of how concrete spoil will be minimised and cleared.
- 9) Method of undertaking earthworks, including spoil management, erosion, dust and noise controls.
- 10) Motivation and method for undertaking any construction related activities within a "no-go" area, including requisite emergency procedures. Unless need clearly motivated and proposed methodology exhibits clear focus on environmentally sensitive construction practice, no activity will be permitted within the defined "no-go" areas.

4.3.2 Environmental awareness training

Within seven days of the Commencement Date, the Contractor's site staff including foremen and site management staff shall attend an environmental awareness training course, of approximately one-hour duration. The Contractor shall liaise with the Engineer prior to the Commencement Date to fix a date and venue for the course. The Contractor shall provide a suitable venue with facilities as required by the Specification Data, and ensure that the specified employees attend the course.

No more than 20 people shall attend each course and the Contractor shall allow for sufficient sessions to train all personnel. Subsequent sessions shall be run for any new personnel coming onto site.

The environmental awareness training course shall be held in the morning during normal working hours. Any new employees coming on to site after the initial training course and the Contractor's suppliers and subcontractors shall also attend the course. Provision should also be made for quarterly refreshers courses to be undertaken during the course of the Contract. The Contractor shall ensure that all attendees sign an attendance register, and shall provide the Engineer with a copy of the attendance register the day after each course.

4.3.3 Construction personnel information posters

The Contractor shall erect and maintain information posters for the information of his employees depicting actions to be taken to ensure compliance with aspects of the Specifications. Such posters will be supplied by the Engineer and shall be erected at a location specified by the Engineer.

4.3.4 Site clearance

The Contractor shall ensure that the clearance of vegetation is restricted to that required to facilitate the execution of the Works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be to the Engineer's approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.

The Contractor shall strip the Topmaterial within the working areas. The Topmaterial shall be stockpiled separately from subsoil and used for subsequent rehabilitation and revegetation. Topmaterial stockpiles shall not be compacted.

Should fauna be encountered during site clearance, earthworks shall cease until fauna have been safely relocated.

4.3.5 Site division

The Engineer shall be advised of the area that the Contractor intends using for his site establishment. The Contractor's camp shall occupy as small an area as possible, and no site establishment shall be allowed within 50 m of any watercourse unless otherwise approved by the Engineer.

The Contractor shall inform the Engineer of the intended actions and programme for site establishment. The site layout shall be planned to facilitate ready access for deliveries, facilitate future works and to curtail any disturbance or security implications for neighbours.

4.3.6 Site demarcation

As required by the Specification Data, the Contractor shall erect and maintain permanent and/or temporary fences of the type and in the locations directed by the Engineer. Such fences shall, if so specified, be erected before undertaking designated activities.

4.3.7 "No go" areas

If so required by the Specification Data, certain areas shall be considered "no go" areas. The Contractor shall ensure that, insofar as he has the authority, no unauthorised entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated "no go" areas.

"No go" areas shall be demarcated with fencing consisting of wooden or metal posts at 3 m centres with 1 plain wire strand tensioned horizontally at 900 mm from ground level. Commercially available danger tape shall be wrapped around the wire strand. The Contractor shall maintain the fence for the duration of construction and ensure that the danger tape does not become dislodged.

4.3.8 Protection of natural features

The Contractor shall not deface, paint, damage or mark any natural features (e.g. rock formations) situated in or around the Site for survey or other purposes unless agreed beforehand with the Engineer. Any features affected by the Contractor in contravention of this clause shall be restored/ rehabilitated to the satisfaction of the Engineer.

The Contractor shall not permit his employees to make use of any natural water sources (e.g. springs, streams, open water bodies) for the purposes of swimming, personal washing and the washing of machinery or clothes.

4.3.9 Protection of flora and fauna

Except to the extent necessary for the carrying out of the Works, flora shall not be removed, damaged or disturbed nor shall any vegetation be planted without authorisation.

Trapping, poisoning and/ or shooting of animals is strictly forbidden. No domestic pets or livestock are permitted on Site.

Where the use of herbicides, pesticides and other poisonous substances has been specified, they shall be stored, handled and applied with due regard to their potential harmful effects.

4.3.10 Protection of archaeological and palaeontological remains

The Contractor shall take reasonable precautions to prevent any person from removing or damaging any fossils, coins, articles of value or antiquity and structures and other remains of archaeological interest discovered on the Site, immediately upon discovery thereof and before removal. The Contractor shall inform the Engineer immediately of such a discovery and carry out the Engineers instructions for dealing therewith. All construction within the vicinity of the discovery shall cease immediately and the area shall be cordoned off until such time as the Engineer authorises resumption of construction in writing.

The Engineer will contact the relevant heritage authority.

