ANNEXURE D

LIFE-CYCLE ENVIRONMENTAL MANAGEMENT PLAN (EMP)

- Life Cycle Environmental Management Plan

Report Number: 9686a/109378

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS: PROPOSED 75MW PV8 PHOTOVOLTAIC (SOLAR) ENERGY FACILITY ON THE FARM HOEKPLAAS NEAR COPPERTON, NORTHERN CAPE

DEA AND NEAS REF. NO.:

14/12/16/3/3/2/499 & DEA/EIA/0001760/2013

REVISED FINAL LIFE-CYCLE ENVIRONMENTAL MANAGEMENT PROGRAMME

23 MARCH 2015

CONSULTANT
Aurecon South Africa (Pty) Ltd
PO Box 494
Cape Town
8000

Tel: (021) 526 9400
Fax: (021) 526 9500
Email: franci.gresse@aurecongroup.com

PROPONENT
Hoekplaas Solar PV8 (Pty) Ltd
PO Box 50
Cape Town International Airport
Cape Town
7525

Tel: (021) 934 5278
Fax: (021) 935 0505
Email: warren@mulilo.com

Page has been left intentionally blank

Document Control Record

Document prepared by:
Aurecon South Africa (Pty) Ltd
1977/003711/07
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City
Cape Town
7441
PO Box 494
Cape Town
8000
South Africa

T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W aurecongroup.com

A person using Aurecon documents or data accepts the risk of:

a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
b) Using the documents or data for any purpose not agreed to in writing by Aurecon.

Document control						
Report Title	Revised Final Life-Cycle Environmental Management for the Proposed 75MW PV8 Photovoltaic Energy facility on the Farm Hoekplaas near Copperton, Northern Cape.					
Document ID	9686a		**Project Number**	109378		
File Path	P:\Projects\109378- Mulilo Extended Prieska PVs\03 DELIVERY\01 REPORTS\EIA\FEIAR\Batch 1- rev2\FEIAR Hoekplaas PV8\Report\Working Docs\Hoekplaas PV8 LEMP Final.doc					
Client	Hoekplaas Solar PV8 (Pty) Ltd		**Client Contact**	Warren Morse		
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
1	23 March 2015		Simon Clark	Corlie Steyn Franci Gresse	Franci Gresse	Louise Corbett
Current Revision	1					

Approval			
Author Signature		**Approver Signature**	
Name	Franci Gresse	**Name**	Louise Corbett
Title	Project leader	**Title**	Associate

This report is to be referred to in bibliographies as: AURECON. 2015. Proposed 75MW PV8 Photovoltaic Energy facility on the Farm Hoekplaas near Copperton, Northern Cape: Revised Final Life-Cycle Environmental Management. *Report No. 9686a/10937*

Page has been left intentionally blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

CEMPR	Construction Phase Environmental Management Programme
CLO	Community Liaison Officer
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
ECO	Environmental Officer
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 EMP	Specification Environmental Management Plan

1 OVERVIEW

This document represents the Life-Cycle Environmental Management Programme (LEMP) for the proposed photovoltaic (PV) solar energy facility, referred to as Hoekplaas Solar PV8 (PV8) on the farm Hoekplaas No. 146, near Copperton, 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 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 various life-cycle stages of the proposed development. The following stages are included:

- 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 (iv, 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 14 of Regulation R546 (18 June 2010).

On 4 December 2014 new EIA Regulations were promulgated and came into effect on 8 December 2014. In terms of the 2014 EIA Regulations, Activity 28, as listed in GN R983, and Activity 15 of GN R984, which are not included in the Listing Notice 1 (GN R545) or Listing Notice 3 of the 2010 EIA regulations, would be triggered by the proposed project. As it is a requirement of Section 53 (3) of the 2014 EIA Regulations, these activities were therefore also assessed as part of the EIA process.

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 1.1 lists the requirements of an EMP as stipulated by Section 33 of the EIA Regulations R543. Table 1.2 lists the requirements of an EMP as stipulated by Section 24N (2) and (3) of the NEMA.

Table 1.1 Section 33 of EIA Regulation R543 listing the requirements of an EMP

33. *A draft environmental management programme must comply with section 24N of the Act and include –*

(a) details of –
- *(i) the person who prepared the environmental management programme; and*
- *(ii) the expertise of that person to prepare an environmental management programme;*

(b) 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) planning and design;*
- *(ii) pre-construction and construction activities;*
- *(iii) operation or undertaking of the activity;*
- *(iv) rehabilitation of the environment; and*
- *(v) closure, where relevant.*

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;

(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);

(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

(f) 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;

(g) a description of the manner in which it intends to—
- *(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*
- *(ii) remedy the cause of pollution or degradation and migration of pollutants;*
- *(iii) comply with any prescribed environmental management standards or practices;*
- *(iv) comply with any applicable provisions of the Act regarding closure, where applicable;*
- *(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;*

(h) time periods within which the measures contemplated in the environmental management programme must be implemented;

(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;

(j) an environmental awareness plan describing the manner in which—
- *(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and*
- *(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;*

(k) where appropriate, closure plans, including closure objectives.

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.

Hoekplaas Solar PV8 (Pty) Ltd (the Applicant) 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)'s[1] *Guideline for Environmental Management Plans* (2005) aims to inform and guide the preparation and implementation of EMPs. 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 1.2.

Table 1.2 Section 24N (2) and (3) of the NEMA listing the requirements of an EMP

24N.(2)	*the environmental management programme must contain-*
(a)	*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) planning and design;
	(ii) pre-construction and construction activities;
	(iii) the operation or undertaking of the activity in question;
	(vi) the rehabilitation of the environment; and
	(vii) closure, where relevant.
(b)	*details of –*
	(i) the person who prepared the environmental management programme; and
	(ii) the expertise of that person to prepare an environmental management programme
(c)	*a detailed description of the aspects of the activity that are covered by the draft environmental management plan;*
(d)	*information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);*
(e)	*information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance.*
(f)	*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*
(g)	*a description of the manner in which it intends to-*
	(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
	(ii) remedy the cause of pollution or degradation and mitigation of pollutants; and
	(iii) comply with any prescribed environmental management standards or practices.
(3)	*the environmental management programme must , where appropriate-*
(a)	*set out time periods within which the measures contemplated in the environmental management programme must be implemented;*
(b)	*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*
(c)	*develop an environmental awareness plan describing the manner in which-*
	(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
	(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.

[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.

The LEMP aims to meet the EMP requirements as legislated by the NEMA Regulations as well as falling in line with the DEA&DP guideline document for an Environmental Management Plan[2]. 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:

1. Chapter 2: Description of project.
2. Chapter 3: Discussion summarising environmental management influencing the planning and design of the proposed project.
3. Chapter 4: Construction EMP based on identified impacts and mitigation measures from the EIAR.
4. Chapter 5: Operational Framework based on identified impacts and mitigation measures from the EIAR.
5. Chapter 6: Monitoring programme.
6. Chapter 7: Erosion management plan.
7. Chapter 8: Decommissioning Framework providing guidance on key considerations to be considered during decommissioning/closure.
8. Chapter 9: 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 **Annexure 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 facility. This LEMP would be used for all PV facility included in the EIA. 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

Hoekplaas Solar PV8 (Pty) Ltd (Mulilo) proposes to construct a PV facility with a generation capacity of approximately 75 MW [Alternating Current (AC)] on The Farm Hoekplaas No. 146 near Copperton in the Northern Cape. The total extent of the proposed facility would be approximately 208ha.

Table 2.1 Footprint, capacity and coordinates of the proposed facility

Plant	Footprint (ha)	Capacity (MW)	Coordinates (middle point)	
PV8	208	75	30° 1'32.91"S	22°24'9.96"E

The proposed PV8 facility would consist of the following:

- **Transmission line:** 132kV Double Circuit overhead transmission line (Error! Reference source not found.) to connect the facility to the newly constructed Hoekplaas Solar PV10 Substation or an existing Eskom substation which is situated offsite (i.e. Kronos substation).
  - Hoekplaas Solar PV8 will connect to the grid via the F to A routing option should no other project be awarded an EA and Preferred Bidder Status. However should Hoekplaas PV10 be awarded an EA and Preferred Bidder Status the line would connect from A to C.
- **Substation:** An onsite 132kV, six bay.
- **Roads:** Access and internal roads for servicing and maintenance of the facility would use routing XYQ if no other projects are awarded an EA and Preferred Bidder Status. If PV5 or PV7 are awarded an EA and Preferred Bidder Status, the connection route would be Y to Q. No route would be required in PV8 or PV9 were awarded an EA and Preferred Bidder Status
- **Boundary fence:** The facility would have an electrical or barbed wire fence for safety and security.
- **Buildings:** Buildings would likely include an onsite substation, a connection building, operational and maintenance building, guard cabin, an electrical substation and solar resource measuring substation.

Multiple PV facilities are proposed for Farm Hoekplaas and shared infrastructure may occur if more than one project is awarded:

- **Stormwater infrastructure:** Including, but not limited to, drainage spines, drainage channels, multiple apron outlets, detention areas and kinetic energy dissipaters.
- **Buildings:** Buildings would likely include an onsite substation, a connection building, operational and maintenance building, guard cabin, an electrical substation and solar resource measuring substation.

The following infrastructure can also be shared among the proposed PV facilities and received environmental authorisation in terms of the PV1[3] and PV4[4] projects on farm Hoekplaas:

- **Water supply infrastructure:** It is proposed that potable water would be obtained from the Alkantpan pipeline while negotiating sourcing of water from the local municipality.
- **Buildings:** Buildings would likely include Operations and Maintenance Building, guard cabin, an electrical substation and solar resource measuring substation to monitor the performance of the plant compared to the solar radiation.[5]

Sensitive environmental areas identified on site during the EIA are shown in Figure 2.1 illustrates how the proposed project takes cognisance of these sensitivities.

3 DEA Ref. No. 12/12/20/2501 & NEAS Ref. No. DEAT/EIA/0000611/2011

4 DEA Ref. No. 14/12/16/3/3/2/495 & NEAS Ref. No. DEA/EIA/0001756/2013

[5] Shared infrastructure may occur if more than one project is awarded but each facility will need to have the necessary infrastructure authorised should they need to operate individually.

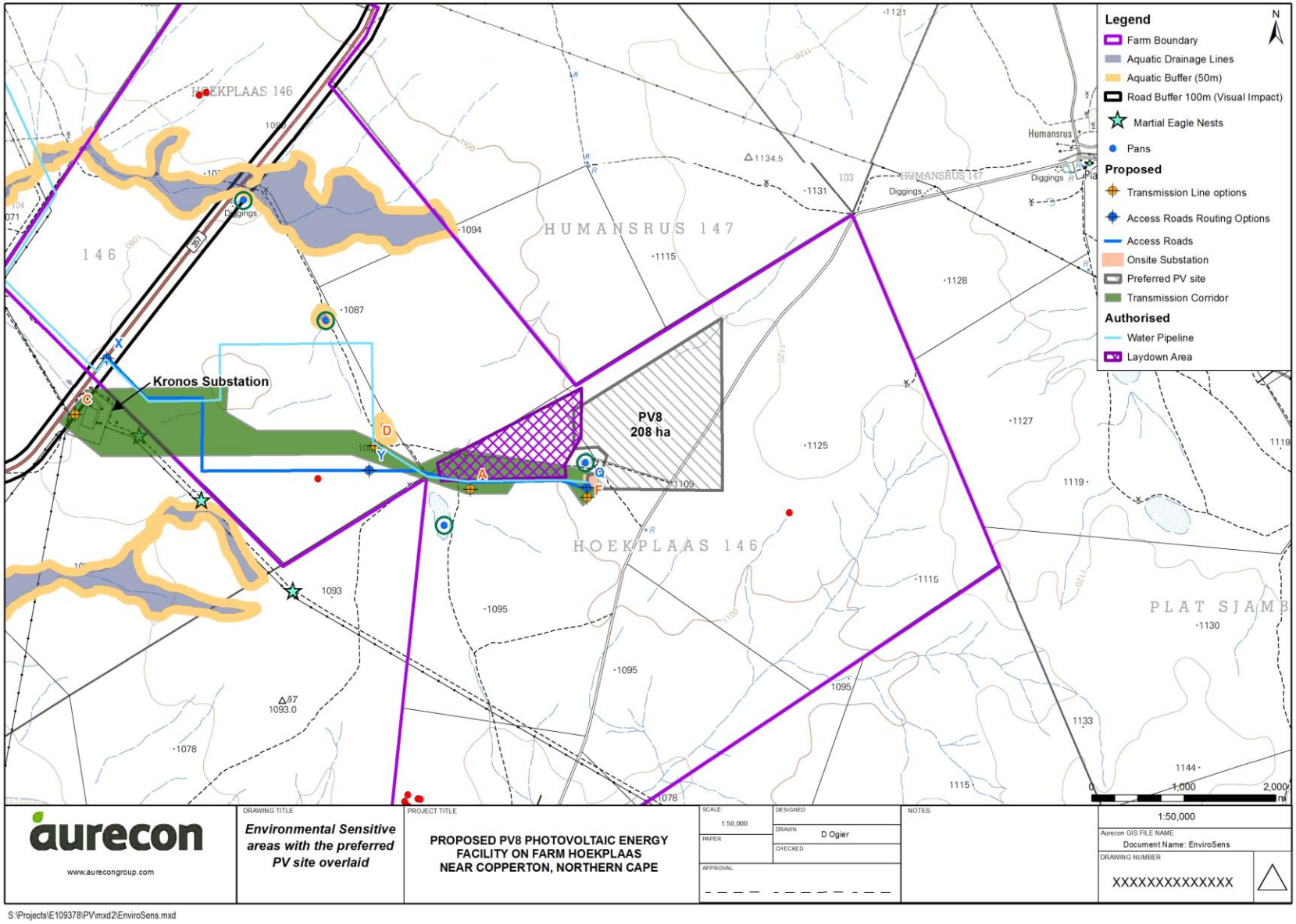

Figure 2.1 Sensitive environmental areas

Page left intentionally blank

3 PLANNING AND DESIGN

The design for the proposed PV8 facility should respond to the identified environmental constraints and opportunities. Therefore mitigation measures that would reduce environmental impacts related to the design of the proposed developments are provided below and must be adhered to.

Furthermore, during this phase various plans, programmes and permits are needed to meet the requirements of the LEMP. Table 3.1[6] below provides a quick reference list of these requirements[7]. Note that these requirements were identified during the EIA Phase and may require amendments as the project proceed.

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

Planning phase	Plans, programmes and permits required	Notes
Flora	Alien invasive management plan	To be compiled and implemented during the planning and construction phases.
	Plant rescue and protection plan	To be compiled and implemented during the planning and construction phases.
	Open space management plan	To be compiled during the planning phase and implemented during construction and operational phases.
	Re-vegetation and rehabilitation plan	Compiled during the planning phase and implemented during construction and operational phases.
	Removal and transportation permit[8]	To be obtained prior to site clearance.
Avifauna	Pre-construction monitoring as part of the long term avifauna monitoring programme	In process. Section 6 of this LEMP includes details of the avifaunal monitoring programme.
Heritage	Fossil collection permit	Heritage specialist to obtain prior to construction (if required).
Socio-Economic	Local employment policy and training programme	To be compiled during the planning phase and implemented during construction and operational phases.
Surface water	Stormwater Management Plan	To be completed during the planning phase and implemented during the operational phase. Conceptual stormwater management plan included in Annexure C.
	General Authorisation in terms of the National Water Act (No. 36 of	Commencement as soon as Stormwater Management Plan have been finalised

[6] Please note that the plans and permits listed in Table 4 may change depending on the requirements of the Environmental Authorisation and/or amendments to applicable legislation. It is therefore recommended that this table be revised during the initiation phase of the project should it receive preferred bidder status

[7] Department: Environmental Affairs , Requirements of EMPr, Letter dated 28/08/2013

[8] Removal and transportation permits may be required from the Department of Environment and Nature Conservation: Northern Cape in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Planning phase	Plans, programmes and permits required	Notes
	1998)	
Roads	Traffic management plan and transport management plan Permits for any abnormal loads	To be compiled during the planning phase and implemented during construction and operational phases. Should abnormal loads be required, then permits will be obtained.
Sedimentation and Erosion	Erosion management plan	See Section 7 of the LEMP.

3.1 Design of the Project

3.1.1 Flora

- All construction activities shall be contained within the PV facility footprints to minimise disturbance outside these areas;
- A plant rescue and protection plan shall be compiled and implemented with the aid of a suitably qualified rehabilitation specialist. The plan will allow for the maximum for the maximum transplant of conservation important species from areas to be transformed. This plan will be implemented prior to the commencement of the construction phase;
- A rehabilitation plan shall be compiled and implemented with the aid of a rehabilitation specialist;
- An open space management plan will be complied and implemented during the construction and operational phase;
- The site shall be cleared in sections as required for construction and not all at once;
- Protected trees must be avoided or if that is not possible, permission must be obtained for their removal. Any *Aloe* species, particularly *Aloe claviflora* should be relocated if affected by the PV8 facility;
- Shallow depressions, well defined pans and seasonal watercourses should be avoided, with buffer zones of at least 30m around pans and from 'Leegte Shrubland'. Roads and transmission lines traversing such areas should be avoided where possible and if not, physical impacts should be limited as far as possible. Locate the proposed project in such a way that the development footprint is minimized;
- Position access roads in such a way that no clearing within no-go areas is necessary and definite drainage areas are avoided; and
- Design the construction of access roads for minimal impact.

3.1.2 Fauna

- Allow small ground level openings, 20-30cm in height, in the electrical or barbwire fence to facilitate the movement of small mammals and reptiles through the site; and
- No-go areas shall be demarcated during pre-construction monitoring.

3.1.3 Avifauna

- Pre-construction monitoring is required as part of the long term avifauna monitoring programme in Section 6. The pre-construction monitoring is already being done;
- Construction timeframes shall be reduced as much as possible;

- 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 0 of this LEMP;
- The entire length of all new lines shall be marked with bird flight diverters to avoid additional cost should this be retro-fitted post-construction, based on the findings of the monitoring programme.
- Relocate Martial eagle nests to pylons more than 1 km away in order to put greater distance between the resident eagles and the disturbance sources of the development. This would have to be done outside of the eagle and falcon breeding seasons (i.e. between December/January and February/March, and would involve deconstructing all affected nest structures in the area, and re-building at least one structure in a specially designed galvanized steel basket, and positioning this in the 'waist' area of a tower. Such an exercise would require the cooperation of Eskom, and the practical assistance of their live-line maintenance team, as well as active supervision by an experienced avian specialist at all times.

3.1.4 Heritage

- Buffer zones of 90m shall be applied to all pans.
- Once the exact alignments of the linear components of the project have been decided on these shall be examined by a heritage specialist and possibly subjected to a walk-down survey.
- The mitigation worthy archaeological site located within the most western laydown area shall be demarcated as a "no-go" area. Mitigation measures shall be implemented should it be found during construction that the site cannot be avoided.
- All mitigation-worthy sites falling in the proposed project area that would be impacted on should have archaeological mitigation in the form of excavation, sampling and analysis carried out before the construction phase start. Should Layout 2 receive environmental approval, the area in the far southeast (part of PV3) would need to be assessed for archaeological remains through a pre-construction survey; and
- The palaeontologist concerned with mitigation work will need a valid fossil collection permit from 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).

3.1.5 Visual

- The fencing shall be grey in colour and located as close as possible around the PV site. If possible, natural water ways and drainage lines indicated as sensitive should not be fenced in;
- The PV footprint shall maintain a 100m buffer from the R357. The fence shall not be within 50m of the R357;
- No construction works shall be undertaken at night or during weekend;
- All lighting shall be kept to a minimum within the requirements of safety and efficiency;
- Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, shall be used;

- No naked light sources shall be directly visible from a distance. Only reflected light shall be visible from outside the site;
- Necessary aircraft warning lights shall be installed as per the relevant authority requirements;
- External lighting shall consist of 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;
- Security and perimeter lighting shall be shielded so that no light falls outside the area needing to be lit. Excessively tall light poles shall be avoided;
- Repairs shall be carried out promptly and the site buildings and perimeter fence shall be kept tidy;
- Implement good traffic management and keep local people informed of activities. Information on the project should be provided to local people, such as through a poster at the entrance to the site;
- Lay-down area(s) should preferably be located outside of direct view of the R357 and should be screened with shade cloth; and
- Site offices and structures should be limited to single storey and they should be sited carefully to reduce visual intrusion. Colours should reflect hues of the surrounding vegetation and/or the ground. Roofs should be grey and non-reflective. Doors and window frame colour should reference either the roof or wall colours.

3.1.6 Socio-Economic

- A local employment policy shall be developed together with a training programme;
- Obtain a list of locally available labour and skills. Preference shall be given to local communities for employment opportunities; and
- Recruitment shall be based on sound labour practices and with gender equality in mind.

3.1.7 Surface Water

- All stormwater management infrastructure shall take cognisance of the thresholds and requirements of GA 398 of 2004 (in terms of the National Water Act, No. 36 of 1998) and not exceed any of these thresholds, as well as ensure that the relevant requirements are met.
- The project shall be registered with the Department of Water and Sanitation[9] in terms of GA 398 of 2004.
- The 1:100 year floodline for Hoekplaas farm house and other dwelling using a detailed survey must be determined;
- The spillway channel must be planned and improved;
- Housing must be protected with a berm;
- No stormwater should be directed into the endorheic pans due to the ecological changes it may facilitate within these sensitive areas i.e. if there is increased runoff into the pans, the pans would stay wetter for longer causing the composition of the plant species to change;
- Two other ephemeral pans, which have been deemed not as ecologically sensitive as the above mentioned endorheic pans, immediately west of the farm and located within a drainage line, are also considered important for ground water recharge and should be

[9] Previously known as the Department of Water Affairs.

incorporated into the PV internal drainage system, so that stormwater is directed into them rather than away from them;

- The area should be sub-divided into smaller sub-catchments (which will distribute the runoff) and have multiple outlets from the site;
- Concrete aprons with rip-rap no less than 12m long should be used at the multiple outlets;
- Design and implement a cut-off drain and insertion of culverts under road R357 (currently no culverts);
- The minor storm design period should be used to determine the size of the earth channels. A return period of 1:5 years is applicable which approximates to an average intensity of 30 mm/hour; and
- The major storm occurrence (i.e. 1:25 year, 1:50 year & 1:100 year) should be used to calculate culverts in defined drainage lines and determine flood levels where necessary. The intensities for each occurrence are: 1:25 year – 46 mm/hour, 1:50 year – 53 mm/hour and 1:100 year – 61 mm/hour respectively.
- Stormwater management infrastructure should not concentrate flow from a large area (≥200ha) to one outlet as this would cause erosion and change the hydrology from overland flow to channelled flow.

3.1.8 Roads (internal and external)

- Internal gravel roads shall have a crowned driving surface and a shoulder area that slopes directly away from the edge of the driving surface, as well as a ditch;
- Where the roads intersect drainage lines a suitably sized culvert shall be used. It is important that ditches and culverts be kept clear from obstructions;
- A traffic management plan shall be compiled and implemented during the construction and operational phase;
- A transportation plan shall be compiled and implemented for the transport of panel components;
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled;
- Ensure that road junctions have good sightlines;
- Implement traffic control measures where necessary;
- Transport components overnight as far as possible;
- Internal roads shall be designed to have minimal impact on the environment; and
- Where internal roads need to be realigned, these should not cross drainage lines (where possible).

3.1.9 Land Capability and Erosion Potential

Sedimentation and Erosion

- Refer to the Erosion Management Plan in Section 7.

