

APPENDIX A:
ESKOM TRANSMISSION DRAFT
ENVIRONMENTAL MANAGEMENT PLAN

TRANSMISSION SERVICES

DRAFT ENVIRONMENTAL MANAGEMENT PLAN

PROJECT NAME :

DATE :

ESKOM ENVIRONMENTAL ADVISOR:

TEL:

ENVIRONMENTAL ASSESSMENT PRACTITIONER:

NAME:

TEL:

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1. INTRODUCTION

The construction and refurbishment of Transmission lines can have a major impact on the environment. It is thus imperative that better precautions be taken to ensure that environmental damage is minimised. This will take a concerted effort from the project team and proper planning is of the utmost importance.

The scope of this document is to give environmental management plan, to the Contractor constructing the transmission line, in fulfilment of ISO 14001 requirements. This document is part of the contract and supplementary to Eskom's TRMSCAAC1 REV 3. The recommendations and constraints, as set out in this document are enforceable under the general conditions of the contract.

The objective of this management plan is to ensure that:

- All anticipated environmental impacts during the construction periods are identified and mitigation measures are clearly outlined.
- All Environmental Management conditions and requirements are implemented through out the project,
- All Landowner special conditions are identified and taken into consideration as the line traverses private properties.
- Ensure that Eskom Transmission's Environmental Policy TRMPBAAX3 Rev 3 is underwritten at all times.
- Ensure that all environmental conditions as stipulated in the Record of Decision (ROD) are implemented.
- Ensure that problems and claims arising from damage are immediately resolved to ensure a smooth flow of operations.
- To preserve the natural environment by limiting destructive actions on site.
- To ensure that all relevant legislation (including national, provincial and local) is complied with during the construction and operation phases

- To ensure that the completion date of the contract is not delayed due to problems with Landowners arising during the course of construction.

1.1. PROJECT SCOPE OF WORKS

1.2. BACKGROUND INFORMATION

1.2.1. Project Execution area

The execution area is limited to the area as demarcated by Eskom and shown on the locality plan (annexed....) and site plans (annexed...). Any area outside the Eskom servitude area, required to facilitate access, construction activities, construction camps or material storage areas, shall be negotiated with the affected Landowner and written agreements shall be obtained. All construction areas shall be cleared in accordance with the Eskom Standard for Bushclearing ESKASABG3. Any extra space to be cleared outside the servitude shall be negotiated with the relevant Landowner and approved by Eskom. All areas marked as no go areas inside the servitude shall be treated with the utmost care and responsibility.

Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the Landowner. **Should the Contractor be required to use water from a natural source, the Contractor shall supply a method statement to that effect and obtain the required permits.** Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.

1.2.2. TECHNICAL SPECIFICATION

1.2.2.1. LENGTH:

The length of the line will be approximately _____ km.

1.2.2.2. CONSTRUCTION AREA:

The servitude width is _____ m. Construction is limited to the width of the servitude in which the line will be constructed.

1.2.2.3. TOWER PARAMETERS:

- Tower spacing : _____ m. (Average)
- Tower height : _____ m. (Average)
- 1.3.3.3. Conductor attachment height : _____ m. Average)
- 1.3.3.4. Conductor type : _____.
- 1.3.3.5 Minimum ground clearance : _____ m.

1.2.2.4. TOWER DESIGN:

The following types of towers are used on this project:

(Update list as per project requirements)

Types of Towers	Y/N
Cross rope suspension tower.	
Compact cross rope suspension tower.	
Guyed-V suspension tower.	
Self-supporting suspension tower.	
Self-supporting strain tower.	

(Provide Photo of the tower)

1.2.2.5. MAJOR ACTIVITIES OF THE PROJECT

The project involves 21 major activities. These are outlined in the table below (to be provided by the project manager):

ACTIVITIES	PROPOSED PROGRAMME	
	START	FINISH
<ul style="list-style-type: none"> • Environmental Impact Assessment – Refer to annexure “E” for a Copy of Record of Decision (ROD). 		
<ul style="list-style-type: none"> • Negotiations for the servitude –Landowners, their contact details and their special conditions are listed under section 5 of this document . 		
<ul style="list-style-type: none"> • Land survey to determine the exact routing of the line and tower placement. 		
<ul style="list-style-type: none"> • Pegging of bend tower by a Transmission surveyor. 		
<ul style="list-style-type: none"> • Profiling work to produce the profiles for construction (refer to annexure “C”). 		
<ul style="list-style-type: none"> • Establishment of camp sites for the Contractors’ workforce. An approved (by the relevant Government authorities) site Camp EMP will be used to guide the establishment of the camp site 		
<ul style="list-style-type: none"> • Negotiations with landowners for access roads to the servitude. 		
<ul style="list-style-type: none"> • Servitude gate installation to facilitate access to the servitude. 		
<ul style="list-style-type: none"> • Vegetation clearing to facilitate access, construction and the safe operation of the line. 		

<ul style="list-style-type: none"> Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3. 		
<ul style="list-style-type: none"> Pegging of tower positions for construction by the contractor. 		
<ul style="list-style-type: none"> Transportation of equipment, materials and personnel to site and stores. 		
<ul style="list-style-type: none"> Excavation and casting of concrete for foundations for the towers. 		
<ul style="list-style-type: none"> Tower assembly and erection. 		
<ul style="list-style-type: none"> Conductor stringing and regulation. 		
<ul style="list-style-type: none"> Taking over the line from the contractor for commissioning. 		
<ul style="list-style-type: none"> Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation. 		
<ul style="list-style-type: none"> Rehabilitation of disturbed areas. 		
<ul style="list-style-type: none"> Signing off of all Landowners upon completion of the construction and rehabilitation 		
<ul style="list-style-type: none"> Handing over and taking over of the servitude by the Grid Environmental Manager. 		
<ul style="list-style-type: none"> Operation and maintenance of the line by the Grid. 		

The final inspection for the release of the Contractors' guarantee takes place a year after completion of the project. The line will be in operation immediately after completion of the project and will stay operational for the lifetime of the plant.

2. ACRONYMS

Name of Act / Eskom Specification/ Procedure	Abbreviation
Access to Farms	TRMPVACV2 REV1
Agricultural Pests Act of 1983 (Act No. 36 of 1983)	APA
Air Quality Act of 2004 (Act No 39 of 2004)	NAQA
Animals Protection Act of 1962 (Act No. 71 of 1962)	APA
Atmospheric Pollution Prevention Act of 1965 (Act No. 45 of 1965)	APPA
Biodiversity Act of 2004 (Act No. 10 of 2004)	BDA
Bush Clearing	ESKASABG3
Conservation of Agricultural Resources Act of 1993 (Act No. 43 of 1983)	CARA
Contractor Environmental Control Officer	CECO
Department of Environmental Affairs and Tourism	DEAT
Department of Water Affairs	DWAF
Environment Conservation Act of 1989 (Act NO. 73 of 1989)	ECA
Environmental Control Officer	ECO
Environmental Management Plan	EMP
Eskom Manual on Storage and Handling of Flammable and combustible liquids	ESKAMAAD1
Fencing Act of 1963 (Act No. 31 of 1963)	FA
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947)	FFFAS
Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act of 1947 (Act No. 36 of 1947)	FFASA
Game Theft Act of 1991 (Act No. 105 of 1991)	GTA
Hazardous Substances Act of 1973 (Act No. 15 of 1973)	HSA
Labour Relations Act of 1995 (Act No.66 of 1995)	LRA
Mineral and Petroleum Resources Development Act of 2002 (Act No.	MPRDA

28 of 2002)	
Mountain Catchment Areas Act of 1970 (Act No. 63 of 1970)	MCAA
National Environmental Management Act of 1998 (Act No. 107 of 1998)	NEMA
National Forests Act of 1998 (Act No. 84 of 1998)	NFA
National Veld and Forest Fire Act 1998 (Act No. 101 of 1998)	NVFFA
National Water Act of 1998 (Act No. 36 of 1998)	NWA
Natural Heritage Resources Act of 1999 (Act No. 25 of 1999)	NHRA
Eskom Nesting Guideline	TRMAGAAZ3
Occupational Health and Safety Act of 1993 (Act No. 85 of 1993)	OHSA
Protected Areas Act of 2003 (Act No. 57 of 2003)	PAA
Protected Areas Amendment Act of 2004 (Act 31 of 2004)	PAAA
Record of Decision	ROD
Skills Development Act of 1998 (Act No. 97 of 1998)	SDA
Transmission Line Towers and Line Construction	TRMSCAAC1 REV3
Water Services Act of 1997 (Act 108 of 1997)	WSA
World Heritage Convention Act of 1999 (Act No. 49 of 1999)	WHCA

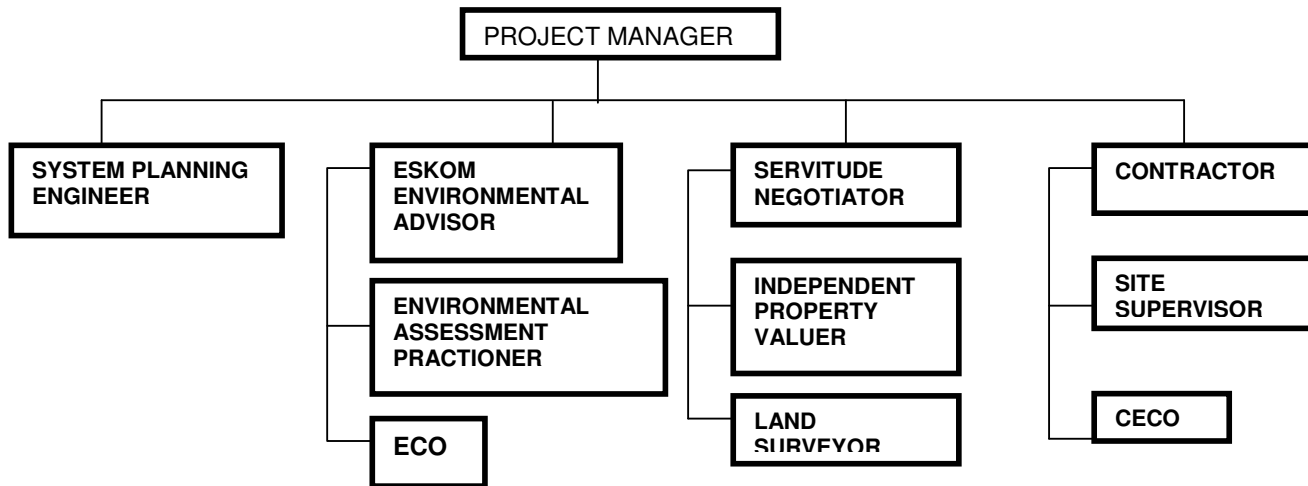
3. Project team

Profession/Role	Name	Contact Details	Remarks
System Planning Engineer			
Eskom Environmental Advisor			
Servitude Negotiator			
Project Manager (PM)			
Site Manager			
ECO			
Contractor			
CECO (Dedicated person)			

appointed by the contractor)			
Grids Environmental Practitioner			
Grid Line & Servitude Manager			
Environmental Assessment Practitioner			
Authorising Department			

This should also outline the responsible parties and reporting procedures- including progress reporting.

3.1. REPORTING STRUCTURE.



3.2. ROLES AND RESPONSIBILITIES OF THE PROJECT TEAM

3.2.1 System Planning Engineer

3.2.2 Eskom Environmental Advisor (during feasibility stages & construction phases)

- To ensure that an un-biased, EIA with a thorough public participation is conducted for the proposed project. Such assessment to be in accordance to the latest legislation and acceptable to all interested and affected parties and to finally be approved by the relevant authority.

- To secure an uncontested Record of Decision.
- To project manage the Independent Environmental Consultants through out the EIA life cycle and to ensure that a friendly, practical, EMP for the construction phase of a project is compiled and approved by the relevant and appropriate government authorities.
- To ensure that all conditions as stipulated in the ROD are met.
- To conduct spot audit during construction.

3.2.3 Servitude Negotiator

- To select a route where Tx powerline will transverse, within the environmentally prescribed corridor.
- To negotiate servitude on private and public owned properties.
- To identify landowner conditions & requirements

3.2.4 Project Manager/ Site Manager

- Represents and act on behalf of Eskom Transmission regarding the administration of contracts.
- In consultation with the system Planning Engineer, determines the scope of work.
- To provide scheduling, aspects of co-ordination and estimating
- Ensure implementation of the project plan within cost, time and quality constraints
- Ensure that implementation of EMP is executed as planned.
- Keep the asset owner informed of progress made during the life cycle of the project.

No work shall commence until permission is granted from the Environmental Advisor from Transmission Services and the ROD from DEAT has been obtained. The Project Manager shall ensure that all conditions in the ROD are fulfilled before the Contractor occupies

the site. The Grid shall be kept informed of all developments on construction at all times. All the requirements from the Grid must be considered during the construction phase to ensure smooth transition.

3.2.5 Environmental Control Officer

The Environmental Control Officer shall convey the contents of this document, the conditions of the Record of Decision from DEAT as well as the Landowner Special conditions to the Contractor site staff and discuss the contents in detail with Eskom Project Manager and Contractor at a pre-construction meeting. This formal induction training is a requirement of ISO 14001 and shall be done with all main and sub-contractors. Record of the training date, people whom attended and discussion points shall be kept by the ECO.

The Environmental Control Officer shall make contact with the local Extension Officer of the Dept. of Agriculture and the Chairpersons of the Farmers Associations where the route traverses, as these contacts have valuable information about the area and the local farming community.

Landowners shall therefore be informed timeously of the construction programme, duration and all interference with their daily activities.

The contact numbers of the ECO and CECO shall be made available to Landowners.

ECO officer will report progress made on a monthly basis to the PM and Land & Rights EIA Manager. These reports shall be available at all times, on site or in project file and on request by auditors, DEAT and other I&APs.

ECO shall record all Non Conformances and action plans to ensure that measures are put in place to remedy possible effect.

3.2.6 Contractor

- To provide all necessary supervision during the execution of the project. He/ She should be available on site all the time.
- To appoint a competent CECO
- To implement the projects as per the approved project plan.
- To ensure that implementation is conducted in an environmentally acceptable manner.
- To fulfil all obligations as per the agreed contract.
- To comply with special conditions as stipulated by Landowners during the negotiation process.
- To inform and educate all employees about the environmental risks associated with the different activities that should be avoided during the construction process and lessen significant impacts to the environment.

3.2.7 Eskom Environmental Advisor (During Operational Stage)

- To implement and integrate environmental management systems by ensuring compliance to ISO 14000 & monitoring performance
- Report environmental incidents
- Provides environmental training
- Ensures compliance to legislations and other legally binding documents

3.2.8 Environmental Assessment Practitioners

- Investigate and produce assessment of impacts on the environment related to the project
- Ensure the implementation of a thorough public participation process
- Draft and submit scoping and EIR to relevant Government Departments

- Draft EMP and submit for approval to the relevant Government Departments.

3.2.9 Authorising Department.

To provide ROD on all applications lodged for the proposed Transmission lines, substations and related activities.

4 ENVISAGED ACTIVITY SCHEDULE AND ASSOCIATED IMPACTS

- *Lists predicted negative environmental impacts for which mitigation is required*
- *Description of mitigation measures. These should be described in detail and should be accompanied by designs, equipment description and operating procedures.*
- Description of implementation of the mitigation ,measures.

Implementation Schedule:

Description of monitoring programme: Describes the implementation programme and monitoring system.

Use of KPI, measuring methods, and threshold that will signal the need for corrective actions.

All Environmentally sensitive areas are indicated on the profiles and the Project Manager and Contractor shall take note of these. **The Contractor (TRMSCAAC1 REV 3 section 4.1.2) shall take all the necessary precautions against damage.**

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
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1. SITE ESTABLISHMENT								
1.1 Set up living quarters, site office, assembly area and workshops	<ul style="list-style-type: none"> Bush clearing and levelling, Install Concrete floor, Install Waste Collection Area, Cast concrete slabs for buildings & concrete bundled area for servicing vehicles Appointment of contractors labourers 	<ul style="list-style-type: none"> Damage to protected / endangered vegetation Damage to topsoil / waste concrete Compacting of ground Employment and skills development 	NEMA BDA CARA LRA SDA	<p>Objective:</p> <ul style="list-style-type: none"> Topsoil must be conserved and stockpiled for rehabilitation Minimise scarring of the soil surface and land features Minimise disturbance and loss of topsoil Rehabilitate all disturbed areas along the servitude Avoid wet areas Minimise damage to vegetation Minimise possibility of erosion due to removal of vegetation Minimise removal of plant material on river and stream embankments Local labourers should be used wherever possible Improve local skills wherever possible <p>Mechanisms:</p> <ul style="list-style-type: none"> Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site. The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction. The Contractor shall supply a 	<ul style="list-style-type: none"> Written agreement between Land Owner and Contract regarding occupation of site. No visible erosion scars once construction is completed No claims regarding damage leading to litigation due to unauthorised removal of vegetation All damaged areas successfully rehabilitated one year after completion No damage to wet areas Only 8m vegetation cleared along the centre of the servitude for access purposes No vegetation interfering with structures and statutory safety requirements upon completion of the contract No de-stumping of vegetation on river and stream embankments All alien invaders and densifiers removed to limit the fire hazard No visible herbicide damage to the vegetation along the servitude one year after completion of the 	Report on all NCRs identified Perform Spot Audits regularly Conduct final audit before site handover to the asset owner		ECO Eskom Envir. Practitioner / Advisor Eskom Envir. Practitioner / Advisor

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				wastewater management system that will comply with legal requirements and be acceptable to Eskom. <ul style="list-style-type: none"> Location of construction camp will be negotiated with the affected landowner prior to occupation. Camp site will be fenced off and kept locked at all times Compacted ground shall be rehabilitated by ripping to a minimum depth of 600mm 	contract due to incorrect herbicide use			
1.3 Use of ablution facilities and kitchen facilities	Install drainage system for toilets, waste water, water supply Use veld for toilet	Ground water pollution and impact on vegetation Pollution of ground water and soil Health risk / spreading of diseases	NWA OHSA NEMA TRMSCAAC1 REV 3 OHSA	Objective: To ensure proper sanitation is achieved and minimise the spread of diseases Machanism: <ul style="list-style-type: none"> The Contractor shall install mobile chemical toilets on site Staff shall be sensitised to the fact that they should use these toilets at all times No use of the veld shall be allowed, as this always create problems with the landowners and lead to claims for problems with stock diseases Toilet paper is also a source of littering in the veld, and the Contractor shall be forced to clean up any litter The Contractor shall take all the necessary precautions against the spreading of disease, especially under livestock. 	No complaints received from landowners regarding sanitation	A record shall be kept of drugs administered and the dates when this was done. This should be available on site. A record of all complaints should be available on request. ECO officer to keep records		

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
1.4 Set up batching plant	Negotiate the site for batching plant.	Damage to top soil	TRMSCAAC1 REV 3	<p>objective:</p> <ul style="list-style-type: none"> To ensure all agreements with Landowners are adhered to Prevention of complaints from Landowners Successful rehabilitation of disturbed areas <p>Mechanisms: The siting of batching plants shall be done in conjunction with the landowner and ecologist/botanist and archaeologist</p> <ul style="list-style-type: none"> The batching plant area shall be operated in such a way as to prevent contaminated water to run off the site and polluting nearby streams or water bodies. To this effect diversion berms can be installed to direct all wastewater to a catchment area. 	<ul style="list-style-type: none"> No Complaints from Land Owners All disturbed areas to be rehabilitated successfully, three months after construction 	Landowner to sign off after completion of project.		

