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**FINAL OPERATIONAL AND CONSTRUCTION
ENVIRONMENTAL MANAGEMENT PLAN FOR
THE UPGRADE OF BRIDGE CROSSING
BRAAMHOEKSPRUIT, DOWNSTREAM THE
LOWER RESERVOIR**

Report No : 11821

Submitted to:

Eskom
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2000

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EXECUTIVE SUMMARY

The purpose of this Environmental Management Plan (Operation and Construction EMP) is to set out environmental management measures for the (a) construction, operation and decommissioning of construction camps and related infrastructure, and (b) construction and operation of the temporary by-pass road and Upgrade of the Ingula Bridge.

The sequence of events during the construction phase of the Upgrade of Ingula Bridge is for (a) the contractors' work areas and campsites to be marked out and provided with basic services for water supply, wastewater treatment and power, (b) the contractors take occupation of the work areas and campsites and are responsible for their operation and maintenance while undertaking the construction for the upgrade of Ingula Bridge, and (c) upon completion of the construction and its commissioning the contractors evacuate their work areas and campsites that are dismantled, decommissioned and rehabilitated.

The permanent infrastructure to be built during the present construction phase includes the upgraded higher level bridge crossing. Temporary works include contractors' work areas, contractors' camps and the temporary by-pass road during the four months of construction.

A Basic Assessment Report was performed whereby environmental aspects and impacts were identified and their significance assessed. This EMP constitutes an Appendix to the Basic Assessment Report. Various tables were developed for the various construction activities, showing significant impacts, mitigation measures, duration, frequency, responsibility, accountability, who should be contacted and informed.

Throughout the undertaking of the environmental studies, individual aspects were generally found to have had several environmental impacts. The main environmental aspects included noise, atmospheric pollution, solid waste, hazardous waste, construction footprints, veld fire, water supply and wastewater discharge and runoff, health and safety, environmental degradation, soil and water pollution, erosion, habitat loss, wetland scouring and visual impacts.

Monitoring of the effect of the environmental management measures is required in terms of this EMP.

TABLE OF CONTENTS

SECTION	PAGE
1	INTRODUCTION..... 1
2	LEGAL CONTEXT 1
3	BRIEF PROJECT DESCRIPTION..... 3
3.1	Background Information.....3
3.2	Description of the Proposed Project.....3
4	SCOPE OF THE EMP 3
4.1	Purpose of the EMP4
4.2	Objectives of the EMP4
5	MANAGEMENT GUIDELINES..... 5
5.1	Resource allocation5
5.2	Eskom and Contractor Commitment5
5.3	Reporting Structure6
5.4	Responsible parties7
5.4.1	Project Manager7
5.4.2	Contractor / Service Provider8
5.4.3	Environmental Control Officer8
5.4.4	Environmental Officer9
5.5	Monitoring of the EMP9
6	TECHNICAL SPECIFICATIONS / CONSTRUCTION METHODS 10
6.1	Temporary Diversion of Road10
6.2	Demolishing of the Existing Bridge10
6.3	Abutment Construction.10
6.4	Bridge Deck Construction10
6.5	Road Surface Layer Works.....11
6.6	Fencing and Rehabilitation11
7	ENVIRONMENTAL MANAGEMENT MEASURES 12
7.1	Construction Initiation12
7.2	Site Establishment.....15
7.3	Designated Storage Areas.....22
7.4	Hazardous Delivery of Materials26
7.5	Water Management (including Storm Water, Water Sources, Wet Areas).....30
7.6	Fire Prevention35
7.7	Waste Management37
7.8	Flora Management (including Vegetation Clearing, General, and Herbicides)42
7.9	Fauna Management55
7.10	Erosion, Donga and River Crossings59
7.11	Claims from Damages61
7.12	Residential Property and Interaction with Adjacent Landowners.....63
7.13	Noise / Working Hours.....64
7.14	Archaeology65
7.15	Temporary Road Diversion.....67

LIST OF TABLES

Table 1: Providing a list of applicable legislation to this development.....	1
Table 3: Environmental Management Measures for Construction Initiation for the Upgrade of Ingula Bridge.....	12
Table 4: Environmental Management Measures for the site establishment for the upgrade of bridge.....	15
Table 5: Environmental Management Measures for designated storage areas during construction for the upgrade of bridge.....	22
Table 6: Environmental Management Measures for the delivery of hazardous materials for the upgrade of bridge.	26
Table 7: Environmental Management Measures for the Water Management during the upgrade of bridge.....	30
Table 8: Environmental Management Measures for fire prevention during the upgrade of bridge.....	35
Table 9: Environmental Management Measures for waste management during the upgrade of bridge.....	37
Table 10: Environmental Management Measures for vegetation clearing for the Upgrade of Ingula Bridge.....	42
Table 11: Environmental Management Measures for Fauna Management for the upgrade of bridge.....	55
Table 12: Environmental Management Measures for the management of Erosion, Donga and River Crossings for the upgrade of bridge.....	59
Table 13: Environmental Management Measures for Claims and Damages for the upgrade of bridge.....	61
Table 14: Environmental Management Measures for Residential Property and Interaction with Adjacent Landowners for the upgrade of bridge.....	63
Table 15: Environmental Management Measures for Noise / Working Hours for the upgrade of bridge.....	64