Agricultural land

- If possible a phased approach should be adopted as illustrated in Figure 3.1;
- Allow normal agricultural activities to continue in unaffected areas and comply with the no-go areas;
- Stocking rates shall be temporarily reduced during the construction phase in order to reduce the risk of overgrazing of the remaining land portions;

- Land rehabilitation and re-vegetation shall commence immediately upon completion of construction; and
- It is recommended that more palatable species for part of the re-vegetation plan to enable faster stocking initiation.

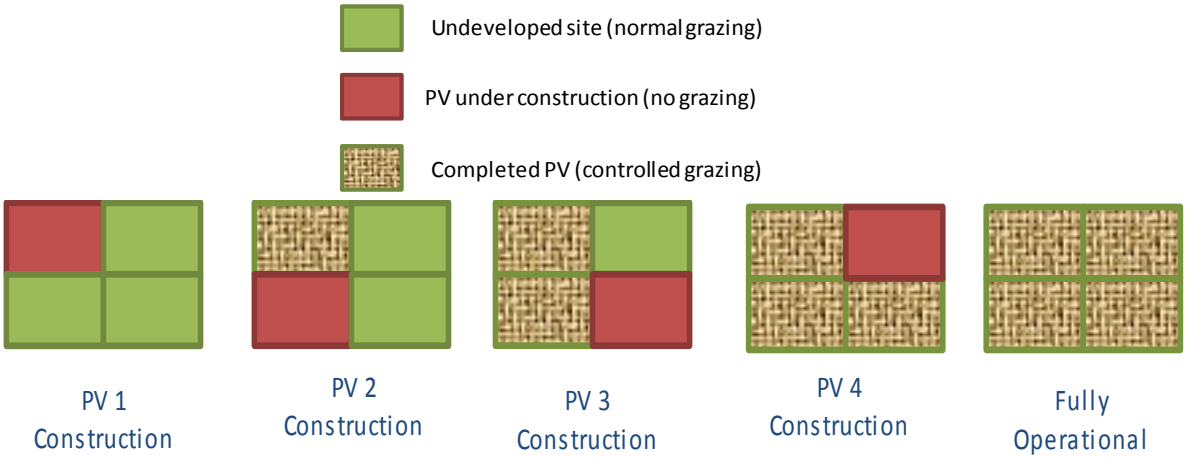

Figure 3.1 Proposed phased approach and grazing schedule

3.1.10 South African Square Kilometre Array (SKA) Project

- A detailed impact analysis shall be carried out in close consultation with the SKA Project Office. The SKA Project Office shall therefore be involved during the planning phase in order that the correct studies are completed to ensure that the PV facility does not interfere with the operations of the SKA Project.

4 CONSTRUCTION PHASE EMP

The Construction EMP 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 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 4.1 below provides a quick reference list of these requirements.

Table 4.1 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

4.3 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 PV facility, near Copperton, Northern Cape. Where any discrepancy or difference occurs between this SDEMA and the Specification: Environmental Management, 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.

4.4 Specification Data: Environmental Management (SDEMA)

SDEMA 4.3.1 Materials handling, use and storage (Subclause 4.1.1)

The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of both natural and manufactured materials. No stockpiling shall occur outside of the working area (as designated by the engineer) and without the Engineer's prior approval of the proposed stockpiling areas. Imported material shall be free of litter, contaminants or exotic plant seed. The Contractor shall ensure that material is not stockpiled along the border of any water body (permanent or seasonal), including pans or within close proximity to no-go areas.

Location and treatment of material stockpiles shall take consideration of prevailing wind directions and dwellings. Stockpiles shall be stored under cover so as to prevent erosion and run off during rainy periods.

Dust suppression measures shall be used particularly during dry periods of weather during the summer months.

SDEMA 4.3.2 Hazardous substances (Subclause 4.1.2)

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

Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Engineer.

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.

SDEMA 4.3.3 Shutter oil and curing compound (Subclause 4.1.2.1)

Shutter oil and curing compound shall be stored and dispensed within a bunded area, and not located closer than 32m from river banks / water courses / drainage lines.

4.5 Requirements

SDEMA 4.4.1 Ablution facilities (Subclause 4.2.1)

A sufficient number of chemical toilets shall be provided by the Contractor in the construction camp area and at appropriate locations approved by the Engineer. 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. All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause. Toilets shall be located within a reasonable walking distance from the workers.

SDEM 4.4.2 Solid Waste Management (Subclause 4.2.2)

The Contractor shall set up a solid waste control and removal system and a Method Statement is required in this regard. Waste and litter shall be disposed of into scavenger- and weatherproof bins (with a lid / cover) that are secured from blowing over. These bins shall be stored in a secure, lined area and emptied daily to prevent windblown waste from leaving the site. The Contractor shall then remove the refuse collected from the working areas from Site at least once per week. Refuse must be disposed of at a registered landfill site and disposal certificates shall be provided to the Environmental Control Officer (ECO). The Contractor shall make provision for workers to pick up solid waste from the site on a daily basis. Hazardous wastes (if any) shall only be sent to landfill sites registered for hazardous wastes. Burying or burning of solid waste shall be prohibited on site. A waste management system shall be established to ensure regular waste removal.

SDEMA 4.4.3 Contaminated Water (Subclause 4.2.3)

The Contractor shall prevent the discharge of any pollutants, such as soaps, detergents, cements, concrete, lime, chemicals, hydrocarbons, glues, solvents, paints and wastewater into the surrounding terrestrial and aquatic environment.

SDEMA 4.4.4 Site Structures (Subclause 4.2.4)

No site structures shall be located within 32m from the top of the river banks / water courses / drainage lines. Construction yards should be restricted in extent as far as possible and should be screened by visually impermeable material.

Ensure the camp is neat and tidy at all times. Site offices, if required, should be limited to single storey and should be sited carefully using temporary screen fencing to screen from the wider landscape. Site offices, if required, shall be limited to single storey and shall be sited carefully using temporary screen fencing to screen from the wider landscape.

SDEMA 4.4.5 Fuel (Petrol and Diesel) and oil (Subclause 4.2.7)

Fuels in the form of diesel and petrol shall not be stored within 32m from the top of the river banks/water courses / drainage lines. The fuel storage area shall adorn the appropriate warning signage so as to notify all onlookers of the associated risks and hazards. Where reasonably practical, equipment shall be refuelled at the fuel storage area. If it is not reasonably practical

then the surface under the refuelling area shall be protected against pollution to the satisfaction of the Engineer and ECO and prior to any refuelling activities. Should a mobile fuel bowser be used, all refuelling shall occur with appropriate measures in place to prevent spillages; these may include the use or drip trays, funnels, non-drip dispensing nozzles, and any other similar device. Regardless of the preventative measures in place, all fuel browsers shall carry a spill-kit that is sufficient in size to contain at least a 200 litre spill at all times.

SDEM 4.4.6 Equipment Maintenance and Storage (Subclause 4.2.8)

Wastewater generated from construction or the washing of vehicles shall not be permitted to enter water courses, either directly or via a stormwater system.

SDEMA 4.4.7 Stormwater Erosion Control (Add Section 4.2.10)

An erosion management plan has been compiled (refer to Section 7) and conceptual stormwater management plan (refer to Annexure C) has been compiled (refer to Section 7).

A storm water management plan shall be compiled and implemented. The plan shall ensure that any runnels or erosion channels developed during the construction period or during the maintenance period shall be backfilled and compacted to limit the impacts of sediment deposition.

The following shall be required to manage onsite stormwater erosion:

- Straw barriers shall be installed in drainage paths to act as a check dam, i.e. to reduce velocity, and as a sediment trap during construction. These are erosion barriers shall be placed at intervals of 25-50m apart in the drainage paths to intercept suspended solids from entering the natural drainage paths;
- Packed stone (also known as rip-rap) shall 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;
- Earth cut-off channels shall be located at the boundaries of the facility. These shall assist in directing flow away from the site and reduce the possibility of flooding from runoff origination from outside the site; and
- 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.

SDEMA 4.4.8 Method Statements (Subclause 4.3.1)

The following additional method statements shall be provided by the Contractor within 14 days of the receipt of the Letter of Acceptance and prior to the activity covered by the Method Statement being undertaken:

- Layout and preparation of the Contractor's construction camp.
- Logistics for the environmental awareness course for all the Contractors employees.

- The roles and responsibilities of those who will be implementing the CEMP, e.g. contractor, engineer, ECO, etc.
- Emergency procedures for fire, accidental leaks and spillages of hazardous materials. The Method Statement shall include the following:

    - The location of all emergency equipment.
    - The individual(s) responsible for the upkeep and maintenance of the emergency equipment.
    - An indication of how regularly the emergency equipment will be checked to ensure that it is working properly.
    - Who shall be notified in the event of an emergency, including contact numbers for the Siya Themba Local Municipality.
    - Fuels and fuel spills: Methods of refuelling vehicles and details of methods for fuel spills and clean-up operations

- Detail how the site and contracted workers will be managed to ensure the safety and security of the public and surrounding residents.
- Location, layout and preparation of cement / concrete batching facilities including the methods employed for the mixing of concrete and the management of runoff water for such areas. An indication shall be given of how concrete spoil will be minimised and cleared.
- Method of undertaking earthworks, including spoil management, erosion, dust and noise controls.
- Method of undertaking blasting (if required).
- Management measures to be undertaken in instances where traffic flows may be interrupted.
- Extent of areas to be cleared, the method of clearing and the preparation for this clearing so as to ensure minimisation of exposed areas.
- Measures to be put in place during temporary closure periods, e.g. December holidays.

All the Contractor's employees and Sub-Contractor's employees and any suppliers' employees that spend more than 1 day a week or four days in a month on site, must attend an Environmental Awareness Training course presented by the ECO on behalf of the Contractor, the first of which shall be held within one week of the Commencement Date. Subsequent courses shall be held as and when required. A register shall be kept for all environmental awareness training.

In addition, a comprehensive employee induction programme shall be presented within one week of the Commencement Date to address issues such as HIV/ AIDS and Tuberculosis as well as alcohol and substance abuse. The induction shall also address a code of behaviour for employees that would align with community values.

No more than 20 people shall attend each course and the cost, venue and logistics for this/ these course/s shall be for the Contractor's responsibility.

The Contractor shall submit a Method Statement detailing the logistics of the environmental awareness training course.

SDEMA 4.4.9 Site Clearance (Subclause 4.3.4)

Only 20% of the construction footprint shall be cleared from vegetation. Vegetation on the remaining 80% shall be brush cut to a height of 40-50 cm to ensure leaves remaining on shrubs. The Contractor shall strip the top material and root material of cleared vegetation (top 300mm layer), for subsequent use during rehabilitation and re-vegetation. Top material shall be stripped from all areas of the Working Area where topsoil will be impacted by construction activities, including areas for temporary facilities, as directed by the Engineer. The Contractor shall not make use of herbicides or other chemical methods to clear the proposed site especially near the identified water courses. In order to limit erosion the Contractor shall retain original groundcover, as far as practically possible.

SDEMA 4.4.10Site division and Site demarcation (Subclause 4.3.5)

The Engineer shall be advised of the area that the Contractor intends using for the Construction Camp. 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 public using the area. The site camp should be fenced in an appropriate manner determined by the Engineer.

SDEMA 4.4.11 "No go" areas (Subclause 4.3.7)

All works to be undertaken shall be within the boundary of the site. A "no go" area shall extend on either side of the working area i.e. all areas outside of the defined working area and designated access roads. The working area shall be demarcated in an appropriate manner determined by the Engineer. The "no-go" area shall be demarcated by a semi-permanent fence to prevent workers from entering the undisturbed areas.

SDEMA 4.4.12 Community Relations (Subclause 4.3.10)

The Contractor shall recognise that the Site is visible to the public. As such, the construction camp shall be kept neat and clean at all times. The Contractor shall take all reasonable measures to ensure the safety of people in the surrounding area. A register shall be kept of all complaints and shall be made available to the Department of Environmental Affairs (DEA) on request.

Information boards erected on and/ or around the site shall comply with the applicable Local Authority By-Law for the control of outdoor advertising or in the absence of local legislative controls must comply with the South African Manual for Outdoor Advertising Control (SAMOAC).

The number and location of the information boards shall be determined by the Engineer.

Should an incident like stock theft occur, the incident will be reported to the local police for investigation.

SDEMA 4.4.13 Dust control (Subclause 4.3.15)

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 should, as a minimum, take cognisance of the following:

- Measures to ensure that material loads are properly covered during transportation.
- Minimisation of the areas disturbed at any one time and protection of exposed soil against wind erosion, e.g. by dampening with water.
- Location and treatment of material stockpiles taking into consideration prevailing wind directions and dwellings as well as to prevent erosion and run off.
- Adherence to provisions of the Occupational Health and Safety Act.

During summer, dampening of areas shall be undertaken to control dust generation, and the Contractor shall ensure that the sprays do not generate excess run off. Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible. Vehicle speeds shall not exceed 20km/h when traversing unconsolidated or non-vegetated areas.

SDEMA 4.4.14 Botanical, avifauna and fauna (Subclause 4.3.9)

The construction phase shall be closely monitored by an ECO who shall identify areas that require rehabilitation in the post-construction phase. A re-vegetation and habitat rehabilitation plan shall be compiled and implemented with the aid of a suitably qualified rehabilitation specialist, for inclusion in the LEMP. The rehabilitation specialist shall recommend species to be used in rehabilitation (including species suitable for grazing) as well as any special measures required, e.g. shade-netting and alien vegetation removal. Furthermore, ground shall be returned as far as possible to original levels / gradients and any excess material shall not be left in piles, but shall be removed off-site.

All construction activities should be contained within the PV facility footprints to minimize disturbance outside these areas.

An alien invasive management plan shall be compiled and implemented. The plan shall include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.

The construction phase shall be closely monitored by an Environmental Control Officer who shall identify areas that require rehabilitation in the post-construction phase.

No flora shall be removed or damaged, outside of the designated working area, without specialist botanical input. The collection of firewood by construction workers is prohibited.

During construction of power lines, the entire length of a new line should be marked with bird flight diverters to avoid additional cost should this be retro-fitted post-construction through findings of the monitoring.
Any snakes found on site shall be removed from site and released into an area away from the site, without harm.

SDEMA 4.4.15 Protection of archaeological and paleontological remains (Subclause 4.3.10)

A follow-up survey must be undertaken to deal with linear developments and any areas still considered sensitive prior to development.

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), including the site located within the most western laydown area. Mitigation measures shall be implemented should it be found that the site cannot be avoided after confirming with the ECO.

The ECO responsible for the development should be aware of the possibility of important fossils (e.g. mammalian bones, teeth) being present or unearthed on site and should monitor all substantial excavations into superficial sediments as well as fresh (i.e. unweathered) sedimentary bedrock for fossil remains.

In the case of any significant fossil finds (e.g. vertebrate teeth, bones, burrows, petrified wood) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (SAHRA. Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) so that any appropriate mitigation (i.e. fossil recording, sampling or collection) by a palaeontological specialist can be considered and implemented, at the developer's expense.

The no-go areas and their buffer zones must be cordoned off during the construction phase.

SDEMA 4.4.16 Access routes/ haul roads (Subclause 4.3.11)

The contractor shall ensure that all regulations relating to traffic management are noted and local traffic officials are informed of the proposed construction activities. As far as possible, attempts shall be made to ensure that high construction related road usage coincides with low traffic flow periods. Transport components overnight as far as possible.

Signage and safety measures during the construction of the access roads shall comply with the guidelines as set out in the latest issue of the SADC Road Traffic Signs Manual. Standard "construction ahead" warning signs should be placed on all relevant roads in the area. Ensure access roads are kept clean and storage of materials is screened and that that all road junctions have good sightlines.

A traffic management plan for the site access roads shall be compiled and implemented to ensure that no hazards would results from the increased truck traffic and that traffic flow would

not be adversely impacted. This plan shall include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.
A transportation plan shall be compiled and implemented for the transport of PV components, and other large pieces of equipment.

SDEMA 4.4.17 Cement and concrete batching (Subclause 4.3.12)

No cement and / or concrete batching shall occur within the “no-go” areas or within 32m from the top of river banks/water courses/drainage lines. Reasonable measures shall be implemented to limit contaminated surface run-off into the surrounding vegetation.

SDEMA 4.4.18 Earthworks (Subclause 4.3.13)

Any blasting is to be executed by a suitably qualified person.

Controlled blasting techniques shall be employed to minimise dust and fly rock during blasting.

Prior to blasting the Contractor shall notify the relevant occupants / owners of surrounding land and address any concerns. Buildings within the potential damaging zone of the blast shall be surveyed preferably with the owner present, and any cracks or latent defects pointed out and recorded either using photographs or video. All Local Authority regulations are to be adhered to and all service infrastructures are to be located prior to commencement of blasting activities.

Blasting or drilling shall take place during normal working hours. The Contractor shall notify emergency services, in writing, a minimum of 24 hours prior to any blasting activities commencing on site. Adequate warning must be issued to all personnel on site prior to blasting activities taking place. All legally required signals are to be clearly indicated. The Engineer shall be issued daily updates of the days intended blasting activities.

The Contractor shall prevent damage to special features and the general environment, which includes the removal of flyrock. Damage caused by blasting / drilling shall be repaired to the satisfaction of the Engineer.

Minimise areas disturbed at any one time and protect exposed soil against wind erosion, e.g. by dampening with water or covering with hessian.

SDEMA 4.4.19 Erosion and sedimentation control (Subclause 4.3.19)

An erosion management plan for the monitoring and rehabilitating erosion events has been compiled (refer to Section 7). Where necessary, sedimentation barriers shall be laid between the Work Area and the “no-go” areas to limit sediment deposition. The sedimentation barrier shall consist of a geotextile fabric stretched across and attached to supporting posts and stabilised with sandbags. The barrier shall be inspected daily and any damage shall be repaired immediately. Sediment deposits shall be removed once they reach half the height of the barrier.

SDEMA 4.4.20 Site closure and rehabilitation (Subclause 4.3.28)

All construction debris found within the disturbed areas shall be removed and disposed of at a registered landfill site.

A re-vegetation and habitat rehabilitation plan shall be compiled for inclusion in the Construction EMP. The plan shall recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal. The construction footprint associated with the activity shall be re-vegetated with indigenous vegetation, as directed by the rehabilitation plan. Disturbed areas shall be rehabilitated as soon as possible after construction.

SDEMA 4.4.21 Labour requirements (Add Subclause 4.3.32)

A local employment policy shall be developed together with a training programme. This plan shall be audited. Furthermore, recruitment shall be based on sound labour practices and with gender equality in mind.

A local procurement policy shall be developed and adopted to maximise the benefit to the local economy. The general contractor shall be responsible for making available the contact details for all the local businesses offering related goods and services to the sub-contractors.

Appropriate training shall be provided to enable individuals to apply their skills to other construction and development project in the region once the construction phase is completed.

SDEMA 4.4.20 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.

4.6 Compliance with requirements and penalties (SDEMA 5)

SDEM 5.1 Penalties (Subclause 5.2)

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 operations operating within the designated boundaries of a "no-go" area.	R10 000
b)	Any mechanised excavation equipment related to the Contractor's operations operating within the designated boundaries of a "no-go" area abutting the two streams.	R10 000
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.

SDEMA5.2 Amendments to CEMPr & Registers

Amendments to the CEMPr 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 table which constitutes 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.

This section contains the Operational Framework EMP table which constitutes 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 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; and
  - 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

5.1 Specification Data: Environmental Management (SDEMA)

	Operational Framework Environmental Management Programme Table						
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 unavoidable 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 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	Developer	Twice in the 1st three years and then once every five years	ECO / Independent Auditor
2.	Environmental management of the operational phase	Positive impacts on socio-economic environment during operation	**Objective:** To ensure that the operation of the wind energy facility maximises positive impacts on the socio-economic environment. **Mechanism:** 1) Train local people for operation and maintenance of facility; and 2) 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	Developer	During Operational Phase (full lifetime) when the need arise to employ people.	ECO / Independent Auditor
3.	Protection of fauna, flora and avifauna	Constructing a PV facility may have impacts on the vegetation.	**Objective:** To prevent unnecessary disturbance to natural vegetation.	No animals are injured. No employees	Developer	Construction and operational phases (from site establishment to	ECO / Independent Auditor

	Operational Framework Environmental Management Programme Table						
No	**ASPECT**	**IMPACT**	**MITIGATION MEASURE: (objective and mechanism)**	**PERFORMANCE INDICATOR**	**RESPONSIBILITY**	**SCHEDULE**	**VERIFICATION**
		The site will be cleared of all vegetation and this area could become prone to alien species.	**Mechanism:** 1) A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to; 2) Shallow depressions, well defined pans and seasonal watercourses should be avoided, with buffer zones of at least 30 m around pans and from 'Leegte Shrubland'. Roads and transmission lines traversing such areas should be avoided where possible and if not, physical impacts should be limited as far as possible; 3) It is anticipated that there would be minimal loss of vegetation due to the installation of the distribution power-line to the Kronos Sub-station or Cuprum sub-station. In the latter case existing approved Eskom servitudes could be used; 4) Exclude development from within at least a 1km radius of the occupied and possibly active Martial Eagle nest site located on the south-western edge of the development area. This buffer area should remain as undisturbed and undeveloped as possible; 5) Exclude development from areas/microhabitats identified during the bird monitoring project (see below) as being of particular value to threatened/priority species (e.g. Red Lark, Sclater's Lark); 6) Minimise noise and disturbance associated with maintenance activities at the plant once it	enter the no-go areas. No alien vegetation establishment. Invasive alien vegetation monitoring programme implemented.		contract completion).	

	Operational Framework Environmental Management Programme Table						
No	**ASPECT**	**IMPACT**	**MITIGATION MEASURE: (objective and mechanism)**	**PERFORMANCE INDICATOR**	**RESPONSIBILITY**	**SCHEDULE**	**VERIFICATION**
			becomes operational; 7) Minimise 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; 8) Minimise the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds; 9) Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared, or where panel washing occurs. These should be disposed of in an appropriate manner to prevent future re-infestation and / or spreading of alien vegetation; 10) The small ground level openings in the electrical or barbwire fence, 20-30cm in height, should be kept clear to allow for small mammals and reptiles to move through the site; 11) New aboveground lines should be fitted with bird flight diverters and marked along their entire length. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future; and 12) Instituting a comprehensive impact monitoring scheme, and using the results of this scheme to inform and refine a dynamic approach to mitigation.				