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
1.5 Set up store area	<ul style="list-style-type: none"> Install fencing & Digging holes, Insert Poles & concrete, Erect fence, grading and clearing the area Create fire breaks Storage of hazardous Substances 	<ul style="list-style-type: none"> Disturbance of topsoil Waste concrete Damage to protected / endangered vegetation Wire offcuts Fire risks Spillages 	CARA NEMA ECA BDA HSA FA TRMSCAAC1 REV 3	Objectives: <ul style="list-style-type: none"> To prevent fire breakout To prevent soil pollution Mechanisms: <ul style="list-style-type: none"> Fencing in of the storage areas for drums on site is also proposed, as this will keep out animals and prevent injury. Should the Contractor want to leave guards on site, this should be discussed and negotiated with the Landowner. Proper facilities must be provided to ensure sanitation standards are met. Mobile chemical toilets shall be installed at such sites where a large number of the workforce is concentrated. The contractor is referred to FA. All gates installed in electrified fencing shall be re-electrified. All gate positions shall be three (3) metres off centre to allow for continued access when stringing takes place All storage tanks to be protected underneath by a plastic sheeting and trench or bund wall around them to avoid ground pollution Contractor to remove all polluted soil to an approved toxic site or to be treated chemically. All spills to be cleaned and rehabilitated immediately All hazardous substances shall be stored in suitable containers 	<ul style="list-style-type: none"> No incidents recorded No complaints from Landowners Certificate of treatment of soil Aspects and impacts register A register on all substances available on site All spills rehabilitated. All spills to be cleaned and rehabilitated immediately A register shall be kept on all substances and be available for inspection at all times Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately 	<ul style="list-style-type: none"> The Environmental Control Officer shall approve gate positions. ECO to report NCRs Regular monitoring and recording of spills on the register Monitor register	Monthly Monthly	ECO ECO ECO

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>and storage areas shall be bunded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid.</p> <ul style="list-style-type: none"> • Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately. • Any leaking containers shall be repaired or removed from site. 				
1.6 Set Up Batching plant	Dust and Noise Management during site establishment	Dust nuisance from the excavated and stockpiled material		<p>Objectives: To avoid dust nuisance from excavated material And avoid noise nuisance from operating construction equipment</p> <p>Mechanism:</p> <ul style="list-style-type: none"> • Implement dust suppression measures e.g. regular watering • Concrete mixing to be carried out away from sensitive areas • Develop and implement dust monitoring programme • Limit working hours of noisy equipment to daylight hours • Fit silencers to equipments 				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
<p>1.7 Use of vehicles for material, equipment and personnel transportation</p>	<ul style="list-style-type: none"> Trucks delivering material to store area Servicing vehicles resulting in draining oil and removing filters & Emergency repairs due to breakages Transport of personnel and material to site 	<ul style="list-style-type: none"> Oil, lubricants or fuel spills Waste material containers / packaging 	<ul style="list-style-type: none"> NWA ECA NEMA HSA 	<p>Objectives: To prevent and minimise pollution to the environment. Prevent transgressing acts that governs pollution</p> <p>Mechanisms:</p> <ul style="list-style-type: none"> Where possible and practical all maintenance of vehicles and equipment shall take place in the workshop area. During servicing of vehicles or equipment, a suitable drip tray shall be used to prevent spills onto the soil, especially where emergency repairs are effected outside the workshop area. Leaking equipment shall be repaired immediately or be removed from site to facilitate repair. All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site. A certificate of disposal shall be obtained by the Contractor and kept on file Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and re-mediated to the satisfaction of the ECO. The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site, All hazardous substances shall 	<ul style="list-style-type: none"> No oil spills A register shall be kept on all substances and be available for inspection at all times. Areas shall be monitored for spills and any spills shall be recorded rehabilitated immediately 	<p>Monitor register</p>	<p>Daily</p>	<p>Contractor CECO</p>

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>be stored in suitable containers and storage areas shall be bunded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid..</p> <ul style="list-style-type: none"> Any leaking containers shall be repaired or removed from site (See above actions for spills). 				
1.8 Tower Pegging	Vehicle driving in veld	<ul style="list-style-type: none"> Damage to protected / endangered vegetation Damage to heritage sites Oil Spills 	BDA NHRA NWA CARA	<p>Objective: To minimise environmental impact</p> <p>Mechanisms: Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer. In accordance with the Conservation of Slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced. Other methods of rehabilitation of tower sites may also be used at the discretion of the ECO, e.g. stone pitching, logging, etc. Contour banks shall be spaced according to the slope on tower sites. The type of soil shall also be taken into consideration.</p>				
	Surveyor pegging towers	Littering of packaging & pegging materials	NEMA ECA	Refer to littering under site establishment.				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
1.9 Bush clearing	<ul style="list-style-type: none"> • People cutting vegetation by hand • Bulldozer clearing vegetation 	<ul style="list-style-type: none"> • Damage to protected / endangered vegetation • Disturbance of topsoil • Damage to heritage sites 	BDA NHRA	<p>Objectives:</p> <ul style="list-style-type: none"> • Minimise damage to vegetation • Keep servitude as natural looking as possible • Minimise interference by vegetation to flow of electricity • Minimise possibility of erosion due to removal of vegetation • Minimise removal of plant material on river and stream embankments • Eradication of alien invader and densifier species that cause a fire hazard <p>Mechanisms:</p> <ul style="list-style-type: none"> • Protected or endangered species of plants shall not be removed unless they are interfering with a structure. • Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation. • All protected species not to be removed must be clearly marked and such areas fenced off if required. • No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river- and stream banks. Vegetation shall only be cut to allow for the passage of the 	<ul style="list-style-type: none"> • Only 8m vegetation cleared along the centre of the servitude for access purposes • No vegetation interfering with structures and statutory safety requirements upon completion of the contract • No de-stumping of vegetation on river and stream embankments • All alien invaders and densifiers removed to limit fire hazard • No visible herbicide damage to the vegetation along the servitude one year after completion of the contract due to incorrect herbicide use • No litigation due to unauthorised removal of vegetation 			

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>pilot-cables and headboard.</p> <p>Contractor requirements:</p> <ul style="list-style-type: none"> • Contractor must be in possession of a valid herbicide applicators licence • Contractor to have necessary knowledge to identify protected species as well as species not interfering with operation of the line due to their height and growth rate • Contractor to be able to identify all declared weeds & alien species that can be totally eradicated. 				
	<ul style="list-style-type: none"> • Clearing of vegetation on river banks • Excessive clearing of servitude 	<p>Erosion and invader plants</p> <p>Damage to protected / endangered vegetation</p>	<p>CARA</p> <p>BDA</p> <p>NWA</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • Minimise erosion damage on donga crossings • Minimise impeding the natural flow of water • Minimise initiation of erosion through donga embankments • Minimise damage to river and stream embankments • Minimise erosion of embankments and subsequent siltation of rivers, streams and dams • Minimise erosion damage on donga crossings • Minimise impeding the natural flow of water <p>Mechanisms:</p> <p>No vegetation clearing shall be allowed across ravines and gullies,</p>	<ul style="list-style-type: none"> • No interference to dongas embankment • No erosion visible to donga embankment due to construction activities • No interference with natural flow of water • No disturbance to donga embankments • No erosion visible on donga embankments due to construction activities • No interference with the natural flow of water • Licence requirement to be met where applicable. 			

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				as this vegetation will very rarely interfere with the clearance to the strung conductor				
1.10 Gate installation	<ul style="list-style-type: none"> Flattening of fences to gain access Tying off fence and straining fence wires 	<ul style="list-style-type: none"> Damage to fences Damage to electrical fencing Wire off cuts and broken fences 	FA TRMPVACV2 REV1 TRMSCAAC1 REV 3	<p>Objectives:</p> <ul style="list-style-type: none"> To install gates to allow access for construction Minimise damage to existing fences and gates To limit access to Eskom & contractor employees by using keys All fences properly tied off to the gate posts All fences properly and neatly installed according to specifications <p>Mechanisms:</p> <ul style="list-style-type: none"> The Landowners shall be kept abreast of all developments and shall be kept informed about the progress and phases of the contract. All gates shall be fitted with locks and be kept locked at all times during the construction phase. Gates shall only be left open on request of the Landowner if he accepts partial responsibility for such gates in writing, once the Contractor have left site and the gates are fitted with Eskom locks. Such gates shall be clearly 	<ul style="list-style-type: none"> No Transgression of the fence act and therefore no litigation No damage to the fence and no complaints from land owner All gates to be kept locked at all times to limit access to keyholders No complaints and claims due to unclosed gates 			

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>marked by painting the posts green.</p> <ul style="list-style-type: none"> All claims arising from gates left open shall be investigated and settled in full by the Contractor. If any fencing interferes with the construction process, such fencing shall be deviated / protected until construction is completed. Game gates, drawing 0.00/10280 Rev 0, shall be installed where necessary. All gates installed in electrified fencing shall be re-electrified. The Environmental Control Officer shall approve gate positions. All gate positions shall be three (3) metres off centre to allow for continued access when stringing takes place. 				
	Dig holes	Disturbance of topsoil	CARA	<p>Mechanisms:</p> <ul style="list-style-type: none"> At any gate poles where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation. During backfilling operations, the Contractor shall take care not to dump the topsoil in the bottom of the foundation and then put spoil on top of that 				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
	<ul style="list-style-type: none"> Insert gate and pour concrete Installation of concrete sill in Vermin proof fence 	Waste concrete	NEMA ECA	<p>Objective:</p> <p>Mechanisms:</p> <ul style="list-style-type: none"> No waste material shall be left on site that may harm man or animals. Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner. Concrete trucks shall not be washed on site after depositing concrete into foundations. Any spilled concrete shall be cleaned up immediately 				
2. ACCESS ROADS CONSTRUCTION								
	<ul style="list-style-type: none"> Mark access roads Vehicles driving off servitude road Illegal use of private roads 	<ul style="list-style-type: none"> Damage to protected / endangered vegetation Damage to drifts and bridges & irrigation lines 	BDA	<p>Objectives:</p> <ul style="list-style-type: none"> Minimise damage to river and stream embankments Minimise erosion of embankments and subsequent siltation of rivers, streams and dams <p>Mechanisms:</p> <ul style="list-style-type: none"> A physical access plan along the servitude shall be compiled and the Contractor shall adhere to this plan at all times. Proper planning when the physical access plan is drawn up by the ECO in conjunction with the Contractor shall be 	<ul style="list-style-type: none"> Access plan approved by ECO All access roads will be marked No complaints from residents and landowners No access roads through river and stream banks No visible erosion scars on embankments once construction is completed 			

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>necessary to ensure access to all tower sites.</p> <ul style="list-style-type: none"> • All access roads will be marked • Agreed on Access to be used at all times. • No illegal use of private roads during construction due to damage anticipated as a result of heavy vehicles and equipment • All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties. • Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect. • Upon completion of the project all roads shall be repaired to their original state. • No roads shall be cut through river- and stream banks as this may lead to erosion causing siltation of streams and downstream dams. • Existing drifts and bridges may be used if the Landowner gives his consent. Such structures shall then be thoroughly examined for strength and durability before they are used. New drifts and bridges shall only be constructed with the approval of Eskom and the Landowner and at the discretion of the 				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>Environmental Control Officer.</p> <ul style="list-style-type: none"> All structures constructed for access purposes shall be properly designed and drawings of such structures shall be available for record purposes. Permanently wet areas are shown on the profiles. No vehicular traffic shall be allowed in such areas. Only existing roads through such areas may be used with the approval of Eskom and the Landowner. No equipment shall be used which may cause irreparable damage to wet areas. The contractor shall use alternative methods of construction in such areas. 				
	Bulldozer blading access roads	<ul style="list-style-type: none"> Damage to protected / endangered vegetation Damage to heritage sites, Damage to private roads 	BDA NHRA	<p>Objectives:</p> <p>Mechanisms:</p> <ul style="list-style-type: none"> No scalping shall be allowed on any part of the servitude road unless absolutely necessary. The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed. All trees and vegetation cleared from the site shall be cut into manageable lengths and neatly stacked at regular intervals along the line. 				

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ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<ul style="list-style-type: none"> No vegetation shall be pushed into heaps or left lying all over the servitude. Protected or endangered species of plants shall not be removed unless they are interfering with a structure. Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation 				
	Blading of access roads through dongas	Causing erodable areas, Erosion and loss of topsoil	CARA	<ul style="list-style-type: none"> Vegetation clearing must be kept to a minimum. Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. Any vegetation cleared shall be removed or flattened and not be pushed to form an embankment. 	<ul style="list-style-type: none"> Only 8m vegetation cleared along the centre of the servitude for access purposes No vegetation interfering with structures and statutory safety requirements upon completion of the contract No de-stumping of vegetation on river and stream embankments All alien invaders and densifiers removed to limit the fire hazard No visible herbicide damage to the vegetation along the servitude one year after completion of the contract due to incorrect herbicide use No litigation due to unauthorised removal of vegetation 			

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ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
					<ul style="list-style-type: none"> No litigation due to unauthorised removal of vegetation 			
	Construction of drifts / donga crossings	Erosion / impedance of water flow	NWA					
	Road construction on slopes	Erosion and loss of topsoil	CARA					
	Installation of diversion berms	Prevention of erosion	NWA CARA					
3. TOWER CONSTRUCTION								
	Excavation of foundation	Disturbance of topsoil and vegetation Loss of topsoil with seedbank	CARA TRMSCAAC1 REV 3	<p>Objectives:</p> <p>Mechanisms:</p> <p>Disturbance of topsoil on tower sites with severe slopes shall be minimised at all costs.</p> <ul style="list-style-type: none"> At any tower sites where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation of such tower sites. During backfilling operations, the 				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<p>Contractor shall take care not to dump the topsoil in the bottom of the foundation and then put spoil on top of that</p> <ul style="list-style-type: none"> • Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer. • Slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced. Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc. • Contour banks shall be spaced according to the slope on tower sites. The type of soil shall also be taken into consideration. 				
		Damage to heritage sites	NHRA					
	Drilling of foundation	Noise and dust pollution	NEMA ECA	<p>Objectives: To avoid dust nuisance from excavated material And avoid noise nuisance from operating construction equipment</p> <p>Mechanism:</p> <ul style="list-style-type: none"> • Implement dust suppression measures e.g. regular watering • Develop and implement dust monitoring programme • Limit working hours of noisy equipment to daylight hours • Fit silencers to equipments 				

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
	Installation of steel reinforcing	Waste material	NEMA ECA	Objectives: Mechanisms: <ul style="list-style-type: none"> • No waste material shall be left on site that may harm man or animals. • Any broken insulators shall be removed and all shards picked up. • Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site. 				
	<ul style="list-style-type: none"> • Casting of concrete & washing of concrete truck on site 	Waste concrete	NEMA ECA	Objectives: Mechanisms: <ul style="list-style-type: none"> • Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner. • Concrete trucks shall not be washed on site after depositing concrete into foundations. • Any spilled concrete shall be cleaned up immediately • Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner 				

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ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
	<ul style="list-style-type: none"> Assembling of towers Dressing of towers with hardware and insulators 	<ul style="list-style-type: none"> Waste bolts and nuts Insulator breakage littering glass shards in veld 	<p>NEMA ECA</p>	<p>Objectives:</p> <p>Mechanisms:</p> <ul style="list-style-type: none"> No waste material shall be left on site that may harm man or animals. Any broken insulators shall be removed and all shards picked up. Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site. 				
	Punching and painting of nuts	Paint spillages	NWA	Rehabilitation of soil				
	Erection of towers with crane	<p>Trucks / crane breaking and spilling oil / lubricants</p> <p>Fuel spillages during re-fuelling</p>	NWA	How to rehabilitate oil and prevention				
	Erection of towers with helicopter	Noise and dust pollution	<p>NEMA ECA</p>	<p>Objectives: To avoid dust nuisance from excavated material And avoid noise nuisance from operating construction equipment</p> <p>Mechanism:</p> <ul style="list-style-type: none"> Implement dust suppression measures e.g. regular watering Develop and implement dust monitoring programme Limit working hours of noisy 				