Table 16: Environmental Management Measures for Archaeology for the upgrade of bridge.65

Table 17: Environmental Management Measures for the temporary road diversion for the upgrade of bridge.....67

LIST OF FIGURES

Figure 1: Reporting structure for Ingula EMP.6

LIST OF APPENDICES

Appendix A Project Management Schedule during the construction for the Upgrade of Ingula Bridge

1 INTRODUCTION

Zitholele Consulting (Pty) Ltd have been appointed to undertake the Basic Assessment Process and to compile an Environmental Management Plan (EMP) for the Upgrade of the Ingula Bridge as per Government Notice R. 386 No. 1m (iii); 7; 15; and 25.

This EMP addresses the management of environmental impacts related to the upgrade of the bridge over the Braamhoekspruit, downstream the Ingula Pumped Storage Scheme (PSS), Kwa-Zulu Natal. The document provides a basis for managing, mitigating and monitoring the environmental impacts associated with all construction operations as identified during the upgrade construction planning and the Basic Assessment Process for the site. This report should be read in conjunction with the Basic Assessment Report for the "Upgrade of the bridge over the Braamhoekspruit, downstream the Ingula PSS, Kwa-Zulu Natal" (August 2008).

2 LEGAL CONTEXT

A growing awareness of the environment and an increase in the number of environmental laws and regulations, present company management with a daunting task of monitoring, interpreting and implementing systems to produce a workable plan to comply with legal requirements.

The list below was compiled to ensure that the person responsible for the activities of the bridge project is aware of his/her legal responsibilities and liabilities. Complying with these laws and regulations will minimise the risks in terms of legal, financial (claims) and rehabilitation costs.

Non compliance to environmental law is a criminal offence and if prosecuted Eskom will be liable for any environmental damage incurred.

Table 1: Providing a list of applicable legislation to this development

ACT NAME		ACT NO	NOTES/REMARKS
National Management Act	Environmental	107 of 1998	List of activities and competent authorities identified in terms of Sections 24 and 24D

ACT NAME	ACT NO	NOTES/REMARKS
Conservation of Agricultural Resources Act	43 of 1983	Control of utilisation and protection of wetlands; soil conservation; control and prevention of veld fires; control of weeds and invader plants.
Environment Conservation Act	73 of 1989	Controls for the effective protection and utilisation of the environment, littering, waste disposal, noise and various other activities, which may have a detrimental effect on the environment <i>F Waste management</i> <i>F Application of waste disposal permit</i>
Fencing Act	31 of 1963	Prohibition of damage to a property owner's gates and fences <i>F Climbing or crawling over or through fences without permission</i> <i>F Closing gates</i>
Veld and Forest Fires Act	101 of 1998	Prevention of unauthorised veld and forest fires
Transvaal Nature Conservation Ordinance	12 of 1938	Endangered plants and wild animals. Protected fauna and flora
Occupational Health and Safety Act	85 of 1993	Prescribes health and safety measures necessary to adhere to for all construction workers
National Water Act	36 of 1998	All aspects relating to pollution of surface and ground water.

3 BRIEF PROJECT DESCRIPTION

3.1 Background Information

Eskom is in the process of constructing the Ingula Pumped-Storage Scheme (PSS). The Ingula PSS comprises two reservoirs (referred to as upper and lower reservoirs, respectively), an underground powerhouse complex, waterway tunnels linking the reservoirs with the powerhouse complex, access roads and transmission lines, among other activities. The lower reservoir is located on the Braamhoekspruit. The scheme received environmental authorization in 2004, and the access roads in April 2006.

A gravel road crosses the Braamhoekspruit via a low-level crossing bridge, located approximately two kilometers downstream of the lower reservoir. The gravel road is used frequently by the local communities and other road users. This bridge gets flooded when there are heavy rains because of its technical design and specification.

Eskom has identified that, although the magnitude of flood peaks downstream of the lower reservoir will be reduced, the duration of these reduced peaks will be over a longer period due to the attenuation effect and release system of the reservoir. This could result in longer duration of overtopping of the low-level crossing bridge than is experienced without the lower reservoir. To mitigate this extended period of overtopping, Eskom is planning to construct a normal-level crossing bridge with adequate opening to accommodate large flows without overtopping.

3.2 Description of the Proposed Project

This project entails construction of a normal-level crossing bridge structure across the Braamhoekspruit, to replace the current low-level crossing bridge, on a gravel road, at a distance of approximately two kilometers downstream of the proposed lower reservoir. The road level will be raised at the point of crossing as the bridge will be higher than the current bridge. During the upgrade construction (approximately four months) of the bridge, a temporary by-pass road will be constructed.

4 SCOPE OF THE EMP

The scope of this document is to provide environmental management guidelines to the Contractor responsible for the upgrade of the bridge and the construction of the temporary by-pass road.