	Operational Framework Environmental Management Programme Table						
No	**ASPECT**	**IMPACT**	**MITIGATION MEASURE: (objective and mechanism)**	**PERFORMANCE INDICATOR**	**RESPONSIBILITY**	**SCHEDULE**	**VERIFICATION**
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.	**Objective:** Prevent stormwater from eroding the land and becoming contaminated. **Mechanism:** 1) Implement erosion control measures should there be evidence or erosion; 2) All site roads shall remain un-surfaced, with only the main access road from the R357 to the plant substation, surfaced; 3) Channel runoff shall be diverted in such a way as to minimise erosion and if necessary, soil stabilising techniques shall be implemented in vulnerable areas; 4) Channel runoff should be diverted in such a way as to minimise erosion and if necessary, soil stabilising techniques should be implemented in vulnerable areas; 5) Drainage system and pans shall be completely avoided and well buffered from any infrastructure and operational activities; and 6) Monitoring in accordance with an environmental management plan as operation proceeds	Stormwater not contaminated by construction activities. Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop. Freshwater ecosystems are not unduly disturbed by construction activities within the drainage channels.	Contractor	After site clearing has taken place up to the end of the construction phase.	ECO / Independent Auditor
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) Good management practices and dust control; 2) Keep all lighting to a minimum within the requirements of safety and efficiency; 3) Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce	No complaints from the public.	Developer	Construction and operational phases (from site establishment to contract completion).	ECO / Independent Auditor

	Operational Framework Environmental Management Programme Table						
No	**ASPECT**	**IMPACT**	**MITIGATION MEASURE: (objective and mechanism)**	**PERFORMANCE INDICATOR**	**RESPONSIBILITY**	**SCHEDULE**	**VERIFICATION**
			light spillage and pollution, should be used; 4) No naked light sources are to be directly visible from a distance. Only reflected light should be visible from outside the site; 5) Install any necessary aircraft warning lights as per the relevant authority requirements; 6) 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; 7) Security and perimeter lighting must also be shielded so that no light falls outside the area needing to be lit. Excessively tall light poles are to be avoided; and 8) Carrying out of repairs shall take place promptly. All site buildings, as well as the perimeter fence shall be kept tidy at all times.				
6.	Impact on agricultural land	The activity might impact on the agricultural potential of the site	**Objective:** To protect the agricultural land **Mechanism:** 1) Initiate land rehabilitation and re-vegetation as soon as possible and continue to monitor for early signs of degradation and erosion; 2) It is recommended that more palatable species form part of the re-vegetation plan to enable faster stocking initiation; 3) Allow normal agricultural activities to continue in unaffected areas; and 4) Allow periodic grazing within the PV Site (sheep and goats). This mitigation will minimise the loss of grazing land and reduce	To minimise impacts on agricultural land	ECO	Construction and operational phases (from site establishment to contract completion).	ECO / Independent Auditor

	Operational Framework Environmental Management Programme Table						
No	**ASPECT**	**IMPACT**	**MITIGATION MEASURE: (objective and mechanism)**	**PERFORMANCE INDICATOR**	**RESPONSIBILITY**	**SCHEDULE**	**VERIFICATION**
			the impact on agricultural production. It is recommended that the proposed PV Site are used as rotational grazing camps.				
7.	Impacts on local economy (employment) and social conditions	The activity might impact on the economy (local shops, restaurants, and Guest Houses, etc.)	**Objective:** To ensure on-going sustainability of the local tourism / hospitality industry. **Mechanism:** 1) Give preference to local communities for employment opportunities; and 2) Base recruitment on sound labour practices and with gender equality in mind.	Contribute to local community upliftment	Contractor, ECO, Engineer	During the construction phase (from site establishment to contract completion).	ECO / Independent Auditor
8.	Land use	Based on the distance to the nearest (SKA) station the proposed development could potentially impact on the SKA project.	**Objective:** To prevent electromagnetic interference generated from the power generation equipment and prevent the facility from acting as secondary transmitters. **Mechanism:** 1) Implement measures recommended in the modelling study, as agreed to with SKA.	No interference with the SKA project.	Developer	Construction and operational phases (from site establishment to contract completion).	SKA

Page left intentionally blank

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 750m in length, should be established in areas representative of all the avian habitats present within and around the periphery of the Hoekplaas 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 5m 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. 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 facility on the density and community structure of surrounding passerine populations.

6.1.4 Future monitoring

Should the results from the monitoring programme show that the cumulative impacts from the multiple renewable energy projects in the Copperton area are causing high negative impacts on bird species on a local and regional scale (i.e. beyond a radius of 10km from farm Hoekplaas), DEA shall be contacted to discuss the implementation of an integrated mitigation approach by all renewable energy facilities contributing to the cumulative negative impact on avifauna.

7 EROSION MANAGEMENT PLAN

Excessive erosion can lead to land degradation and the reduction of the area's carrying capacity. It is therefore of importance to implement an erosion management plan during the lifespan of the project.

7.1 Soil Erosion Monitoring

Soil erosion will need to be monitored visually by the appointed 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 shall not be allowed, especially on steep slopes. Following the clearing of an area, the surfaces of all exposed slopes shall 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 shall either be armoured with fascine like structures or vegetated[10].
- If a cleared area is not going to be built on immediately, the top layer (nominally 150mm) 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, EcoLogsTM and Bio JuteTM are recommended if erosion problems are noted during construction and operation phases.

[10] A fascine structure usually consists of natural wood material and is used for the strengthening earthen structures or embankments.

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 asphalting.
- 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.

Page left intentionally blank

8 DECOMMISSIONING

The Power Purchase Agreement for the Hoekplaas PV8 facility is only valid for a period of 20 years after which the plant would most likely be decommissioned and the site rehabilitated. Given that environmental legislation might change considerably in 20 years' time, the decommissioning of the proposed facility shall be preceded by the review of all relevant environmental legislation at the time to determine due process required. However, as a minimum the following measures should be undertaken.

- Should the PV facility 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 PV8 facility comprises of inert materials (mostly concrete), the residual risks associated with decommissioning would be negligible. Should the need arise to decommission the PV facility; 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 shall be developed approximately 24 months before closure of the PV facility. The construction phase EMPr could be used as a guideline to facilitate the detailed decommission phase EMPr. Mitigation measures below are only provisional mitigation measures.
    - All PV structures, associated structures and fencing shall be removed and recycled.
    - Unnecessary internal roads (as agreed upon by the landowner) shall be ripped and then rehabilitated.
    - All impacted footprint areas shall be rehabilitated and restored to indigenous, endemic vegetation as per the rehabilitation plan.
    - Noise and disturbance associated with decommissioning activities shall be kept to the minimum.

Page left intentionally blank

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.

Page left intentionally blank

ANNEXURE A

CURRICULUM VITAE OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS

See Annexure C of the EIA Report

ANNEXURE B

CONSTRUCTION EMP GENERAL SPECIFICATIONS (COMPREHENSIVE)

ANNEXURE C

CONCEPTUAL STORMWATER MANAGEMENT PLAN

See Annexure E of the EIA Report

ANNEXURE D

LIFE-CYCLE ENVIRONMENTAL MANAGEMENT PLAN (EMP)

- Comprehensive Environmental Management Plan

GENERAL ENVIRONMENTAL SPECIFICATION FOR CONSTRUCTION

CONTENTS

---o0o---

1 GENERAL

1.1 SCOPE

This Specification covers the standard 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 to impose pro-active controls on the extent to which the construction activities impact on the environment. This Specification contains only generic specification clauses which may be augmented or superseded by project specific specifications contained in an Environmental Management Plan or Environmental Authorisation.

The Specifications contained herein shall apply to contractors undertaking work as part of the project. The Principle Contractor shall be responsible for the implementation of these Specifications.

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

1.2 DEFINITIONS

For the purposes of this Specification the definitions and abbreviations given in the applicable specifications listed in 1.4and 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. Any substance or mixture containing such substances as listed in the OHSA General Machinery Regulation 8: Schedule A.

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.

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 suitably experienced person, not an employee of the Employer, 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.

Top material: The top 150 mm of soil (topsoil) and root material of cleared vegetation.

1.3 NORMATIVE REFERENCES

1.4 Supporting specifications and legal framework

The following specifications shall, *inter alia*, form part of the Contract Document.

a) An approved Environmental Management Plan;
b) The conditions associated with any relevant Environmental Authorisation or Permit;
c) SANS 1200 Series of Standardized Specifications;
d) SANS 1200 A or SANS 1200 AA, as applicable;
e) Occupation Health and Safety Act (OHSA): Specification AO,
f) Construction Regulations, 2003, and
g) Standards listed in Appendix A.

1.5 Management and administration

This Specification and any supporting document containing project specific specifications shall be provided to a perspective Contractor's at the tender / quoting stage. The implementation of this General Specification (or subsequent agreements as the case may be) is non-negotiable and every perspective contractor shall cost for and make the necessary provisions available to ensure implementation of these General Environmental Specifications and any associated documents (i.e. Environmental Management Plan and or Environmental Authorisation). The Contractor may defer responsibility for implementation and oversight of environmental requirements onto a third party, but may not defer liability and will held accountable for any non-compliances and associated damages.

The Contractor shall construct and/or implement all the necessary environmental protection measures in each area before any construction work may proceed under the direction of the Engineer or delegated official. The Engineer may suspend the Works at any time should the Contractor, in the Engineer or delegated official's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately. The costs of such suspension shall be to the Contractor's account.

1.5.1 Environmental Site Officer (ESO)[1]

The Contractor shall, at commencement, appoint, in writing, a suitably qualified or otherwise senior member of his permanent site staff to perform the role of the ESO. The Contractor shall ensure that this appointee is provided adequate time to fulfil the requirements of the role, which will be proportional to the project scale and extent. Should the Engineer find that the ESO does not adequately fulfil the role and duties of the ESO then the Contractor maybe directed to recruit a suitably qualified, dedicated ESO for the duration of the construction period. The ESO will be required to develop a detailed understanding of the Specifications and ensure that the Contractor's fulfils the requirements of the specifications and remains compliant throughout the project term, including any defects liability period. The ESO will be required to report of compliance issues during monthly progress meetings and to co-operate with the any official representative from the Government, Client and Engineer on environmental management matters. The key responsibilities of the ESO include the following:

- Develop a detailed understanding of the requirements of this specification;
- Obtain confirmation in writing from the Client that all regulatory processes, authorisation and permit requirements have been fulfilled. Copies of the permits and authorisations shall be obtained, and retained onsite, and studied by the EO prior to the commencement of site establishment and site works. Any conditions contained in a permit or authorisation shall be deemed to form part of this Specification. Special attention must be given to any areas identified as No Go areas during an EIA study.
- Undertake routine inspections of all areas and activities under the Contractor's control, identify environmental non-conformances and incidents and initiate measures to remedy such issues.
- Ensuring that the Contractor's staff abide by the Specification and initiate disciplinary actions where required.
- Report on environmental incidents and compliance matters at monthly progress meetings.
- Liaise and co-operate with any official environmental representative from the Government, Client

[1] This role is the same as an Environmental Officer (EO)

and Engineer regarding environmental matters associated with the project.

- Ensure that any environmental monitoring requirements are met and undertaken with precision, according to best practice sampling and monitoring methodologies.

2 CONTRACTOR MOBILISATION AND GENERAL PROVISIONS

2.1 Baseline photography

Following official handover of the site to the Contractor and prior to the commencement of mobilisation activities, the Contractor shall take photographs of all areas that will be impacted by construction activity and their immediate surrounds. Photographs shall include, *inter alia*, all works areas, site establishment and laydown areas, access roads, gates, no go and natural areas, debris, boundary fences, existing structures and infrastructure on the site and any defects or issues to any of the foregoing. These photographs shall be provided to the Engineer for reference purposes.

2.2 Method statements

Method statements shall be produced and submitted for approval by the Engineer at least five working days prior to the commencement of the activities. The Contractor shall not commence the activity until the Method Statement has been approved. Approval of method statements shall not unreasonably be withheld. The Engineer may approve, reject or approve with conditions any method statement.

The Engineer may request, on an *ad hoc* and reasonable basis, that a method statement be produced for any activity or component of the works which carries significant risk. All method statements must comply with the provisions of this Specification, unless, if there is a need to deviate from the provisions of the specification such deviation must be clearly articulated in the method statement or letter, a motivation provided for the need for such deviation and proposed mitigation measures that will be implemented to ensure that such deviation will not pose a undue risk to the environment. The Engineer shall, without risk of prejudice, retain the right to reject any proposed deviation and is under obligation to consult with and confirm the acceptability of such deviation with an Environmental Specialist or Government Official. A method statement containing a proposed deviation must also be approved in writing by the Client. Method statements containing proposed deviations shall be submitted at least 15 working days prior to the commencement of the activity.

The following is a provisional list of required method statements:

1) Mobilisation Plan, with consideration to the following:
    a. A plan indicating the layout of the site establishment area, laydown and staging areas, workshops, fuel storage and dispensing areas, stores (including explosives), offices, ablutions, recess areas, roads and sidings, fences and gates, signboards, central waste storage area and any other temporary structure or use area that will be directly affected by site establishment or routine project administration.
    b. Provisions to address and maintain housekeeping throughout the site.
    c. A detailed plan and design for the fuel storage site, including the type and volume of storage container and the design and capacity of the bund. The plan shall include procedures and measures to prevent spills and leaks of fuels and oils during transference.
    d. A provisional list of major vehicles, plant and equipment that will be permanently based on site and where plant, equipment and vehicles will be parked when not in use.
    e. A list of the bulk construction materials and a description of how they will be transported to site and where they will be staged prior to use.
    f. A description of a temporary storm water control measures to be installed around yards and site establishment areas.
    g. A description of the proposed security and access control measures.
    h. A description and plan of roads to be used during construction and the proposed traffic safety measures.
    i. A provision list of potentially hazardous materials that will be used during construction phase and a description of how and where these will be stored.
    j. A detailed description of a waste management plan giving consideration to:
        i. Measures relating to recycling, reducing and reusing any waste.
        ii. A description of the type and the proposed number and location of rubbish bins.

iii. The location and design of the central waste storage area including hazardous wastes.
iv. A plan for dealing with inert waste including building rubble and spoil.

k. Provisional Construction Programme.
l. Outline of the Contractor's staff recruitment policy.
m. Description of the construction staff accommodation provisions and policy.
n. Any special arrangements or agreements made between the Contractor, the landowner, municipality, local businesses/ service providers and or neighbouring land owners.

2) Emergency preparedness and response plan, detailing the following:
   a. A telephone contact list of personal responsible for emergency prevention and response, including the relevant Client and Engineer representatives and local emergency services.
   b. A list and description of the types of emergencies that may arise on site.
   c. Site evacuation procedures and emergency assembly point.
   d. Procedures to be followed in the event of a fire.
   e. Safeguard measures to prevent fire, with special reference to hazardous materials, fuels and lubricants and explosives stores.
   f. A plan showing the following:
      i. The location and type of firefighting equipment.
      ii. Emergency assembly point
      iii. Evacuation routes.
   g. Measures for the handling use and storage aimed at preventing spills and leaks of hydrocarbons and other hazardous substances.
   h. Procedures to be followed after spill or leak of hydrocarbon or other hazardous substances including.
      i. Training of plant and equipment operators in the procedures.
      ii. A description and location of spill containment, clean up materials, personal protective equipment and specialist handling equipment of site or in plant and equipment.
      iii. Procedure for reporting a spill, containment, clean up, remediation and disposal.

3) Earthworks plan, detailing the following:
   a. A layout drawing indicating the following
      i. Location and extent of all areas to be cleared.
      ii. Location of topsoil stockpiles.
      iii. Location of temporary and final spoil areas
   b. A description of how cleared vegetation and other debris will be dealt with.
   c. A description of how dust will be controlled.
   d. A description of and plans for dealing with water:
      i. Preventing ingress of water into excavations.
      ii. Approach to dewatering.
      iii. Storm water and erosion control measures.
      iv. Pollution and sediment control and treatment measures and disposal of contaminated water.

4) Concrete works plan, detailing the following:
   a. How concrete will be produced on site (Batched on site or ready-mix). If batched on site then detailed procedures and plans must be produced as to how much, where and how this will be undertaken.
   b. Measures to avoid the contamination of water and measures to treat contaminated water, including storm water control interventions and cleaning of tools and equipment, including drum wash, that used in the concrete operations;
   c. Measures to prevent and clean up spillage of concrete spills and over pours.
   d. Measures for dealing with concrete admixtures, shutter oil and any other chemical substances that may be employed in the concrete works.
   e. Any other measure employed during the batching, transport or pouring of concrete to avoid pollution of contamination of the environment.

2.2.1 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. The Contractor shall liaise with

the Engineer prior to the Commencement Date to fix a date and venue for the course. The environmental awareness training course shall be held in the morning during normal working hours. The Contractor shall provide a suitable venue and ensure that the specified employees attend the course. The Contractor shall keep a register of attendance and attendees must sign that they were in attendance and shall provide the Engineer with a copy of the attendance register the day after each course as part of their monthly submissions. The Environmental awareness course will be included in the general orientation of any new employees, who must also sign acknowledgement of receiving the course and any associated materials.

Subject to the implementation of a written warning system and any appropriate disciplinary interventions, repetitive failure to observe the requirements set out in this specification by any one member of staff should be treated as a dismissible offence. Should recurring non-compliances occur as a result of the actions or omissions of one individual, the Engineer may instruct the Contractor to remove such person from site.

2.2.2 Toolbox talks

Relevant environmental site matters, incidents and issues shall form part of the Contractor's tool box talks. The Contractor shall make a note of what environmental subjects were discussed

2.2.3 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.

2.3 Surveying and setting out

2.3.1 Site establishment

The Engineer shall be advised of the area that the Contractor intends using for his site establishment by way of the Mobilisation plan discussed under item 1) of Clause 2.2. 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.

2.3.2 Site fencing and demarcations

As may be required, 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. The Contractor shall not damage or remove any boundary fences without the agreement of the adjoining landowner. Where property fences are replaced these shall, at the minimum, meet specification of the fencing it replaces, in terms of top height, sturdiness and rigidity (pole foundations and supports and strength and wire gauge), security (barbed or razor wire) and size of the largest openings (i.e. distances between horizontal wires or mesh dimensions.

2.3.3 No Go Areas

If required, certain areas shall be considered "no go" areas and these may be detailed in the Environmental Management Plan or as conditions attached to an Environmental Authorisation. 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" area demarcation fencing shall be established prior to the commencement of construction in the vicinity.

"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.

2.4 Overarching environmental requirements

The following provisions relate to all areas of construction.

2.4.1 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 ensure that plant, equipment, materials and staff are not permitted to enter any designated “no go” area.

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

2.4.2 Protection of flora and fauna

Except to the extent necessary for the carrying out of the Works (as per an approved method statement), flora shall not be removed, damaged or disturbed nor shall any vegetation be planted without the Engineer’s approval. Firewood may not be collected from the site unless written approval is provided by the Engineer.

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

The use of biocides is subject to the approval of the Engineer unless provided for in the project specification. Where the use of biocides and other poisonous substances has been specified, they shall be stored, handled and applied with due regard to their potential harmful effects. Persons using any biocide or poisonous substances shall have received training in the appropriate handling, use and storage of such materials. Care will be taken to ensure no movement or drift occurs into non-target areas. Dyes shall be mixed into sprayed biocide so that the treatment areas may be inspected and the risk of over spray / re-spraying is avoided.

2.4.3 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 and follow due process as required by the relevant authority.

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.

2.4.4 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, 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 excessive 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.

Where loud construction operations or plant are required, that cannot be practically barricaded (i.e. Pile driving, hydraulic breakers or rock crushing), nearby residents that may be disturbed by the operation will be notified and provided with a program for the works prior to commencement. The Contractor shall be reasonable in accommodating the needs of neighbours and take reasonable measures to minimise the impact of noise on neighbouring communities.

With the exception of warning and emergency sirens and public address systems used during an emergency, no sound is to be broadcast across the site with approval from the Engineer.

2.4.5 Lighting

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. Subject to meeting the minimum requirements of the OHSA and general security, lighting shall be kept to the minimum. Care will be taken to ensure lighting is task specific and does not spill into the surrounding environment through appropriate placement and shielding. Floodlighting of expansive work areas or up- or down lighting of vertical structures or natural features shall only be permitted if approved by Engineer.

2.4.6 Fuel (petrol and diesel) and oil

Unless otherwise specified, 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 employ the use of appropriate non-spill dispensing equipment and drip trays to prevent spills during refuelling. 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 ensure that staff responsible for refuelling of plant is trained to clean up any fuel of oil spills as they occur. The Contractor shall obtain the Engineer's prior approval for any refuelling or maintenance activities. The fuel bowsers and stores must be inspected daily by the Contractor and any contaminated soil shall be collected and disposed of via the hazardous waste system. Care will be taken to ensure that oil contaminated soil, rags or other materials are not disposed of as part of domestic waste system due to the fire risk.

2.4.7 Contaminated water

The Contractor shall take reasonable measure to prevent the contamination of water and where this is not

possible will 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.

2.4.8 Stormwater and drainage

The Contractor shall ensure that storm water is managed in such a way that prevents erosion. The Contractor shall install temporary stormwater control measures which may include cut off drains, berms, side drains, retention ponds or similar needed to divert stormwater away from earthworks areas, or as directed by the Engineer.

2.4.9 Solid waste management

The Contractor shall provide sufficient bins with lids on Site to store the 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 offsite at an approved landfill site. The Contractor shall supply the Engineer with a certificate of disposal.

2.4.9.1 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.

2.4.9.2 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 bunded 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.

2.4.9.3 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 bunded 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.

2.4.10 Workshop, equipment maintenance and storage

The Contractor shall ensure that all items of plant and equipment are inspected daily prior to commencement. Any maintenance requirements shall be seen to before start-up. Inspection checklists shall be retained and submitted to the Engineer on request.

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 generators, pumps and compressors) and for Transport and Earthmoving Equipment (such as scrapers, diggers, loaders, trucks, cranes, etc.). 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.

2.4.11 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.

2.4.12 Dust

The Contractor shall take 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 dry and, or windy periods, a water tanker shall be available for the control of dust, and the Contractor shall ensure that the sprays do not generate excess run off.

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

As required by the National Dust Control Regulations, promulgated in terms of section 53(o) of National Environmental Air Quality Act (Act 39 of 2004) the Contractor shall establish of a network of dust monitoring points using method ASTM D1739: 1970[2] (or equivalent), sufficient in number to establish the contribution of the person to dustfall in residential and non-residential areas in the vicinity of the premises, to monitor identified or likely sensitive receptor locations, and to establish the baseline dustfall for the district.. The following standards will apply:

- For residential areas the dust fallout may not exceed 600mg/m^2/day (on a 30 day average) more than two times a year and not on sequential months.
- For non-residential areas the dust fallout may not exceed 1200mg/m^2/day (on a 30 day average) more than two times a year and not on sequential months.

All items of plant capable of generating significant volumes of dust (i.e. crusher plants, concrete batching plants) shall be equipped with necessary equipment (Bag filters in cement silos, sprayers and conveyor transfer and fall points and hoppers) to ensure that fugitive dust is minimised.

2.4.13 Aesthetics

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.

The Contractor shall take reasonable measures to ensure that construction activities do not have an unreasonable impact on the aesthetics of the area. Measures will be taken to obscure construction yards and associated plant and equipment from onlookers as far as is reasonable. Refer also to 2.4.4 regarding requirements for lighting.

2.4.14 Disruption to existing and neighbouring land use activities

The Contractor shall take measures to limit the disruption of any existing land use activities occurring on the site or neighbouring sites as far as reasonable. Where construction may impact on access routes, safe alternative access shall be provided to the satisfaction of the Engineer. Refer also to clauses 2.4.4, 2.4.5, 2.4.11 and 2.4.13 regarding dust, noise, lighting and aesthetics. Where construction will result in disruptions to activities, the Contractor shall notify the affected landowner and inform him of the construction activity, the program and what mitigations measures will be implement to minimise the disruptions. The Client, Contractor and Engineer shall make compensations and or accommodate landowner's requests and to maintain the *status quo,* as far as is reasonable.

2.4.15 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:

[2] American Standard for Testing and Materials method D1739

- 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 for at least two standby staff displayed.
- Pipe stockpile wedged/ secured.
- Emergency equipment, including firefighting and spill response materials and equipment remain readily accessible to standby staff.
- Site security measures in place.
- All plant and equipment have their keys removed or are disabled to prevent unauthorised start-up / theft.

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.
- All plant and equipment not in use are withdrawn from areas prone to flooding.

2.4.16 Public roads

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. Where road safety may be impacted on the Contractor shall notify the relevant roads authority and arrange for the necessary road warning signage and appoint trained points men to control traffic around any hazards. Any damage caused to the public road system as a result of construction or as a direct result of construction vehicles and equipment shall be repaired to the satisfaction of the Engineer.

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.

2.4.17 Security and access control

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.

All authorised personal and visitors shall be issued with an identification card (or similar) to ensure that the security personnel may identify authorised persons.