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ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
				<ul style="list-style-type: none"> equipment to daylight hours Fit silencers to equipments 				
	Discarding packaging material on site	Waste material littering in veld	NEMA					
4. STRINGING OPERATIONS								
	Installation of phase and earth conductors	Damage to structures and agricultural crops	TRMSCAAC1 REV 3	<p>Objective:</p> <ul style="list-style-type: none"> Prevent damage to expensive structures and crops, Prevent disruption of services <p>Mechanisms:</p> <ul style="list-style-type: none"> The necessary scaffolding / protection measures must be installed to prevent damage to structures supporting certain high yield agricultural crops, such as vineyards, orchards, nurseries, etc., as well as the crops itself All structures supplying services such as telephone and smaller power lines, as well as main and farm roads, shall be safeguarded by measures to prevent disruption of services Use of "rugby" posts to protect roads and telephone lines are sufficient. 	<ul style="list-style-type: none"> No claims emanating from damage to supporting structures and crops No complaints or claims arising from disruption of services 			

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	<ul style="list-style-type: none"> Clearing of drum, tensioner and winch stations Creating fire breaks around drum stations 	Damage to protected / endangered vegetation	BDA	<p>Objectives:</p> <ul style="list-style-type: none"> Minimise damage to vegetation Minimise damage to topsoil Successful rehabilitation of barren areas <p>Mechanisms:</p> <ul style="list-style-type: none"> The siting of winch and tensioner stations shall be done in conjunction with the landowner and ecologist/botanist and archaeologist that participated in the compilation of the EMP where necessary. Specifications require the protection of Eskom supplied material on site, especially conductor drums. This normally means that a firebreak is bladed around a drum station in the veld. These areas are left to rehabilitate on their own which could be disastrous. Once the stringing of conductor has been completed in a certain area, the winch- and tensioner stations shall be rehabilitated where necessary. If the area was badly damaged, re-seeding shall be done and fencing in of the area shall be considered and carried out. 	<ul style="list-style-type: none"> No damage to vegetation outside the servitude No visible erosion three months after completion of the contract No loss of topsoil 			
	Using bulldozer for tension purposes	Damage to heritage sites, Disturbance of topsoil and	NHRA BDA	<p>Objectives:</p> <ul style="list-style-type: none"> Protection of archaeological sites and land considered to be of cultural value 	<ul style="list-style-type: none"> No destruction of or damage to known archaeological sites Management of existing 			

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		vegetation	CARA	<ul style="list-style-type: none"> • Protection of known sites against vandalism, destruction and theft • The preservation and appropriate management of new archaeological finds should these be discovered during construction • Protection of sites and land considered to be of cultural value • Protection of known sites against vandalism, destruction and theft • The preservation and appropriate management of new finds should these be discovered during construction <p>Mechanisms:</p> <ul style="list-style-type: none"> • The position of known sites will be shown on the final profiles. Such areas shall be marked as no go areas. • Artefacts shall not be removed under any circumstances. • Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. • Permits shall be obtained from the South African Heritage Resources Association (SAHRA) should the proposed line affect any world heritage sites or if any sites are to be destroyed or altered. 	<p>sites and new discoveries in accordance with the recommendations of the Archaeologists</p> <ul style="list-style-type: none"> • No litigation due to destruction of sites 			

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				<ul style="list-style-type: none"> No dolomite, breccia or stromatolites may be removed or disturbed without the required permits from SAHRA. All monuments, heritage sites and historical sites shall be treated with the utmost respect. Any graves shall be clearly marked and treated as no go areas. No destruction of any site shall be allowed. Should it be necessary to remove any graves, the necessary procedures shall be followed and permits obtained. 				
	<ul style="list-style-type: none"> Jointing and crimping of conductors Discarding wooden cable drum material on site 	Waste material littering in veld	NEMA ECA	<p>Objective:</p> <p>Mechanisms: Any broken insulators shall be removed and all shards picked up. Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.</p>	No waste material shall be left on site that may harm man or animals.			
	No protection for fences during stringing	Damage to fences	FA	<p>Objectives: No damage to fences</p> <p>Mechanisms:</p> <ul style="list-style-type: none"> All fences shall be protected against damage during stringing operations. All damage to be repaired immediately and to the satisfaction of the landowner. 				

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	Tractor pulling out pilot wire	Damage to protected / endangered vegetation	BDA					
5. REHABILITATION OF SERVITUDE								
	Installation of diversion berms	Prevention of erosion	CARA					
	Fixing of fences	Waste material littering in veld	NEMA ECA					
	Re-seeding of barren areas	Wrong seed used	BDA FA TRMSCAAC1 REV 3	<p>Objective</p> <ul style="list-style-type: none"> Minimise damage to topsoil and environment at tower positions Successful rehabilitation of all damaged areas Prevention of erosion <p>Mechanisms:</p> <ul style="list-style-type: none"> Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer. Slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced. Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc. Contour banks shall be spaced 	<ul style="list-style-type: none"> No loss of topsoil due to construction activities No loss of topsoil due to construction activities All disturbed areas successfully rehabilitated within three months of completion of the contract- No visible erosion scars three months after completion of the contract No open fires shall be allowed on site under any circumstance 			

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				<p>according to the slope on tower sites.</p> <ul style="list-style-type: none"> • The type of soil shall also be taken into consideration. • A mixture of seed can be used provided the mixture is carefully selected to ensure the following: <ul style="list-style-type: none"> ○ Annual and perennial plants are chosen ○ Pioneer species are included ○ All the plants shall not be edible ○ Species chosen will grow in the area without many problems. ○ Root systems must have a binding effect on the soil. ○ The final product should not cause an ecological imbalance in the area. • To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the Dept of Agriculture. • Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. • Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of 				

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				the ECO, unless specifically requested by a Landowner (Specifics about the project, special tower positions, helicopter construction, etc.)				
	Picking up all rubble and litter	Servitude left clean and neat	NEMA ECA HSA	The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place. All packaging material shall be removed from site and disposed of and not burned on site. No landfill may be used without the consent from the Landowner. Should a landfill be used for biodegradable materials only, the rubble shall be compacted and at least 1m of soil shall cover the waste material. No hazardous material, e.g. oil or diesel fuel shall be disposed of in any unregistered waste site.				
	<ul style="list-style-type: none"> Settling of all outstanding claims Signing off 	Landowners happy Servitude ready for handover to Grid		<p>Objectives: Minimize claims and litigation from landowners</p> <p>Mechanisms:</p>	<ul style="list-style-type: none"> Successful completion of the contract with all landowners signing the release form six months after completion of the 			

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	all landowners			<ul style="list-style-type: none"> All anticipated crop damage shall be noted while access negotiations are underway. All damage to commercial crops shall be recorded immediately. The ECO The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable. All claims for compensation emanating from crop damage should be directed to the ECO for appraisal. The Contractor shall be held liable for all unnecessary damage to the environment and crops. A register shall be kept of all complaints from Landowners. All claims shall be handled immediately to ensure timeous rectification / payment. 	<ul style="list-style-type: none"> project All claims investigated and dealt with in one month No litigation due to unsettled claims 			
Fire control	Making fires in winter due to cold weather Cooking food on site / smoking	Veld fires	NVFFA FA	<p>Objective: Prevention of veld fires</p> <p>Mechanisms</p> <ul style="list-style-type: none"> No open fires shall be allowed on site under any circumstance The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months. 	No reported fire incidents	Daily physical checks		ECO

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
Use veld for toilet		Health risk / spreading of measles	OHSA TRMSCAAC1 REV 3	<ul style="list-style-type: none"> The Contractor shall install mobile chemical toilets on site. Staff shall be sensitised to the fact that they should use these toilets at all times. No use of the veld shall be allowed, as this always create problems with the landowners and lead to claims for problems with stock diseases. Toilet paper is also a source of littering in the veld, and the Contractor shall be forced to clean up any litter. Applicable where the transmission line traverses land where stock (cattle and sheep) and game farming is practised. 				
		Unauthorised access		No camping shall be allowed on any private property. If the Contractor wants to leave guards on site, it shall only be done with the written consent of the Landowners involved				
Transportation of personnel and material to site		Trucks breaking and spilling oil	NWA ECA HSA	See 1.7 above				
5. WASTE MANAGEMENT								

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
	<ul style="list-style-type: none"> • Erect temporary houses and tents, • Erect store for oil, lubricants and parts • Install waste collection bins 	<p>Waste material / littering</p> <p>Waste foodstuff and food containers</p>	<p>NEMA</p> <p>TRMSCAAC1 REV 3</p>	<p>Objective:</p> <ul style="list-style-type: none"> • To avoid pollution of environment with solid wastes • To keep the servitude neat and clean • Disposal of rubble and refuse in an appropriate manner • To avoid water contaminations and soil pollution caused by oil spills <p>Mechanisms:</p> <ul style="list-style-type: none"> • No material shall be left on site that may harm man or animals. • Littering by the employees of the Contractor shall not be allowed • Ensure sufficient waste bins/containers are made available for waste control. • The Contractor shall collect all litter and dispose thereof in a suitable manner on a regular basis. • Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management • Under no circumstances may solid waste be burned on site unless burned off-site in a registered facility. 	<ul style="list-style-type: none"> • No solid waste stored on site • No incidents recorded • No complaints from Landowner • No litigation cases • No visible spillages of oil or concrete • No rubble or refuse lying around on site • No incidents of litigation • No complaints from Landowners 	<ul style="list-style-type: none"> • The ECO shall monitor the neatness of the work sites as well as the campsite. • ECO to record all incidents and report same to Project Manager • ECO to recommend corrective action 		
6. SOCIAL ISSUES								

4.1 ACTIVITY AND ASSOCIATED IMPACTS DURING CONSTRUCTION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
1. Landowner relations				Objectives: Maintain good relations with Landowners Mechanisms:	<ul style="list-style-type: none"> • No delays in the project due to Landowner interference • No Claims or litigations from landowner • Landowner signs final release form 			
2. Interaction of staff	Staff activities	<ul style="list-style-type: none"> • Job creation • General incidents 		Objective: <ul style="list-style-type: none"> • Wherever possible local labour should be used. • Avoid interactions between farm labourers and construction staff. 				

4.2 ACTIVITY AND ASSOCIATED IMPACTS DURING OPERATION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
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Maintenance	<p>Removal of alien vegetation</p> <p>Access Roads- what is the activity</p> <p>Bush and reeds Clearing</p> <p>Clearing of alien and invasive species</p> <p>Grass Cutting</p> <p>Disposal of cut material</p> <p>Wild Life Interaction , cattle, game, birds, protected</p>	<p>Hardware Servitude</p> <p>Erosion</p> <p>Line faults</p> <p>Breeding of raptors and stocks disturbed (if any)</p> <p>Collision of birds with overhead lines</p>	TRMAGAAZ3	<p>Objective: Prevent bird electrocutions</p> <p>Objective: Prevet collision of birds with overhead lines</p> <p>Mitigation: Use bird flight diverters and bird flappers</p>				Eskom grid staff
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4.2 ACTIVITY AND ASSOCIATED IMPACTS DURING OPERATION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
	species Herbicides							
	Waste							
Projects	Grass Cutting							
	Bush Clearing							
Line Patrol	Foot Patrols							
	Vehicle Patrol							
	Helicopter Patrol							
Rehabilitation	Servitude rehabilitation Hardware Rehabilitation							
Building development	Farm dwelling Rural dev Urban dev Industrial dev							
Land								

4.2 ACTIVITY AND ASSOCIATED IMPACTS DURING OPERATION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
Owner Interaction								
Control of illegal encroachment on the servitude		Electrocution		Regular patrols by Eskom Staff				Eskom grid staff
Agricultural Activities	Forestry							
	Maize/ Beans							
	Cane							
	Grazing							
	Citrus/Nuts/ Fruits							
Fire Management	Vineyards Game Farm							
Aviation activity		Collision with aircrafts		Objective: Prevent collision with aircrafts Mitigation: Use aircraft warning spheres across deep valleys in forested areas				Eskom grid staff
Archaeological sites			SAHRA	Objective: Prevent destruction of these sites Mitigation: Mark these sites clearly and make				Eskom grid staff

4.2 ACTIVITY AND ASSOCIATED IMPACTS DURING OPERATION PHASE

ACTIVITY / ISSUE	ASPECTS	POSSIBLE IMPACTS	RELEVANT LEGISLATION/ ESKOM SPEC	MITIGATION MEASURES	PERFORMANCE INDICATORS	MONITORING METHOD	SCHEDULE/ FREQUENCY	RESPONSIBLE PARTY
		Damage or destruction of these sites		staff aware of their location, characteristic and significance				

4. OUTLINE OF ROD CONDITIONS

5 SUMMARY OF LAND OWNER DETAILS & CONDITIONS

The successful completion of the project depends a lot on the good relations with the Landowner. It is therefore required that the Contractor will supply one person to be the liaison officer (CECO) for the entire contract, and that this person shall be available to investigate all problems arising on the work sites concerning the Landowners (TRMSCAAC1 REV 3)

All negotiations for any reason shall be between Eskom, the Landowner and the Contractor. **NO** verbal agreements shall be made. All agreements shall be recorded properly and all parties shall co-sign the documentation. It is proposed that a photographic record of access roads be kept. This will then be available should any claims be instituted by any Landowners. Any claims instituted by the Landowners shall be investigated and treated promptly. Unnecessary delays should be avoided at all costs.

The Landowners shall always be kept informed about any changes to the construction programme should they be involved. If the Environmental Control Officer is not on site the Contractor's Environmental Control Officer should keep the Landowners informed. The contact numbers of the Contractor's ECO officer and the Eskom ECO shall be made available to the Landowners. This will ensure open channels of communication and prompt response to queries and claims.

All contact with the Landowners shall be courteous at all times. The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.

Eskom shall ensure that all agreements reached with the Landowner are fulfilled, and that such areas be rehabilitated once construction is completed. Should any claim be instituted against Eskom, due to the actions of the Contractor at a batching plant site, Eskom shall hold the Contractor fully responsible for the claim until such time that the Contractor can prove otherwise with the necessary documentation.

5.1. LIST OF LANDOWNERS, CONTACT DETAILS, CONDITIONS AND REQUIREMENTS.

PORTION NO	NAME OF LAND OWNER	LAND OWNER CONTACT DETAILS	LAND OWNER CONDITIONS	TOWERS AFFECTED	CO-ORDINATES	ENVIRONEMTAL IMPACTS ANTICIPATED TOWERS	REFERENCE TO PROFILES & DRAWINGS
1. Portion 5 of farm JR	Mr. Peit Botha	082 395 678					

6 COST ESTIMATES FOR IMPLEMENTING THE MITIGATION MEASURES AND OPERATIONAL MAINTENANCE THEREOF (EXAMPLE).

6.1. Environmental Cost Estimates during construction phase

Construction phase Cost Estimates				
Categories and activities	Explanations	Examples	Operational costs	Capital costs
Environmental costs associated with the Transmission network	Environmental impact quantification costs associated with the compilation of scoping documents, EIA's, EMP's, risk assessments and the compilation, implementation of EMP's, and EMP's for new or existing projects EXCLUDING internal man-hours. This would include costs associated with contractors employed to undertake EIA's and EMP's.	Environmental impact quantification costs associated with the compilation of scoping documents, EIA and EMP reports. Costs associated with EIA, EMP reports and line modifications due to environmental reasons.		
Drainage	Costs associated with the construction of, modifications too, repair and maintenance of all sewerage drainage systems			
Fire protection –	Costs associated with the modifications of, repair and maintenance too all transformer bund walls			
	Costs associated with modifications of, repair and maintenance too all substation oil dams			
Water treatment	Costs associated with the,repair and maintenance of all substation water pipes and associated water infrastructure			
Animal interaction.	Costs associated with the installation of bird			

	diverters			
Rehabilitation	All costs associated with the rehabilitation of disturbed land			
Internal Man-hours	Environmental Cost Centres for dedicated full time Environmental Personnel. This includes man-hours and other costs incurred that are charged to the cost centre by non dedicated environmental personnel	Costs associated with actual time spent on managing, documenting, monitoring, reviewing and mitigating environmentally related impacts (air, water, waste, land) Environmental costs associated with capital projects are capitalised (i.e. charged to one of the categories under capital expenditure) and hence are not to be included as part of the costs assigned to the environmental cost centre. Only the supply amount must be used at all times to remove the risk for double accounting.		
Categories and activities	Explanations	Examples	Operational costs	Capital costs
Audits	All costs associated with environmental audits			
<ul style="list-style-type: none"> • Internal audits. • External audits 				
Training (internal and external)	Costs associated with environmental training, for courses attended internally and externally, including environmental related interventions for non environmental practitioners who are required to incorporate environmental considerations in the	Costs associated with environmental training, only for EDCO registered courses attended internally and externally by non environmental practitioners who are required to		

	performance of their duties	incorporate environmental considerations in the performance of their duties. EDCO registered environmental related courses, which support the Transmission Group's business goals and Key Performance Areas. Other adhoc courses, seminars and conferences, which are not registered on the EDCO system, will not be reported on.		
Waste management Costs associated with the management of domestic and hazardous waste as per the waste directive.	Costs associated with the repair and maintenance of all sewerage pipes. Costs associated with all sewerage removal contracts			
	PCB: <ul style="list-style-type: none"> • Costs associated with the removal, storage and disposal of all hazardous waste • Costs associated with the incineration of PCB's 			
	Costs associated with the removal of domestic waste at Transmission business units and substations.			
	Costs associated with the replacement and			

	removal of asbestos slabs			
Categories and activities	Explanations	Examples	Operational costs	Capital costs
Land management Biodiversity and land management. Costs related to managing and maintaining servitudes and land including erosion control, firebreaks, alien plant eradication and animal interactions. All costs related to grass cutting shall not be included.	Costs associated with all erosion contracts initiated for the sole purpose of rectifying damage too the environment.			
	Rehabilitation: Costs associated with the rehabilitation of disturbed land during construction.			
	Aesthetics: Costs associated with modifications for aesthetic reasons.			
	Costs associated with the eradication of Alien / invader vegetation.			
	Projects initiated in the supply plan and fulfilling the criteria of environmental expenditure as per the definitions			