In terms of the National Environmental Management Act (NEMA) No 107 of 1998, the proponent must submit an Environmental Management Plan (EMP) with the Basic Assessment Report for authorisation of a listed activity in terms of Regulation 385, 386 and 387 of the aforementioned Act. This report constitutes the fulfilment of that requirement.

4.1 Purpose of the EMP

This EMP has been compiled to address potential environmental impacts, during construction and operation of the temporary by-pass road and construction and operation of the upgrade of the bridge across the Braamhoekspruit, downstream the Ingula PSS. This document serves as the environmental specification to Eskom personnel and outside Contractors with regard to addressing environmental issues identified prior to construction. It is the responsibility of the Project Manager and Contractor to ensure compliance with all the environmental specifications in the document as well as the relevant legislation.

This EMP should also ensure the sustainable management (to avoid and/or minimise environmental damage) of the environment whilst the construction is being undertaken. This EMP must be viewed as a contract document to which all Eskom employees and outside Contractors involved in the proposed construction must be committed to.

Thus the aim of this EMP is to:

- Ensure that the project team are familiar with the environmental procedures to be followed and comply with all the recommendations made within it;
- Ensure that a list of environmental representatives involved in the project are given to the construction team;
- Ensure that an environmental incident register is implemented and maintained to address environmental impacts;
- Ensure that the mitigatory measures are implemented to avoid and/or minimise the identified negative environmental impacts and to enhance the positive impact of the project on the environment; and
- Ensure that a monitoring programme is in place that tracks the effectiveness of the implemented mitigatory measures.

4.2 Objectives of the EMP

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

- Appropriate Environmental Management measures and requirements are implemented from the commencement of the project;
- Precautions against damage and claims arising from damage are taken timeously; and
- The completion date of the contract is not delayed due to problems with landowners arising during the course of construction.

5 MANAGEMENT GUIDELINES

5.1 Resource allocation

Since this project forms part of the bigger Ingula Pumped Storage Scheme Project, the current Ingula **Environmental Manager** shall be appointed by Eskom to ensure that this EMP is implemented and to assume responsibility for ensuring the implementation of this EMP and for monitoring compliance with the management measures contained in this document.

5.2 Eskom and Contractor Commitment

A commitment is required from the Eskom Project Manager and the Contractor on the following issues:

- Ensure that environmental conditions that are stipulated in the Environmental Authorisation are implemented;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- To implement this EMP for the benefit of all involved; and
- To preserve the natural environment by limiting destructive actions on site.