2.4.18 Access routes / haul roads

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

Where temporary roads are required for construction the route, design and layout shall be subject to the approval of the Engineer. Roads shall be routed to limit environmental impact by avoiding sensitive environmental features including rivers, wetlands, areas of botanical significance or any other areas as identified through environmental planning processes. Roads shall follow routes that minimise stormwater related risks (i.e. steep gradients, cuts and fills, drainage lines, marshy areas). Where temporary roads cross

drainage lines (which must be an approved, see Activity 18 of R 544 of NEMA) the reasonable provision shall be made to accommodate flooding without structural damages to the road crossing, approaches or to the river banks, the design of crossings shall be subject to approval by the Engineer. Subject to the preceding requirements, roads shall be designed to have the least possible footprint needed to meet project objectives. All temporary roads shall undergo full rehabilitation at project completion and the expense of such shall be to the Contractor's account. Unless inside the urban edge or part of an environmental authorisation in terms of NEMA R544 Activity No. 22.(II) no new construction road shall exceed 8m or where such road already exists be widened by more than 6m or lengthened by more than 1000m.

2.4.19 Housekeeping

The Contractor shall make available the time and resources need to undertake routine housekeeping of the works areas and site establishment areas at a minimum of a weekly interval. Housekeeping shall include maintenance of barriers, structures, signage, material stockpiles to ensure that they are safe and aesthetically acceptable and to the satisfaction of the Engineer. Construction materials shall be stacked in a safe, neat and orderly fashion and shall comply with the requirements of the OHSA. Windblown litter, construction debris and spoil shall be collected and removed for disposal.

2.4.20 Ablution facilities

The Contractor shall deploy an adequate number (As per the requirements of the OHSA) of portable toilets at the various works areas and site establishment area, including provision for security and access control personal. Toilets should not be located further than 100m from the place of work. Toilets should be placed in shaded areas wherever possible. The Contractor shall make provision to have the toilets cleaned and maintained in a hygienic fashion and shall supply toilet paper. Toilets shall be secured to the ground to ensure they are not blown over during high winds or bumped over by some other means. The Contractor shall also make available a hand washing facility. Where portable toilets are located within view of the public or neighbouring residences or places of business, efforts should be taken to screen such facilities from view and provide privacy to users.

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 and must be treated at a registered waste water treatment works. The Contractor shall keep record, and provided such records upon request, of the location and volumes of waste disposed. The use of pit latrines and soak-a-ways is prohibited unless approved by the Engineer.

Washing, whether of the person or of personal effects and acts of excretion and urination are strictly prohibited other than at the facilities provided. The Contractor shall take disciplinary action against any staff member found in contravention of this requirement.

2.4.21 Recess areas and canteens

The Contractor shall provide covered recess areas at the site establishment area and at various working areas, which are situated too far from the site establishment area to allow staff to return for recesses. The recess area should be located in an area that provides natural shade but should not be located within 32m of a drainage lines or wetland, in or adjacent a "no go" area, in dense combustible vegetation or near any neighbour or activity to which they may cause disturbance. The recess areas should also be located away from construction noise, dust, waste storage areas, hazardous materials stores, fuel storage and dispensing areas and any other activity that may contaminate food or impair comfort. The recess areas shall provide adequate seating to accommodate the staff stationed at that area of the works. Recess areas shall be located near, but not next to, ablution and hand washing facilities. Recess areas should also have an adequate supply of cool potable water, as determined by the number of staff working in that area. An adequate number of rubbish bins shall be provided to contain the waste generate by this facility in a day. The recess areas shall make provision for a smoking area, including seating and a fire proof sand filled container for extinguishing cigarettes. Smoking shall otherwise be prohibited across the site and in the works areas. The recess areas shall be equipped with an appropriate sized fire extinguisher to deal with a fire at this location. Subject to implementation of reasonable fire protection measures and the presence of fight fighting equipment, the Contractor may establish a purpose built warming or cooking fire in an area cleared of all combustible material near the recess area (Note in terms of Clause 2.4.2 however that firewood may not be collected for the surrounding area). Staff shall not be permitted to eat or rest during recess times in any other

areas other than the designated recess or canteen area.

The following specifications will apply to a site canteen. The Canteen will be situated according to the principles for recess areas, as provided above. The Canteen will shall be designed to ensure the hygienic preparation of food and cleaning of cooking utensils cutlery and crockery. Water decanted from cooking processes or that from the washing shall not be disposed of into the environment but rather via a storage tank and then the sewage disposal system. The Canteen shall be equipped with the appropriate size and type of fire extinguished needed to deal with type and nature of fire that may arise. The Canteen shall have an adequate number of scavenger and weather proof rubbish bins needed to deal with the days' waste. Rubbish bins shall be cleared daily to the central waste storage area. The Contractor shall take measure to ensure that housekeeping and maintenance of hygienic conditions are strictly observed..

2.4.22 Site clinic or first aid station

Should the scale of construction warrant the need for a first aid station (clinic, sick bay, medical bay) the following requirements shall apply. The design and maintenance of the first aid station shall be such that the hygienic safety of the patients can be assured. The first aid station shall be operated by a certified first aider or paramedic. All waste arising from the first aid station or site ambulance shall be treated as hazardous waste and shall not be disposed of via the domestic waste system. . A safe potable water supply shall be provided. Effluents from washing shall be direct to a tank, collected and disposed via the sewage disposal system.

2.5 Emergency procedures

In addition to the emergency procedures set out in the Contractor method statement titled Emergency preparedness and response plan as dealt with under Item 2) of Clause 2.2, the Contractor's procedures for the following emergencies shall include:

2.5.1.1 Fire

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.

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. The Contractor shall provide adequate fire protection measures at each work area and the site establishment area to deal with the type and nature of fire that may arise. On large construction site located in a wilderness area or adjoin commercial forestry of agricultural land use that may be prone to and susceptible to veld fires the Engineer may specify that the Contractor install fire breaks along boundary fences together with any other fire protection measure deemed necessary to protect property and lives of site staff and neighbours.

2.5.1.2 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.

2.6 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 and any measures or agreements made in resolution to such complaint.

The Contractor shall develop an employment policy and shall disseminate this to interested communities, informing them of how many opportunities are available and the skills required for such opportunities. Depending on the scale of the project and the proximity and populace of nearby communities, the Contractor shall consider appointing a community liaison officer and an employment desk in the interested communities to manage the recruitment of staff. Local South Africans should be given first priority with regard to any employment opportunities and the Contractor's recruitment policy and nature and number of job opportunities should be communicated timeously and clearly to manage expectations and avoid conflict.

2.7 Construction Methods and procedures

2.7.1 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.

2.7.2 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.

2.7.3 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. Readymix trucks shall not be permitted to dump drum wash on site unless into contaminated water pond which must be fully rehabilitated at completion and the sediment collected for disposal.

2.7.4 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.

2.7.5 Dewatering

Pumps shall be placed over a drip tray in order to contain fuel spills and leaks. Pumps shall be located sufficiently above the water line to ensure that that it does not become inundated if pumping is discontinued. The Contractor shall take all reasonable precautions to prevent spillage during the refuelling of these pumps.

The Contractor shall ensure that, unless of similar to the upstream water quality, 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.

2.7.6 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.

2.7.7 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 m^2 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.

2.7.8 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 were concrete buckets are in use).

2.7.9 Trenching

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

- Topsoil shall be removed and stockpiled separately from and not mixed with the subsoil. Preferably topsoil should be placed on the upslope side of the trench which subsoil is placed on the downslope side of the trench, levelled and used for construction access. The areas used for topsoil and subsoil stockpiling should not be cleared of shorter herbaceous vegetation and must not be grubbed. Only once the trench is backfilled and shaped will the topsoil be spread across the trench area,
- 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.
- Trench lengths shall be kept as short as practically possible before backfilling and compacting.
- Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion.
- Stormwater control measures shall be used to reduce the ingress of stormwater into the trench. Where needed the Contractor shall provide temporary stormwater pipes to allow stormwater to cross the open trench.

2.7.10 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.

2.7.11 Stockpiling

The Engineer will identify suitable sites for stockpiling. Stockpiles shall be convex in shape and shall be limited in height so that it does not result in undue visual impacts or significant dust, as approved by the Eengineer. 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. Unless otherwise stipulated, areas for temporary stockpiling will not be cleared of shorter herbaceous vegetation as this compacted vegetation layer will serve protect the topsoil and serve as a marker during stockpile reclamation. 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 result in the damming of water or run off, or is itself washed away.

Top material 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, ameliorated before use in rehabilitation works.

2.7.12 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 or compacted. Once construction is complete the Contractor shall clear all construction debris and materials 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 specified.

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 irrigation of rehabilitated areas for a minimum period of six to eight weeks to encourage germination. They may elect to extend the irrigation programme or the Engineer may specify ongoing irrigation programme if required. However any irrigation programme must taper off over a period of four to eight weeks before complete cessation as an abrupt cessation is likely to result in high seeding mortality rates (depending on local soil and climatological factors).

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.

2.7.13 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 foreign debris, shall be removed and disposed of via the solid waste management system. The area shall be revegetated as follows:

a) Compacted areas, such as roads, stockpile areas and construction platforms shall be ripped or scarified to depth of 300mm.

b) The surface shall be levelled by hand or machine as far as practically possible.

c) Alien vegetation shall be cleared by cutting the plants off at ground level, and painting the stump with 0.5% Garlon in diesel.

d) 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 50mm and 400mm, delivered to Site in bales and shall be applied evenly by hand or machine at a rate of 1 bale per 20m^2 over the area to be revegetated. It shall then immediately be rotovated into the upper 100 mm layer of soil.

e) The prepared area shall be hydro- or hand-seeded at a rate of 40 kg/ha using a suitable indigenous grass species or 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.

f) 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 must be from an approved source.

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.

3 COMPLIANCE WITH REQUIREMENTS AND PENALTIES

3.1 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.

3.2 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.

3.3 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 2.4.10 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.

4 MEASUREMENT AND PAYMENT

4.1 Basic principles

4.1.1 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.

4.1.2 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).

4.1.3 Work "required by the Engineer"

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

4.2 Billed items

4.2.1 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.

4.2.2 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).

---o0o---

ANNEXURE D

LIFE-CYCLE ENVIRONMENTAL MANAGEMENT PLAN (EMP)

- Key Staff Curriculum Vitas

Curriculum vitae: Mr A VAN DER MERWE

Name	:	**VAN DER MERWE, ANDRIES**
Date of Birth	:	23 September 1973
Profession/Specialisation	:	Environmental engineering and environmental auditing
Years with Firm	:	17
Nationality	:	South African
Years of experience	:	17

Key qualifications

Andries is an Environmental Engineer and heads up the environmental team of the Environment & Advisory Services Unit of the Aurecon Cape Town Delivery Centre, which includes a branch in George. He takes final responsibility for all projects and marketing activities undertaken by his team and has been involved in a wide spectrum of infrastructure development projects throughout Africa. He regularly acts as project team leader and provides technical assistance and input on projects undertaken that typically include large-scale Environmental Impact Assessments (EIAs) related to the resource and energy sectors. He has a keen interest in the application of Multicriteria Decision Making (MCDM) Models in EIA, environmental engineering and strategic planning projects and enjoys challenges in this regard. Recent large EIAs include the Phase 2 SEIA for the Rössing Uranium Mine Expansion Project in Namibia and a series of EIAs for the proposed Moatize Mine Expansion and Nacala Rail Corridor through Mozambique and Malawi for Vale in which he acted as the overall project leader, supported by a senior project manager per each of the five EIA packages.

He has been involved in a number of training and capacity building projects in the field of environmental management. Recent examples include the second phase of the Integrated Industrial Pollution Prevention programme in Mozambique that focused on capacity building in the Environmental Ministry in Mozambique, with specific emphasis on hazardous waste, pollution control and related strategies, as well as the environmental management module of the European Union funded infrastructure asset management training programme run by the National Department of Provincial and Local Government in South Africa for officials of various local and district authorities.

He is a trained SABS/ISO 14001 Environmental Management Systems (EMS) auditor and his specific expertise allows him to assume a leading role in the compilation of Environmental Management Systems (EMSs) and Environmental Management Plans (EMPs) for all life-cycle phases of typical infrastructure development projects, as well as the monitoring and auditing of the implementation of EMSs and EMPs on site. Recent projects of this nature include the operational EMP for the Sunderland Ridge Wastewater Treatment Works, the design and construction EMP for the Gautrain project, EMP implementation monitoring on the 60km Polokwane Effluent Transfer Project for Anglo Platinum and the first phase of EMS development completed for Yum! Restaurants International, that represents KFC in South Africa.

Earlier in his career, he has been exposed to construction environments in both full time and part-time site supervision roles and the design office where he was responsible for the engineering designs and contract documentation for a wide spectrum of infrastructure projects and again later in his career with specific focus on construction EMP implementation monitoring and auditing.

Employment record

01/2012 - Date	Aurecon, Environmental Specialist/Technical Director
01/2004 - 12/2011	Aurecon, Environmental Engineer and Auditor/Associate
08/1999 - 12/2004	Aurecon, Environmental Engineer and Auditor
08/1998 - 07/1999	Aurecon, Resident Engineer
01/1996 - 07/1998	Aurecon, Design Engineer

Experience record

Environmental and Social Impact Assessment (ESIA) for three Shoprite supermarkets **(Regional, Angola) 02/2012 - Date.** *Project Director (Environmental and Social Component).* The project entailed an Environmental and Social Impact Assessment (ESIA) for three proposed new Shoprite Checkers supermarkets and line shops in Angola (Kwanza-sul, Benguela and Luanda), including site screening, scoping study, final Environmental Impact Statement, and a monitoring plan. (Shoprite Angola Imobiliaria Lda).

Environmental Management Plans (EMPs) for Coal Bed Methane Prospecting Activities **(Tete, Mozambique) 06/2012 - 07/2012.** *Project Director.* Rio Tinto Coal Mozambique (RTCM) intended to expand their currently authorised coal prospecting activities in Mozambique to include prospecting for Methane. Aurecon was appointed to urgently compile EMPs to control activities associated with prospecting for Coal Bed Methane for lease areas 935L, 948 and 945L in Tete Province, Mozambique. (Rio Tinto Coal Mozambique).

The Erongo Power Station Environmental Socio-Economic Impact Assessment (ESEIA) **(Erongo, Namibia) 09/2011 - 28/2013.** *Project Director.* The project entailed a study of a proposed new power station which would increase the electricity generating capacity of the Erongo Region in Namibia. Aurecon was appointed by NamPower to undertake the ESEIA process in terms of the Environmental Management Act No 7 of 2007 and the Environmental Assessment Policy of 1994. This ESEIA aimed to assess the impact of a 150/300/800MW coal-fired power station with associated coal stockyard, an ash disposal facility and transport systems to deliver coal. Involved for 3.75 person-months. (Namibia Power Corporation (NamPower)).

Environmental Impact Assessment (EIA) for the construction of the AfriSam cement factory, quarries and associated infrastructure **(Western Cape, South Africa) 02/2011 - Date.** *Prject Director.* Aurecon was appointed to undertake an Environmental Impact Assessment (EIA) process for a new cement plant, mine and associated infrastructure located on Farm 1139 in the Saldanha Industrial Area. The project entailed mining activities at limestone quarries, including Prospect Hill Quarry, Oranjevlei Quarry and Holvlei Quarry; and a conveyor belt linking the quarries to the cement factory with a registered servitude. (AfriSam South Africa).

Emergency desalination plant, Mossel Bay **(Mossel Bay, South Africa) 05/2010 - 12/2012.** *Project Leader.* Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 15M/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase Environmental Management Plan. (Mossel Bay Municipality).

Environmental and Social Impact Assessments (ESIAs) for five Shoprite Checkers stores in Angola **(Regional, Angola) 08/2010 - 03/2013.** *Project Director (Environmental Component).* This project entailed undertaking several Environmental and Social Impact Assessments (ESIAs) for the construction and expansion of shopping centres. Aurecon was appointed to undertake five Environmental and Social Impact Assessments (ESIAs) for the construction of two new shopping centres and the expansion of the three existing shopping centres. (Shoprite Angola Imobiliaria Lda).

Environmental Impact Assessment (EIA) for the Moatize Coal Mine expansion project **(Tete, Mozambique) 03/2010 - 04/2011.** *Project Leader.* The additional infrastructure required for the Moatize coal mine expansion included a second primary crusher and second coal processing plant, increased raw water supply and storage capacity, an upgraded water treatment plant and power substation, a new coal conveyor system, enlarged storage yard to accommodate two lines of coal, optimised materials handling between the existing operations and proposed expansion, upgraded leachate cut-off drains, upgraded tailings dam effluent filtration system, and solid waste landfill and hazardous waste disposal facilities. The Environmental Impact Assessment coincided with a pre-feasibility study (FEL2 Level) undertaken to determine the infrastructure required to accommodate the expansion of the mine. The aim of the assessment was to seek a decision regarding the project acceptability from the Mozambican environmental authorities (MICOA) through an update of the assessment completed for the first Moatize Mine complex and to describe, include and assess the proposed additional infrastructure. Involved for 1.3 person-months. (Vale).

Application of a Multi-criteria Decision Making (MCDM) model to rank development sites within Etosha National Park **(Namibia) 04/2010 - 04/2011.** *Environmental Engineer.* Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 2M/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase Environmental Management Plan. Involved for 0.8 person-months. (Millennium Challenge Account Namibia).

Environmental Impact Assessments (EIAs) for the Nacala Rail Corridor **(Mozambique and Malawi) 03/2010 - 12/2011.** *Project Leader.* A series of four Environmental Impact Assessment packages for the proposed 860km Nacala Rail Corridor for the export of coal from the Vale Moatize Mine involving the construction and rehabilitation of the railway line between the loading terminal at the mine and the offloading terminal at the proposed deepwater port at Nacala-a-Velha, passing through southern Malawi. The project

assessed the following components: the expansion of the existing mine loading terminal to accommodate the additional train traffic, transport of coal in trains (each comprising 4 diesel electric locomotives and 115 wagons with a capacity of 60t), management of train movement in the yards with priority given to loaded trains, signalling and control of movement of trains along the route based on GPS technology to allow for monitoring the movement of each and depots along the route to allow for provision of supplies and exchange of teams. It also included the deepwater port at Nacala-a-Velha with new coal terminal off-loading facilities using rail car tippler dumpers, workshops to house rolling stock and to allow for maintenance of trains following discharge and infrastructure for fuel provision. Construction is proposed to start mid-2011, with export capacity ramping up to 26Mtpa in 2016. The focus of the assessments was to review the relevant scoping reports, EPDA reports and available baseline data and acquiring updated information where necessary to describe and assess the predicted social and environmental impacts of the proposed additional infrastructure. Each package included a common assessment of the strategic impacts related to the project as a whole within the region, to allow for an understanding of each component within the bigger picture. (Vale).

Khanyisa Power Station - Geohydrological Investigation **(Mpumalanga, South Africa) 09/2010 - 12/2012.** *Project Director (Environmental Management Programme Component).* Aurecon was appointed to perform an Environmental Impact Assessment (EIA) for the proposed Khanyisa Power Station near Witbank in the Mpumalanga Province. The scope of services involved the quantification of the anticipated impacts on the geohydrological environment caused by the construction, operation and decommissioning of a Power Plant and associated ash disposal in the vicinity of Anglo American Thermal Coal (AATC). Involved for 0.5 person-months. (Anglo Coal).

Pre-feasibility study for the Great Lakes Railway **(Regional) 03/2010 - 12/2012.** *Project Director (Environmental Component).* This project revolved around the Governments of Burundi, the DRC, Rwanda, Uganda and Zambia, who needed to improve port, inland waterway and rail inter-connectivity in the Great Lakes Region (Lake Kivu, Lake Edward, Lake Tanganyika, Lake Victoria and Lake Albert) based on several transportation constraints experienced. Responsible for to investigate the potential environmental impacts. Involved for 0.75 person-months. (Common Market for Eastern and Southern Africa (COMESA)).

Social and environmental management plan for new sulphuric acid storage tank at the Rössing Uranium Mine **(Arandis, Namibia) 02/2010 - 06/2010.** *Project Leader.* The project comprised the compilation of a social and environmental management plan for the proposed new 15Kt sulphuric acid storage tank located within the mine precinct adjacent to similar tanks to increase acid storage capacity. Involved for 0.1 person-months. (Rössing Uranium/Rio Tinto).

Emergency upgrading of Keurbooms rising main and pumps and later application for authorisation for a further length of rising main rehabilitation **(Plettenberg Bay, South Africa) 06/2009 - Date.** *Project Leader.* The project consisted of the urgent environmental application for the upgrading of the Keurbooms pump station, abstraction works and an initial length of steel rising raw water main to allow for an increase in river abstraction and, later, the application for an environmental management plan. Subsequently, also appointed as the Environmental Control Officer for the construction phases. (Bitou Municipality).

Decommissioning of the Sonae Novobord Fibreboard factory **(George, South Africa) 07/2009 - Date.** *Project Leader.* The project consisted of an Environmental Management Plan (EMP) for the decommissioning of the Sonae Novobord factory in George Industria, with a focus on the recovery and handling of salvageable materials and the lawful recovery and safe disposal of hazardous wastes and contaminated soil. Later, responsible for acting as the Environmental Control Officer during the decommissioning phase to oversee the implementation of the EMP. (Sonae Novobord).

Emergency desalination plant, Plettenberg Bay **(Plettenberg Bay, South Africa) 12/2009 - Date.** *Project Leader.* Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 2M?/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase Environmental Management Plan. (Bitou Municipality).

Health and Safety Executive (HSE) brochure for Rössing Uranium's expansion project **(Arandis, Namibia) 09/2009 - 11/2011.** *Project Leader.* The project entailed the compilation of a succinct and easily accessible brochure describing Rössing Uranium's health, safety and environmental management system components such as management policies, programmes and procedures already in use at the mine for wider public understanding. (Rössing Uranium/Rio Tinto).

Social and environmental management plan for mineral exploration drilling **(Arandis, Namibia) 01/2009 - 01/2011.** *Project Leader.* The project entailed the compilation of a social and environmental management plan for exploration drilling activities within the overlap of the sensitive Namib-Naukluft Park and Rössing Uranium Mine license area. Also appointed for a phase 2 exploration drilling social and environmental management plan to address more detailed infill drilling, including rehabilitation plans for drill sites and access routes. Involved for 0.5 person-months. (Rössing Uranium/Rio Tinto).

Develop of an Environmental Management Plan (EMP) for the ash dumps at the Kriel Power Station **(Mpumalanga, South Africa) 11/2009 - 04/2013.** *Project Director.* This project revolved around the Kriel power station; which was quickly reaching the capacity of their ash dams, one site had been identified adjacent to the most recent ash dam, within their premises, and the project allowed for an extension of the existing ash dams facility. (Eskom).

Unifying and standardising of highway engineering practices **(Abu Dhabi, United Arab Emirates) 08/2009 - Date.** *Project Leader (Environmental Manual Component).* This project revolved around the highway network of the United Arab Emirates (UAE) and gulf region, which is expanding rapidly year by year to accommodate construction developments. Aurecon was appointed to project manage the development of documents which included guidelines, manuals, specifications and standards for the management, planning, design, construction, maintenance and operation of highway projects. These covered all aspects of roads, highway structures and appurtenances, and associated infrastructure. Involved for 0.5 person-months. (UAE Department of Transport).

Social and environmental screening of potential railway route alternatives **(Southern Malawi) 05/2009 - 12/2009.** *Project Leader.* The project consisted of the screening of four potential railway alternatives through southern Malawi as part of a wider study to determine the feasibility of establishing an export corridor from Tete in Mozambique, through Malawi, to the port of Nacala-a-Velha in Nampula. The environmental screening coincided with an FEL2 level engineering study evaluating the technical and financial feasibility of the routes. The environmental and social screening was done using a simplified Multi-criteria Decision Making (MCDM) model and comprised a review of background information, authority liaison and meetings, compilation of a list of suitable social and environmental screening criteria and rating methodology for each specified criteria, a detailed legal framework review, fieldwork to confirm sensitivity of the receiving environment, a fatal flaw analysis, Geographic Information System (GIS) mapping of findings, preparation of cost estimates of social and environmental mitigation measures including resettlement (split into capital and operational costs), and presentation of the findings and recommendations in a summary report. Involved for 0.8 person-months. (Vale).