Pollution	All costs associated with the clean up and mitigation of oil, herbicide or hazardous substance spills.			
Production equipment	All assets purchased for the primary reason of sustaining, improving, rectifying damage too or protecting the environment from real or perceived impact			
Other	Other environmental costs costed for the sole purpose of sustaining, improving, rectifying damage too or protecting the environment from real or perceived impact			
TOTALS				

6.2. Environmental Cost Estimates during operational phase

Operational Phase Cost Estimates				
Categories and activities	Explanations	Examples	Operational costs	Capital costs
Environmental costs associated with the Transmission network	Environmental impact quantification costs associated with the compilation of scoping documents, EIA's, EMP's, risk assessments and the compilation, implementation of EMP's, and EMP's for new or existing projects EXCLUDING internal man-hours. This would include costs associated with contractors employed to undertake EIA's and EMP's.	<p>Environmental impact quantification costs associated with the compilation of scoping documents, EIA and EMP reports.</p> <p>Costs associated with EIA, EMP reports and line modifications due to environmental reasons.</p>		R7,858,364.66

Drainage	Costs associated with the construction of, modifications too, repair and maintenance of all sewerage drainage systems			
Fire protection –	Costs associated with the modifications of, repair and maintenance too all transformer bund walls			
	Costs associated with modifications of, repair and maintenance too all substation oil dams			
Water treatment	Costs associated with the,repair and maintenance of all substation water pipes and associated water infrastructure			
Animal interaction.	Costs associated with the installation of bird diverters			
Rehabilitation	All costs associated with the rehabilitation of disturbed land			
Internal Man-hours	Environmental Cost Centres for dedicated full time Environmental Personnel. This includes man-hours and other costs incurred that are charged to the cost centre by non dedicated environmental personnel	Costs associated with actual time spent on managing, documenting, monitoring, reviewing and mitigating environmentally related impacts (air, water, waste, land) Environmental costs associated with capital projects are capitalised (i.e. charged to one of the categories under capital expenditure) and hence are not to be included as part of the costs assigned to the environmental cost centre. Only the supply amount must be used at all times to remove the risk for double accounting.	R1,044,032.76	
Categories and activities	Explanations	Examples	Operational costs	Capital costs

<p>Audits</p> <ul style="list-style-type: none"> • Internal audits. • External audits 	<p>All costs associated with environmental audits</p>			
<p>Training (internal and external)</p>	<p>Costs associated with environmental training, for courses attended internally and externally, including environmental related interventions <u>for non environmental practitioners</u> who are required to incorporate environmental considerations in the performance of their duties</p>	<p>Costs associated with environmental training, only for EDCO registered courses attended internally and externally by non environmental practitioners who are required to incorporate environmental considerations in the performance of their duties. EDCO registered environmental related courses, which support the Transmission Group's business goals and Key Performance Areas. Other adhoc courses, seminars and conferences, which are not registered on the EDCO system, will not be reported on.</p>	<p>R16,876</p>	
<p>Waste management Costs associated with the management of domestic and hazardous waste as per the waste directive.</p>	<p>Costs associated with the repair and maintenance of all sewerage pipes. Costs associated with all sewerage removal contracts</p>			
	<p>PCB:</p>			

	<ul style="list-style-type: none"> • Costs associated with the removal, storage and disposal of all hazardous waste • Costs associated with the incineration of PCB's 			
	Costs associated with the removal of domestic waste at Transmission business units and substations.			
	Costs associated with the replacement and removal of asbestos slabs			
Categories and activities	Explanations	Examples	Operational costs	Capital costs
Land management Biodiversity and land management. Costs related to managing and maintaining servitudes and land including erosion control, firebreaks, alien plant eradication and animal interactions. All costs related to grass cutting shall not be included.	Costs associated with all erosion contracts initiated for the sole purpose of rectifying damage too the environment.			
	Rehabilitation: Costs associated with the			

	rehabilitation of disturbed land during construction.			
	Aesthetics: Costs associated with modifications for aesthetic reasons.			
	Costs associated with the eradication of Alien / invader vegetation.			
	Projects initiated in the supply plan and fulfilling the criteria of environmental expenditure as per the definitions			
Pollution	All costs associated with the clean up and mitigation of oil, herbicide or hazardous substance spills.			
Production equipment	All assets purchased for the primary reason of sustaining, improving, rectifying damage too or protecting the environment from real or perceived impact			
Other	Other environmental costs costed for the sole purpose of sustaining, improving, rectifying damage too or protecting the environment from real or perceived impact			
TOTALS				

7. GENERAL

7.1. PHYSICAL ACCESS PLAN

The Contractor (CECO), in conjunction with the ECO and Landowners, shall draft a physical access plan. No decisions shall be made without the consent of the Landowner. All agreements should be in writing and well documented.

The physical access plan shall allow for the installation of concrete pipes and drifts where such structures may be needed to facilitate access. The Environmental Control Officer in conjunction with the Contract Manager shall use discretion as to what special measures will be required to ensure access (Refer also Section 10.1). The necessary agreements reached shall be implemented to the satisfaction of the landowner.

7.2. AWARENESS AND TRAINING OF CONTRACTOR

7.3. SITE DOCUMENTATION / MONITORING

The standard Eskom site documentation shall be used to keep records on site. All documents shall be kept on site and be available for monitoring and auditing purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. The documentation shall be signed by all parties to ensure that such documents are legitimate. Regular monitoring of all site works by the Environmental Control Officer is imperative to ensure that all problems encountered are solved punctually and amicably. When the Environmental Control Officer is not available, the Contract Manager/Site Supervisor shall keep abreast of all works to ensure no problems arise.

Two-weekly reports shall be forwarded to the appointed Transmission Environmental Advisor with all information relating to environmental matters. The following **Key Performance Indicators** must be reported on a two-weekly basis:

1. Complaints received from Landowners and actions taken.
2. Environmental incidents, such as oil spills, concrete spills, etc. and actions taken (litigation excluded).
3. Incidents possibly leading to litigation and legal contravention's.
4. Environmental damage that needs rehabilitation measures to be taken.

The following documentation shall be kept on site:

- Access negotiations and physical access plan.
- Complaints register.
- Site daily dairy.
- Records of all remediation / rehabilitation activities.
- Copies of two-weekly reports to the Tx Engineering Environmental Advisor at MWP.
- Copy of the Environmental Management Programme (EMP) file.

7.4. AUDITS

During the construction period at least two (2) Environmental Audits shall be conducted to determine compliance with the recommendations of the EIA, EMP and conditions of the Record of Decision (ROD). These can be internal audits or external by DEAT or the ISO14001 auditors or combined audits.

7.4.1. Proposed Audit Programme

7.4.2. Audit Reporting

8. Conclusion

TRANSMISSION SERVICES



ENVIRONMENTAL MANAGEMENT PROGRAMME

EMP Substation construction/refurbishment work

2006

**J Geeringh (Pr Sci Nat)
Senior Environmental Advisor
Tx Services, Land & Rights focus area**

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QUESTIONNAIRE

1. SCOPE

The scope of this document is to give environmental management guidelines, to the Contractor doing the construction work, in fulfilment of ISO 14001 requirements. This document is part of the contract and supplementary to Eskom's technical specifications. **The recommendations and constraints, as set out in this document are enforceable under the general conditions of contract.**

The EMP has a long-term objective to ensure that:

- 1) Environmental Management considerations are implemented from the design phase of the project,
- 2) The Contractor is able to and shall include any costs of compliance with this EMP into the tender price
- 3) Precautions against environmental damage and claims arising from such damage are taken timeously, and
- 4) The completion date of the contract is not delayed due to environmental problems with the Landowner, Grid staff, Communities or Regulatory Authorities arising during the course of the project execution,
- 5) The asset created conforms to environmental standards required by ISO 14001 and Transmission Policy.

Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:

1. To underwrite Eskom Transmission's Environmental Policy TRMPBAAX3 Rev 2 at all times.
2. Ensure environmental conditions stipulated in the Record of Decision (ROD) are implemented.
3. Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations.
4. To implement this Environmental Management Programme for the benefit of all involved.
5. To preserve the natural environment by limiting destructive actions on site.

The Project Manager and Contractor must take into consideration that this EMP will be implemented and amended as required for the duration of the contract. The management of the environment changes over time and therefore the document shall be updated regularly to ensure environmental management is implemented during all phases of a project.

Responsibility Matrix.

Function	Name + Tel	Responsibility
Project Manager (PM)		Overall management of project and EMP implementation.
Contract Manager (CM)		Contract management.
Site Supervisor (SS)		Site supervision.
Environmental Control Officer (ECO)		Implementation of EMP and liaison between Eskom, Contractor and the Landowner.
Contractor (C)		Implementation and compliance with recommendations and conditions of the EMP, Appoints / delegates a dedicated person to work with ECO when required.
Tx Services Environmental Advisor (Eskom)	John Geeringh 011 800 2465 083 632 7663	Environmental advice and monitoring

(Table to be completed upon contract award)

2. INTRODUCTION

The construction, refurbishment or upgrading of Transmission Substations can have a major impact on the environment. Construction of a new substation and upgrading of an existing facility is also regulated by legislation under the Environment Conservation Act, 73 of 1989. It is thus imperative that precautions are taken to ensure that environmental damage is minimised. This will take a concerted effort from Eskom and the Contractor and detailed planning is of the utmost importance.

The Environmental Control Officer shall convey the contents of this document, the conditions of the Record of Decision from DEAT as well as the Landowner Special conditions to the Contractor site staff and discuss the contents in detail with the Eskom Project Manager and Contractor at a pre-construction meeting. This formal induction training is a requirement of ISO 14001 and shall be done with all main and sub-contractors. Record of the training date, people whom attended and discussion points shall be kept by the ECO.

For all construction and upgrading of substation sites that require new land take, a ROD is obtained from DEAT after completion of the Environmental Impact Assessment (EIA) for the project.

Good relations with the Landowner / legal occupier (hereafter referred to as **Landowner**), Grid staff and Communities need to be established and sustained. This will help in the solving of problems and the prevention thereof. Lines of communication should always be open to ensure proper and timeous reaction to complaints. The contact numbers of the ECO and / or Eskom Site Supervisor shall be made available to the Landowner (for new substation sites and extensions) and Grid staff (for All sites). The reputation of both the Contractor and Eskom is at stake and should be the drive for everybody involved to perform in excellence.

During the construction period for new substations and extensions environmental personnel shall monitor the works, to measure compliance with

the recommendations of the EMP and conditions of the ROD. The Grid Environmental Advisor shall inspect refurbishment and upgrading projects upon completion of the contract. If satisfied the works shall be taken over by the Grid.

3. DESCRIPTION OF THE PROJECT

3.1. SUBSTATION

The substation where the work will be performed is _____.

3.2. PROJECT EXECUTION AREA

Construction, refurbishment or upgrading activities are limited to the area as demarcated by Eskom and shown on the site plans. Any area outside Eskom owned property, required to facilitate access, construction camps or material storage areas, shall be negotiated with the Landowner and written agreements shall be obtained.

Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the Landowner in the presence of Eskom. **Should the Contractor be required to use water from a natural source, the Contractor shall supply a method statement to that effect.** Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.

In case of a new substation or an extension to an existing substation, the works area shall be fenced to prevent livestock or local community members from wandering onto site and getting injured. All works shall be limited to the fenced area and the Contractor workforce shall refrain from venturing outside this area onto private property.

No work shall commence until permission is granted from the Environmental Advisor from Transmission Services and the ROD from DEAT has been obtained. The Project Manager shall ensure that all

conditions in the ROD are fulfilled before the Contractor occupies the site. The Grid shall be kept informed of all developments on construction at all times. All the requirements from the Grid must be considered during the construction phase to ensure smooth transition.

3.3. SITE ESTABLISHMENT

Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site. The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction. The Contractor shall supply a wastewater management system that will comply with legal requirements and be acceptable to Eskom. A septic tank system is recommended to ensure the best practice environmental solution.

Where Eskom facilities are available the Contractor shall make use of such facilities where it is viable and negotiated with the Grid. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities.

The Contractor shall supply waste collection bins where such is not available and all solid waste collected shall be disposed of at a registered waste dump. A certificate of disposal shall be obtained by the Contractor and kept on file. **Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.** The disposal of waste shall be in accordance with all relevant legislation. **Under no circumstances may solid waste be burned on site unless a suitable incinerator is available.**

3.4. WORKSHOP AND EQUIPMENT STORAGE AREAS

Where possible and practical all maintenance of vehicles and equipment shall take place in the workshop area. During servicing of vehicles or equipment, a

suitable drip tray shall be used to prevent spills onto the soil, especially where emergency repairs are effected outside the workshop area. Leaking equipment shall be repaired immediately or be removed from site to facilitate repair. All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site. A **certificate of disposal** shall be obtained by the Contractor and kept on file.

Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and re-mediated to the satisfaction of the ECO. The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site.

The following shall apply to hazardous substance spills:

- All contaminated soil / yard stone shall be removed and be placed in containers. Contaminated material can be taken to one central point where bio-remediation can be done.
- Smaller spills can be treated on site.
- A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.
- All spills of hazardous substances must be reported to the ECO and appointed Transmission Engineering Environmental Advisor (**Tx Key Performance Indicator requirement**).

3.5. STORAGE AREAS OF HAZARDOUS SUBSTANCES

All hazardous substances shall be stored in suitable containers and storage areas shall be bunded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid. A register shall be kept on all substances and be available for inspection at all times. Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately. Any leaking containers shall be repaired or removed from site (See above for actions after spills).

4. PHYSICAL ISSUES AND THEIR CONTROL

4.1. SUBSTATION TERRAIN AREA

Where terracing is required, topsoil shall be collected and retained for the purpose of re-use later to rehabilitate disturbed areas not covered by yard stone. Such areas include terrace embankments and areas outside the high voltage yards. Where required, all sloped areas shall be re-vegetated and stabilised to ensure proper rehabilitation is effected. These areas can be stabilised using design structures or vegetation as specified in the design to prevent erosion of steep embankments. The contract design specifications and Environmental Impact Report (EIR) recommendations shall be adhered to and implemented strictly.

The retained topsoil shall be spread evenly over areas to be rehabilitated and suitably compacted to effect re-vegetation of such areas to prevent erosion. Where required re-vegetation can also be enhanced using a vegetation seed mixture as described in section 4.10 of this EMP.

(Specifics about project)

4.1.1. Management objectives

- Minimise scarring of the soil surface and land features other than on site
- Minimise disturbance and loss of topsoil from site
- Rehabilitate all disturbed areas in the substation area

4.1.2. Measurable targets

- No visible erosion scars once construction is completed
- All disturbed areas successfully rehabilitated

4.2. NATURAL DRAINAGE'S

Under no circumstances shall the contractor interfere with any watercourses in the vicinity of the site. Should deviation of such watercourses be required as

part of the contract design specification, the specifications shall be adhered to strictly. The Environmental Control Officer shall ensure that all watercourses are adequately protected to prevent downstream siltation due to erosion on site. Rubble from the construction process shall be removed from site and may under no circumstances be dumped into any natural drainage channels. The normal flow of runoff water must not be impeded, as this will enhance erosion.

4.2.1. Management objectives

- Avoid damage to natural drainage channels
- Avoid damage to river and stream embankments
- Minimise erosion of embankments and subsequent siltation of rivers and streams

4.2.2. Measurable targets

- No damage to natural drainage channels
- No damage to river and stream banks
- No visible erosion scars on embankments once construction is completed

4.3. ACCESS ROADS TO THE SITE

Planning of access routes to the site for construction purposes shall be done in conjunction between the Contractor, Eskom and the Landowner. All agreements reached should be documented and no verbal agreements should be made. The Contractor shall properly mark all access roads. Roads not to be used shall be marked with a " **NO ENTRY** " sign.

Where new access roads are constructed, this must be done according to design and contract specifications. Drainage channels shall be suitably designed to ensure erosion does not occur, especially at the outflows. The new access road shall be designed to allow for the natural flow of water where required. Crossing of dongas and eroded areas on access routes to new substation sites shall be thoroughly planned and installed according to design and contract specifications. All areas susceptible to erosion shall be protected

with suitable erosion control measures from the onset of the project. Prevention is the total aim as restoration is normally very difficult and costly.

Where necessary suitable measures shall be taken to rehabilitate damaged areas next to the newly constructed road.

4.3.1. Management objectives

- Minimise damage to existing access roads
- Minimise damage to environment due to construction of new access roads
- Minimise loss of topsoil and enhancement of erosion
- Minimise impeding the natural flow of water

4.3.2. Measurable targets

- No claims from Landowners due to damage on existing access roads
- No erosion visible on access roads three months after completion of construction
- No loss of topsoil due to runoff water on access roads
- No interference with the natural flow of water

4.4. CONSTRUCTION RUBBLE DISPOSAL

The Contractor shall dispose of all excess material on site in an appropriate manner and at a registered landfill. All packaging material shall be removed from site and disposed of and not burned on site. A negotiated landfill may be used but when it is closed up, the rubble shall be compacted and there shall be at least 1m of soil covering the waste material. No landfill may be used without the consent from the Landowner. No non-biodegradable materials shall be disposed of in any unregistered waste site.

No material shall be left on site that may harm man or animals. Broken, damaged and unused spares such as porcelain, glass, nuts, bolts and washers shall be picked up and removed from site. Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas

as agreed by the Landowner. Concrete trucks shall not be washed on site after depositing concrete into foundations. Any spilled concrete shall be cleaned up immediately.