5.3 Reporting Structure

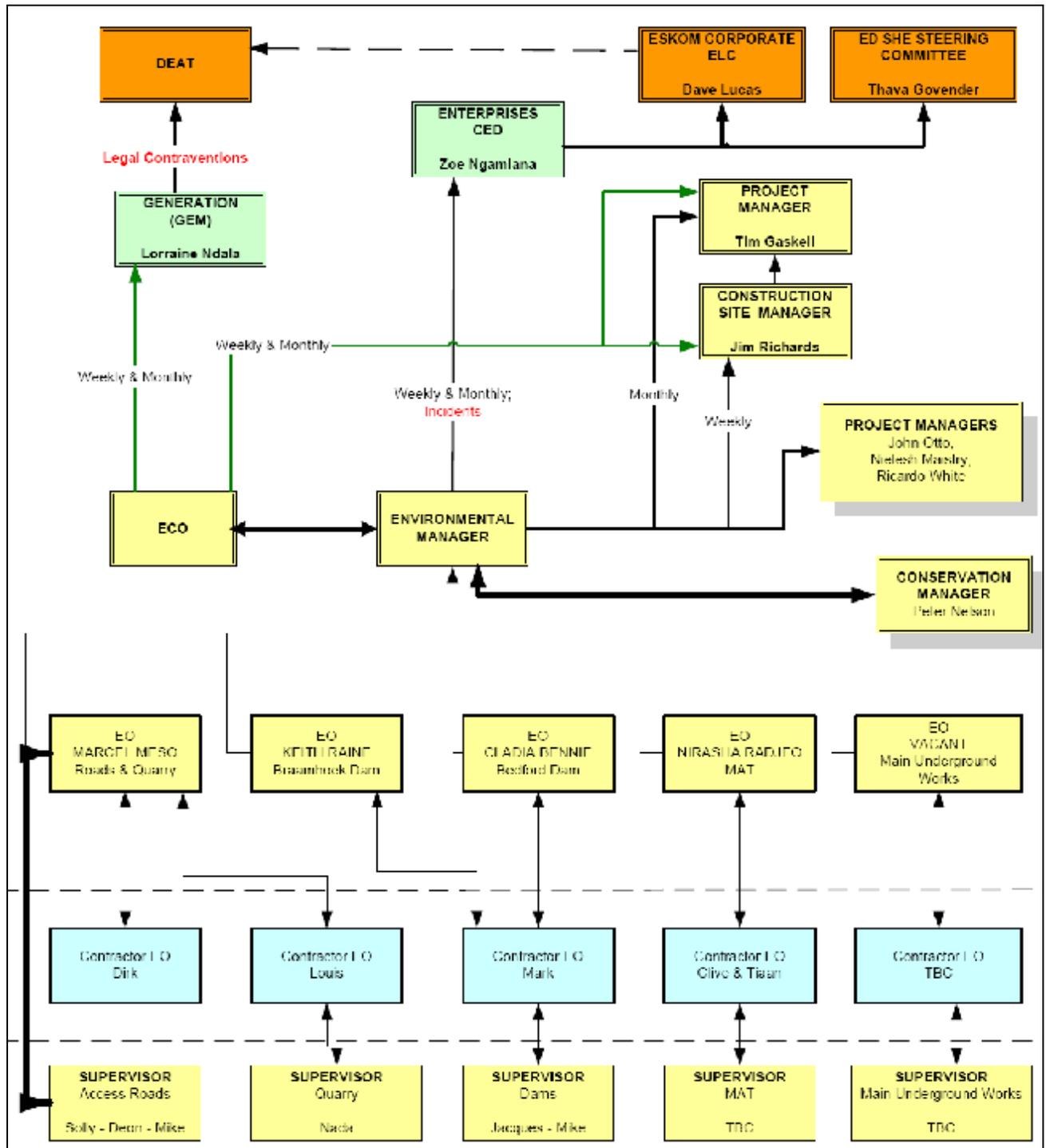


Figure 1: Reporting structure for Ingula EMP.

ECO: Environmental Control Officer – an independent resource, reports to EMC / ELC / DEAT.

CM: Contract Manager (Eskom)

CECO:	Contractor Environmental Control Officer (Dedicated person)
PM:	Project Manager (Eskom)
EA:	Environmental Advisor (Eskom)
EM:	Environmental Manager (Eskom)
RA	Relevant Authority (e.g. DEAT)

5.4 Responsible parties

5.4.1 Project Manager

The primary responsibility of the Project Manager is to ensure that the Contractor complies with the environmental specifications in this document. In addition, the Project Manager shall:

- Assume overall responsibility for the effective implementation and administration of the EMP;
- Ensure that the EMP is included in the Contractor's contract;
- Ensure that the EMP is given to the applicable Construction Supervisor and the contractors;
- In conjunction with the Construction Supervisor; undertake regular inspections of the Contractor's site as well as the installation works in order to check for compliance with the EMP in terms of the specifications outlined in this document. Inspections shall take place at least once a week and copies of the monitoring checklist contained in the file;
- Keep a register of all incidents (spills, injuries, complaints, legal transgressions, etc) and other documentation related to the EMP;
- Report to the Environmental Advisor any problems (or complaints) which cannot first be resolved in co-operation with the Contractor(s);
- Implement recommendations of possible audits; and
- Ensure that construction staff is trained in accordance with requirements of the EMP.

5.4.2 Contractor / Service Provider

The Contractor / Service Provider shall:

- Ensure that the environmental specifications of this document (including any revisions, additions or amendments) are effectively implemented. This includes the on-site implementation of steps to mitigate environmental impacts;
- Discuss implementation of and compliance with this document with staff at routine site meetings;
- Preserve the natural environment by limiting any destructive actions on site;
- Monitor environmental performance and conformance with the specifications contained in this document during site inspections;
- Report progress towards implementation of and non-conformances with this document at site meetings with the Project Manager;
- Ensure that suitable records are kept and that the appropriate documentation is available to the Project Manager;
- Advise the Project Manager of any incidents or emergencies on site, together with a record of action taken;
- Report and record all accidents and incidents resulting in injury or death;
- Take into consideration the legal rights of the individual Landowner, Communities and Eskom staff;
- Ensure quality in all work done, technical and environmental;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- Underwrite Eskom's Environmental Policy at all times, and
- Use this Environmental Management Plan for the benefit of all involved.

5.4.3 Environmental Control Officer

The ECO shall:

- Know the background to the project and monitor the implementation of the EMP.
- Act as a guide, advisor and consultant to the contractors on environmental issues during construction, implementation and rehabilitation.

-
- Ensure continuous auditing of the project for adherence to the EMP, identify problem areas and provide action plans to avoid costly stoppages and / or further environmental damage.
 - Ensure that open communication lines exist for reporting of any significant environmental incidents to the Department of Environmental Affairs and Tourism (DEAT) and resolve any problems or complaints from the public rapidly.
 - Make (propose) changes (for approval) to the EMP as necessary.
 - Ensure that all environmental requirements are met.

5.4.4 Environmental Officer

The **Environmental Officer's** (or officers, if more than one is required) primary role shall be to coordinate the environmental management activities on site. The Environmental Officer shall:

- Support the ECO in the monitoring and execution of the sub -contractors' Method Statements and the Management Plans by maintaining a permanent presence on site.
- Inspect the site as required to ensure adherence to the management actions of the Construction and Operation EMP, Management Plans and the Method Statements;
- Complete the Site Inspection Forms on a weekly basis;
- Provide inputs to the monthly environment report that is to be prepared by the ECO;
- Liaise with the construction team on issues related to implementation of and compliance with the EMP.
- Maintain a record of environmental incidents (spills, impacts, legal transgressions etc) as well as corrective and preventive actions taken, for submission to the ECO; and
- Maintain a public complaints register in which all complaints are recorded, as well as action taken, for submission to the ECO.