4.3.11 Access routes/ haul roads

Access to the Construction camp and working areas shall utilise existing roads or tracks. Entry/exit points onto public roads shall take cognisance of traffic safety. Traffic safety measures shall included appropriate signage and signalmen where relevant.

On the Site, and, if so required by the Specification Data, within such distance of the Site as may be stated, the Contractor shall control the movement of all vehicles and plant including that of his suppliers so that they remain on designated routes, are distributed so as not to cause an undue concentration of traffic and that all relevant laws are complied with. In addition such vehicles and plant shall be so routed and operated as to minimise disruption to regular users of the routes not on the Site. On gravel or earth roads on Site and within 500 m of the Site, the vehicles of the Contractor and his suppliers shall not exceed a speed of 20 km/h.

Mud and sand deposited onto public roads by construction activities shall be cleared on a daily basis.

4.3.12 Cement and concrete batching

Where applicable, the location of the batching plant (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the Engineer. The concrete/cement batching plant shall be kept neat and clean at all times.

No batching activities shall occur directly on unprotected ground. The batching plant shall be located on a smooth impermeable surface (concrete or 250 µm plastic covered with 5 cm of sand). The area shall be bunded and sloped towards a sump to contain spillages of substances. All wastewater resulting from batching of concrete shall be disposed of via the contaminated water management system and shall not be discharged into the environment. Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented

Empty cement bags shall be stored in weatherproof containers to prevent wind blown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives. The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.

The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

Where “readymix” concrete is used, the Contractor shall ensure that the delivery vehicles do not wash their chutes directly onto the ground. Any spillage resulting from the “readymix” delivery shall be immediately cleared and disposed of via the solid waste management system.

4.3.13 Earthworks

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer.

4.3.14 Pumping

Pumps shall be placed over a drip tray in order to contain fuel spills and leaks. The Contractor shall take all reasonable precautions to prevent spillage during the refuelling of these pumps.

The Contractor shall ensure that none of the water pumped during any dewatering activities, including well points, is released into the environment without the Engineer’s approval. The Engineer’s approval is required prior to the discharge of this water into the Municipal sewer system.

4.3.15 Bitumen

Over spray of bitumen products outside of the road surface and onto roadside vegetation or the surrounding environment shall be prevented using a method approved by the Engineer.

When heating bitumen products, the Contractor shall take cognisance of appropriate fire risk controls. Heating of bitumen products shall only be undertaken using LPG or similar zero emission fuels and appropriate fire fighting equipment shall be readily available.

Stone chip/gravel excess shall not be left on road / paved area verges. This shall be swept / raked into piles and removed to an area approved by the Engineer.

Water quality from runoff from new/ fresh bitumen surfaces will be monitored visually by the Engineer and remedial actions taken where necessary by the Contractor.

4.3.16 Fire control

No fires may be lit on site. Any fires that occur shall be reported to the Engineer immediately. Smoking shall not be permitted in those areas where it is a fire hazard. Such areas shall include the workshop and fuel storage areas and any areas where the vegetation or other material is such as to make liable the rapid spread of an initial flame. In terms of the Atmospheric Pollution Prevention Act (No. 45 of 1965), burning is not permitted as a disposal method.

The Contractor shall ensure that there is basic fire-fighting equipment available on Site at all times. This shall include at least rubber beaters when working in urban open spaces and fynbos areas, and at least one fire extinguisher of the appropriate type when welding or other "hot" activities are undertaken.

4.3.17 Emergency procedures

The Contractor's procedures for the following emergencies shall include:

i) Fire

The Contractor shall advise the relevant authority of a fire as soon as one starts and shall not wait until he can no longer control it. The Contractor shall ensure that his employees are aware of the procedure to be followed in the event of a fire.

ii) Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the emergency procedure(s) to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 l of hydrocarbon liquid spill.

4.3.18 Community relations

The Contractor shall erect and maintain information boards in the position, quantity, design and dimensions specified. Such boards shall include contact details for complaints by members of the public in accordance with details provided by the Engineer.

The Contractor shall keep a "Complaints Register" on Site. The Register shall contain all contact details of the person who made the complaint, and information regarding the complaint itself.

4.3.19 Erosion and sedimentation control

The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities. Where erosion and/or sedimentation, whether on or off the Site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the Engineer. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the Engineer.

Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brushcut packing, mulch or chip cover, straw stabilising (at a rate of one bale/20 m² and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

4.3.20 Aesthetics

The Contractor shall take reasonable measures to ensure that construction activities do not have an unreasonable impact on the aesthetics of the area.

4.3.21 Recreation

If so required by the Specification Data, the Contractor shall take measures to reduce disruption to recreational users of the area abutting the Site.