Phase 2: social and environmental impact assessment for Rössing Uranium's expansion project **(Namibia) 08/2008 - 06/2012.** *Project Leader.* The project comprised a social and environmental impact assessment for the second phase of Rössing Uranium's expansion project, including increased production in the current SJ open pit and the establishment of associated process facilities with additional crushers and ore stockpiles, the establishment of an acid heap leaching facility that would be a first in uranium processing, as well as increased waste rock dump capacity and tailings capacity. Involved for 12.5 person-months. (Rössing Uranium/Rio Tinto).

Environmental and socio-economic impact assessment for a proposed NamPower coal-fired power station at Walvis Bay **(Walvis Bay, Namibia) 05/2008 - 08/2009.** *Environmental Engineer.* The project consisted of an environmental and socio-economic impact assessment for a proposed NamPower coal-fired power station at Walvis Bay which included a site screening and selection process through the application of a multiple criteria decision-making model, a scoping study, and the development of an Environmental Management Plan (EMP). Involved for 2 person-months. (Namibian Power Corporation).

Application of a Multiple-criteria Decision-Making (MCDM) model to optimise future land use planning at Rössing Uranium **(Arandis, Namibia) 04/2008 - 03/2009.** *Project Leader.* The project comprised the development and application of an MCDM model to optimise future land use planning focusing on the new waste dump areas, heap leach and ripios sites and mine tailings areas. Involved for 1 person-month. (Rössing Uranium/Rio Tinto).

Environmental Impact Assessment (EIA) for the feasibility update and the development of studies to evaluate the transport of coal from Moatize to Nacala and its shipment **(Mozambique) 11/2008 - 06/2009.** *Environmental Project Leader.* The project comprised the updating of the 2006 Bankable Feasibility Study (BFS) to 14Mtpa and was done to create a rail capacity simulation and trade-offs model for the ramp-up period. Alternative heavy haul routes had to be investigated on Sections 2 and 3 before it was assumed that the base case route was the best route for the new tonnages. There was also a phased

upgrade of the railway line from 4 to 26Mtpa. Responsible for the high level environmental screening. Involved for 3 person-months. (Vale).

Garden Route environmental management framework **(South Africa) 06/2008 - 05/2009.** *Environmental Engineer.* Responsible for a supporting role contributing to the hydrology and infrastructure information layers and provision of local liaison support for the development of the Garden Route environmental management framework, focusing on the Kaaimans River to Noetzie study area on the Garden Route in the Southern Cape. Involved for 0.2 person-months. (earthINC/Department of Environmental Affairs and Tourism).

Review of the environmental studies and order of magnitude cost estimate and planning for mine expansion in Moatize and Nacala Rail Corridor from Moatize to Nacala-a-Velha **(Mozambique and Malawi) 11/2008 - 06/2009.** *Project Leader.* An updated Bankable Feasibility Study was required for the entire Moatize Phase 2 mine expansion to step up production and export through the planned rail link to Nacala through southern Malawi, inclusive of the planned construction of a deepwater port at Nacala-a-Velha in Mozambique. The deliverables included a general social and environmental mitigation cost estimate, a specific social resettlement mitigation cost estimate, generic statements of risk and identification of potential fatal flaws related to the different alternatives, detail on the required specialist studies with associated cost estimates, costs for completion of full Environmental Impact Reports (EIRs) and recommendations for way forward in a summary report. Involved for 3 person-months. (Vale Mozambique).

Social and environmental impact assessment for a bulk sulphur handling facility **(Walvis Bay, Namibia) 07/2008 - 12/2009.** *Project Leader.* The project entailed the compilation of a social and environmental impact assessment, which included a social and environmental management plan for the proposed bulk sulphur importation, stockpiling and handling facility in the Port of Walvis Bay. Involved for 0.5 person-months. (Rössing Uranium/Rio Tinto).

Paratus emergency generation facility **(Walvis Bay, Namibia) 05/2008 - 08/2008.** *Environmental Engineer.* The project consisted of the environmental authorisation process in relation to a proposed 50MW heavy fuel oil emergency electricity generation facility located within Walvis Bay. Involved for 0.5 person-months. (Namibian Power Corporation).

Social and environmental management plan for Rössing Uranium Expansion Socio-Economic Impact Assessment (SEIA) Phase 1 **(Namibia) 02/2008 - 08/2008.** *Environmental Engineer.* The project involved the social and environmental management plan for the first phase of Rössing Uranium's expansion project including an acid plant, ore sorter and SK4 pit. Involved for 1.5 person-months. (Rössing Uranium/Rio Tinto).

Environmental impact assessment for the upgrading of the Knysna Wastewater Treatment Works (WWTW) **(Knysna, South Africa) 10/2007 - 05/2008.** *Internal Reviewer.* The project was concerned with an environmental impact assessment and environmental management plan for upgrading the existing Knysna WWTW in the sensitive Knysna Lakes area in the Southern Cape. Involved for 0.1 person-months. (Knysna Municipality).

Polokwane effluent transfer project **(Polokwane, South Africa) 02/2007 - 12/2007.** *Environmental Control Officer.* Responsible for acting as the part-time Environmental Control Officer on this project to transfer treated sewage effluent from the Polokwane Wastewater Treatment Works (WWTW) to the AngloPlatinum mine outside Mokopane, including two pump stations, approximately 60km of pipeline and several reservoirs along the alignment. Involved for 2 person-months. (AngloPlatinum).

Upgrading of Khutala pumpstation **(Kriel, South Africa) 03/2007 - 08/2007.** *Project Leader.* The project entailed a basic assessment for the construction of a bypass pipeline at the Khutala pump station to ensure increased capacity and reduced operating costs. Involved for 0.45 person-months. (Department of Water Affairs and Forestry).

Environmental screening of infrastructure alternatives, Sishen Iron Ore, Sishen **(South Africa) 09/2007 - 12/2007.** *Project Leader.* The project consisted of the environmental screening of proposed infrastructure route alternatives as input into the design processes for the relocation of infrastructure required as part of the Sishen expansion project. This was done to increase production at the Sishen opencast iron ore mine. Involved for 0.5 person-months. (Kumba Iron Ore).

Basic assessment for the Vaal River Eastern Sub-system Augmentation Project (VRESAP) access road **(Vaal Marina, South Africa) 05/2007 - 09/2007.** *Project Leader.* The project consisted of a basic

assessment for the 2.2km access road to the Boschkop pump station of VRESAP through the Vaal Marina and traversing the Gauteng and Mpumalanga Provinces. Involved for 0.4 person-months. (Vaal Pipeline Consultants/Trans Caledon Tunnel Authority).

Automotive supplier park **(Rosslyn, South Africa) 02/2007 - 12/2007.** *Project Manager and Environmental Control Officer.* Responsible for providing environmental management support to the Supplier Park Development Company in the second phase of the establishment of the Automotive Supplier Park in Rosslyn, north of Pretoria. This entailed fulfilling the role of Environmental Control Officer during the construction phase of new projects within the park in this Gauteng Province Blue IQ initiative. Involved for 1.7 person-months. (Project Management Solutions Africa/Supplier Park Development Company).

Upgrading of the Rietfontein Nature Reserve **(Paulshof, South Africa) 06/2007 - 09/2007.** *Project Leader.* Responsible for acting as Environmental Control Officer on the construction phase of the upgrading of facilities within the Rietfontein Nature Reserve in Paulshof, northern Johannesburg. The first phase of upgrading focused on the establishment of an environmental education centre within the reserve. Involved for 0.2 person-months. (Johannesburg City Parks).

Overhead 132kV powerlines to Liqhobong and Kao Diamond Mines **(Lesotho) 09/2006 - 02/2008.** *Project Leader.* The project entailed an environmental impact assessment, social impact assessment and public participation for the 38km of 132kV overhead power lines from the Ha Lejone substation to the new Liqhobong and Kao Diamond Mines in northern Lesotho in difficult and inaccessible mountainous terrain. Involved for 4 person-months. (Liqhobong Mining Development Company and Kao Diamond Mine/Plantech Associates).

Rietfontein weir dredging and landfilling **(Trichardt, South Africa) 04/2006 - 12/2007.** *Project Leader.* In this project, the Environmental Impact Assessment (EIA) for the dredging and land-filling of contaminated silt from the Rietfontein weir in the Trichardtspruit north of the SASOL Syferfontein Mine outside Trichardt included the public participation process and permitting the proposed hazardous waste landfill. Involved for 1.5 person-months. (Department of Water Affairs and Forestry).

Doornkraal Reservoir **(Polokwane, South Africa) 11/2006 - 12/2007.** *Environmental Control Officer.* Responsible for acting as part-time Environmental Control Officer on the 30Ml Doornkraal Reservoir construction, west of Polokwane. Involved for 0.8 person-months. (AngloPlatinum).

Laudium bulk supply upgrade **(Laudium, South Africa) 12/2006 - 12/2007.** *Project Leader.* The project involved basic assessment for the upgrading of an existing bulk supply line of 1.5km to an internal diameter of 700mm, linking a Rand Water supply to the City of Tshwane reservoir in Laudium. Involved for 0.6 person-months. (City of Tshwane).

Upgrading of the K46 Bridge over the Jukskei River **(Dainfern, South Africa) 08/2006 - 09/2007.** *Environmental Engineer.* The project comprised an application for exemption from the requirements for environmental authorisation for the proposed upgrading of the K46 route over a total distance of 8km. This included alignment improvements and the construction of new dual carriageway bridges to accommodate the 1:100 year flood where the alignment crosses the Jukskei River at Dainfern, north of Johannesburg. Involved for 0.33 person-months. (Gautrans).

McHardy stream diversion basic assessment **(Cullinan, South Africa) 07/2006 - 09/2007.** *Project Leader.* The project involved basic assessment in terms of the National Environmental Management Act's Environmental Impact Assessment (EIA) regulations for the diversion of McHardy Stream through the Cullinan Diamond Mine grounds to separate polluted runoff from mining activities and unpolluted natural stormwater flow. Involved for 0.63 person-months. (De Beers Group Cullinan Diamond Mine).

Lesotho Highlands further phases studies **(Lesotho) 04/2006 - 01/2007.** *Environmental Engineer.* The project consisted of the application of the Ideal Mode Analytical Hierarchy Process Multiple Criteria Decision Making (MCDM) model in the initial technical planning workshop to optimise potential further phases' alternatives in the Lesotho Highlands Water Project, with specific focus on MCDM model setup, configuration and application. Involved for 0.8 person-months. (Lesotho Highlands Water Commission).

Joint Maputo River Basin water resources study **(Mozambique, Swaziland and South Africa) 09/2006 - 03/2007.** *Environmental Engineer.* The project consisted of the compilation of Environmental Impact Assessment (EIA) best practice guidelines based on a comparative review of EIA triggers and process requirements in the Tripartite Permanent Technical Committee member countries and international best practice. This contributed to an integrated comprehensive study of the water resources of the Maputo River

Basin, including Mozambique, Swaziland and South Africa. Involved for 1 person-month. (Tripartite Permanent Technical Committee / European Union).

BKM mine infrastructure **(South Africa) 02/2006 - 03/2006.** *Project Leader.* The project entailed environmental technical assistance to the engineering design team involved with the design of mine access and services infrastructure for the BKM iron ore mine. The assistance focused on the review of all available baseline information and mine environmental authorisation applications to establish a list of criteria that would ensure compliance with environmental best practice and authorisation permit conditions applicable to the design of services infrastructure. The proposed mine was an opencast mine with a washing, screening and beneficiation plant, ore stockpiles, a crushing plant, conveyors and a rapid rail loading facility. Involved for 0.2 person-months. (BKM Iron Ore Mine).

Sunderland Ridge Wastewater Treatment Works (WWTW) Environmental Management Plan (EMP) implementation monitoring and operational EMP **(Centurion, South Africa) 06/2006 - 12/2006.** *Environmental Engineer.* The project comprised the monitoring of construction EMP implementation on site for the upgrading of the Sunderland Ridge WWTW in Centurion to increase operational capacity with 20Ml day and reporting on EMP implementation status. This included the preparation of monthly summary reports for submission to the provincial environmental authority. Responsible for completing an operational EMP for the upgraded facility. Involved for 0.81 person-months. (City of Tshwane Metropolitan Municipality).

Technical and project management assistance to the Komati Basin Water Authority (KOBWA) **(Swaziland) 06/2006 - 08/2006.** *Environmental Engineer.* The project consisted of environmental management assistance to KOBWA, with a specific focus on the compilation of a tender document used in a call for tenders for the second round of ecological and aquatic monitoring, tender evaluation and adjudication. Monitoring requirements based on the treaty between South Africa and Swaziland were used as input into the study to determine the environmental water requirements. Involved for 0.25 person-months. (Komati Basin Water Authority).

Bizana solid waste disposal site **(Bizana, South Africa) 10/2005 - 02/2006.** *Environmental Engineer.* The project involved the development of proposals to formalise the existing Bizana solid waste dump and the operational and decommissioning Environmental Management Plan (EMP) to guide operations up to the site's final closure. Involved for 0.3 person-months. (Mbizana Local Municipality).

Braamhoek pumped storage access roads **(South Africa) 08/2005 - 02/2006.** *Project Leader.* The project entailed an Environmental Impact Assessment (EIA) for the access roads to the Braamhoek pumped storage scheme, spanning the KwaZulu-Natal and Free State border, and includes both the upgrading of sections of existing roads and the construction of new sections of road in mountainous areas. Involved for 0.2 person-months. (ESKOM Generation Division).

KwaDukuza solid waste management Section 78 assessment **(KwaDukuza, South Africa) 07/2005 - 03/2006.** *Environmental Engineer.* The project included a Section 78 assessment in terms of the Municipal Systems Act to assess existing solid waste management processes in KwaDukuza and to evaluate the merits of both internal and external service providers based on the financial modelling of both scenarios. Responsible for providing technical solid waste management input to the assessment. Involved for 0.2 person-months. (PriceWaterHouseCoopers Inc/Greater KwaDukuza Municipality).

Mafikeng Industrial Development Zone (IDZ) **(Mafikeng, South Africa) 01/2005 - 01/2006.** *Project Leader.* The project involved a due diligence assessment and Environmental Impact Assessment (EIA) for the proposed Mafikeng IDZ that was planned around the existing Mafikeng Airport. The development caters for export and high-tech industries and includes a variety of industrial and technology land uses. Initial development was focused on providing for minerals export, livestock export and quarantine facilities, as well as a cluster of light industrial stands. Involved for 0.5 person-months. (Mafikeng Industrial Development Zone (Pty) Ltd).

Senqu and Senqunyane Bridges **(Lesotho) 06/2005 - 02/2006.** *Project Leader.* This project consisted of an Environmental Impact Assessment (EIA) for two bridges spanning the Senqu and Senqunyane Rivers in Lesotho as part of the proposed Roma-Semongkong-Sekake Road which would reduce travel time to and from the south of Lesotho and increase accessibility to the remote villages to the north of the Senqu and Senqunyane Rivers. Involved for 0.5 person-months. (Lesotho Ministry of Public Works Roads Branch).

Kokstad solid waste management Section 78 assessment **(Kokstad, South Africa) 05/2005 - 03/2006.** *Environmental Engineer.* The project concerned a Section 78 assessment in terms of the Municipal Systems Act to assess existing solid waste management processes in Kokstad and to evaluate the merits of both

internal and external service providers based on the financial modelling of both scenarios. Responsible for providing technical solid waste management input to the assessment. Involved for 0.25 person-months. (PriceWaterHouseCoopers Inc/Greater Kokstad Municipality).

Groenpunt Prison Wastewater Treatment Works (WWTW) **(Sasolburg, South Africa) 08/2005 - 11/2005.** *Environmental Engineer and Project Leader.* The project entailed a scoping assessment and Environmental Management Plan (EMP) for the upgrading of the Groenpunt Prison WWTW on the banks of the Vaal River at Sasolburg. The upgraded works reduced the pollution risk that the existing system posed and mainly treats effluent from the large piggery on site. Involved for 0.25 person-months. (Stewart Scott International/Department of Public Works).

City of Tshwane: city development strategy **(Tshwane, South Africa) 07/2005 - 07/2005.** *Environmental Engineer.* The project concerned technical and engineering input into the review and updating of the City of Tshwane's city development strategy, with specific inputs focusing on general environmental management strategic issues and solid waste management opportunities and constraints. The strategy aimed to unlock the potential of the north of Tshwane by providing suitable infrastructure to stimulate growth. Involved for 0.2 person-months. (City of Tshwane Metropolitan Municipality).

Integrated industrial pollution prevention, Phase 2, national hazardous waste management strategy **(Mozambique) 01/2004 - 03/2006.** *Environmental Engineer and Project Leader of Subconsultancy Team.* The project consisted of technical assistance to the Environmental Ministry of Mozambique, in association with Ramboll, as part of the second phase of the integrated industrial pollution prevention programme funded by the Danish International Development Agency (DANIDA). This programme is aimed at hazardous waste management in Mozambique and capacity building within the Ministry regarding issues relating to the identification, handling, disposal, monitoring and regulation of hazardous waste. It also involves monitoring operations at the newly established hazardous waste disposal facility at Mavoco, Beluluane. Involved for 2.5 person-months. (Ministerio para a Coordenacao a Accao Impacto Ambiental (Micoa) / DANIDA).

Coega Industrial Development Zone (IDZ) Zone 1 infrastructure **(Port Elizabeth, Eastern Cape, South Africa) 05/2004 - 03/2006.** *Environmental Control Officer.* The project included environmental technical assistance to the project implementation team involved with the design and construction supervision of the infrastructure developed for Zone 1 of the Coega IDZ outside Port Elizabeth in the Eastern Cape Province. Responsible for acting as the Environmental Control Officer on site for the duration of construction. Involved for 1.1 person-months. (Coega Development Corporation).

Lagos toll roads feasibility **(Nigeria) 08/2004 - 11/2005.** *Environmental Engineer.* The project consisted of an Environmental Impact Assessment (EIA) and social impact assessment as part of the feasibility study for the development of approximately 150km of new toll roads through Lagos and along the Lekki Peninsula outside Lagos. Involved for 1 person-month. (Asset and Resource Management Company).

Facim commercial development **(Mozambique) 10/2004 - 01/2005.** *Project Leader.* The project entailed an environmental opinion and detailed Environmental Management Plan (EMP) for the Facim commercial development which includes an exhibition area, conference facilities, shopping centre and office space in downtown Maputo, and potentially presents the single largest private real estate investment in Mozambique. Involved for 0.5 person-months. (HLM Financial Enterprises CC).

Ibisi sanitation project **(uMzimkulu, South Africa) 05/2004 - 06/2005.** *Project Leader.* The project consisted of an Environmental Impact Assessment (EIA) and social impact assessment as part of the feasibility study for the development of approximately 150km of new toll roads through Lagos and along the Lekki Peninsula outside Lagos. Involved for 0.2 person-months. (uMzimkulu Local Municipality).

Department of Provincial and Local Government (DPLG)/European Union (EU) capacity building, phase 2 **(South Africa) 07/2004 - 02/2005.** *Environmental Training Facilitator.* This was a follow-up to the pilot project to establish environmental capacity on local and district authority level for the operation and maintenance of municipal infrastructure services. An environmental management module was presented to officials from various authorities in Mpumalanga and Limpopo Provinces. Involved for 1 person-month. (Department of Provincial and Local Government).

Ekurhuleni Northern Region Environmental Management Framework (EMF) **(South Africa) 03/2004 - 01/2005.** *Environmental Engineer.* The project included the development of an integrated EMF to facilitate the existing conflict between development, conservation and high potential agricultural land in Ekurhuleni. Involved for 0.8 person-months. (Ekurhuleni Metropolitan and Gauteng Department of Agriculture, Conservation and Environment (GDACE)).

Maluti landfill Environmental Impact Assessment (EIA) **(Eastern Cape, South Africa) 05/2004 - 07/2005.** *Environmental Engineer and Project Leader.* The project comprised the compilation of an EIA for the development of a new general communal landfill for the town of Maluti in the Eastern Cape Province. Involved for 1 person-month. (Alfred Nzo District Municipality).

North-West Agrivillage project **(Mafikeng, South Africa) 09/2004 - 01/2005.** *Project Leader.* The project concerned an Environmental Impact Assessment (EIA) for a new rural agricultural project, including an access road outside Mafikeng as part of a poverty relief initiative under the Expanded Public Works (EPW) programme. Involved for 0.2 person-months. (North West Provincial Department of Public Works).

Mehloding Adventure Trail access roads **(Eastern Cape, South Africa) 06/2004 - 12/2004.** *Environmental Auditor.* The project entailed monitoring the implementation of the construction Environmental Management Plan (EMP) for the construction of vehicular access roads in mountainous terrain to the chalets of the Mehloding Adventure Trail near Maluti in the Eastern Cape Province. Involved for 1 person-month. (Alfred Nzo District Municipality).

Vector Logistics Solutions technical assistance **(Gauteng, South Africa) 06/2004 - 08/2004.** *Environmental Engineer.* The project concerned technical assistance and conflict resolution for external potential activity impacting on the Vector Logistic food distribution centre in Florida, Johannesburg. Involved for 0.2 person-months. (Vector Logistic Solutions).

Gautrain Rapid Rail Link Environmental Management Plan (EMP) **(South Africa) 03/2003 - 02/2007.** *Environmental Engineer and Project Leader.* The project consisted of a review of the environmental Record of Decision (RoD) for the project, the drafting of a construction EMP framework for the client to use in a bid for the project, and assistance with specialist environmental management aspects throughout the bidding process. Subsequent further EMP development and refinement followed the announcement of Bombela Consortium as the preferred bidder, leading to the development of both design criteria and a construction phase EMP for the project. Involved for 7.2 person-months. (Bombela Consortium).

Limpopo National Park first phase infrastructure **(Mozambique) 10/2003 - 03/2006.** *Environmental Engineer.* The project involved an Environmental Impact Assessment (EIA) for the first phase infrastructure development for the Limpopo National Park comprising a camp, workshop, administrative complex, staff housing, ranger posts and a new entrance gate. Involved for 2 person-months. (Limpopo National Park/Peace Parks Foundation).

Mbombela State of the Environmental Report (SoER) **(Mpumalanga, South Africa) 01/2003 - 03/2004.** *Environmental Engineer.* The project comprised an SoER for the Mbombela Local Municipality in Mpumalanga Province in South Africa which entailed the establishment and development of a base for environmental reporting based on the United Nations Driving-Forces-Pressures-State-Impacts-Responses (DPSIR) model. Involved for 1.5 person-months. (Mbombela Local Municipality).

Windhoek Environmental Structure Plan (ESP) and policy **(Windhoek, Namibia) 01/2003 - 05/2004.** *Environmental Engineer.* The ESP is a Geographic Information System (GIS)-based product that provides essential information for land-use planning for development programmes. It classifies an area into environmental zones for various types of development and is supported by a database of physio-ecological information. The project also involved the drafting of an environmental policy for the city of Windhoek after completion of the ESP. Involved for 1.5 person-months. (City of Windhoek).

Moses Kotane environmental policy **(North West Province, South Africa) 10/2003 - 05/2004.** *Project Leader.* The project included the development of an environmental policy for the Moses Kotane Local Municipality in the North West Province of South Africa. Involved for 0.2 person-months. (Moses Kotane Local Municipality).