4.4.1. Management objectives

- To keep the site neat
- Disposal of construction rubble in an appropriate manner
- Minimise litigation
- Minimise Landowner complaints

4.4.2. Measurable targets

- No construction rubble left lying around on site
- No incidents of litigation
- No complaints from Landowners

4.5. SITE CLEARING

Vegetation clearing to allow for site establishment as well as construction purposes will sometimes be required. Vegetation can be cleared mechanically with a bulldozer where terracing is required, but should be cleared by hand on other areas. All alien vegetation shall be eradicated from site during the project. Indigenous vegetation that does not pose any risks to the operation of the substation upon completion of the contract should be retained for esthetical purposes. **Such vegetation shall be identified during design and clearly indicated on the site plans.**

Protected or endangered species of plants shall be retained where possible. Where such species have to be removed due to interference with structures, the necessary permission and permits shall be obtained by the ECO **from Provincial Nature Conservation**, prior to commencement of site works. Search, rescue and replanting of indigenous, valuable and protected species is highly recommended where possible and viable.

The use of herbicides shall only be allowed after a proper investigation into the type to be used, the long-term effects and the effectiveness of the agent. Eskom's guidelines regarding the use of herbicides (TRR/S91/032) shall be adhered to strictly. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the Supplier's specifications.

The Contractor for vegetation clearing shall comply with the following parameters:

- **The contractor must have the necessary knowledge to be able to identify different species.**
- **The contractor must be able to identify declared weeds and alien species that can be totally eradicated.**
- **The contractor must be in possession of a valid herbicide applicators licence.**

NATURAL FEATURES SHALL BE TAKEN INTO CONSIDERATION DURING DESIGN AND WHERE POSSIBLE THESE SHALL BE PROTECTED UNLESS THEY WILL INTERFERE WITH THE OPERATION OF THE SUBSTATION.

(Specifics about project)

4.5.1. Management objectives

- Minimise unnecessary damage to vegetation
- Keep site as natural looking as possible
- Minimise possibility of erosion due to removal of vegetation
- Minimise removal of plant material on river and stream embankments
- Minimise damage to natural features

4.5.2. Measurable targets

- Only vegetation cleared as required for site construction purposes

- No vegetation interfering with structures and statutory requirements upon completion of the contract
- No de-stumping of vegetation on river and stream embankments
- No visible erosion scars three months after completion of the contract due to vegetation removal
- No visible damage to the vegetation outside the site one year after completion of the contract due to herbicide leaching
- No litigation due to unauthorised removal of vegetation
- No unnecessary damage to natural features

4.6. FENCING REQUIREMENTS

The site shall be fenced to prevent any loss or injury to persons or livestock during the construction phase. All Eskom gates shall be fitted with locks and be kept locked at all times during the construction phase, especially when works are stopped during weekends and holidays. All claims arising from gates left open shall be investigated and if at fault, settled in full by the Contractor. If any fencing interferes with the construction process, such fencing shall be deviated until construction is completed. The deviation of fences shall be negotiated and agreed with the landowner in writing.

4.6.1. Management objectives

- Properly installed gates to allow access to the site
- Minimise damage to private fences
- Limit access to Eskom and Contractor personnel

4.6.2. Measurable targets

- No transgressions of the fencing act and therefore no litigation
- No damage to fences and subsequent complaints from Landowners
- All gates kept locked at all times to limit access to construction staff

4.7. FIRE PREVENTION

No open fires shall be allowed on site under any circumstance (The Forest Act, No 122 of 1984). All cooking shall be done in demarcated areas that are safe and cannot cause runaway fires. The Contractor shall have operational fire-fighting equipment available on site, especially during the winter months.

4.7.1. Management objectives

- Minimise risk of runaway veld fires
- Minimise damage to private property

4.7.2. Measurable targets

- No veld fires started by the Contractor's work force
- No claims from Landowners for damages due to veld fires
- No litigation

4.8. NOISE POLLUTION

The Contractor shall ensure that noise levels remain within acceptable limits, especially in built up areas. This applies especially after working hours and during the night.

4.8.1. Management objectives

- Prevention of noise pollution
- Minimise nuisance factor of construction activities

4.8.2. Measurable targets

- No complaints from landowner or community
- No litigation

4.9. CLAIMS FOR DAMAGES

The ECO shall keep a photographic record of any damage to areas outside the demarcated site area. The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held

liable. All claims for compensation emanating from damage should be directed to the ECO for appraisal. The Contractor shall be held liable for all unnecessary damage to the environment. **A register shall be kept of all complaints from the Landowner, Grid or community. All complaints / claims shall be handled immediately to ensure timeous rectification / payment by the responsible party.**

4.9.1. Management objectives

- Minimise complaints from Landowners and communities
- Prevent litigation due to outstanding claims
- Completion of the contract on time

4.9.2. Measurable targets

- No claims from the Landowner or communities
- All claims investigated and settled within one month
- No litigation due to unsettled claims

4.10. REHABILITATION

All damaged areas shall be rehabilitated upon completion of the contract in accordance with design specifications. In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced. Extra seed shall be sown on disturbed areas as directed by the ECO (see below for specifications). Other methods of rehabilitating disturbed sites may also be used at the discretion of the PM to comply with the conditions of the ROD and EMP, e.g. stone pitching, logging, etc. Contour banks shall be spaced according to the slopes. The type of soil shall also be taken into consideration.

A mixture of vegetation seed can be used provided the mixture is carefully selected to ensure the following:

- a) Annual and perennial species are chosen.**
- b) Pioneer species are included.**
- c) All the species shall not be edible.**

- d) Species chosen will grow in the area under natural conditions.**
- e) Root systems must have a binding effect on the soil.**
- f) The final product should not cause an ecological imbalance in the area.**

To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local Extension Officer of the Dept of Agriculture. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding will always be at the discretion of the PM, unless specifically requested by a Landowner / Grid staff.

4.10.1. Management objective

- Minimise damage to topsoil and environment
- Successful rehabilitation of all damaged areas
- Prevention of erosion

4.10.2. Measurable targets

- No loss of topsoil due to construction activities
- All disturbed areas successfully rehabilitated within one year of completion of the contract
- No visible erosion scars one year after completion of the contract

4.11. MATERIAL STORAGE AREAS

Specifications require the protection of Eskom supplied material on site, especially conductor drums. This normally requires that a firebreak be created around a material storage area. These areas are left to rehabilitate on their own which could be disastrous. Once construction has been completed on site and all excess material has been removed, the storage area shall be rehabilitated. If the area was badly damaged, re-seeding shall be done and fencing in of the area shall be considered if livestock will subsequently have access to such an area. For seeding the same provisions as in 4.10 shall apply.

4.11.1. Management objectives

- Minimise disturbance of topsoil
- Successful rehabilitation of disturbed areas

4.11.2. Measurable targets

- No remaining disturbance to vegetation outside the substation area
- No loss of topsoil
- All disturbed areas successfully rehabilitated one year after completion of the contract

4.12. BATCHING PLANTS

In remote areas where batching plants have to be established, these sites shall be negotiated with the Landowner / Grid staff depending on their location. These sites shall be cleared of all excess material upon completion of the contract. Such areas shall be rehabilitated to their natural state. Any spilled concrete shall be removed and soil compacted during construction shall be ripped, levelled and re-vegetated.

4.12.1. Management objectives

- Minimise complaints from Landowners / Grid staff
- Successful rehabilitation of disturbed areas

4.12.2. Measurable targets

- No complaints from Landowners / Grid staff
- All disturbed areas successfully rehabilitated one year after completion of the contract

4.13. OLD EQUIPMENT

All old equipment removed during refurbishment or upgrading projects shall be stored in such a way as to prevent pollution of the environment. Oil containing equipment shall be stored to prevent leaking or be stored on drip trays should such equipment already be leaking. All scrap steel shall be stacked neatly and any disused and broken insulators shall be stored in containers.

Once material has been scrapped and the contract has been placed for removal, the Contractor shall ensure that any equipment containing pollution causing substances is removed in such a way as to prevent spillage and pollution of the environment. The Contractor shall also be equipped to contain and clean up any pollution causing spills. Disposal of unusable material shall be at a registered waste disposal site and a certificate of disposal shall be obtained and copied to Eskom.

4.13.1. Management objectives

- To prevent pollution of the environment
- Prevention of litigation due to illegal dumping

4.13.2. Measurable targets

- No complaints from Landowners / Grid staff / Communities
- No pollution of the environment
- No litigation due to illegal dumping

4.14. TRANSPORT OF EQUIPMENT

All equipment moved onto site or off site during a project is subject to the legal requirements as well as Eskom specifications for the transport of such equipment. Oil filled equipment such as CT's, VT's and capacitor cans have specific safety requirements regarding their handling, transport and storage. The Contractor shall meet these safety requirements under all circumstances. All equipment transported shall be clearly labelled as to their potential hazards according to specifications. All the required safety labelling on the containers and trucks used shall be in place.

The Contractor shall ensure that all the necessary precautions against damage to the environment and injury to persons are taken in the event of an accident.

4.14.1. Management objectives

- Safe handling and transport of equipment
- Safe handling and transport of hazardous substances

- Minimise environmental pollution and damage

4.14.2. Measurable targets

- All equipment delivered to site in tact
- No spillage of hazardous substances
- No litigation due to environmental pollution

5. SOCIAL ISSUES AND THEIR CONTROL

5.1. SANITATION

The Contractor shall install mobile chemical toilets on. Staff shall be sensitised to the fact that they should use these facilities at all times. No indiscriminate excretion or urinating on site shall be allowed. Ablution facilities shall be within 100m from workplaces but not closer than 50m from any natural water bodies. There should be enough toilets available to accommodate the workforce (minimum requirement 1: 20 workers). Toilets shall be serviced regularly and the ECO shall inspect toilets regularly to ensure compliance to health standards.

5.1.1. Management objectives

- Ensure that proper sanitation is achieved
- Prevent spreading of disease

5.1.2. Measurable targets

- No complaints received from Landowners or Grid staff regarding sanitation
- No litigation or compensation claims

5.2. PREVENTION OF DISEASE

The Contractor shall take all the necessary precautions against the spreading of disease such as measles, foot and mouth, etc. especially under livestock. A record shall be kept of drugs administered or precautions taken and the time and dates when this was done. This can then be used as evidence in court should any claims be instituted against Eskom or the Contractor.

5.2.1. Management objectives

- Prevent litigation due to infestation of livestock
- Prevent spreading of sexually transmitted diseases

5.2.2. Measurable targets

- No complaints from Landowners / Communities
- No litigation

5.3. INTERACTION WITH AFFECTED PARTIES

The success of any project depends mainly on the good relations with the affected Landowner, Communities and Grid staff. It is therefore required that the ECO and the Contractor establish good relations with all the affected parties at the substation site.

All negotiations for any reason shall be between the ECO, the affected parties and the Contractor. **NO** verbal agreements shall be made. All agreements shall be recorded in writing and all parties shall co-sign the documentation.

The affected parties shall always be kept informed about any changes to the construction programme should they be involved. If the ECO is not on site the Contractor should keep the affected parties informed. The contact numbers of the Contractor and the ECO shall be made available to the affected parties. This will ensure open channels of communication and prompt response to queries and claims.

All contact with the affected parties shall be courteous at all times. The rights of the affected parties shall be respected at all times.

5.3.1. Management objectives

- Maintain good relations with affected parties

5.3.2. Measurable targets

- No delays in the project due to interference from affected parties

5.4. LITTERING CONTROL

Littering by the employees of the Contractor shall not be allowed under any circumstances. The ECO shall monitor the neatness of the work sites as well as the Contractor campsite (See also 3.3).

5.4.1. Management objectives

- Neat workplace and site

5.4.2. Measurable targets

- No complaints from affected parties

5.5 DUST POLLUTION

The Contractor shall be responsible for dust control on site to ensure no nuisance is caused to the Landowner, neighbouring Communities or Grid staff at the substation. Watering of access roads is recommended, as this is normally the greatest cause of dust pollution. Speed limits can also be effected, especially on private dirt roads leading to the site. Any complaints or claims emanating from the lack of dust control shall be attended to immediately by the Contractor.

5.5.1. Management objectives

- Site works does not cause a nuisance to other people in the area

5.5.2. Measurable targets

- No formal complaints or claims arising due to dust pollution

5.6. AESTHETICS

The site shall be kept visually and aesthetically pleasing, especially in and around the Contractor camp. The ECO shall regularly inspect the site to ensure that it is neat and clean. Where required the campsite shall be screened by the Contractor to ensure that there is no unacceptable visual intrusion in the area of the site. Screening can be done by use of shade cloth or corrugated fencing.

5.6.1 Management objectives

- Aesthetically pleasing works area, campsite and storage areas

5.6.2. Measurable targets

- No complaints from affected parties on or around the site

6. BIOLOGICAL ISSUES AND THEIR CONTROL

6.1. FAUNA

The Contractor shall under no circumstances interfere with livestock without the Landowner or Community members being present. This includes the moving of livestock where they interfere with construction activities. Should the Contractors workforce obtain any livestock for consumption, they must be in possession of a written note from the owner. The transportation of meat for consumption shall take into consideration any legal requirements regarding the spreading of disease. No poaching shall be tolerated under any circumstances.

6.1.1. Management objectives

- Minimise disruption of farming activities
- Minimise disturbance of animals
- Minimise complaints and litigation

6.1.2. Measurable targets

- No stock losses where construction is underway
- No complaints from Landowners and Communities
- No litigation concerning stock losses and animal deaths

6.2. FLORA

Protected or endangered species may occur on the site. Special care should be taken not to damage or remove any such species unless absolutely necessary. Permits for removal must be obtained **from Provincial Nature Conservation** should such species be affected. All plants not interfering with the operation of the substation shall be left undisturbed, clearly marked and indicated on the site plan. **Collection of firewood outside the site area is strictly prohibited** (refer also 4.5 and conditions of the ROD where applicable)

6.2.1. Management objectives

- Minimal disturbance to vegetation where such vegetation does not interfere with construction and operation of the substation
- Prevention of litigation concerning removal of vegetation

6.2.2. Measurable targets

- No litigation due to removal of vegetation without the necessary permits

6.3. HERBICIDE USE

Herbicide use shall only be allowed with the approval of Eskom and according to contract specifications. The application shall be according to set specifications and under supervision of a qualified technician. The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used (See also 4.5).

6.3.1. Management objectives

- Control over the use of herbicides

6.3.2. Measurable targets

- No signs of vegetation dying due to leaching of herbicides one year after completion of the contract
- No Landowner complaints and litigation

7. CULTURAL ISSUES AND THEIR CONTROL

7.1. ARCHAEOLOGY

The position of any known sites shall be shown on the final design plans. Such areas shall be marked as no go areas. Artefacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. Permits shall be obtained from the South African Heritage Resources Association (SAHRA) should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered.

Should any archaeological sites be uncovered during construction, their existence shall be reported to Eskom immediately, John Geeringh to be informed at 011 800 2465 or the Grid Environmental Advisor.

7.1.1. Management objectives

- Protection of archaeological sites and land considered to be of cultural value
- Protection of known sites against vandalism, destruction and theft
- The preservation and appropriate management of new archaeological finds should these be discovered during construction

7.1.2. Measurable targets

- No destruction of or damage to known archaeological sites
- Management of existing sites and new discoveries in accordance with the recommendations of the Archaeologist

7.2. MONUMENTS / HISTORICAL SITES

All monuments and historical sites shall be treated with the utmost respect. Any graves shall be clearly marked and treated as no go areas. No destruction of any site shall be allowed. Should it be necessary to remove any graves, the necessary procedures shall be followed and permits obtained.

7.1.1. Management objectives

- Protection of sites and land considered to be of cultural value
- Protection of known sites against vandalism, destruction and theft
- The preservation and appropriate management of new finds should these be discovered during construction

7.1.2. Measurable targets

- No destruction of or damage to known sites
- Management of existing sites and new discoveries in accordance with legislation
- No litigation due to destruction of sites

7.3. FARMHOUSES / BUILDINGS

Most Landowners will see the construction period as interference with their daily activities. There will be a negative attitude towards the whole construction process. Landowners are always apprehensive toward changes they do not control and strangers on their properties. If and where the substation is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants. The Contractor shall under no circumstances interfere with the property of Landowners, Grid staff or nearby Communities.

7.3.1. Management objectives

- Control over actions and activities in close proximity to inhabited areas

7.3.2. Measurable targets

- No complaints from Landowners, Grid staff or Communities
- No damage to private property

7.4. INFRASTRUCTURE

No interruptions other than those negotiated shall be allowed to any essential services. Damage to infrastructure shall not be tolerated and any damage shall

be rectified immediately by the Contractor. A record of any damage and remedial actions shall be kept on site.

All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties. Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect.

Any possible disruptions to essential services must be kept to a minimum and should be well advertised and communicated to the Landowners and surrounding Communities. Care must be taken not to damage irrigation equipment, lines, channels and crops, as this could lead to major claims being instituted against Eskom and the Contractor. The position of all pipelines and irrigation lines in the vicinity of a site must be obtained from the Landowners or local Community and clearly marked. Where required such lines shall be deviated.