5.5 Monitoring of the EMP

Eskom and its Environmental Manager shall compile a monitoring plan to monitor whether all of the environmental management measures in the EMP are a) implemented and b) effective. The Environmental Manager shall assess conformance to the plan on a regular basis, shall record non-conformances and shall initiate corrective action.

The purpose of the environmental monitoring programme is to serve as an early warning system of undesirable impacts arising from the construction activities during the construction for the upgrade of the bridge. From this information the EMP is amended as necessary to provide an effective remedy. This ensures that environmental protection is optimised and demonstrates compliance with regulatory requirements. The key objectives of environmental monitoring are to:

- Provide information on the impact of an operation's activities;
- Detect changes to environmental baselines that may be a result of the operations;
- Detect short and long term trends with respect to environmental conformance; and
- Recognise environmental changes to enable analysis of their cause.

6 TECHNICAL SPECIFICATIONS / CONSTRUCTION METHODS

The following construction methods are discussed in chronological order.

6.1 Temporary Diversion of Road

The road deviation will be done either upstream or downstream of the existing bridge. The river crossing will consist of concrete beams of sufficient strength to handle the expected annual flow and rockfill. The road surface will be constructed with layers of suitable material to create an acceptable road surface. In that way, turbidity will be minimized during the construction phase at the Braamhoekspruit.

6.2 Demolishing of the Existing Bridge

The demolishing of the existing bridge will be done as far as possible with hydraulic breakers. No explosives will be used due to the close proximity of local residents and the damage this would cause on the environment, especially the aquatic environment. The demolished material will be disposed of at a suitable registered disposal site. Some of the material that will be demolished will be used in the rehabilitation of the temporary by-pass road after completion of the project. This will be done on the cuttings on either side to reinstate the river bank to its former state.

6.3 Abutment Construction.

The excavation of the two abutments will be done on either side of the river with concentrating the water in the centre by suitable means without contaminating the water through turbidity. Concrete will be supplied by the Braamhoek batch plant including mixer trucks. The concrete will be placed with crane and concrete bucket.

6.4 Bridge Deck Construction

The Bridge deck is a composite deck consisting of pre-cast slabs and in-situ concrete. The precast beams will be inspected and approved. Once the abutments are finished the precast beams will be placed in position with the mobile crane positioned at the abutment end. Once the precast beams are in place, the insitu deck and all other relevant features will be completed.

6.5 Road Surface Layer Works

The materials needed for the construction of the surface layer will be sourced from the approved areas.

6.6 Fencing and Rehabilitation

The fencing will be erected according to the drawings compiled. Site rehabilitation will be done according to specification and site de-establishment and handover will follow.

7 ENVIRONMENTAL MANAGEMENT MEASURES

The management measures documented in each of the sections below have been compiled using the following information:

- Impact Assessment and mitigation measures documented in the Final BAR for the upgrade of the bridge.
- The standard EMP utilised by Eskom

Please refer to Section 5.3 for the acronyms used in the tables below.

7.1 Construction Initiation

Table 2: Environmental Management Measures for Construction Initiation for the Upgrade of Ingula Bridge.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
1	Labour Issues	Eskom must appoint a suitably qualified Environmental Officer (hereafter referred to as ECO) who would act on behalf of the applicant, on a daily basis, monitor project compliance with the conditions of environmental authorisation, environmental legislation and the recommendations of the revised EMP. This role will be fulfilled by the appointed ECO and CECO.	Throughout Project	Daily	PM	EA	EM	C
		The ECO / CECO must be appointed prior to the commencement of construction and pre-construction related activities and the authorities must be notified of such and appointment.	Throughout Project	Once off	PM	EA	EM	C / RA

		The ECO / CECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to Eskom by the contractor for operation;	Throughout Project	Daily	PM	EA	EM	C
		The ECO shall maintain the following on site: <ul style="list-style-type: none"> • A daily site diary; • A non-conformance register; and • A public complaint registers. 	Throughout Project	Daily	CECO	ECO	EA SM	EM PM
2	Initiation	The authorised activity / activities may not commence within thirty (30) days of the date of signature of the authorisation;	Prior to authorisation	Once off	PM	PM SM	EM EA ECO	RA C
		Should Eskom be notified by the minister of a suspension of the authorisation pending appeal procedures, Eskom may not commence with the activity / activities unless authorised by the minister in writing.	Throughout Project	Throughout Project / as and when necessary	PM	PM SM	EM EA ECO	RA C
		Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence.	Prior to commencement	Once - off	CECO	PM SM	EA EM ECO	RA
		Fourteen (14) days written notice must be given to the Department that the operational phase of the activity will commence.	14 days	Prior to operation commencement	CECO	PM SM	EA EM ECO	RA
		A copy of the authorisation must be kept at the property where the activity will be undertaken. The authorisation must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertake work at the property;	Throughout	Monthly Inspection	CECO	SM	EA	EM PM
		No work shall commence until permission is granted from the Environmental Control Officer and acceptance of this proposal and EMP from DEAT has been obtained.	Prior to commencement	Once-off	ECO C	PM	ECO	EA EM