4.3.22 Access to site

The Contractor shall ensure that access to the Site and associated infrastructure and equipment is off-limits to the public at all times during construction. If so required, as directed by the Engineer, the Contractor shall fence the site to ensure effective control of access to the site. This fence shall be a diamond mesh fence or similar with a minimum height of 1.8 m, and it shall be erected around the site and shall be maintained for the duration of construction.

4.3.23 Crane operations

Drive plants shall be well maintained and drip trays shall be positioned at potential leak areas. Over-greasing of crane cables shall be avoided.

Movement and lifting of hazardous materials shall be undertaken such that they do not cause a pollution, spillage or safety risk (in particular where concrete buckets are in use).

4.3.24 Trenching

Trenching for services shall be undertaken in accordance with the engineering specifications with the following environmental amplifications, where applicable:

- a) Soil shall be excavated and used for refilling trenches i.e. soil from the first trench shall be excavated and stockpiled, thereafter soil from the second excavated trench length shall be used to backfill the trench behind it once the services have been laid. The last trench shall be filled using the soil stockpiled from the first trench.
- b) Trench lengths shall be kept as short as practically possible before backfilling and compacting.
- c) Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion.

4.3.25 Demolition

Hazardous and non-hazardous materials shall be separated at site and disposed of in a manner approved by the Engineer.

All buildings older than 60 years require a permit from South African Heritage Resources Agency in terms of the National Heritage Resources Act (no. 25 of 1999). A demolition permit is also required from the local authority in terms of the National Building Regulations.

4.3.26 Drilling and jack hammering

The Contractor shall take all reasonable measures to limit dust generation and noise as a result of drilling operations. The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.

Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the Contractor to the satisfaction of the Engineer.

4.3.27 Stockpiling

The Engineer will identify suitable sites for stockpiling. Stockpiles shall be convex in shape, shall be no higher than 2 m and shall be located so as to cause minimal disturbance. Stockpiles shall be so placed to occupy minimum width compatible with the natural angle of repose of material, and measures shall be taken to prevent the material from being spread over too wide a surface. Where required, appropriate precautions shall be taken to prevent the erosion and limit the compaction of the stockpiles. The Contractor shall ensure that all stockpiles do not cause the damming of water or run off, or is itself washed away.

Topmaterial stockpiles shall not be covered with any material (e.g. plastic) that may kill seeds or cause it to compost. If the stockpiles start to erode significantly or cause dust problems, they shall be covered with hessian. Where practical, Topmaterial shall not be left for longer than six to eight months before being used for rehabilitation. If stored for longer than six months, the Topmaterial shall be analysed and, if necessary, upgraded before placement.

4.3.28 Site closure and rehabilitation

Any areas that the Engineer believes may have been impacted upon or disturbed, shall be rehabilitated to the satisfaction of the Engineer, which includes all areas where Topmaterial has been stripped. Once construction is complete the Contractor shall clear everything from the Site not forming part of the Permanent Works. The area to be rehabilitated shall first be landscaped to match the topography of the surrounding area as it was prior to construction. The composition of vegetation to be used for any rehabilitation shall be as specified in the Specification Data.

The Contractor may not use herbicides, pesticides, fertilisers or other poisonous substances for the rehabilitation process unless otherwise agreed with the Engineer.

All rehabilitated areas shall be considered “no go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas.

The Contractor shall undertake to remove all alien vegetation re-establishing on the area and shall implement the necessary temporary or permanent measures to combat soil erosion.

4.3.29 Temporary revegetation of the areas disturbed by construction.

Where there is likely to be a delay of greater than two weeks in the landscaping and revegetation of a disturbed area or where that site is likely to be the subject of further construction activities at a later stage, the Contractor shall ensure that the area is temporarily revegetated to combat dust generation and prevent erosion. This revegetation shall occur incrementally immediately upon completion of the construction activities at the subject location.

Prior to revegetation structures and material not forming part of the Permanent Works, including remnants of building materials, concrete foundations, timber and other foreign debris, shall be removed and disposed of via the solid waste management system. The area shall be revegetated as follows:

- a) The surface shall be levelled by hand or machine as far as practically possible.
- b) Alien vegetation shall be cleared by cutting the plants off at ground level, and painting the stump with 0.5% Garlon in diesel.
- c) For areas with a slope of greater than 1:3, straw shall be utilised as a binding material to stabilise the soil during revegetation and rehabilitation of the site. Straw shall consist of natural, dried fibres of hay or chaff of various lengths between 50 mm and 400 mm, delivered to Site in bales and shall be applied evenly by hand or machine at a rate of 1 bale per 20 m² over the area to be revegetated. It shall then immediately be rotovated into the upper 100 mm layer of soil.
- d) The prepared area shall be hydro- or hand-seeded at a rate of 40 kg/ha using Rye grass (*Lolium multiflorum*). In the event of hand-seeding, the seed mixture as specified shall be mixed with two parts per volume of clean dry plaster sand, then divided in half and applied evenly in two successive applications, one after the other, by means of an approved hand seeding machine (known colloquially as a “tefsaaier”). On completion of the seeding the surface shall be lightly raked to cover the seed with no more than 5 mm of soil.
- e) Water used for the irrigation of vegetated areas shall be free of pollutants that will have a detrimental effect on the plants. The vegetated area shall only be watered once, immediately following seeding. Watering should be carried out from a tanker, using a fine nozzle spray to avoid erosion and disturbance of the vegetation. Water for irrigation purposes may not be drawn from any water body.