7.4.1. Management objectives

- The control of temporary or permanent damage to plant and installations
- Control of interference with the normal operation of plant and installations
- Securing of the safe use of infrastructure, plant and installations

7.4.2. Measurable targets

- No unplanned disruptions of services
- No damage to any plant or installations
- No complaints from Authorities, Landowners and Communities regarding disruption of services
- No litigation due to losses of plant, installations and income

8. REQUIREMENTS DURING CONSTRUCTION PERIOD

1. Proper and continuous liaison between Eskom, the Contractor and Landowners to ensure everyone is informed at all times.
2. The Landowners shall be informed of the starting date of construction as well as the phases in which the construction shall take place.
3. The Contractor must adhere to all conditions of contract including the Environmental Management Programme and landowner special conditions.
4. Proper planning of the construction process to allow for disruptions due to rain and very wet conditions.
5. Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. If necessary some repairs should be done to prevent damage to equipment and plant.
6. All manmade structures shall be protected against damage at all times and any damage shall be rectified immediately.
7. The Contractor shall ensure that all damaged areas are rehabilitated to the satisfaction of Eskom and each and every property owner and that outstanding claims are settled.
8. Proper documentation and record keeping of all complaints and actions taken.
9. Regular site inspections and good control over the construction process throughout the construction period.
10. Appointment of an Environmental Control Officer on behalf of the Contractor to implement this EMP as well as deal with all Landowner related matters.
11. Environmental Audits to be carried out during and upon completion of construction (at least two for the project).

9. SITE SPECIFIC PROBLEM AREAS

Site specific problems, if any, are shown on the layout plans (**Design**) and accompanying photographs (Appendix 13.1). No-go areas, if any, are also identified on the plans.

9.1. ESTIMATED QUANTITIES FOR SPECIAL WORKS ON THE SITE

(As per specific contract identified in the EIR, ROD conditions and design where applicable)

10. METHOD STATEMENTS FOR THE CONTRACT

The Contractor shall supply method statements for all works required **as per specific contract requirement**. All agreements regarding **extra works for environmental compliance** shall be in writing and well documented. Work shall only commence upon approval by Eskom.

The ECO shall ensure that all works are in accordance with method statements and contract specifications.

11. SITE DOCUMENTATION / MONITORING / REPORTING

The standard Eskom site documentation shall be used to keep records on site. All documents shall be kept on site and be available for monitoring purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. The documentation shall be signed by all parties to ensure that such documents are legal. Regular monitoring of site works by the ECO is imperative to ensure that all problems encountered are solved punctually and amicably. When the ECO is not available, the Contract Manager / Site Supervisor shall keep abreast of all works to ensure no problems arise.

Regular monthly environmental compliance reports shall be forwarded to the Transmission Engineering Environmental Advisor (appointed per

project) with all information relating to environmental matters. The following **Key Performance Indicators** must be reported on a monthly basis by the ECO:

1. Complaints received from affected parties and actions taken.
2. Environmental incidents, such as oil spills, etc. and actions taken.
3. Incidents possibly leading to litigation and legal contravention's.
4. Environmental damage that needs specialised rehabilitation measures to be taken.

The following documentation shall be kept on site by the ECO:

1. Site daily dairy.
2. Complaints register.
3. Records of all remediation / rehabilitation activities.
4. Copies of monthly reports to the Transmission Engineering Environmental Advisor for auditing purposes.
5. Copy of the Environmental Management Programme.
6. Copy of ROD.
7. Minutes of site meetings including discussions on environmental issues.

12. APPENDICES

1. ASPECT AND IMPACT REGISTER FOR THE PROJECT ACTIVITIES
2. ROD
3. Tx ENVIRONMENTAL POLICY

REFERENCES

Conservation of Agricultural Resources Act, Act 43 of 1983 and amendments.
Corporate directive for the management of PCB, ESKADAAO3 REV 1.
Environmental Impact Assessment of the Project.
Eskom Guidelines for Herbicide Use, TRR/S91/032.
Environment Conservation Act, Act 73 of 1989 and amendments.
Fencing Act, Act 31 of 1963 and amendments.
Hazardous Substances Act, 15 of 1973 and amendments.
Health Act, Act 63 of 1977.
Herbicide Management, ESKPBAAD4 REV 0.
Minerals Act, Act 50 of 1991.
National Environmental Management Act, Act 107 of 1998.
National Forest Act, Act 84 of 1998.
National Heritage Resources Act, Act 25 of 1999.
National Water Act, Act 36 of 1998.
Occupational Health and Safety Act, Act 85 of 1993
Record of Decision and conditions– DEAT.
Standard passive fire protection for oil-filled equipment in High Voltage yards,
TRMASAAQ8 REV 4
Standard for management of PCB, ESKASAAC2 REV1.

**PRO FORMA TO BE SIGNED BY THE CONTRACTOR AND ESKOM
PROJECT MANAGER AT CONTRACT AWARD.**

CONTRACT NAME: _____

CONTRACT NUMBER: _____

ENVIRONMENTAL COMPLIANCE

I _____ ON BEHALF OF _____ (C)

I _____ ON BEHALF OF ESKOM

DECLARE AS FOLLOWS:

1. I AM AWARE THAT CONSTRUCTION, REFURBISHMENT OR UPGRADING ACTIVITIES CAN HAVE A MAJOR IMPACT ON THE ENVIRONMENT.
2. I UNDERTAKE TO ADHERE TO THE REQUIREMENTS OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND THE RECORD OF DECISION FROM DEAT.
3. I PLEDGE TO INFORM ALL SITE STAFF OF THEIR INVOLVEMENT IN MANAGING ENVIRONMENTAL IMPACTS ON SITE.
4. I COMMIT TO IMPLEMENTING ENVIRONMENTAL BEST PRACTISE ON SITE AT ALL TIMES DURING THE CONTRACT.

SIGNED: _____ DATE: _____

CONTRACTOR

SIGNED: _____ DATE: _____

ESKOM

Questionnaire to be completed during tender stage by the contractor for evaluation purposes of the tender for substation construction:

PLEASE TICK APPROPRIATE BOX (All yes answers to be accompanied by proof)	YES	NO
ENVIRONMENTAL MANAGEMENT SYSTEM - GENERAL		
1-Is your company ISO 14001 certified?		
2-Is your company ISO 14001 compliant?		
3-Does your company have an Environmental Management System in place?		
4-Does your company have an Environmental Policy?		
5-Does your company have an Environmental Statement?		
6-Is your company in the process of implementing any of the above?		
7-Will you be using sub-contractors during the project?		
8-Does any of your proposed sub-contractors comply with 1-6 above?		
ENVIRONMENTAL MANAGEMENT PROGRAMME - GENERAL		
1-Do you understand the contents and context of this EMP attached to the tender document?		
2-Do you agree to implement the requirements of the EMP on site?		
3-Did you allow for the appointment of a specific person to act as the dedicated Contractor Environmental Control Officer (CECO) on site for the duration of the contract? (As per responsibility matrix on page 5 of the EMP)		
4-Is your CECO qualified to implement the EMP conditions? Please attach CV.		
5-Have you allowed sufficient funds for implementing the requirements of the EMP? (Environmental management requirements)		
ENVIRONMENTAL MANAGEMENT PROGRAMME - SPECIFIC		
1-Did you supply a method statement for water supply?		
2-Did you supply a method statement for solid waste management?		
3-Did you allow for camp wastewater management?		
4-Did you allow for camp and site ablution management?		
5-Did you allow for the installation of sealed and bunded fuel storage areas?		
6-Did you allow for a contained workshop area for servicing of vehicles?		
7-Did you allow for signage to mark access roads to the site?		
8-Did you allow for emergency spill kits to address possible spills of fuel and oil to prevent pollution?		
9-Does the vegetation-clearing contractor comply with section 4.7 of the EMP?		
10-Did you allow for suitable means and materials to safeguard excavations?		

APPENDIX B:
ESKOM GUIDELINES FOR MARKING OF POWER LINES
AND PLACEMENT OF BIRD GUARDS

Title: **TRANSMISSION BIRD COLLISION
PREVENTION GUIDELINE**

Reference: **TGL41-335**

Revision: **0**

Effective date: **November 2006**


Total pages: **1** Of **10**

Revision date: **November 2009**

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1. Introduction

A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds can usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. In South Africa, bird collisions with transmission lines are a major form of unnatural mortality among several threatened species. Research is ongoing to attempt to gauge the effect of this form of mortality on these species, especially cranes. Preliminary results indicate that the mortality could be unsustainable for regional populations of species such as Blue Cranes in the central Karoo.

2. Background and extent of the problem of bird collisions

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The graph below shows the number of collisions reported per species on transmission lines from August 1996 to present (EWT unpublished data). Most of the heavily affected species are Red Data species. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. It is also important to note that the mortalities recorded by Anderson (2001) as discussed below are not included in the graph below.

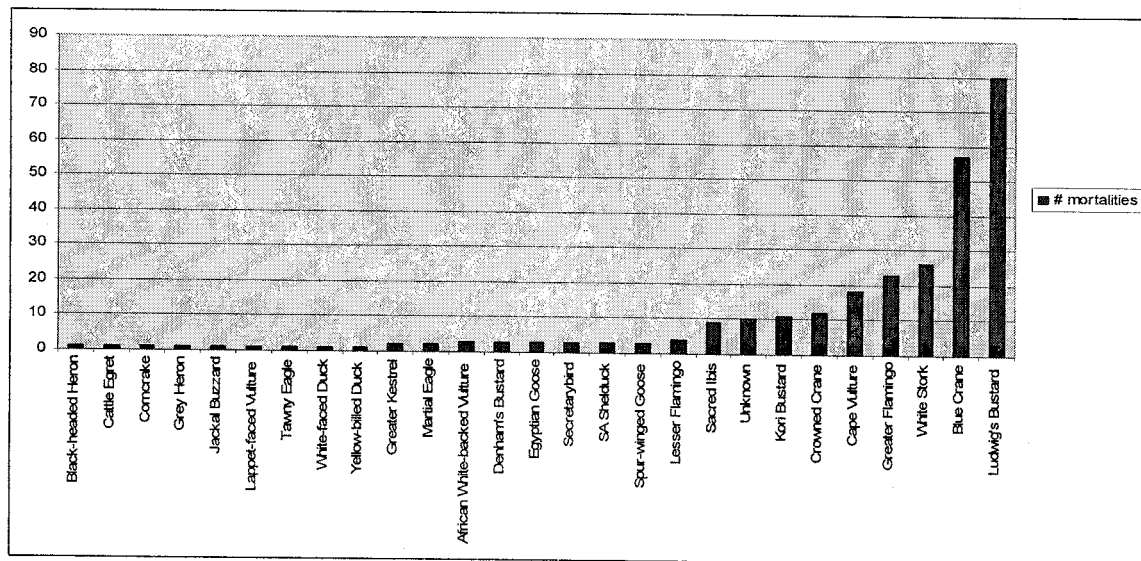


Figure 1: Number of reported collisions per species on transmission lines from August 1996 to the present (EWT unpublished data).

Although significant in itself, figure 2 is not a true reflection of the extent of the problem, because few of the collision localities were closely monitored over a substantial period of time. Where long term monitoring did happen, the picture is disturbing. In one instance, where bi-monthly monitoring did take place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape province between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards) the majority under transmission lines (Anderson 2001).

The Red Data species vulnerable to power line collisions are generally long-lived, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. Another example is the Great White Pelican that only breeds successfully at Dassen Island in the Western Cape. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

Using Vortex computer modelling, the South African Crane Working Group estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (app. 2000 individuals in Mpumalanga and KwaZulu-Natal) by 90% by the end of the 21st century (McCann *et.al.* 2001). At that stage the population would be functionally extinct.

From the figures quoted above, it is clear that power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

3. Solutions to the problem of bird collisions.

3.1. Background

A measure that has been proved to be reasonably successful in reducing collisions is to fit the earth wire with anti-collision devices.

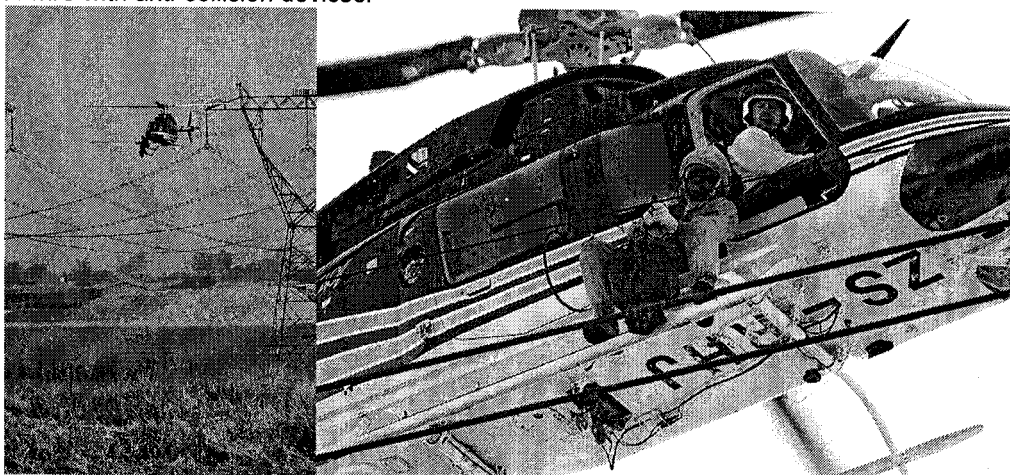


Figure 2: The installation of flappers on the shield wire from a helicopter.

Success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999). There are several devices available in southern Africa for the marking of power lines. These devices will be described below and the advantages and disadvantages discussed. The fitting of the marking devices are typically done from a helicopter, which adds considerably to the cost of any project.

3.2. Static devices

Static devices are mechanically more durable than dynamic devices because they lack the element of wear and tear that moving parts inevitably have. However, in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones (see figure 5). A better option would be to use the bigger pigtail (see figure 5, right), although it is still not the preferred option.

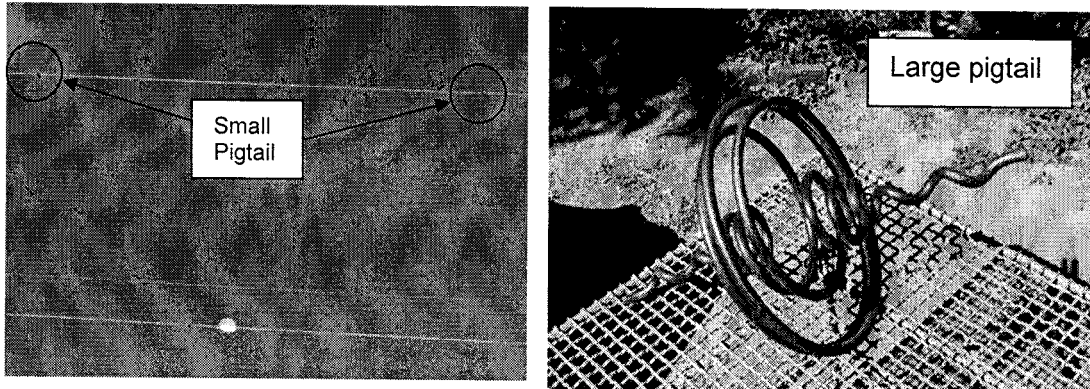


Figure 3: Example of static devices.

3.3. Dynamic devices

Dynamic devices (usually called bird flappers), have moving parts as opposed to static devices where there are none. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well (van Rooyen unp. data) probably because of the movement that attracts attention. The disadvantage of dynamic devices is that they are subject to extensive wear and tear, inevitably limiting the lifespan of the device. Wear could result on the device itself as well as on the cable to which it is attached.

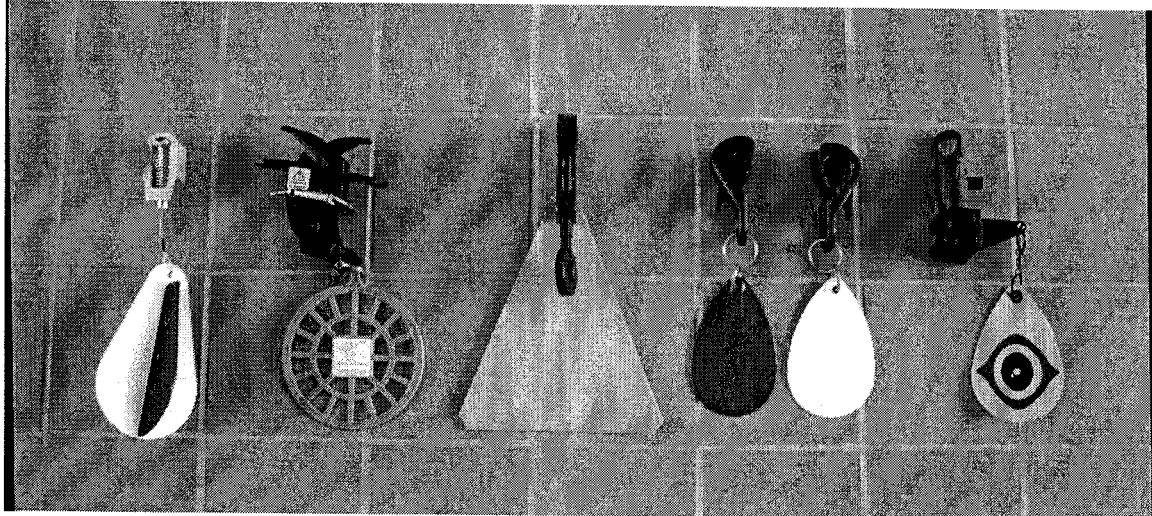


Figure 4: Examples of the dynamic bird flapper devices

This has obvious cost implications if a line needs to be re-marked at intervals of a few years. No solution to that problem has been found to date and it must be accepted as a constraint. Figure 4 shows examples of bird flappers currently available on the market.

3.4. Reflective devices

A new product that shows great potential is the Inotec BFD88, a reflective stainless steel sphere of 70mm diameter. Experiments have shown the visibility of this device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back. Due to the spherical shape, the device reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset (Van Rooyen, pers obs.) When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below.