		Obtain a signed agreement statement from the contractor indicating their willingness to comply to the EMP.	Prior to commencement	Once - off	CECO C	SM	ECO	PM EA EM
Construction Phase								
1	Construction Initiation	Where any of the applicant's contact details change, including the name of the responsible person, the physical or postal address and/or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant;	Throughout construction	Throughout construction	SM	PM	ECO	EA EM RA
		The holder of the authorisation must notify the Department, in writing and within 24 hours, if conditions of the authorisation cannot be or is not adhered to. In all other cases, the holder of the authorisation must notify the Department, in writing, within 48 hours if a condition of the authorisation is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance; and	Prior to commencement	Once off	CECO	SM	ECO EA	PM EM RA
		Non-compliance with a condition of the authorisation granted may result in criminal prosecution or other actions as per the National Environmental Management Act, 1998 and the regulations.	Throughout	Throughout	CECO	SM	ECO EA	PM EM RA
2	Labour Issues	Ensure proper supervision of employees at all times.	Throughout	Throughout	C	SM	ECO EA	PM EM RA
Rehabilitation Phase								
None								
Operational Phase								
None								

7.2 Site Establishment

Table 3: Environmental Management Measures for the site establishment for the upgrade of bridge.

Objectives.	<p>Contractors Camp:</p> <ul style="list-style-type: none"> To make provision for the necessary ablation facilities, and to ensure the proper utilisation, maintenance and management thereof; To make provision for the workforce all amenities required for smooth take on of the project. Reduced sick leave and higher worker productivity. Reduced water treatment costs. <p>Eating Areas:</p> <ul style="list-style-type: none"> To make available the necessary dish washing facilities; To ensure that wastewater is disposed of appropriately; To ensure that that erosion and build up of detergents is prevented as the discharge point will appropriately be positioned; To avoid fires caused by escaping embers by positioning this area to such an extent that no vegetation, including over hanging trees are in close proximity. <p>Site Decommissioning:</p> <ul style="list-style-type: none"> To ensure that all areas where site infrastructure or camp sites have been established, must be rehabilitated to their original state in which they were found. 							
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted
Pre-Construction Phase								
1	Site Establishment- Contractor's camp, waste water management, and power supply.	<p>A site laydown and office area will be required to accommodate the following:</p> <ul style="list-style-type: none"> A site office consisting of a mobile unit that will be 6m x 2.4m in size; Two storage containers for construction materials which will be 12m x 2.4m in size; A pre-cast area of 30m x 20m for the casting of the re-enforced concrete beams (6 of 15m); A laydown area of 20m x 20m for the shutters required; A parking area of 18m x 4m for construction vehicles; 	Pre-construction	Once-off	Contractor and ECO	SM	ECO	EA EM PM

	<ul style="list-style-type: none"> • The Contractor's camp shall be sited so as to cause the least amount of disturbance to the adjacent land owners. • The Contractor's camp shall be fenced and the Contractor shall maintain in good order all fencing for the duration of the construction activities. <p>Site establishment shall take place in an orderly manner and all amenities shall be installed at camp sites before the main work force move onto site.</p>						
	<p>The site establishment will be phased in and located at the best possible position to cause the least environmental disturbance. The Contractors shall commence working on the road deviation with sanitation and potable water located in the existing road servitude and vehicles will be parked on the by-pass road. Once the road deviation has been constructed and is complete the aforementioned facilities will be moved to the original road off the final road alignment.</p>	Pre-Construction and during Rehabilitation	Once-off	Contractor	SM	ECO	EA EM PM
	<p>No cooking areas will be available on site. The workers will be accommodated by the PSS construction village.</p>	Pre-Construction and Throughout	Once-off	Contractor	SM	ECO	EA EM PM

			construction					
		Potable water for workers will be supplied from a reputable source on a regular basis.	Throughout construction	Daily	Contractor	SM	ECO	EA EM PM
		A suitably demarcated bunded area must be made available for the storage for diesel for the generator.	Throughout construction	Daily	Contractor	SM	ECO	EA EM PM
2	Sanitation	The Contractor will be responsible for the provision of and the utilisation, maintenance and management of toilet, wash and waste facilities. Toilet facilities supplied by the contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers, i.e. 2 toilets. All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.	Throughout construction	Daily	Contractor	SM	ECO	EA EM PM
		Prior to the establishment of the ablution facilities, The Site Manager must approve the appropriate location.	Pre-construction	Once-off	Site Manager	SM	ECO	EA EM PM
		A waste skip will be provided by a reputable supplier for domestic and building rubble generated on site. The amount (12m ³ /month) and type of waste generated should lend in recycling facilities, therefore the waste should	Pre-construction and Construction phase	Once-off	Site Manager	SM	ECO	EA EM PM