Three bridges in Lesotho: Environmental Impact Assessment (EIA) **(Lesotho) 07/2003 - 07/2004.** *Environmental Engineer and Project Leader.* Responsible for drafting a project brief document with a construction Environmental Management Plan (EMP) for the construction of bridges across the Qhoali, Sebapala and Phutiatsana Rivers in Lesotho. Involved for 1 person-month. (Ministry of Public Works: Roads Branch).

Freedom Park Legacy Project Environmental Impact Assessment (EIA) **(Lesotho) 08/2003 - 08/2004.** *Environmental Engineer and Auditor.* The project entailed an EIA for the first phase of the development of the Freedom Park Legacy Project on Salvokop in Pretoria, Gauteng. The project included a detailed visual

assessment and construction Environmental Management Plan (EMP), with EMP implementation monitoring on site during construction. Involved for 0.5 person-months. (Freedom Park Trust).

Limpopo Province State of the Environmental Report (SoER) **(Limpopo Province, South Africa) 08/2003 - 01/2004.** *Environmental Engineer.* The project entailed the establishment and development of a base for environmental reporting based on the United Nations Driving Forces-Pressures-State-Impacts-Responses (DPSIR) model for the Limpopo Province in South Africa. Involved for 1 person-month. (Limpopo Department of Agriculture, Land and Environmental Affairs).

Water Services Development Plan (WSDP) for Tshwane **(Gauteng, South Africa) 04/2003 - 12/2003.** *Environmental Engineer and Project Leader.* Responsible for drafting the environmental policy and strategic environmental management plan for the City of Tshwane Division: Water and Sanitation, as well as completing the environmental chapter for the WSDP. Involved for 2 person-months. (City of Tshwane Metropolitan Municipality).

New Lesotho parliament building and staff housing **(Lesotho) 03/2003 - 10/2003.** *Project Leader.* The project entailed an Environmental Impact Statement (EIS) for the proposed new Lesotho parliament and staff housing complex in Maseru. This included a social impact assessment and specialist vegetation study, as well as an Environmental Management Plan (EMP) with mitigatory measures for potential impacts. Involved for 0.5 person-months. (Ministry of Public Works: Building Design Services).

Rehabilitation Environmental Management Plan (EMP) for Road TR1/11 **(Namibia) 11/2003 - 12/2003.** *Environmental Engineer and Project Leader.* Responsible for drafting an EMP for the construction and rehabilitation phases of Road TR1/11 from Ondangwa to Oshikango in Namibia. Involved for 0.5 person-months. (Roads Authority of Namibia).

Environmental management system for Yum! Restaurants International **(South Africa) 07/2003 - 10/2003.** *Environmental Auditor and Project Leader.* The project consisted of the first phase of Environmental Management System (EMS) development for Yum! Restaurants International which represents KFC in South Africa. This involved gap analysis, a legal review, and a review of existing operational policies and procedures with recommendations for further EMS development. Involved for 0.5 person-months. (Yum! Restaurants International).

Master plan for the development of Mussulo Peninsula **(Luanda, Angola) 01/2002 - 12/2003.** *Environmental Engineer.* The project entailed a master plan for the development of the Mussulo Peninsula, incorporating an Environmental Management Framework (EMF) to focus development on the least sensitive areas, as well as proposals for applicable design standards and norms based on the carrying capacity of the Peninsula to ensure sustainable development. Involved for 3 person-months. (Ministério dos Transportes de Angola).

Spatial representation of industrial areas in Gauteng Province and recommendations on Buffer Zones, Phase 2 **(Gauteng, South Africa) 12/2002 - 02/2003.** *Environmental Engineer.* Phase 2 of this project consisted of the refining and spatial representation of different categories of industrial land use in Gauteng Province in a Geographic Information System (GIS)-based decision support tool with recommendations on buffer zones for each. Involved for 1 person-month. (Gauteng Department of Agriculture, Conservation, Environment and Land Affairs).

Nestlé Isando Environmental Impact Assessment (EIA) **(South Africa) 11/2002 - 12/2003.** *Environmental Engineer and Project Leader.* The project involved an EIA for the new dry pet food plant for Nestlé Purina Petcare in Isando and included specialist air pollution dispersion modelling and noise assessment. The aim of the study was to establish status quo conditions on site prior to operation, to predict impacts and to propose suitable mitigation measures where applicable Involved for 0.5 person-months. (Nestlé Purina Petcare - Friskies).

Environmental Impact Assessment (EIA) and review of engineering design of the Mavoco hazardous waste disposal facility **(Beluluane, Mozambique) 01/2002 - 02/2003.** *Environmental Engineer.* Responsible for an EIA, a Social Impact Assessment (SIA) and Environmental Management Plans (EMPs) for the construction, operation and rehabilitation phases. Also responsible for reviewing the engineering design of the Mavoco hazardous waste landfill site and access road near Mozal. Involved for 2 person-months. (Ministério para a Coordenação da Acção Ambiental (Micoa)).

Combolcha to Gundewein major link road Environmental Impact Assessment (EIA) **(Ethiopia) 11/2002 - 12/2003.** *Environmental Engineer.* The project comprised an EIA with a social impact assessment for the

proposed major link road from Combolcha to Gundewein in Ethiopia. Involved for 1 person-month. (Ethiopian Roads Authority).

***Environmental Management Plan (EMP) for the Kruger Mpumalanga International Airport (KMIA)* (Primkop, White River, South Africa) 07/2002 - 12/2002.** *Environmental Auditor.* Responsible for the EMP for the construction phase of the new KMIA, as well as implementation monitoring and auditing during construction Involved for 3 person-months. (Primkop Airport Management).

***Environmental Impact Assessment (EIA) for the telemetry masts for Kanyamazane Water Treatment Works (WTW) and reticulation system* (Kanyamazane Mbombela, South Africa) 03/2002 - 08/2002.** *Environmental Engineer and Project Leader.* Responsible for EIAs for four telemetry masts of the treatment and reticulation system of the southern Nsikazi regional water scheme. This included construction Environmental Management Plans (EMPs). Involved for 1 person-month. (Mbombela Local Authority).

***Survey of tourism potential and Socio-economic Impact Assessment (SIA) in four focus areas, namely: Madikwe, Barberton, Valley of the Olifants and Khayelitsha* (South Africa) 01/2002 - 05/2002.** *Environmental Engineer.* The project involved a tourism promotion and development potential survey as well as an SIA to review socio-economic conditions, estimate tourism demands and determine the socio-economic impacts of tourism development in each of the focus areas. Involved for 1 person-month. (Japanese International Cooperation Agency (JICA)).

***Technical information document on the environmental legislation impacting on engineering work* (South Africa) 03/2002 - 07/2002.** *Environmental Engineer.* Responsible for drafting a technical information document with a summary of the requirements for Environmental Impact Assessments (EIAs) in terms of South African legislation, with particular reference to engineering work. Involved for 1 person-month. (Aurecon).

***Spatial representation of industrial areas in Gauteng and recommendations on buffer zones* (Gauteng, South Africa) 01/2002 - 03/2002.** *Environmental Engineer.* The project comprised the development of a Geographic Information System (GIS)-based decision support tool to ensure that housing projects in Gauteng are not allowed in areas posing environmental and health risks, by mapping and classifying all industrial areas in the province and establishing worst and best case buffer zones based on legal requirements and expert consultation. Involved for 1 person-month. (Gauteng Department of Agriculture, Conservation, Environment and Land Affairs).

***Instream Flow Requirements (IFR) for rivers in the King Sabata Dalindyebo study area* (King Sabata, South Africa) 06/2002 - 07/2002.** *Environmental Engineer.* The project included the ecological classification of rivers and estimates of IFRs with recommendations on integrated environmental management procedures and ecological management categories for planning purposes. Involved for 1 person-month. (Department of Water Affairs and Forestry (DWAF)).

***Operational Environmental Management Plan (EMP) for the Kruger Mpumalanga International Airport* (Primkop, White River, South Africa) 04/2002 - 06/2002.** *Environmental Auditor.* The project involved an operational EMP covering all operational aspects of the international airport for inclusion in the airport operations manual series. Involved for 1 person-month. (Primkop Airport Management).

***Environmental Management Plan (EMP) implementation monitoring on the Mohale feeder roads bridge sites* (Mohale, Lesotho) 11/2001 - 02/2003.** *Environmental Auditor.* Responsible for monitoring the implementation of the construction EMP and making recommendations on mitigation on the three Mohale feeder roads bridge sites. Involved for 2 person-months. (Lesotho Highlands Development Authority (LHDA)).

***Environmental Management Framework (EMF) for Alexandra Township* (Alexandra, South Africa) 06/2001 - 10/2001.** *Environmental Engineer.* The Alexandra EMF was developed on a Geographic Information System (GIS) platform integrating impact management policy with spatial environmental priorities to seek sustainable development as part of the Presidential Alexandra Renewal Project. The EMF was developed at a scale of 1:5 000 to indicate the required level of detail to fast-track environmental approvals and permitting procedures in areas with low sensitivity, and included a generic environmental management plan for construction in these areas. Involved for 1 person-month. (Gauteng Department of Agriculture, Conservation, Environment and Land Affairs).

***Kamiesberg electrification project Environmental Impact Assessment (EIA)* (Northern Cape, South Africa) 01/2001 - 03/2001.** *Environmental Engineer and Project Leader.* The project included an EIA for the

provision of three-phase electricity to eight rural settlements in the Kamiesberg District in Namaqualand, including the assessment of the alignment of approximately 160km of new overhead electricity supply lines. Involved for 1 person-month. (Kamiesberg Municipal Authority).

Bronberg Reservoir Environmental Management Plan (EMP) **(Pretoria, South Africa) 04/2000 - 10/2005.** *Environmental Auditor.* The project comprised an EMP for the construction of the new 100Ml Bronberg Reservoir, and included site implementation monitoring and auditing. Involved for 1.5 person-months. Involved for 1.5 person-months. (Greater Pretoria Metropolitan Council (GPMC)).

Nelspruit Airport Environmental Risk Assessment (ERA) **(Nelspruit, South Africa) 11/2000 - 01/2001.** *Environmental Auditor.* Responsible for assessing the environmental performance of activities within the property boundaries of the Nelspruit Airport. Involved for 1 person-month. (ABB).

Centurion Environmental Management Framework (EMF) Phase 2 **(Centurion, South Africa) 07/2000 - 06/2001.** *Environmental Engineer.* The project involved Centurion's overarching EMF covering the whole of Centurion at a scale of 1:15 000 on a Geographic Information System (GIS) platform integrating impact management policy with spatial environmental priorities to seek sustainable development within Centurion. Involved for 2 person-months. (Centurion Town Council).

Mohale Dam feeder roads Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) **(Mohale, Lesotho) 11/2000 - 08/2001.** *Environmental Engineer.* The project included an EIA, Social Impact Assessment (SIA), review of the route alignments, and an EMP for the construction phase of the feeder roads around Mohale Dam as part of Phase 1B of the Lesotho Highlands Water Transfer Scheme. Involved for 3 person-months. (Lesotho Highlands Development Authority (LHDA)).

Environmental Risk Assessment (ERA) for the proposed Kruger Mpumalanga International Airport **(Primkop, White River, South Africa) 11/2000 - 01/2001.** *Environmental Auditor.* The project involved an assessment of the environmental performance of current activities on the proposed site and an assessment of inherent environmental risk with the development of the proposed international airport. Involved for 1 person-month. (Primkop Airport Management).

Nelspruit Airport operational Environmental Management Plan (EMP) **(Nelspruit, South Africa) 07/2000 - 09/2000.** *Environmental Auditor.* Responsible for an EMP for the operational phase of the airport, based on the outcome of the previously completed risk assessment. Involved for 2 person-months. (ABB).

North West road upgrade Environmental Management Plan (EMP) **(North West Province, South Africa) 10/2000 - 11/2000.** *Project Leader and Environmental Auditor.* The project involved a generic EMP for an extensive road rehabilitation project, including borrow pits, for the upgrading of 42 roads in the North West Province. Involved for 0.5 person-months. (North West Provincial Department of Public Works).

Tsomo sewage treatment works **(Eastern Cape, South Africa) 02/2000 - 03/2000.** *Environmental Engineer.* Responsible for an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the sewage treatment works for Tsomo Village. Involved for 1 person-month. (Eastern Cape Department of Public Works).

Qumbo and Gqunu bulk water supply Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) **(Eastern Cape Province, South Africa) 02/2000 - 03/2000.** *Environmental Engineer.* The project comprised an EIA and EMP to mitigate negative impacts associated with the construction of infrastructure required to supply the villages of Qumbo and Gqunu with piped water. Involved for 1 person-month. (Eastern Cape Department of Public Works).

Environmental Impact Assessment (EIA) and visual assessment for Siemens Cellular Telecommunications masts **(South Africa) 09/1999 - 06/2002.** *National Project Manager.* The project involved an EIA, visual assessments and public participation processes for the construction of cellular telecommunication masts and, permitting, involved both exemption and scoping with mitigation measures for 1 600 potential cellular masts for the third cellular licence in South Africa in Cape Town, Pretoria, Johannesburg and Durban. Involved for 8 person-months. (Siemens Telecommunications).

Centurion Environmental Impact Assessment (EIA) review panel **(Centurion, South Africa) 09/1999 - 12/2001.** *Review Consultant.* Responsible for serving as a member of the Centurion Council's environmental review panel, attending bi-weekly meetings and workshops to review all EIA applications after site visits to sensitive sites. Involved for 2 person-months. (Centurion Town Council).

***Scoping report and Environmental Management Plan (EMP) for remedial work at Leopard Creek Golf Estate* (Malelane, South Africa) 09/1999 - 11/1999.** *Environmental Engineer.* The project involved an extended scoping study for the construction of a 140m gabion structure on the southern embankment of the Crocodile River in Mpumalanga. Involved for 1 person-month. (Leopard Creek Golf Estate).

***Centurion major roads planning* (Centurion, South Africa) 08/1999.** *Design Engineer and Project Leader.* Responsible for network planning for Irene as part of the Centurion major roads planning. Involved for 1 person-month. (Centurion Town Council).

***Centurion Environmental Management Framework (EMF), Phase 1* (Centurion, South Africa) 08/1999 - 10/1999.** *Environmental Engineer.* The project consisted of the first phase of the Centurion EMF and included the planning of one forum of Centurion at a scale of 1:15 000 on a Geographic Information Systems (GIS) platform, integrating an impact management policy with spatial environmental priorities to seek sustainable development within Centurion. Involved for 1 person-month. (Centurion Town Council).

***Ethiopian roads Environmental Impact Assessment (EIA) review* (Ethiopia) 09/1999 - 11/1999.** *Research Member of Environmental Impact Assessment Team.* The project comprised an environmental and social impact assessment of the proposed construction and upgrading of 2 200km of major routes, including a construction Environmental Management Plan (EMP) and detailed mitigation plans. Involved for 1 person-month. (Ethiopian Roads Authority).

***Access road and parking area for Technikon North West* (Ga-Rankuwa, South Africa) 08/1998 - 09/1999.** *Resident Engineer.* Responsible for construction supervision on the construction of an access road and parking area for Technikon North West. Involved for 3 person-months. (Technikon North West).

***Rehabilitation of 14.2km of P158-1 (Ben Schoeman Highway)* (Pretoria and Centurion, South Africa) 08/1998 - 08/1999.** *Assistant Resident Engineer.* Responsible for full-time site supervision on the R40 million rehabilitation of approximately 14.2km of Road P158-1 between Potgieter Street and the Brakfontein Interchange. Involved for 11 person-months. (Gautrans).

***Upgrading of streets and stormwater in Mbabane* (Mbabane, Swaziland) 02/1998 - 08/1998.** *Design Engineer and Project Leader.* Responsible for the design and documentation for the upgrading of streets and stormwater. Involved for 4 person-months. (Mbabane Local Authority).

***Kumasi, Tamale and Secondi landfill sites* (Kumasi, Tamale, and Secondi Ghana) 06/1998 - 07/1998.** *Design Engineer and Project Leader.* Responsible for the design, modelling and volume calculations for the Kumasi, Tamale and Secondi landfill sites. Involved for 1 person-month. (Ghana Department of Local Government).

***Samrand Avenue* (Centurion, South Africa) 10/1997 - 03/1998.** *Design Engineer.* Responsible for the design of Samrand Avenue West of P66-1 in Centurion. Involved for 3 person-months. (Centurion Town Council).

***Roads and volume calculations for the Mbabane landfill site* (Mbabane, Swaziland) 12/1997 - 02/1998.** *Design Engineer.* Responsible for the design of roads and volume calculations for the Mbabane landfill site. Involved for 2 person-months. (Mbabane Local Authority).

***Stormwater drainage design for Taung Hospital* (Taung, South Africa) 08/1997 - 03/1998.** *Design Engineer.* Responsible for the stormwater drainage design for the hospital grounds. Involved for 2 person-months. (Department of Public Works).

***Design of New Park Shopping* (Kimberley, South Africa) 02/1997 - 10/1997.** *Design Engineer and Project Leader.* Responsible for the design of civil works for New Park Shopping Centre including stormwater, access roads, intersections and parking areas. Involved for 3 person-months. (Moolman Brothers).

***Stormwater drainage and pavement design at the South African Bank Note Printers* (Pretoria, South Africa) 02/1997 - 03/1997.** *Design Engineer.* Responsible for stormwater drainage and pavement design for the revised main entrance to the South African Bank Note Printers. Involved for 1 person-month. (South African Bank Note Printers).

***Sunnyside Campus of the University of South Africa (UNISA)* (Pretoria, South Africa) 02/1997 - 05/1997.** *Design Engineer.* Responsible for the civil design of alterations to roads and parking areas for

UNISA's Sunnyside Campus. Involved for 2 person-months. (UNISA).

Stormwater infrastructure design proposal **(Johor Bahru, Malaysia) 05/1997 - 11/1997.** *Design Engineer.* Responsible for the design proposal for stormwater infrastructure for the Johor Bahru Development. Involved for 2 person-months. (Johor Bahru Development).

Design services for Gabonewe School **(Gabonewe, South Africa) 06/1997 - 07/1997.** *Design Engineer and Project Leader.* Responsible for the design of access roads and parking areas for Gabonewe School. Involved for 1 person-month. (Department of Education).

Civil design for Latter Day Saints' (LDS) Meeting House **(Atteridgeville, South Africa) 07/1997 - 10/1997.** *Design Engineer and Project Leader.* Responsible for the civil design for the LDS meeting house. Involved for 1 person-month. (Latter Days Saints' Church).

Design of new sports fields at Technikon North West **(Ga-Rankuwa, South Africa) 01/1997 - 02/1997.** *Design Engineer and Project Leader.* Responsible for the design and documentation for new sports fields, including drainage culverts. Involved for 2 person-months. (Technikon North West).

Design of stormwater drainage at Technikon North West **(Ga-Rankuwa, South Africa) 03/1997 - 05/1997.** *Design Engineer.* Responsible for the design of stormwater drainage at Technikon North West residences. Involved for 1 person-month. (Technikon North West).

Tlhabane Township, Phases 1 and 2 **(Rustenburg, South Africa) 01/1996 - 04/1998.** *Design Engineer.* Responsible for the design of streets and stormwater in Tlhabane Township Phases 1 and 2. Involved for 2 person-months. (Rustenburg Town Council).

Phatsima Township Phases 1 and 2 **(Rustenburg, South Africa) 01/1996 - 04/1998.** *Design Engineer.* Responsible for the design of an access road to Phatsima Township Phases 1 and 2. Involved for 2 person-months. (Rustenburg Town Council).

Design of access road and parking areas at Technikon North West **(Ga-Rankuwa, South Africa) 02/1996 - 05/1997.** *Design Engineer and Project Leader.* Responsible for the design of an access road and parking areas at Technikon North West. Involved for 3 person-months. (Technikon North West).

Stormwater and pavement designs at Berea City Complex **(Pretoria, South Africa) 01/1996 - 08/1997.** *Design Engineer.* Responsible for stormwater drainage and pavement designs at Berea City Complex. Involved for 3 person-months. (EG Chapman Properties).

Stormwater master plan for Tlhabane Township **(Rustenburg, South Africa) 07/1996 - 10/1996.** *Design Engineer.* Responsible for a stormwater master plan for Tlhabane Township, including stormwater drainage development phasing with expenditure estimates for five years. Involved for 3 person-months. (Rustenburg Town Council).

Earthworks design for Samrand flagship building **(Centurion, South Africa) 10/1996 - 12/1996.** *Design Engineer.* Responsible for earthworks design and volume calculations for the Samrand flagship building. Involved for 1 person-month. (Samrand).

Residential units at Hans Merensky Golf Course **(Phalaborwa, South Africa) 09/1996 - 11/1996.** *Design Engineer.* Responsible for the design of streets and stormwater for the proposed development of residential units at Hans Merensky Golf Course. Involved for 1 person-month. (Hans Merensky Golf Club).

Stormwater master plan for Phatsima **(Rustenburg, South Africa) 07/1996 - 10/1996.** *Design Engineer.* Responsible for a stormwater master plan for Phatsima Township, including stormwater drainage development phasing with expenditure estimates for five years. Involved for 3 person-months. (Rustenburg Town Council).

Education

1995 : BEng (Civil), University of Pretoria, South Africa

Career enhancing courses

2013 : SUSOP mechanism for delivering sustainable development projects level 1 training., SUSOP Sustainability Operation
2011 : Investment in African Mining International Conference 2011 (Mining Indaba), Cape Town, International Investment Conferences
2010 : Basic MS Projects Course, Aurecon
2009 : Life-Long Learning Solutions CPD DVD Series 2009, South African Association of Consulting Engineers (SAACE)
2009 : International Association of Impact Assessment South African National Conference, International Association of Impact Assessment South Africa (IAIAsa)
2009 : BST Financial Management Course, Aurecon
2008 : ProMan Financial Management Course, Ninham Shand, Cape Town
2008 : Life-Long Learning Solutions CPD DVD Series 2008, South African Association of Consulting Engineers (SAACE)
2008 : WasteCon 2008, Institute of Waste Management of Southern Africa (IWMSA)
2007 : Life-Long Learning CPD DVD Series 2007, South African Association of Consulting Engineers (SAACE)
2007 : Handling Projects in a Consulting Engineer's Practice, South African Institution of Civil Engineering (SAICE)
2006 : Business Finances for Built-Environment Professionals, South African Institution of Civil Engineering (SAICE)
2006 : Life-Long Learning Solutions CPD DVD Series, South African Association of Consulting Engineers (SAACE)
2006 : Environmental Law Update, North-West University, South Africa
2005 : Environmental Law Update, North-West University, South Africa
2004 : Internal Assessor/Moderator Course, Africon, South Africa
2002 : Role of IT in Management of the RSA Environment, South African Institution of Civil Engineering (SAICE)
2002 : Protocol for Risk-Based Evaluation of the Performance of Waste Disposal Sites, South African Institution of Civil Engineering (SAICE)
2002 : Business Writing Skills, Pula Madibogo
2000 : Microsoft Access, Finlore Education
2000 : Environmental Auditing, University of Potchefstroom, South Africa
2000 : Environmental Law, University of Potchefstroom, South Africa
2000 : Environmental Management Systems (SABS/ISO 14001), University of Potchefstroom, South Africa
2000 : Introduction to Environmental Management, University of Potchefstroom, South Africa
1999 : Environmental Governance, University of South Africa (UNISA)
1998 : Internet and Email, South African Institution of Civil Engineering (SAICE)
1997 : Basic Portuguese, Africon/University of South Africa
1997 : Microsoft Excel Advanced, Edu-Pro, South Africa
1997 : Microsoft Windows 95 Advanced, Edu-Pro, South Africa
1997 : Design of Streets and Stormwater, University of Pretoria, South Africa
1996 : Communication Skills 1, Africon, South Africa
1996 : Microsoft Windows 95, Edu-Pro, South Africa
1996 : Model Maker DTM, Model Maker Systems
1996 : Internal Project Management, Africon, South Africa
1996 : Communication Skills 2, Africon, South Africa

Professional affiliations

Professional Engineer, Engineering Council of South Africa (ECSA)
Member, South African Institution of Civil Engineering (SAICE)
Member, Institute of Waste Management of Southern Africa (IWMSA)
Member, International Association of Impact Assessment (IAIA)

Languages

	Reading	**Writing**	**Speaking**
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

Honours and awards

Merit award for excellence in landscape architecture in the category for ecological planning for the Centurion Environmental Management Framework (EMF) project completed in 2001 received from the Institute of Landscape Architects of South Africa (ILASA) in 2003.