No construction equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been vegetated. Only persons or equipment required for the preparation of areas, application of fertiliser and maintenance of revegetated area shall be allowed to operate on these areas.

4.3.30 Temporary site closure

If the site is closed for a period exceeding one week, the Contractor, in consultation with the Engineer shall carry out the following checklist procedure.

Hazardous materials stores

Outlet secure/ locked
Bund empty (where applicable)
Fire extinguishers serviced and accessible
Secure area from accidental damage e.g. vehicle collision
Emergency and contact details displayed
Adequate ventilation

Safety

All trenches and manholes secured
Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1193)
Emergency and management contact details displayed
Pipe stockpile wedged/ secured

Erosion

Wind and dust mitigation in place
Slopes and stockpiles at stable angle
Revegetated areas watering schedules and supply secured

Water contamination and pollution

Cement and materials stores secured
Toilets empty and secured
Refuse bins empty and secured
Drip trays empty and secure (where possible)
Structures vulnerable to high winds secure

5. COMPLIANCE WITH REQUIREMENTS AND PENALTIES

5.1 Compliance

Environmental management is concerned not only with the final results of the Contractor's operations to carry out the Works but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operations required to complete the Works.

It is thus required that the Contractor shall comply with the environmental requirements on an ongoing basis and any failure on his part to do so will entitle the Engineer to certify the imposition of a penalty as detailed below.

5.2 Penalties

Penalties will be issued for certain transgressions. Penalties may be issued per incident at the discretion of the Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with this Specification. The Engineer will inform the Contractor of the contravention and the amount of the penalty, and shall be entitled to deduct the amount from monies due under the Contract.

Penalties will be as set out in the Specification Data.

5.3 Removal from site and suspension of Works

The Engineer may instruct the Contractor to remove from Site any person(s) who in their opinion is guilty of misconduct, or is incompetent, negligent or constitutes an undesirable presence on Site. Subclause 4.1.9 of this Specification requires that all Plant be in good working order, and accordingly the Engineer may order that any Plant not complying with the Specifications be removed from Site. Where the Engineer deems the Contractor to be in breach of any of the requirements of this Specification, he may order the Contractor to suspend the progress of the Works or any part thereof.

6. Void

7. Void

8. MEASUREMENT AND PAYMENT**8.1 Basic principles****8.1.1 General**

Except as specified below, or in the Specification Data or as billed, no separate measurement and payment will be made to cover the costs of complying with the provisions of this Specification and such costs shall be deemed to be covered by the rates tendered for the items in the Bill of Quantities completed by the Contractor when submitting his tender.

8.1.2 All requirements of the environmental management specification

All work not measured elsewhere, associated with complying with any requirement of this Environmental Management specification will be measured and paid as a sum.

The tendered sum shall cover the cost of with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the Works as specified, described in the Bill of Quantities or shown on the Drawing(s).

8.1.3 Work "required by the Specification Data"

Where a clause in this Specification includes a requirement as "required by the Specification Data", measurement and payment for compliance with that requirement shall be in accordance with the relevant measurement and payment clause of the Specification Data.

8.2 Billed items

8.2.1 Method Statements: Additional work

No separate measurement and payment will be made for the provision of Method Statements but, where the Engineer requires a change on the basis of his opinion that the proposal may result in, or carries a greater than warranted risk of damage to the environment in excess of that warranted by the Specifications, then any additional work required, provided it could not reasonably have been foreseen by an experienced contractor, shall be valued in accordance with the Clause in the General Conditions of Contract dealing with Provisional Sums.

A stated sum is provided in the Bill of Quantities to cover payment for such additional work.

8.2.2 All requirements of the environmental management specification

Unit: Sum

All other work not measured elsewhere, associated with complying with any requirement of the environmental management specification shall be measured as a sum.

The tendered rate shall cover any cost associated with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

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APPENDIX A : APPLICABLE STANDARDS

Reference is made to the latest issues of the following standards:

SANS 1200 A General
SANS 1200 AA General (small works)

Specification AOOccupational Health and Safety

Construction Regulations, 2003.