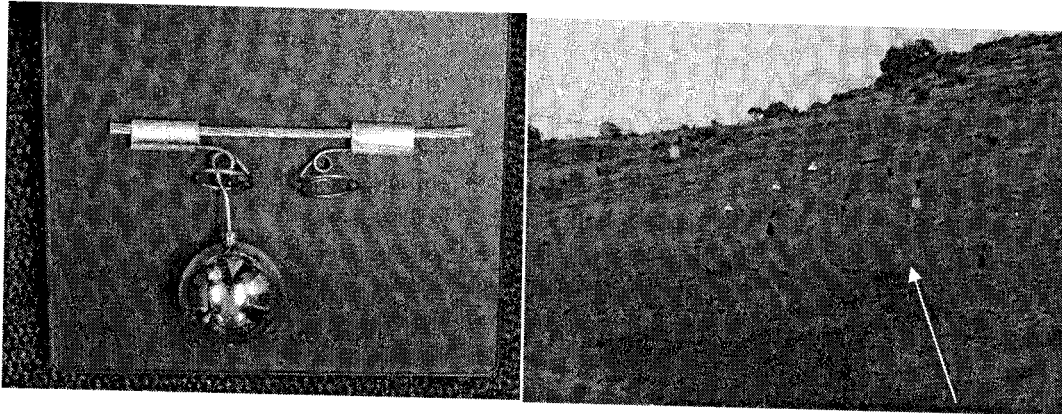


Figure 5: A Reflective Bird Diverter (left) installed on a line with conventional bird flappers (right).

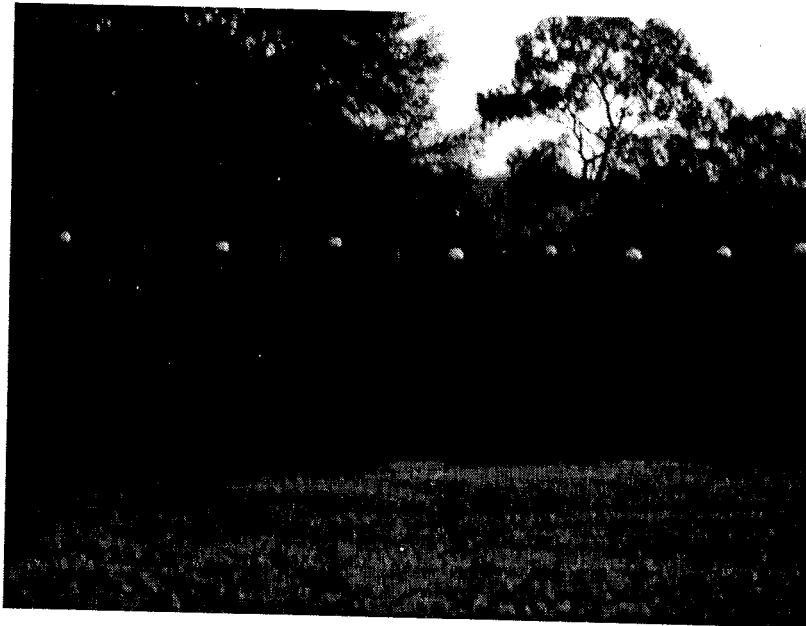


Figure 6: An example of reflective diverters on a test line at dusk with white conventional bird flappers in between

An option could be to string the Inotec NFD88 diverters close enough to form a dotted line on each earth wire on those spans crossing the river (see figure 6). **Due to the relatively small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 metres apart on both earth wires.**

3.5. Spacing intervals

Research in the Netherlands has shown that spacing intervals have a major influence on the effectiveness of anti-collision devices. In South Africa, the same has been found. See Figure 7 for a suggested marking method with Bird Flappers. In the case of the Inotec BFD88 diverters, a similar 5 metre interval is suggested.

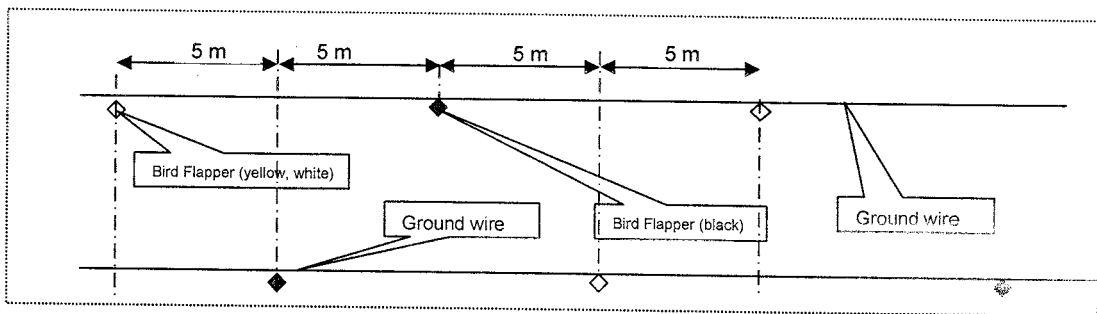


Figure 7: Marking method with Bird Flappers on overhead ground wires (viewed from above)

NB. It is important to alternate the colours (yellow-white) in order for maximum contrast.

3.6. Portion of span to be marked.

Only the middle 60% of each span needs to be marked as this is where most of the collisions occur.

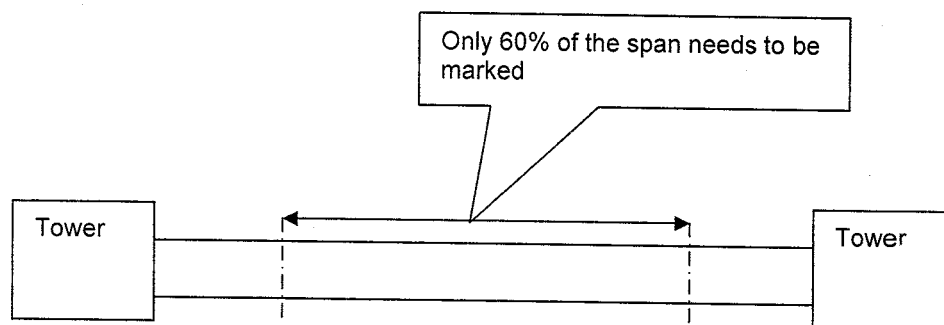


Figure 8: The section that needs to be marked

3.7. Illuminated devices.

A specific problem is posed by birds that fly at night, for example flamingos that migrate great distances at night. A device is available for this problem, namely the Mace Bird Lite, which is a Perspex tube with a fluorescent tube inside.

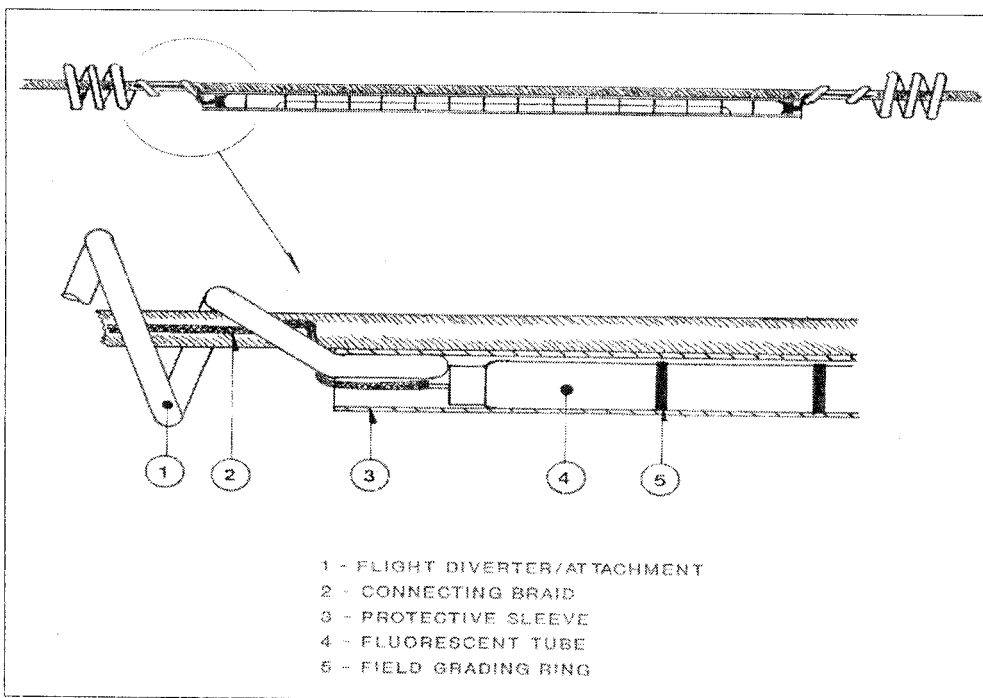


Figure 9: The Mace Bird Lite

It is mounted on the overhead ground wire and the light is energized by the ambient electrical field generated by the conductors. It has been used in South Africa and Botswana and is reported to have worked well for curbing flamingo mortality on power lines. No scientific data is available on the effectiveness but it is generally claimed to be effective.

3 Supporting Clauses

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3.1 Scope

This document covers the subject of bird colliding with Transmission lines.

3.1.1 Purpose

The purpose of this document is to describe the problem of bird collisions with transmission lines and to indicate which mitigation methods are available to address the problem.

3.1.2 Applicability

This guideline shall apply throughout Transmission Division.

3.2 Normative/Informative References

Parties using this guideline shall apply the most recent edition of the documents listed below

3.2.1 Normative

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Alonso J A and Alonso J C, Mitigation of bird collisions with transmission lines through groundwire marking. In: Ferrer M and Janss F E (eds), Birds and powerlines, Quercus, Madrid, 1999, pp113 – 124.

Alonso J A and Alonso J C, Collision of birds with overhead transmission lines in Spain. In: Ferrer M and Janss F E (eds), Birds and powerlines, Quercus, Madrid, 1999, pp57 - 82.

Van Rooyen, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

3.2.2 Informative

Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa: Johannesburg.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa: Johannesburg.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V and Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.

McCann, K., Morrison, K., Byers, A., Miller, P. & Friedman, Y. (eds). 2001. Population and Habitat Viability Analysis for the Blue Crane (*Anthropoides paradiseus*). Conservation Breeding Specialist Group (SA), Endangered Wildlife Trust, Johannesburg.

Van Rooyen, C.S. and Ledger, J.A. 1999. "Birds and utility structures: Developments in southern Africa" in Ferrer, M. & G.F.M. Janss. (eds.) Birds and Power lines. Quercus: Madrid, Spain, pp 205-230

Van Rooyen, C.S. 1999. An overview of the Eskom - EWT Strategic Partnership in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

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Avian Powerline Interaction Committee (APLIC), Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington D.C. 1994, pp77.

Williams A J and Velasquez C, Greater Flamingo *Phoenicopterus ruber*. In: The atlas of southern African birds, Volume 1: Non-passerines, Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans,

M., Tree, A.J., Parker, V & Brown, C.J. (eds). BirdLife South Africa, Johannesburg, 1997, pp112 - 113.

C van Rooyen, Nelson P and Kambouris D, Strategic partnerships as a mechanism to address wildlife interactions with powerlines: The South African approach. Session 15, Proceedings of the Cigré Fourth Southern Africa Regional Conference, Somerset-West, Cape Town, 2001, pp1-7.

Koops F B J and De Jong J, Vermindering van draadslachtoffers door markering van hoogspanningsleidingen in de omgeving van Heerenveen. 1982 Electrotechniek 60 (12): pp641 – 645.

3.3 Definitions

N/A

3.4 Abbreviations

EWT: Endangered Wildlife Trust

3.5 Roles and Responsibilities

The Line and Servitude managers of each Grid shall be responsible to ensure compliance with this document.

3.6 Implementation Date

The implementation date is November 2006.

3.7 Process for monitoring

The line and Servitude managers of each grids shall monitor servitudes for evidence of bird collisions and inform the EWT accordingly.

3.8 Related/Supporting Documents

n/a

4 Authorisation

This document has been seen and accepted by:


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5 Revisions

Date	Rev.	Remarks
November 2006	0	Review document. Add latest equipment available - remain Rev. 0 because of the new reference number.

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1. Introduction

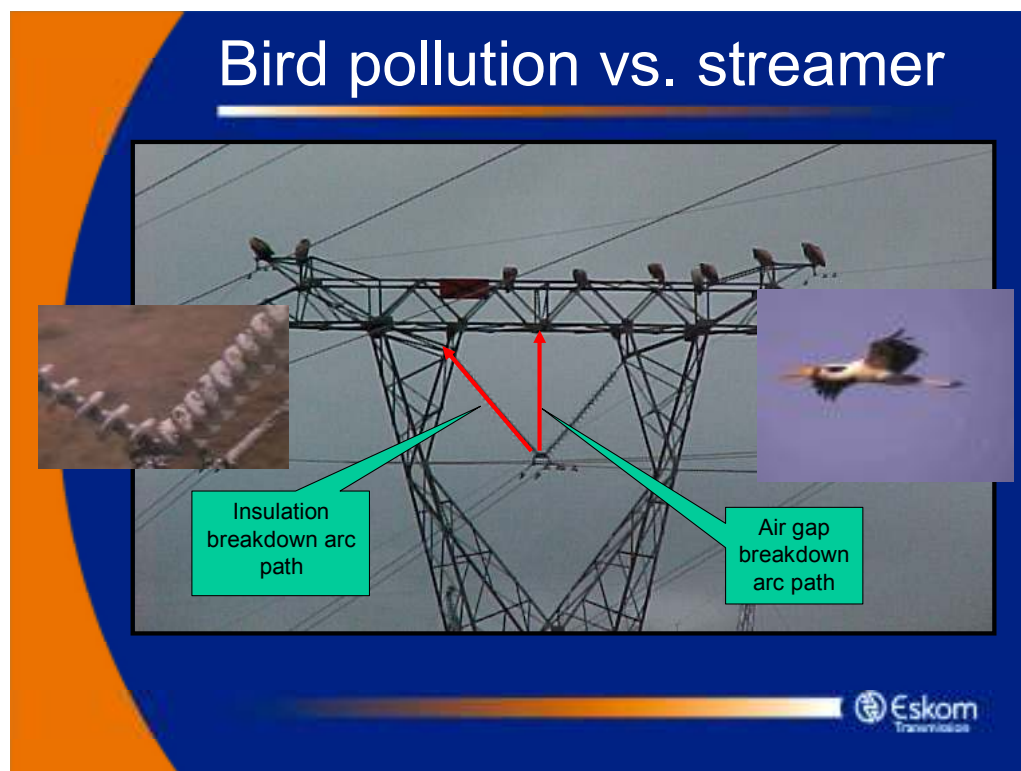
Birds of all descriptions use power line structures for perching and nesting purposes. These structures often are the only (or superior) substrate.

The principle to be followed in perch management is not to prevent birds from roosting on towers, but rather to prevent them from roosting on critical parts of the tower only. The provision of adequate alternative roosting space on the tower will enhance the success of the intervention.

2. Recognizing bird induced faulting: pollution vs. streamers

In generic terms, an electrical fault is caused by pollution, coupled with appropriate moisture, when pollutant build-up takes place on the insulator disks. The coating of pollutant (which could range from marine, agricultural or industrial pollution or to bird droppings) compromises the insulation properties of the insulator and under appropriate wet conditions, a phase-earth flashover may result **across the insulator string**.

In the case of a bird streamer induced fault, the fault normally initiates on the live hardware and it propagates vertically towards the tower. The fault appears to flash across the air gap and **does not** follow an insulator creepage path as observed on pollution faults.



3. Typical indicators of a bird streamer faulting problem

3.1. Position of flash marks

The flash marks of a bird streamer fault is highly characteristic, but difficult to spot. Typically, the flash marks will be situated on the steelwork directly above the live hardware and at the live end of the insulator string, i.e. on the yoke plate, first insulator disk or corona ring. **There are no burn marks at the dead end of the insulator as would be the case with a pollution-induced fault.** In the case of strain towers, the burn marks are similarly situated on the jumper cable and on the tower steelwork directly above.



3.2. Time of faults

Bird streamer faults follow a highly distinctive bimodal, temporal pattern with **peaks usually occurring in the early evening between 18h00 and 23h00 and again in the morning, between 04h00 and 08h00.** A possible explanation for this lies in the natural foraging behaviour of birds, in that they tend to forage away from the line during the day, returning in the early evening to roost until the next morning. It is important to note that the provision of artificial food sources, e.g. vulture feeding stations, could change the roosting behaviour of the birds and result in a changed pattern of faulting.

3.3. Window size

The window size determines the **size of the air gap, which in turn influences the probability of a streamer induced flashover.** In one instance, excessive faulting was experienced on one of two parallel 400kV lines of similar design, with the only difference being that of 3.2m vs. 4.2m window size. Despite vultures utilizing both lines, faulting happened only on the line with the smaller air gap. The most likely explanation for this is that the streamer could not bridge the larger air gap.

3.4. Faulting phase

A dominant faulting phase is a strong indication of bird streamer related faulting. **Bird streamer related faults tend to be prevalent on the phase which is situated below the highest and/or most convenient perching space on the tower.** On vertically configured designs, this usually results in the top phase (or phases in the case of double circuit towers) faulting disproportionately to the other phases, as the birds tend to roost on the highest cross-arm. With horizontally configured designs, the middle phase is usually the dominant faulting phase. In South Africa, the middle phase on 275kV self-supporting towers is the dominant bird streamer related faulting phase due to the tower design which makes it difficult for birds to roost above the outside phases.

3.5. Presence of certain bird species

Large predatory birds tend to create the biggest risk of flashovers. Species such as **vultures, herons, certain ibises and stork species, eagles and large hawks** are high risk species. The presence of these birds on the towers is a strong indicator that bird streamers faults could be present.

Black Eagle



Cape Vulture



Martial Eagle



Grey Heron



3.6. Presence of dead birds under the towers

Although electrocution as a result of a bird streamer induced fault is a rare occurrence, it does occur. If dead birds with burn marks are found under structures **with sufficient clearances to preclude any possibility of the bird having physically bridged the air gap with its body or wings**, it is a strong indication that it was electrocuted via a bird streamer flashover.