Publications

Schneeweiss, R and van der Merwe, A. 2009. "The Application of Multi-criteria Decision Making in the early stages of Environmental Impact Assessment and Technical Project Development Planning for a large mine expansion project". Paper presented at the International Association of Impact Assessment South African National Conference held in Wilderness, South Africa.

Pillay, M, van der Merwe, A and West, A. 2009. "The Application of the Ideal Mode Analytical Hierarchy Process Multi-criteria Decision Making Model in Strategic Project Planning and Environmental Impact Assessments". Paper presented at the International Association of Impact Assessment South African National Conference held in Wilderness, South Africa.

Referees

Company	**Contact Person**	**Telephone nr.**
ABB	Mr Walter Ringelmann	+27 11 236 7221
City of Tshwane Metro	Mr Hannes Scholtz	+27 12 308 8820
Lesotho Highlands Development Authority	Mr Ikarabele Sello	+266 311 280/314 324

Curriculum vitae: Ms FI GRESSE

Name	:	**GRESSE, FRANCIENA ISABELLA**
Date of Birth	:	14 March 1985
Profession/Specialisation	:	Environmental Practitioner
Years with Firm	:	4
Nationality	:	South African
Years experience	:	5

Key qualifications

Franci Gresse is a Senior Environmental Practitioner in the Cape Town office. She completed a Bachelor of Science and an Honours Degree in Conservation Ecology at the University of Stellenbosch. She has been involved in various environmental investigations, including Environmental Impact Assessments (EIAs), Environmental Management Plans (EMPs), Environmental Management Programmes (EMPs), rehabilitation plans and fatal flaw analysis.

Franci was involved with the South African National Biodiversity Institute's (SANBI) wetland rehabilitation programme (Working for Wetlands) for a period of three years which required the compilation of basic EIAs and rehabilitation plans. This project also won the 2012 Aurecon Chairman's Award. She has also been involved with a number of projects in the renewable energy sector; she served on the committee of the South African affiliate of the International Association for Impact Assessment (IAIA) for the Western Cape Branch from 2009 to 2011, and remains a member. She is also in the process of registering as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNSP).

Employment record

03/2009 - Date	Aurecon, Senior Environmental Consultant
2008 - 02/2009	Aurecon, Candidate Environmental Consultant

Experience record

Photovoltaic (PV) energy facilities near Copperton **(Northern Cape Province, South Africa) 02/2013 - Date.** *Project Leader.* The project entails two Environmental Impact Assessments (EIAs) for 15 75MW Photovoltaic (PV) energy facilities, located near Copperton. Responsible for the management and review of the EIA process and finances. (Mulilo Renewable Energy (MRE)).

Fatal flaw study for two potential Wind Energy Facility (WEF) sites **(Northern and Western Cape Provinces, South Africa) 03/2013 - 04/2013.** *Environmental Practitioner.* The study entailed a fatal flaw analysis of two potential Wind Energy Facility (WEF) sites in the Northern and Western Cape Provinces. Responsible for the assessment of the sites and compilation of the fatal flaw report. (Juwi Renewable Energies (Pty) Ltd).

Repair of flood damage to road structures in the Eden District Municipality **(Western Cape Province, South Africa) 2012 - Date.** *Environmental Practitioner.* The project entails the compilation of Maintenance Management Plans (MMP) for seven areas with the Eden District Management Area to repair. Compilation of MMPs, review of reports and liaison with stakeholders and authorities. (Western Cape Provincial Department of Transport and Public Works).

Richtersveld Wind Energy Facility (WEF) **(Northern Cape Province, South Africa) 07/2012 - 08/2012.** *Environmental Practitioner.* The project entailed a due diligence of the proposed Wind Energy Facility (WEF) to review compliance with the requirements of the Department of Energy's Independent Power Producer (IPP) process. Responsible for the review of the environmental reports and compilation of the due diligence report. (TRE Tozzi Renewable Energy S.p.A and Guma Group).

Three Photovoltaic (PV) energy facilities near Copperton **(Northern Cape Province, South Africa) 09/2011 - Date.** *Environmental Practitioner.* The project entailed three Environmental Impact Assessments (EIAs) for three Photovoltaic (PV) energy facilities comprising 75MW to 150MW, located near Copperton. Responsible for the management the EIA process and project specialists, compilation of scoping and EIA reports and liaison with authorities. (Mulilo Renewable Energy (MRE)).

Fatal flaw study for four potential Wind Energy Facility (WEF) sites **(Northern and Western Cape Provinces, South Africa) 11/2011 - 05/2012.** *Environmental Practitioner.* The study entailed a fatal flaw analysis of four potential Wind Energy Facility (WEF) sites across the Northern and Western Cape Provinces. Responsible for the management of specialists, review of reports, assessment of the sites and compilation of the fatal flaw report. (Mainstream Renewable Power South Africa).

Proposed Rehabilitation of Wetlands as Part of the Working for Wetlands **(Western, Northern, Limpopo and Gauteng Provinces) 2010 - 2013.** *Environmental Practitioner.* Appointed by the South African National Biodiversity Institute (SANBI) to conduct Environmental Impact Assessments (EIAs) for the rehabilitation of specific wetlands in all provinces of South Africa over a five year period. Responsible for the compilation of Basic Assessment Reports (BAR) and Wetland Rehabilitation Plans for the Western Cape, Northern Cape, Gauteng and Limpopo Provinces. Other responsibilities included liaison with authorities, public participation process, management of specialists and general project management of the environmental component of the project. (South African National Biodiversity Institute (SANBI)).

Environmental Impact Assessment (EIA) for the proposed extension of the Ash Dam facility at Kriel Power Station **(Mpumalanga Province, South Africa) 2010 - Date.** *Environmental Practitioner.* Appointed by Eskom to conduct an Environmental Impact Assessment (EIA) for the proposed construction of a fourth ash dam facility at the Kriel Power Station. Responsible for the general project management and finances, screening process, compilation of the scoping and EIA reports, public participation and the compilation of a waste management licence application. (Eskom Holdings).

Environmental Impact Assessment (EIA) for proposed solar energy facility, Onder Rietvlei Farm **(Aurora, Western Cape Province, South Africa) 2010 - 2011.** *Environmental Practitioner.* Appointed by Solaire Direct to undertake a basic environmental impact assessment process for the proposed construction of a 10 MW solar energy facility. Responsible for the compilation of the draft and final reports, public participation process, management of specialists and general project management. (Solaire Direct Southern Africa).

Environmental Impact Assessment (EIA) for proposed relocation of solar energy facility, Onder Rietvlei Farm **(Aurora, Western Cape Province, South Africa) 2010 - 2011.** *Project Leader.* Appointed by Solaire Direct to undertake a basic Environmental Impact Assessment (EIA) process for the proposed relocation of an approved, but not yet constructed 10 MW solar energy facility. Responsible for the management and review of the EIA process and finances. (Solaire Direct Southern Africa).

Environmental Sensitivity Study (ESS) for a proposed solar energy facility on a farm Near Aurora **(Western Cape Province, South Africa) 2010.** *Environmental Practitioner.* Appointed to provide and Environmental Sensitivity Study (ESS) which inter alia highlights the potential constraints (“red flags”) and opportunities presented by the site from an environmental perspective. Responsible for the compilation of the ESS. (Solaire Direct Southern Africa).

Proposed remediation, rehabilitation and restoration of the Spruit, Krom, Leeu and Palmiet Rivers **(Western Cape Province, South Africa) 2009 - 2010.** *Environmental Practitioner.* Appointed by the Drakenstein Municipality to undertake the requisite Environmental Impact Assessment (EIA) process for the rehabilitation, remediation and stabilisation of four rivers in Paarl and Wellington. Responsible for the EIA and public participation processes. (Drakenstein Municipality).

Proposed erection of Eskom communication sirens/PA systems **(Blaauwberg, Western Cape Province, South Africa) 2009 - 2010.** *Environmental Practitioner.* The project entailed three Environmental Impact Assessment (EIA) processes for the (a) erection of 10 new sirens in the Parklands area, (b) the relocation of one siren in Bloubergstrand, and (c) the upgrade of five sirens on farms near Melkbosstrand. Responsible for compiling EIA reports, and the public participation process. (Eskom).

Proposed construction of a new pipeline from Bovlei Winer to Withoogte Dam **(Wellington, Western Cape Province, South Africa) 2009 - 2010.** *Environmental Practitioner.* The Drakenstein Municipality proposed to replace a section of the existing pipeline extending from the Withoogte Dam to the Welvanpas Reservoir near Wellington as part of the municipality's water master plan in order to improve the overall water supply. Responsible for the compilation of the Environmental Impact Assessment (EIA) report, management of specialists and the public participation process. (Drakenstein Municipality).

Overberg District Municipality: Integrated Transport Plan (ITP): strategic environmental informants **(Western Cape Province, South Africa) 2009.** *Environmental Practitioner.* Aurecon's Transportation Unit was appointed to revise the Integrated Transport Plan (ITP). The Environmental Unit was sub-contracted to provide environmental input. Responsible for identifying and describing the relevant informants. (Overberg District Municipality).

Annandale Commercial: development of petrol filling station on portion of Erf 5561 **(Kuils River, Western Cape Province, South Africa) 2009.** *Environmental Practitioner.* Appointed to compile a Construction Environmental Management Plan (CEMP) for the construction of a filling station on the corner of Gladioli Street and Amandel Drive, Kuils River. Responsible for the compilation of the project specification document as part of the CEMP. (Communicate).

Overberg District Municipality Integrated Transport Plan (ITP) strategic environmental informants **(Western Cape Province, South Africa) 2009.** *Environmental Practitioner.* Aurecon's Transportation Unit was appointed to revise the Integrated Transport Plan (ITP). The Environmental Unit was sub-contracted to provide environmental input. Responsible for identifying and describing the relevant informants. (Overberg District Municipality).

Environmental Impact Assessment (EIA) for the proposed Langezandt Quays development in Struisbaai Harbour **(Western Cape Province, South Africa) 2008 - Date.** *Environmental Practitioner.* Aurecon was appointed to undertake an Environmental Impact Assessment EIA process for the proposed development of a four storey development on Erf 848 within the Struisbaai harbour precinct. Responsible for drafting responses to the Department of Environmental Affairs' independent review report on the proposed development. (Golden Falls (Pty) Ltd).

Pre-feasibility and feasibility studies for augmenting the Western Cape water supply system **(South Africa) 2008 - 2013.** *Project Staff.* The Department of Water Affairs commissioned pre-feasibility and feasibility studies for the augmentation of the Western Cape water supply system through the further development of the surface water resources. Surface water schemes to be investigated were identified by the Western Cape water supply system reconciliation strategy study. Responsible for the public participation process, managing environmental specialists, and compiling a socio-economic overview of the study area. (Department of Water Affairs (DWA)).

Proposed redevelopment of the Blaauwberg Conservation Area: Eerstesteen Node **(Western Cape Province, South Africa) 2008 - 2010.** *Environmental Practitioner.* The project entailed an Environmental Impact Assessment (EIA) process for redeveloping the Eerstesteen Conservation Area on the West Coast. Responsible for compiling the EIA report, as well as managing specialists and the public participation process. (City of Cape Town).

Table Mountain Group aquifer feasibility study and pilot project **(Western Cape Province, South Africa) 2008 - 2010.** *Environmental Control Officer.* The City of Cape Town initiated a study into the Table Mountain Group Aquifer as a potential water source to augment the city's supply. The feasibility and pilot project phase Record of Decision (RoD) required completion for site-specific Environmental Management Plans (EMPs) for drilling sites that were assessed to be environmentally sensitive. Site-specific EMPs were designed for sensitive sites to ensure minimal environmental impact during the drilling phase. Responsible for monitoring compliance with the RoD and EMP during the drilling phase. (City of Cape Town).

Proposed development of apple and pear orchards on Soetmelksvlei Farm **(Western Cape Province, South Africa) 2008 - 2009.** *Project Staff.* This Agri-development project involved the development of 50ha of apple and pear orchards in the Riviersonderend region. Responsible for compiling the basic assessment report, Environmental Management Plan (EMP), and managing the specialists and public participation process. (BETCO).

Proposed extension of Lock Road **(Kalk Bay, Western Cape Province, South Africa) 2008 - 2009.** *Project Staff.* The project comprised an Environmental Impact Assessment (EIA) process for extending Lock Road to an existing erf. Involved during the final stages of the application. (Mr Rick Bartlett).

Water reconciliation strategy for the Algoa water supply area **(Eastern Cape Province, South Africa) 2008 - 2009.** *Environmental Practitioner.* This project provided an assessment of the environmental opportunities and constraints for a suite of water schemes in the Algoa water supply area. This was undertaken as part of a broader study in the area.

***Application for rectification in terms of Section 24G of the National Environmental Management Act (NEMA) for the unlawful commencement of a fruit processing factory on Op de Tradouw Farm, Number 69* (Barrydale, Western Cape Province, South Africa) 2008 - 2009.** *Environmental Practitioner.* The project consisted of an application for rectification in terms of Section 24G of NEMA. Responsible for compiling an environmental impact report and an Environmental Management Plan (EMP) for the application, as well as managing the public participation process. (Schoonies Family Trust).

***C.A.P.E. Olifants-Doring Catchment Management Agency project: development of a catchment management strategy water resource protection sub-strategy for the Olifants-Doring Catchment* (South Africa) 2008 - 2009.** *Environmental Practitioner.* Appointed by CapeNature to compile a catchment management strategy water resource protection sub-strategy for the Olifants-Doorn catchment. Responsible for compiling a database that lists all institutions and their respective mandates in terms of water resource protection and biodiversity conservation decision making for the Olifants-Doring Catchment, workshop arrangements, and general project related work. (CapeNature).

***Department of Economic Affairs, Environment and Tourism (DEAET) decision-making support* (South Africa) 2008.** *Project Staff.* Responsible for assisting the DEAET with the review and processing of Environmental Impact Assessment (EIA) applications in terms of the Environment Conservation Act.

***Joint Maputo River Basin water resources study* (Mozambique, Swaziland and South Africa) 2008.** *Project Staff.* The project provided an environmental opportunities and constraints assessment of a suite of potential dams in South Africa and Swaziland, within the Maputo River Catchment. This was undertaken as part of a broader study into the catchment.

***Environmental sensitivity study for the proposed Dasdrif Poultry Farm* (Moorreesburg, Western Cape Province, South Africa) 2008.** *Project Staff.* The project consisted of an Environmental Sensitivity Study (ESS) which, inter alia, highlighted the potential constraints ("red flags") and opportunities presented by the site from an environmental perspective. Responsible for compiling the ESS. (Eikenhoff Poultry Farms (Pty) Ltd).

Education

2007 : BSc (Hons) Conservation Ecology, University of Stellenbosch, South Africa

Career enhancing courses

2013 : Using MS Project for EIAs, Aurecon
2012 : Using SANBI's Biodiversity GIS datasets for EIAs, South African National Biodiversity Institute (SANBI)
2008 : Using Natural Resources for Community Development, Gesellschaft Technische Zusammenarbeit (GTZ), South Africa

Professional affiliations

Member, International Association of Impact Assessment (IAIA)

Languages

	Reading	**Writing**	**Speaking**
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

Curriculum vitae: Mr SP CLARK

Name	:	**CLARK, SIMON PETER**
Date of Birth	:	08 February 1978
Profession/Specialisation	:	Environmental Impact Assessments
Years with Firm	:	3
Nationality	:	South African
Years experience	:	3

Key qualifications

Mr Clark is currently employed as an Environmental Practioner at Aurecon's Cape Town Office. His main tasks are related to environmental projects within South Africa and Southern African countries.

Mr Clark obtained a Bachelor's Degree in Environmental Management from the University of South Africa in 2010 and is currently completing his Honours Degree. His specific expertise is in Environmental Impact Assessments and Management Programs with a focus on renewable energy projects. Mr Clark has relevant experience legislation, processes and management of environmental projects gained while working as a Project co-ordinator. He currently works in an integrated multidisciplinary team, where he has developed additional experience in leadership, project management and provides technical support, to a wide range of environmental projects.

Mr Clark uses remote sensed imaging and geological information systems software.

Employment record

2011 - Date	Aurecon, Cape Town, Environmental consultant
2006 - 2010	Meta Acoustic Developments, Environmental Engineer/Project Leader and Designer/Consultant
2002 - 2006	RSnow consulting, Sales and Marketing Manager
1998 - 2001	TPG, Sales Manager

Management experience

2001-2010	Sales and Marketing Manager

Experience record

Environmental Impact Assessment (EIA) for the upgrading of Piketberg Stormwater infrastructure **(Western Cape Province, South Africa) 2012 - Date.** *Project Member.* Piketberg Stormwater Upgrade and Rehabilitation Project, Western Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 8 person-months. (Bergriver Municipality).

Environmental Impact Assessment (EIA) for the construction of Transmission Lines **(Western Cape Province, South Africa) 2012 - Date.** *Project Member.* Mulilo proposes to construct two 132kV overhead power lines in order to connect two-Wind Energy Facilities (WEF), to be developed to the west and east of De Aar in the Northern Cape, to the national grid. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 7 person-months. (Mulilo Renewable Energy (Pty) Ltd).

Environmental Impact Assessment (EIA) for the construction of the Wind and Solar Farm **(Western Cape Province, South Africa) 2012 - Date.** *Project Member.* Mainstream proposes to construct a 750 MW wind energy facility and a 250 MW solar photovoltaic energy facility on farms near Springbok in the Northern Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 12 person-months. (South Africa Mainstream Renewable Power Developments (Pty) Ltd).

Spoil site identification for the Nacala Rail corridor **(Nacala, Mozambique) 09/2012 - 10/2012.** *Project Member.* Identification of suitable sites for excess spoil from a environmental and socio-economical perspective. Key stakeholders engagement, GPS logging of sites, report compilation. Involved for 15 person-months. (VALE).

Environmental Impact Assessment (EIA) for the construction of the Wind Farm **(Western Cape Province, South Africa) 2011 - Date.** *Project Member.* IPD Power proposes to construct a wind energy facility which would potentially consist of in excess of 150 wind turbines, to generate approximately 438 Megawatts (MW) of renewable energy on five farms, near Vredenburg in the Saldanha Bay Municipal Area in the Western Cape. Responsible for report compilation, corresponding with key stakeholders and specialists, coordinating the specialist part of the project team, and undertaking the Public Participation Process (PPP). Involved for 28 person-months. (IPD Power (Pty) Ltd).

Environmental Impact Assessment (EIA) for the construction of the Wind Farm **(Western Cape Province, South Africa) 2011 - Date.** *Project Member.* Mulilo proposes to construct two 155-360 MW wind energy facilities on the eastern plateau approximately 20 km east of De Aar, Northern Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 19 person-months. (Mulilo Renewable Energy (Pty) Ltd).

Environmental Impact Assessment (EIA) for the construction of the Wind Farm **(Western Cape Province, South Africa) 2011 - Date.** *Project Member.* IPD Power proposes to construct 173 wind turbines with a combined maximum output of 519 MW and the total size of the project area (seven farms) under consideration is approximately 11 600 ha near Veldrif in the Bergrivier Bay Municipal Area in the Western Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 28 person-months. (IPD Power (Pty) Ltd).

Environmental Impact Assessment (EIA) for the Sherwood Poultry farm expansion **(Western Cape Province, South Africa) 2010 - Date.** *Project Member.* Sherwood Poultry Farm expansion, Western Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 16 person-months. (Eikenhoff Farms).

Environmental Impact Assessment (EIA) for the Sherwood Poultry farm expansion **(Western Cape Province, South Africa) 2010 - Date.** *Project Member.* Provincial Government Proposed Borrow Pits for supply of materials for re-gravelling and maintenance of district municipalities in the Western Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 5 person-months. (Western Cape, Department Of Transport And Public Works).

Environmental Impact Assessment (EIA) for Working for Wetlands **(Western Cape Province, South Africa) 2010 - Date.** *Project Member.* Working for Wetlands Rehabilitation Programme. Report compilation, key stakeholders engagement, and undertaking the Public Participation Process (PPP). Involved for 26 person-months. (South African National Biodiversity Institute, South Africa).

Environmental Impact Assessment (EIA) for the construction of the Wind Farm **(Western Cape Province, South Africa) 2010 - 01/2013.** *Project Member.* iNca proposes to construct a wind energy facility to generate approximately 30 Megawatts (MW), near Gouda in the Western Cape. Report compilation, key stakeholders engagement, specialists, coordination, and undertaking the Public Participation Process (PPP). Involved for 8 person-months. (iNca Gouda Wind (Pty) Ltd).

Education

2011 : Honours Environmental Management, University of South Africa (UNISA)
2010 : BA Environmental Management, University of South Africa (UNISA)

Career enhancing courses

2013 : -, SUSOP Sustainability Operation

Professional affiliations

Committee, IAIA SA

Languages

	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Afrikaans	Good	Fair	Fair

Curriculum vitae: Mrs K JONES

Name	:	**JONES, KIRSTEN**
Date of Birth	:	11 June 1980
Profession/Specialisation	:	Environmental Consultant
Years with Firm	:	2
Nationality	:	South African
Years experience	:	9

Key qualifications

Kirsten is employed as an environmental consultant in Aurecon's Cape Town office. She has more than seven years' experience in environmental management, specialising in environmental impact assessments (EIAs), social impact assessments (SIAs), public participation and sustainability related projects.

Her EIA experience mainly includes projects in South Africa and the United Kingdom, where her responsibilities have included project coordination and management, including liaison with the client, project engineers, specialists and stakeholders as well as budget control. Her technical responsibilities have involved the compilation and authoring of EIA chapters, such as legislative reviews, need and desirability, environmental statement (ES) as well as assessment of cumulative effects, land use assessments and evaluation of route/site options and alternatives.

Her SIA experience includes conducting and authoring SIA reports as well as undertaking primary and secondary research in South Africa. In the UK, Kirsten undertook many socio-economic assessments, community assessments and assessments of impacts on non-motorised users for transport related projects, all as components of EIAs. Other social experience in the UK includes desk based studies through application of World Bank standards to international projects, social audits and planning of public consultations and strategies. Within the local context, Kirsten has recently conducted the public participation process (PPP) (in terms of the National Environmental Management Act (NEMA) EIA Regulations (2010) for three renewable energy projects, being the key liaison between stakeholders and the applicants.

Kirsten also has sustainability experience, namely sustainability appraisal within the UK context, as well as projects related to mainstreaming sustainability within the local municipal context. She was recently involved in the compilation of an integrated conservation management plan for a world heritage site (WHS), where she was responsible for the compilation of an environmental management plan (EMP). In her role as a researcher at the University of Cape Town (UCT) in South Africa, she has been mostly involved in the field of coastal management.

Kirsten's diverse experience includes writing proposals, initiating and managing research and consulting projects, analysing quantitative and qualitative data and communicating the results in written reports.

She obtained a Master of Science in Environmental Science in 2005, a Bachelor of Science (Honours) in Geography in 2001 and a Bachelor of Science in Zoology and Geography in 2000, all from the University of KwaZulu-Natal (UKZN) in South Africa. She is a registered professional natural scientist (environmental science) with the South African Council for Natural Scientific Professions (SACNASP) as well as a member of the International Association for Impact Assessment South Africa (IAIAsa) and the International Association for Public Participation Southern Africa (IAP2 SA).