		be removed off site and disposed of at a registered waste disposal site (see waste management).						
		The entrance to the ablution facilities shall be adequately screened from public view.	Pre-construction	Once-off	Contractor	SM	ECO	EA EM PM
3	Eating areas	Eating areas shall be designated and demarcated	Pre Construction	Once-off	Contractor	SM	ECO	EA EM PM
		Dish washing facilities shall be provided. These may be very basic, but a process must be put in place to ensure that waste water is disposed of appropriately.	Pre-Construction and Throughout Construction	Once-off	Contractor	SM	ECO	EA EM PM
Construction Phase								
1	Sanitation	The Contractor shall inform all staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		No use of the veld shall be allowed, as this creates problems with the landowners and may lead to claims for problems with stock diseases.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM

		Toilet paper is also source of littering, and the Contractor shall be forced to clean up any litter.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		Ablution facilities must be maintained in a hygienic state and serviced regularly. Toilet paper must be provided continuously.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed provider removes the contents from the site.	Throughout Construction	Weekly	Contractor	SM	ECO	EA EM PM
		Disposal of such waste is only acceptable at a licensed waste disposal facility.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
2	Site Establishment- Contractor's camp, waste water management, and power supply.	The site must be kept tidy and hygienic at all times with special reference to sanitation and water management.	Construction Phase	Construction Phase	Construction Phase	SM	ECO	EA EM PM
		Where possible and practical, all maintenance of vehicles and equipment shall take place in the workshop area.	Throughout Construction	Weekly	Contractor	SM	ECO	EA EM PM
		Workshop area shall be monitored for oil and fuel spills and such fuel spills shall be cleaned and remediated to the satisfaction of the ECO.	Throughout Construction	Weekly	Contractor	SM	ECO	EA EM PM

		The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site.	Throughout Construction	Weekly	Contractor	SM	ECO	EA EM PM
		No equipment shall be used which may cause irreparable damage to wet areas.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		Construction water will be drawn from the Braamhoekspruit. This water will be limited to usage for dust suppression on the development	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		The generator must be monitored to ensure there is no spillage of petrol or oil or diesel	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
3	Eating areas	The feeding of, or leaving of food for animals, is strictly prohibited.	Throughout Construction	Monthly	Contractor	SM	ECO	EA EM PM
		No fires for the cooking or warming purposes will be permitted other than within designated areas, for instance, at the site camp.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Site Decommissioning	All areas where infrastructure or camp sites are established must be rehabilitated to their original state in which they were found, as much as possible.	Once construction is completed during rehabilitation	Monthly	Contractor	SM	ECO	EA EM PM

	Any specific requirements to prevent pollution during demolition of structures must be identified prior to the commencement of rehabilitation activities.	Prior to rehabilitation	Once-off	Contractor	SM	ECO	EA EM PM
	Disposal requirements must be identified prior to the commencement of rehabilitation and structure removal.	Prior to rehabilitation	Once-off	Contractor	SM	ECO	EA EM PM
	Equipment, structures and building material that can be reused will be identified prior to the commencement of the rehabilitation activities.	Prior to rehabilitation	Once-off	Contractor and ECO	SM	ECO	EA EM PM
	Scrap metal and equipment will be sold as scrap or disposed of at a suitably licensed facility.	Once construction is completed during rehabilitation	Monthly	Contractor	SM	ECO	EA EM PM
	Vegetation that was removed for the establishment of site infrastructure shall be reinstated into the area.	Once construction is completed during rehabilitation	Monthly	Contractor	SM	ECO	EA EM PM

Operational Phase

1	Site Establishment- Contractor's camp, waste water management,.	After all the structures that were erected for the construction of the bridge have been removed from site and the road is redirected back to its former state, the only structure that will be left standing is the bridge.	Prior to rehabilitation	to For the life of the bridge	Contractor	SM	ECO	EA EM PM
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7.3 Designated Storage Areas

Table 4: Environmental Management Measures for designated storage areas during construction for the upgrade of bridge.

Objectives	To ensure that cognisance is taken of proper storage of dangerous goods and hazardous materials so as to avoid accidents, spillage, and impacts to the environment								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Workshop, equipment and storage	Where possible and practical, all maintenance vehicles and equipment shall take place in the workshop area.	During construction		Contactor	Monthly	ECO	EA EM PM	
		All hazardous substances shall be stored in suitable containers and storage areas shall be bunded. This includes all substances like Carbon substances like fuel and oil as well as	During construction		Contactor	Monthly	ECO	EA EM PM	

		herbicides and battery acid.						
		A register shall be kept on all substances and be available for inspection for all times.	Throughout Project		Contractor	Monthly	ECO	EA EM PM
Construction Phase								
1	Workshop, equipment and storage	Servicing of vehicles within the site premises is prohibited	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Only emergency repairs shall be allowed on site and a drip tray shall be used for oil spillage prevention.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		In the event of a break down within the site perimeter, any oil spill shall be cleaned and appropriate environmental observation undertaken and recorded.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		The following shall apply: <ul style="list-style-type: none"> All contaminated soil shall be removed and be placed in containers. Contaminated soil shall be taken to one central point at the Contractors campsite 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; 	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