3.7. Clustering of faults in certain areas

The clustering of streamer faults in certain areas could point to birds being attracted to certain sections of the line. This could be related to **food** e.g. vulture feeding stations or recently burnt veld (herons), **wetlands** and/or **agricultural activity** or irruptions of insects or rodents. It could also be related to **nesting** activity on the towers e.g. heronries or large raptor nests or **topography** – vultures prefer to roost on towers that are situated on high topographical features such as hills and mountain ridges.

3.8. Bird droppings and pellets

The presence of **bird droppings** on electrical infrastructure is an indication that it is being used by birds for roosting purposes. Careful examination of the locality of the heaviest pollution could give an indication of where the favourite roosting spots are. The presence of **regurgitated pellets and prey remains** under transmission towers is also evidence that the structure is used by large birds for roosting. Analysis of the pellets can aid in the identification of the species.



3.9. Seasonality of faults

Seasonal upsurges in faults are often related to an influx of migratory or nomadic birds into an area. In South Africa, with a temperate climate, the **onset of summer (the rainy season for most of the country) is associated with a significant increase in bird numbers and bird streamer faults.**

As a result of the highly dynamic nature of the presence of bird in the vicinity of power lines, it is recommended that a stock of bird guards be kept by the Region to permit fast response when bird faults present themselves on lines not fitted with bird guards.

4. Fitting strategies

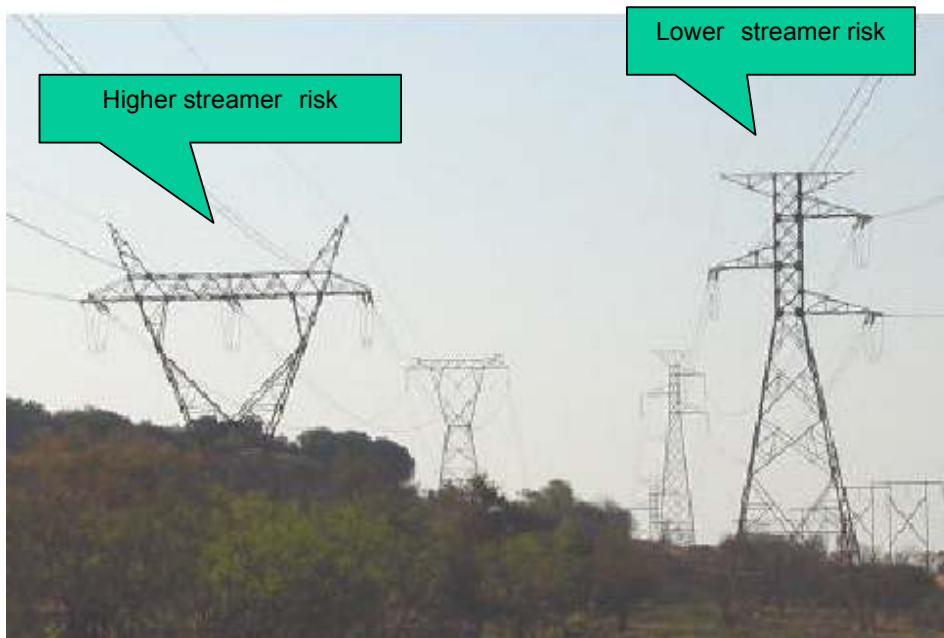
4.1. Micro fitting strategy

The tower configuration and design will determine the placement of bird guards. Care must be taken not to create new perches for birds during the installation process. Bird guards installed on near vertical tower members will result in this situation.

4.1.1. Tower design

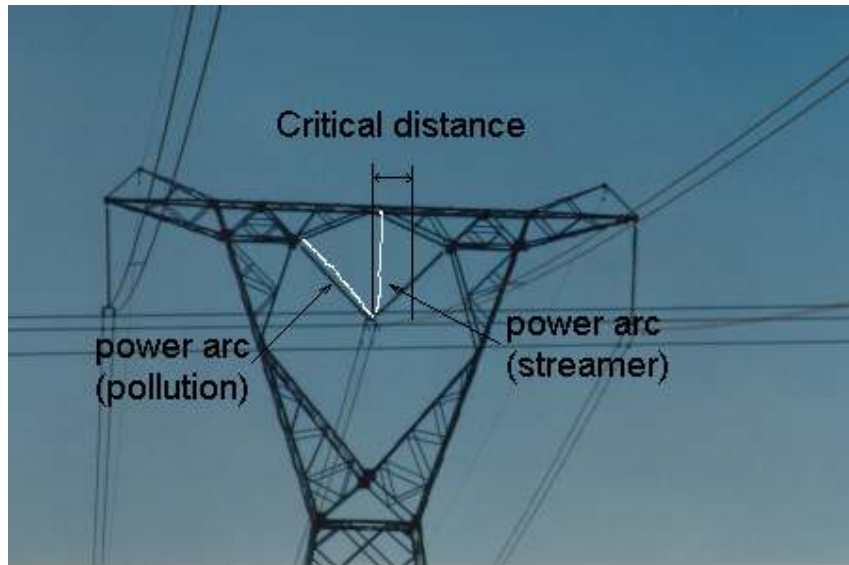
The tower design plays a major role with respect to bird streamer related faults. Vertically configured designs with **ample perching space on top of the tower away from the cross-arms**, experience fewer faults than horizontally configured designs. The reason for this is that with the latter, the birds roost relatively closer to the conductors, therefore increasing the risk of flashovers. With the former, depending on the design, the birds first utilize the available space on top of the tower, thereby reducing the risk of flashovers. Similarly, almost **no bird streamer faulting is experienced on the cross-roped suspension type towers**, presumably due to the unavailability of convenient perching space for birds above the conductors.

Transmission uses a variety of tower designs, with each design having as much as ten variations. As a result, broad guidelines will be given in this document. Final fitting strategies will have to be confirmed with subject specialist for final vetting.



Horizontal strain towers are the most vulnerable to streamer faults, followed by horizontal suspension towers. Delta towers are generally much less vulnerable with suspension towers being the least vulnerable.

Initial research showed that air gaps of just under one-meter, on either side of the conductor would need to be protected from potential bird streamers. Because bird guards are made in lengths of 500mm, 750mm and 1000mm for practical reasons, fitting them **one meter** on both sides of the centerline of the conductor has become the standard at all voltages. (Refer to **critical distance** in picture below). No gap of greater than 150mm should be left between two adjacent bird guards.



A distance of one meter either side of the conductor is regarded as critical in protection against streamer faults.

4.1.2. Fitting on Outer Phases

Experience revealed that faults occurred on the outer phases where the landing plates were not fully protected, which left roosting space for birds. Care must be taken not to leave any roosting space at the outer phase extremes of towers.



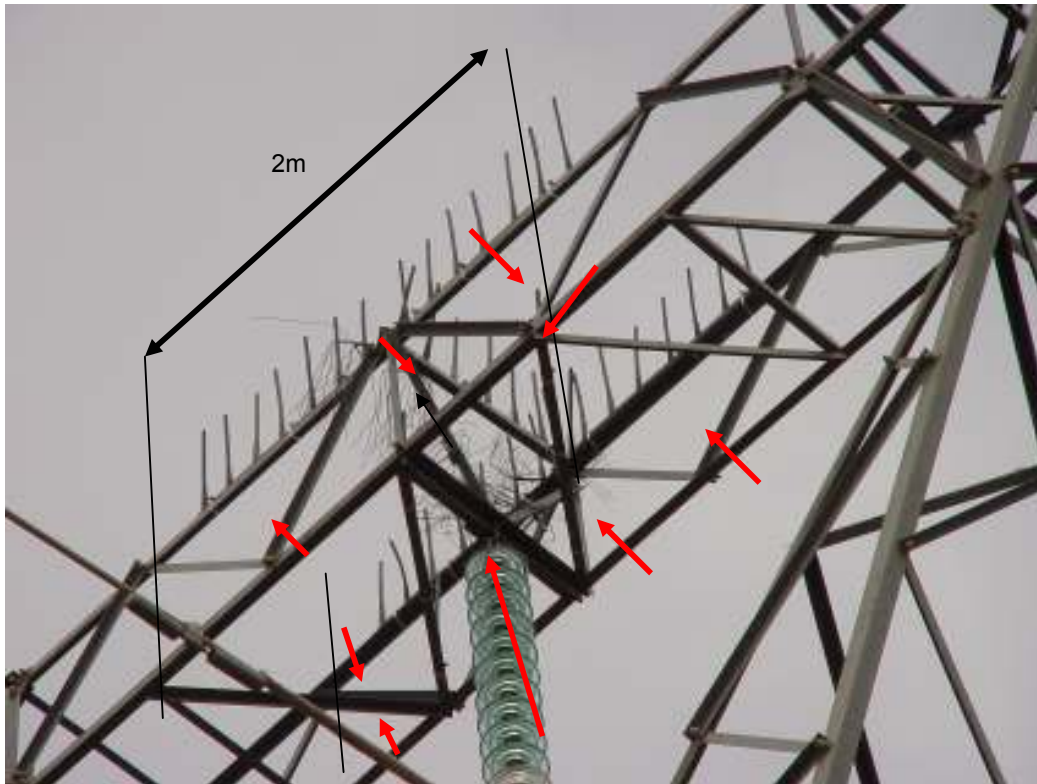
Picture of incorrect fitting leaving the landing plates exposed

4.1.3. V-strings and I-strings

Although V-strings on centre phases were originally thought of as more vulnerable to streamer faults than the I-strings, experience has now shown that the latter are equally vulnerable and should also be protected with bird guards.

4.1.4. Protecting the inside of the boat

Faults have also occurred where birds had entered and roosted inside the boat of the tower. Hadedu Ibis and Black Eagle in particular have been observed exploiting the inside of the boat or lattice member within the critical area, which was not fitted with bird guards.



Picture of an example of insufficient fitting on inside of boat indicated by the red arrows



Comprehensive fitting strategy as implemented on the Hendrina-Kriel 400kV line

4.2. Macro fitting strategy

Whilst a comprehensive fitting strategy is the safest, it also carries a high cost. Results from partial fitting were generally good when comparing risk of streamer fault with cost of installation. It must be pointed out that dependable knowledge of the habitat through which the line runs is critical when partial fitting of a line is contemplated.

The decision to fit bird guards to a line is in the first instance an economical one. It is based on

- the dip sensitive load that the line carries and the effect that these faults are having on the customers and
- the number of bird faults that it experiences (determined from its fault history) ,

Secondly, the habitat through which the line passes and the bird species present in that habitat, and more specifically their behaviour, influences the macro fitting strategy. Bird behaviour refers to aspects such as migration, feeding and roosting habits. Habitat refers to topography, land use, and type and availability of food sources. The help of subject specialist should be used in this regard.

4.2.1. Consideration of adjacent lines

It has been reported that where bird guards resulted in a decrease of roosting space, birds have moved to adjacent lines and streamer faults have occurred there. The increase in bird (and streamer faults) must however also be seen against the influence of wet weather cycles or other phenomena and the general increase in bird population numbers for an area. It is recommended that these factors be considered where unfitted lines run adjacent to the targeted line.

4.3. Special circumstances

Results to date on lines that have been fitted with bird guards have resulted in an average of 80% reduction in bird faulting, and some lines have had a 100% reduction in bird related faulting. It is important to note though that bird guards are not a 100% solution under all circumstances. Isolated instances have been recorded where birds have managed to wedge themselves between bird guards. These incidents are always associated with extreme densities of birds on a particular tower or towers, and are often associated with super-abundance of food. To date the following examples have been recorded:

- Cape Vultures roosting in large numbers on towers at a vulture restaurant. The birds are very large and if they repeatedly force themselves between the bird guards, it will eventually result in bird guards collapsing.
- Large concentrations of Black-headed Herons have been observed on the Nyl River floodplain after the annual flooding. These birds roost in large numbers on the towers during this period, and individuals have managed to wedge themselves between the bird guards when many birds are roosting on one tower.
- One incident has been recorded where a Bald Ibis roosted in a steel bird guard. These birds habitually roost on transmission towers in large numbers and it must be assumed that that could happen, especially as the steel bird guards have bigger gaps between the rods than the plastic bird guards. It is not clear at this stage whether the same will happen with the standard plastic bird guards.

Special circumstances require special solutions, and each incident must be investigated with the help of an ornithologist to arrive at a solution. In doing so it must also be considered whether the level of faulting caused by these "special events" justifies the cost and effort to device a solution that will result in a 100% elimination of faults, especially if the faulting levels are very low and restricted to a short period of time each year."

5. Bird guard Specifications

5.1. Types of bird guard

The types of devices to be used will prevent birds from perching on transmission structures by forming a barrier to birds on the affected parts of the structure. The device will consist of a base with upright shafts as described below and will have no moving parts or anything else that will harm birds.

Three devices have been used successfully as part of the National bird guard project and are recommended for future use. These are:

- BeeTee bird guard.
- Mission Bird guard
- Naledi Bird guard

The latter company no longer manufactures bird guards.

5.2. General aspects

The device required is intended to prevent birds from perching on designated areas of power pylons. It should consist of a square base with upright prongs and should be made from a long life, non-conductive material and should not pose any danger to live line workers or birds. An organic polymer such as high-density polyethylene should be used. These polymers should be treated to enable it to withstand typical environmental conditions found in South Africa for a period in excess of 15 years.

5.3. Dimensions

The device should come in three lengths: 500mm, 750mm and 1000mm. The vertical rods should be about 500mm high, with a spacing of between 125-190mm and an outside diameter of about 20mm. The base should have dimensions of 40mmx40mm.

5.4. Materials to be used

The raw materials used by the manufacturer of bird guards should be sourced from a reputable supplier who shall issue a guarantee with regards to:

- the chemical composition of the materials (DOW HDPE M5010 or similar)
- the additives for ensuring suitable life of the product and estimated life. (The Ciba stabilizing system consisting of 2% minimum level of pigment type carbon black, Irganox B225 @ 0,1% and Tinuvin T783 @ 0,4% or similar system should be used. Eskom will have to approve the stabilizing system before production starts.)
- the proper blending of the raw material with UV inhibitors and other additives, that they supply.
- the manufacturing process that is followed must be sanctioned by the Supplier and Eskom to ensure quality of the product. This includes the adding of any non-virgin material. Not more than 10% of own reground material will be permitted.

5.5. Quality assurance.

All devices shall carry a batch number and date. Eskom must be able to determine the materials used for the manufacture of the particular batch.

Unannounced, random samples of the materials may be taken during the processing for testing. Contracts will be terminated with any manufacturer that does not comply with the quality standards, and costs will be recovered for the removal and refitting of bird guards of a suitable quality. Ciba can do analysis of samples.

Rapid aging and other tests will be required that will indicate the specific properties of the device. Refer to details below. The device should be mechanically sound.

An ongoing programme should be followed to observe and track any deterioration of bird guards

6. Attachment Methods

The preferred method of fitting bird guards is by means of stainless steel straps 12,74mm x 0,7mm. This method is effective but has the disadvantage that the guards can only be removed during live line work by cutting the strap. This results in a situation where in some instances bird guards are removed and not replaced by live line teams (damage to bird guards caused during the installation of optical fibre cables have been reported). Poor attachment has been observed as the single biggest reason for failure of bird guards.

In order to facilitating live-line work, quick release straps were designed and manufactured by a number of suppliers.

The number of straps per bird guard varies depending on the specific tower, size of the member and the position on the tower. Installers should ensure that the bird guard is securely attached to the tower member. As a general rule the following guidelines may be used:

Length	Number of straps
One meter	3
750 mm	2
500mm	2



One example of a quick release strap

These straps permit the partial removal of the bird guard by relaxing the tension on the strap and by pushing the guard out of the way but without causing it to fall from the tower. Upon completion of the work, the bird guard is returned into position and the strap is re-tensioned.

Bird guards may selectively be attached by means of a quick release mechanism in areas where live line work is anticipated. This mechanism should enable live line workers to move the bird guard out of the way but without the device being able to drop from the top of the tower or onto the conductors.

Alternative UV protected polymer straps are also used by overseas companies.

7. Supporting Clauses

NOT APPLICABLE.

8. Index of Supporting Clauses

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8.1. Scope

This document serves as a guideline with regards to the management of perching and roosting behaviour of large birds on Transmission lines. The presence of large birds and the associated streamer activity has a profound impact on quality of supply.

8.1.1. Purpose

The document helps the reader to identify streamer problems and suggests mitigation measures. It also specifies dimensions, materials and the attachment methods of bird guards.

8.1.2. Applicability

This document shall apply to all Transmission power line structures.

8.2. Normative/Informative References

Parties using this guideline shall apply the most recent edition of the documents listed below :

8.2.1. Normative

ISO 9001:2000 Quality Management Systems

8.2.2. Informative

Refer to the latest research report publisher by ERID.

8.3. Definitions

Perch management

This term refers to the method of managing the roosting and perching behaviour of large birds on transmission and other structures. It is applied to prevent streamer faults and electrocutions on smaller lines. It is also used in conjunction with the management of nests on power lines. Whilst not intended, perch management also results in reduced pollution of insulators. Perch management is also used to prevent birds such as vultures from causing damage to fibre optic cables.

Micro fitting strategy

This term refers to the positioning of bird guards on specific parts of the tower.
This decision will be based on the particular design of the tower as well as the bird species that are targeted.

Macro fitting strategy

This term refers to the determination of which towers to fit with bird guards on a particular transmission line. During the National Bird guard project, both comprehensive as well as partial fitting strategies were followed.

8.4. Abbreviations

none

8.5. Roles and Responsibilities

The Line and Servitude Managers for each Grid shall be responsible for the installation of any bird guards in their respective Grids.

8.6. Implementation date

The implementation date is November 2006.

8.7. Process for monitoring

The Line and Servitude Managers for each Grid shall be responsible for the monitoring of the adherence to this guideline.

9. Authorisation

This document has been seen and accepted by:

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10. Revisions

Date	Rev.	Remarks
November 2006	1	Review document as per review period

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