Employment record

01/2013 - Date	Aurecon South Africa (Pty) Ltd, Environmental Consultant
05/2010 - 12/2012	University of Cape Town (UCT), Environmental Evaluation Unit, Environmental Consultant/Researcher
08/2006 - 12/2009	Parsons Brinckerhoff Ltd, London, UK, Senior Environmental and Social Consultant
01/2006 - 06/2006	University of KwaZulu-Natal Centre for Environmental Management, Contract Social Consultant

Experience record

Second bridge over the River Niger **(Delta State, Nigeria) 08/2013 - Date.** *Environmental Specialist.* The

Federal Government of Nigeria proposed to construct a second bridge across the River Niger between Onitsha and Asaba and selected the Julius Berger-AIIM Consortium as the preferred bidder. Aurecon was appointed on behalf of AIIM to undertake an environmental and social impact assessment (ESIA) required in terms of the Environmental Decree No 86 of 1992, in accordance with the International Finance Corporation (IFC) guidelines, which included a resettlement action plan (RAP). The aim was to ensure regulatory compliance with the Nigerian environmental legislation and achieve the highest possible compliance with Equator Principles. Responsibilities include client liaison; coordination of the ESIA process, including 16 specialists; writing of the scoping and ESIA reports to meet Nigerian legislation and IFC standards and consultation with environmental authorities. Involved for 4 person-months. (Nigeria Sovereign Investment Authority (NSIA)).

Environmental impact assessment (EIA) for the fresh produce business hub in Wanaheda **(Windhoek, Namibia) 08/2013 - Date.** *Environmental Specialist.* Aurecon was appointed to render consulting services for an environmental impact assessment (EIA) for the fresh produce business hub in Wanaheda. The aim was to identify the environmental sensitivities of the proposed development, to assess the potential impacts of development and related activities on the environment and to draft mitigation measures and an environmental management plan (EMP) based on the findings. The EIA also included a detailed traffic assessment of the area. Responsibilities included the compilation of the scoping report and EMP as required under Namibia's Environmental Management Act (No 7 of 2007). Involved for 1 person-month. (Namibia Development Corporation (NDC)).

Working for Wetlands Plan 2014 - 2017 **(South Africa) 06/2013 - Date.** *Environmental Specialist.* Aurecon was appointed in 2010 for a three year cycle for the design, planning, environmental, project and risk management of the South African Government's Working for Wetlands Programme, which is a nationally run initiative by the South African National Biodiversity Institute (SANBI). The programme's objective is to rehabilitate damaged wetlands and to protect wetlands throughout South Africa, with an emphasis on complying with the with an emphasis on complying with the principles of the expanded public works programme (EPWP) through employing only local small, medium and micro enterprises (SMMEs). Responsible for reviewing the basic assessment reports (BARs) for the Mpumalanga and Northern Cape Provinces as well as providing assistance with the public participation process (PPP). Involved for 0.5 person-months. (South African National Biodiversity Institute (SANBI)).

Environmental impact assessment (EIA) for the expansion of approved photovoltaic (PV) facilities near De Aar and Prieska **(Northern Cape Province, South Africa) 03/2013 - Date.** *Environmental and Social Specialist.* The project involved an environmental impact assessment (EIA) for the expansion of approved solar energy facilities located on the Hoekplaas and Klipgats Farms in Prieska and the Badenhorst Dam and Du Plessis Dam Farms in De Aar. The expansion of Hoekplaas Farm includes ten additional 75 MW photovoltaic (PV) facilities, while the expansion of Klipgats Pan Farm includes six additional PV units. The expansion of Badenhorst Dam Farm includes four additional 75 MW PV facilities, and that of the Du Plessis Dam Farm includes three additional PV units. Responsibilities include socio-economic impact assessments (SEIAs) as well as the summary and collation of the other specialist reports for the EIAs. Involved for 1 person-month. (Mulilo Renewable Energy (Pty) Ltd).

Road materials supply strategy **(Western Cape Province, South Africa) 06/2008 - Date.** *Environmental Specialist.* Increasing pressures from tightened environmental legislation have resulted in lengthy waiting periods for identifying required material sources. The wait is also caused by investigation phases and getting approval from the Mineral Resources and Petroleum Development Act (DMR), the Department of Environmental Affairs and Development Planning (DEADP), the National Environmental Management Act (NEMA) and the Land Use Planning Ordinance (LUPO). Aurecon was appointed for prospecting suitable road making materials, sampling, testing and identifying technically suitable sources to be used for both identified projects and as strategic pits as well as for getting all the required approvals. Responsibilities included environmental screenings of potential borrow pits and review of over 30 basic assessment reports (BARs) as required under the National Environmental Management Act (NEMA) (No 107 of 1998) as well as liaising with authorities and other specialists and coordinating the public participation process (PPP) for all the NEMA applications. Involved for 12 person-months. (Western Cape Provincial Government (WCPG): Department of Transport and Public Works).

Re-gravelling of roads DR02231, MRR00547 and MR00736 in Bitterfontein **(Western Cape Province, South Africa) 11/2005 - Date.** *Environmental Specialist.* The project involves the investigation of possible material sources for use for the re-gravelling of roads DR02231, MR00547 and MR00736 in the West Coast District Municipal Area. Responsibilities included environmental screening of potential borrow pits in terms of the National Environmental Management Act (NEMA) (No 107 of 1998). Involved for 0.5 person-months. (Western Cape Provincial Government (WCPG): Department of Transport and Public Works).

Robben Island World Heritage Site (WHS): integrated conservation management plan (ICMP) **(Western Cape Province, South Africa) 10/2012 - 11/2012.** *Environmental Specialist.* The project entailed the revision of the integrated conservation management plan (ICMP) for Robben Island. The scope of work included an environmental management plan (EMP), as a requirement of the World Heritage Convention Act (No 49 of1999). Responsible for compiling the EMP. Work included a strength, weakness, opportunity and threat (SWOT) analysis of the natural environment, a review of the legislative framework, interviews with key stakeholders and the development of the EMP. Involved for 2 person-months. (Robben Island Museum).

Mainstreaming environmental projects in integrated development plans (IDPs) **(Western Cape Province, South Africa) 06/2011 - 01/2012.** *Environmental Specialist.* The project entailed a partnership with the Table Mountain Fund (TMF) to mainstream environmental projects into municipal integrated development plans (IDPs) through 'green projects'. Responsible for facilitating and attending meetings and workshops with local government officials and developing a roadmap for the conceptualisation of appropriate 'green projects'. Involved for 1 person-month. (Table Mountain Fund (TMF)).

Basic assessment for the proposed photovoltaic (PV) solar energy facility on a site south of Sutherland **(Northern Cape Province, South Africa) 06/2010 - 02/2012.** *Environmental Specialist and Project Coordinator.* The project involved the management of the environmental authorisation process for the proposed photovoltaic (PV) solar energy facility on a site south of Sutherland, in terms of the National Environmental Management Act (NEMA) environmental impact assessment (EIA) regulations (2010). Responsible for the project coordination of the public participation process (PPP) as well as compilation of the draft and final basic assessment reports. Also responsible for liaising with specialists and reviewing specialist studies. Involved for 2 person-months. (iNca Energy).

Environmental impact assessment (EIA) for the Touwsrivier Solar Energy Facility **(Western Cape Province, South Africa) 05/2010 - 08/2011.** *Environmental Specialist and Project Coordinator.* The project comprised the management of the environmental authorisation process for the Touwsrivier Solar Energy Facility, in terms of the National Environmental Management Act (NEMA) environmental impact assessment (EIA) regulations (2010). Responsible for project coordination of the public participation process (PPP) as well as compilation of the scoping and EIA reports. Also responsible for liaising with specialists and review of specialist studies. Involved for 3 person-months. (Soitec).

Environmental impact assessment (EIA) for the Kerrie Fontein and Darling Wind Farms **(Western Cape Province, South Africa) 05/2010 - 11/2011.** *Environmental Specialist, Social Specialist and Project Coordinator.* The project entailed management of the environmental authorisation process for the Kerrie Fontein and Darling Wind Farms, in terms of the National Environmental Management Act (NEMA) environmental impact assessment (EIA) regulations (2010). Responsible for project coordination of the public participation process (PPP) and the compilation of the scoping and EIA reports. Also responsible for liaising with specialists and reviewing of specialist studies. Also author of the social impact assessment (SIA) as a supporting specialist study. Involved for 3 person-months. (Oelsner Group (Pty) Ltd).

Environmental assessment for the M5 Junction 29 East of Exeter improvements **(Devon, United Kingdom) 06/2009 - 10/2009.** *Social Specialist.* The project entailed an environmental assessment for the improvements to M5 Junction 29 in support of the Exeter and East Devon Growth Point. They are required to improve capacity, safety and amenity to the road network as it continues to support both current and future predicted traffic loads and comprises a new link road to the new Exeter Science Park development. Responsible for the assessment of the pedestrian, cyclists, equestrian and community effects following the Highways Agency's Design Manual for Roads and Bridges (DMRB) guidance for inclusion in the environmental statement. Involved for 0.5 person-months. (Devon County Council (DCC)).

Environmental assessment for the Exeter Park and Ride facility at Alphington Junction **(Devon, United Kingdom) 06/2009 - 11/2009.** *Social Specialist.* The project entailed an environmental impact assessment (EIA) for the Exeter Park and Ride facility at Alphington Junction. This project is a component of the Exeter Principal Urban Area (PUA) project, which is included in the Devon Local Transport Plan (LTP) (2006 - 2011). Responsible for the assessment of effects on humans and settlements for inclusion in the environmental statement (ES). Involved for 0.5 person-months. (Devon County Council (DCC)).

Proposed energy-from-waste (EfW) facility and civic amenity recycling centre **(Devon, United Kingdom) 05/2009 - 10/2009.** *Social Specialist.* The energy-from-waste (EfW) facility in Barnstaple was proposed by Devon County to provide facilities to deal with residual waste once it has been sorted for reuse, recycling or composting. The project required an environmental impact assessment (EIA). Responsible for the assessment of the socio-economic and community impacts of the proposed EfW facility for inclusion in

the environmental statement. Involved for 0.5 person-months. (Devon County Council (DCC)).

Sustainability assessment for Crawley Borough Council Housing **(West Sussex, United Kingdom) 03/2009 - 04/2009.** *Environmental Specialist.* The project involved the assessment and scoring of the sustainability of the identified strategic sites on the urban fringe of Crawley town, which have the capacity to accommodate housing development options (including employment and community uses). Responsible for meeting with the planning consultants and collaborating with them to identify options and the assessment of the options in a matrix. Also responsible for authoring the sustainability appraisal report. Involved for 0.5 person-months. (Crawley Borough Council).

Environmental impact assessment (EIA) for Walker Technology College And **(Newcastle upon Tyne, United Kingdom) 01/2009 - 04/2009.** *Social Specialist.* Aura proposed to develop two new school buildings and associated sports facilities within an area of open space known as Waverdale, which is located within the Walkergate ward of Newcastle. An environmental impact assessment (EIA) was required. Responsible for a socio-economic and community effects assessment for inclusion in the environmental statement. (Aura).

Scoping report for St Helier Town Park **(States of Jersey) 11/2008.** *Social Specialist.* The proposed town park in St Helier, States of Jersey required the scoping of environmental impacts as the first phase of an environmental impact assessment (EIA). Responsible for scoping of the socio-economic and community effects of the proposed park. Involved for 0.5 person-months. (States of Jersey).

Hereford Regeneration Project, Edgar Street Grid **(Herefordshire, United Kingdom) 11/2008 - 02/2009.** *Social Specialist.* The Hereford Regeneration Project in the Edgar Street Grid comprised 43 ha of land north and adjacent to the city centre and is earmarked for development in phases. The project involved the environmental assessment for several of these phases. Responsible for the socio-economic baseline conditions reporting for the project, environmental scoping and assessment of the socio-economic and community impacts for inclusion in the environmental statement (ES) for the link road (Phase 1). Involved for 1 person-month. (ESG Herefordshire Ltd).

Environmental impact assessment (EIA) for Exeter Science Park **(Devon, United Kingdom) 11/2008 - 04/2009.** *Environmental and Social Specialist.* The project entailed an environmental impact assessment (EIA) for the Exeter Science Park, which forms part of the Exeter and East Devon Growth Point. The project also involved the compilation of an environmental statement (ES). Responsible for the assessment of the land use impacts and the cumulative environmental effects of the project for inclusion in the ES. Also responsible for the compilation of the community impact assessment (CIA). Involved for 1 person-month. (Devon County Council (DCC)).

Greenwich Waterfront Transit (GWT) **(London, United Kingdom) 10/2008 - 04/2009.** *Environmental and Social Specialist.* The Greenwich Waterfront Transit (GWT) is a proposed scheme along the south bank of the Thames between Greenwich town centre and Thamesmead, then on to Abbey Wood. The scheme proposes road realignment to allow for the priority of public transport. The project involved identification of route options and environmental assessment. Responsible for the production of the environmental appraisal of route options report and environmental information for consultation report, as well as an assessment of the cumulative effects for inclusion in the environmental statement (ES). Also responsible for the compilation of the community impact assessment (CIA). Involved for 3 person-months. (Transport for London (TfL)).

Environmental evaluation for the East London Transit (ELT) scheme **(London, United Kingdom) 10/2008 - 12/2008.** *Social Specialist.* The proposed East London Transit (ELT) scheme aimed to provide a high quality busway transit service between the areas of Ilford, Barking and Dagenham to the north of the River Thames, and was delivered in a number of phases. An environmental evaluation was required for Phase 1 of the scheme. Responsible as co-author of the socio-economic chapter of the environmental scoping report and the first stage of the socio-economic assessment as part of the scheme environmental evaluation. Involved for 0.5 person-months. (Transport for London (TfL)).

Covanta energy-from-waste (EfW) facility **(Cheshire, United Kingdom) 09/2008 - 06/2009.** *Social Specialist.* The Covanta energy-from-waste (EfW) in Middlewich was proposed to use a mix of commercial and industrial wastes to provide combined heat and power to local homes and businesses. The project involved an environmental assessment. Responsible for assessment of the socio-economic and community impacts of the proposed EfW facility for inclusion in the environmental statement (ES). Also responsible for the preparation of an addendum to submit in support of the planning application in order to update the assessment in the context of the recession. Involved for 2 person-months. (Covanta Energy Ltd).

***Hurst to New Cross cable tunnels* (London, United Kingdom) 07/2008 - 06/2009.** *Environmental Specialist and Project Coordinator.* The project involved the construction of a 400 kV cable tunnel from Hurst to New Cross, aligning with a number of head houses along the route. The project involved environmental screening of the route and the production of two environmental reports. Responsible for project coordination for the production of two environmental reports to assess the impact of a cable tunnel with associated shafts and head houses, from Hurst to Eltham and Eltham to New Cross. Responsibilities also included client liaison, budget control and preparation of budget variations. Technical tasks included the drafting of the introductory chapters of the scoping report and environmental reports, the non-technical summaries and input into the preferred route and site selection report as well as review of the other planning supporting documents. Involved for 4 person-months. (National Grid, UK).

***Planning application for the Olympic Energy Centres* (London, United Kingdom) 03/2008.** *Social Specialist.* As a pre-requisite for development of infrastructure for the London 2012 Olympic Games, the Olympic Delivery Authority (ODA) required outline planning permission for Olympic, Paralympic and legacy transformation infrastructure. A planning application for the King's Yard Energy Centre is part of the approval of reserved matters that was required. Responsible for authoring the equalities statement for submission with the reserved matters planning application. Involved for 0.5 person-months. (Olympic Delivery Authority (ODA)).

***Tewkesbury Borough Council sustainability appraisal* (Gloucestershire, United Kingdom) 03/2008 - 04/2008.** *Environmental Specialist.* The project comprised sustainability appraisal for Tewkesbury Borough as part of the preparation of its core strategy and development control policies development plan document. Responsible for drafting a scoping report. Involved for 0.5 person-months. (Tewkesbury Borough Council).

***Review of the social and environmental compliance for Ibom Power Plant and transmission line* (Akwa Ibom State, Nigeria) 09/2007 - 04/2008.** *Social Specialist.* The project entailed a review, on behalf of the lenders, of the social and environmental compliance of the two environmental impact assessments (EIAs) for the independent power plant (IPP) at Ikot Abasi and associated transmission line, with the World Bank's environmental and social safeguard policies, the Equator Principles and the International Finance Corporation's (IFC's) requirements. Responsible for reviewing the social compliance of the facilities. Involved for 0.5 person-months. (Fortis Merchant Bank).

***New Cairo public-private partnership (PPP) potable water and wastewater treatment plants (W/WWTPs) project study* (Cairo, Egypt) 07/2007.** *Social Specialist.* As part of the New Cairo public-private partnership (PPP) potable water and wastewater treatment plants (W/WWTPs) project study, a comparison report was required as part of a preliminary environmental and social impact assessment (PESIA). Responsible for interpreting and reporting on the social legislation and guidelines applicable in Egypt, by International Finance Corporation (IFC)/World Bank requirements and by the European Union (EU). A comparison report was produced. Involved for 0.5 person-months. (Economic Modernization Section).

***Sustainability audit of the power contractors for Lower Lea Valley* (London, United Kingdom) 06/2007 - 09/2007.** *Social Specialist.* The project comprised a sustainability audit of the operations of the power contractors commissioned by the Olympic Delivery Authority (ODA) to undertake tunnelling work to replace existing overhead power lines through the Lower Lea Valley. Responsible for auditing the social aspects of the contractors. Involved for 0.5 person-months. (Olympic Delivery Authority (ODA)).

***Environmental assessment for the new waste transfer station in Lamby Way* (Cardiff, United Kingdom) 03/2007.** *Social Specialist.* The project entailed an environmental assessment for the new waste transfer station at Lamby Way, which formed a component of Cardiff's Capital Improvement Programme. Responsible for the socio-economic assessment for inclusion in the environmental statement (ES). Involved for 0.5 person-months. (Cardiff City Council).

***Environmental assessment for the Lamby Way in vessel composting facility* (Cardiff, United Kingdom) 03/2007.** *Social Specialist.* The project entailed an environmental assessment for the proposed in vessel composting facility at Lamby Way, which was a component of Cardiff's Capital Improvement Programme. Responsible for the socio-economic assessment for inclusion in the environmental statement (ES). Involved for 0.5 person-months. (Cardiff City Council).

***Widening of the M25 motorway, Section 4* (London, United Kingdom) 12/2006 - 06/2007.** *Environmental and Social Specialist.* The M25 is the 188 km orbital motorway encircling London. As part of a long term strategy to address congestion and growth, widening of the various sections was proposed. Section 4 included the motorway between Junction 27 and 30. An environmental statement (ES) and

community strategy was requited to support the proposals. Responsible for the input into the revision and implementation of the overarching communication plan for the M25 rapid widening scheme and the management and coordination of communication activities preceding the publication of the ES for Section 4. Also responsible for the production of a consultation report documenting the communication activities and assessment of cumulative effects for the ES. Involved for 3 person-months. (Highways Agency).

Scoping report for the proposed Dube TradePort in Durban **(KwaZulu-Natal Province, South Africa) 06/2006.** *Social Specialist.* The proposed Dube TradePort, comprising the proposed King Shaka International Airport (KSIA) and associated trade zone, required a social impact assessment (SIA) as part of the environmental impact assessment (EIA). Responsibilities included assisting the EIA consultants with the creation of a social profile as a baseline for the social impacts of the airport and adjacent trade zones. Involved for 1 person-month. (Airports Company of South Africa (ACSA)/Dube TradePort Company).

Plymouth major scheme bid (MSB), Eastern Corridor extension **(Plymouth, United Kingdom) 04/2006 - 06/2006.** *Social Specialist.* The Plymouth City Council required the assessment of proposed Plymouth Eastern Corridor transport improvement options to address current and future transport capacity. An environmental statement (ES) was required based on the design manual for roads and bridges (DMRB) 'simple' assessment methodology. Responsible for the assessment of the effects on all travellers (such as pedestrian and cyclists) based on the DMRB guidance for inclusion in the ES. Involved for 0.5 person-months. (Plymouth City Council).

Plymouth major scheme bid (MSB), Langage Business Park link road **(Plymouth, United Kingdom) 04/2006 - 06/2006.** *Social Specialist.* The Plymouth City Council required the assessment of proposed options for access to Langage Business Park. An environmental statement (ES) was required based on the design manual for roads and bridges (DMRB) 'simple' assessment methodology. Responsible for the assessment of the effects on all travellers (such as pedestrian and cyclists) based on the DMRB guidance for inclusion in the ES. Involved for 0.5 person-months. (Plymouth City Council).

Social impact assessment (SIA) for the proposed Small Craft Harbour, Durban **(KwaZulu-Natal Province, South Africa) 01/2006 - 06/2006.** *Social Specialist.* The project involved the compilation of a social impact assessment (SIA) as a supporting study to the environmental impact assessment (EIA) for the proposed Small Craft Harbour at the Durban Point Waterfront Development area. Responsibilities included all aspects related to coordinating the SIA: input into the design of the methodology; the creation and maintenance of a stakeholder database; the coordination of public participation and stakeholder workshops; attendance of specialist consultants workshops, compilation of social profile; collection of field data; the analysis of data and report writing. Involved for 3 person-months. (Durban Point Development Company (Pty) Ltd).

Education

2005	:	MSc Environmental Science, University of KwaZulu-Natal (UKZN), South Africa
2001	:	BSc (Hons) Geography, University of KwaZulu-Natal (UKZN), South Africa
2000	:	BSc Zoology and Geography, University of KwaZulu-Natal (UKZN), South Africa

Career enhancing courses

2012	:	Continuing Professional Development (CPD) Course - UIDM 3: Community Development., University of Cape Town (UCT), South Africa
2008	:	Certification Programme: Module 1 Planning for Effective Public Participation, International Association for Public Participation (IAP2)
2008	:	Certification Programme: Module 2 Communications for Effective Public Participation, International Association for Public Participation (IAP2)

Professional affiliations

Member, International Association for Impact Assessment, South Africa (IAIAsa)
Member, International Association for Public Participation Southern Africa (IAP2 SA)
Registered Professional Natural Scientist, South African Council for Natural Scientific Professions (SACNASP)

Languages

	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Afrikaans	Poor	Poor	Fair

Publications

Green L, Hara M, Hauck M, Kirsten K, Paterson B, Raemaekers S, Scott K, Scott D, Sowman M, Sunde J and Turpie J, 2013. "Shallow Waters: Social Science Research in the Marine Environment". African Journal of Marine Science.

Oelofse C, and Scott K, 2005. "The Environmental Politics of the Scoping Phase of the Development of a Small Craft Harbour, Point Waterfront, Durban". International Association for Impact Assessment - South African Affiliate (IAIAsa) Conference, ThabaNchu, 28 - 31 August 2005, 470 - 485.

Oelofse C, and Scott K, 2002. "The Politics of Alien Vegetation: Reconstructing the Sense of Place of Kloof, South Africa". Presented at the International Geographical Union Regional Conference in Durban, South Africa held 4 - 7 August 2002.

Referees

Company	Contact Person	Telephone nr.
Oelsner Group (Pty) Ltd	Hermann Oelsner	+27 22 492 3096/ oelsnergrp@wcaccess.co.za
Robben Island Museum (RIM)	Sabelo Madlala	+27 73 442 1092/ Sabelom@robben-island.org.za
Soitec Solar	Vincenzo Bellini	+27 21 418 1793/ vinni.bellini@soitec.com

By my signature below I certify the correctness of the information above and my availability to undertake this assignment.

_____ _____

Signature of Staff Member Date