	<ul style="list-style-type: none"> The area around the fuel storage drum at the Contractor's Campsite shall also be remediated upon completion of the contract; and All oil spills must be reported to the ECO immediately. 						
	Under no circumstances shall waste be buried on site indiscriminately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No maintenance or repair of construction vehicles or machinery will occur on site during the construction phase. Maintenance of the vehicle and machinery will be performed off-site at a suitably designed workshop.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
	Movement of construction vehicles must be restricted to areas outside of sensitive areas on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	The Contractor shall ensure that if emergency site maintenance occurs on site, that there is no contamination of soil or vegetation (e.g. use of drip trays)	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
	All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM

		removed from the site.						
		The repair of vehicles must be done on paved surfaces to avoid leaking oil sipping in to the ground.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
2	Material use handling and storage	The Contractor will ensure that delivery drivers are informed of all procedures and restrictions required by this document. Such drivers will be supervised during off-loading by the person knowledgeable of the requirements.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Materials will be appropriately secured to ensure safe passage between destinations. Loose loads, (e.g. sand, stone chip, fine vegetation, refuse, paper and cement) will be covered.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported material.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		All material laydown areas and stock piles will be subject to the Site Manager's approval.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Imported fill/ soil/sand materials will be free of weeds, litter and contaminants.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

	Storage areas will be roofed with an impervious material, with a suitable overhang or side cladding. Rain water run-off will be channeled away from the storage area as required.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
	Hazardous and flammable substances must be stored and used in compliance with applicable regulation and safety instructions (MSDS files).	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
	Leaking equipment shall be repaired immediately or be removed from site to facilitate repair.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
None							
Operational Phase							
None							

7.4 Hazardous Delivery of Materials

Table 5: Environmental Management Measures for the delivery of hazardous materials for the upgrade of bridge.

Objectives.	<ul style="list-style-type: none"> Prevent Hazardous substances from entering the environment, and there causing water and soil pollution. To minimise the risk of contaminating the environment and in particular, the water source at a later stage. 							
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted
Pre-Construction Phase								

1	Transportation of material to site	<p>If there is a transport accident resulting in leakage or spillage, the following actions should be followed:</p> <ul style="list-style-type: none"> • Emergency action must be taken to contain the spilled material and to prevent further uncontrolled spillage or leakage. Immediate steps must be taken to clear the area being impacted from any material • These emergency actions are normally initiated by the driver of the vehicle and executed by emergency service personnel. • Emergency action should follow immediately after the incident and would normally last for three to four hours. 	Pre-Construction and Throughout Construction	Once-off	Contractor and ECO	SM	ECO	EA EM PM
Construction Phase								
1	Control of spillage	<p>The accidental or negligent spillage of any fuels or potentially hazardous substances during delivery must be cleaned up immediately using the most appropriate methodologies, equipment and materials.</p>	Throughout Construction and post construction phase.	At the time of the spill	Contractor	SM	ECO	EA EM PM
		<p>Necessary materials and equipment and chemicals should be available on the site to deal with spills of any of the hazardous materials present.</p>	Throughout Construction and operational phase.	Daily	Contractor	SM	ECO	EA EM PM

		A procedure must be put in place to distinguish between those spills that can be cleaned up by the Contractor and those that will require specialist input. The name and contact numbers of various clean up companies must be posted and visible at the camp office.	Throughout Construction and post construction phase.	Once-off	Contractor	SM	ECO	EA EM PM
		Any contaminated soil or water must be removed and stored in a skip until it can be disposed of at an appropriate disposal site.	Throughout Construction and post construction phase.	At the time of the spill	Contractor	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Emergency Action	<p>If the road accident is the cause of the spill or leakage, the driver of the vehicle must immediately notify the ECO of the spill clearly stating the location and the status of the accident itself, whether further leakage is still taking place, whether the vehicle of the load is on fire and what the traffic situation is.</p> <p>Until assistance arrives, the driver will be responsible for warning and if necessary regulating traffic. Bystanders must, under all circumstances be kept away from the</p>	Throughout Construction and post construction phase.	At the time of the spill	Contractor	Supplier	ECO	EA EM PM

		<p>vehicle and its load.</p> <p>It should be noted that the transporter retains primary responsibility for ensuring that adequate steps are taken to minimise the effect of an accident or incident on the public and the environment.</p>						
2	Remedial Action	<p>Remedial action to clean up any spillage remaining on site after an accident has to be initiated by the supplier.</p> <p>If the state becomes responsible for the remediation of the spilled site, the supplier is liable for all costs relating to the remedial action.</p>	Throughout Construction and post construction phase.	At the time of the spill	Contractor	Supplier	ECO	EA EM PM
		<p>The remedial action will depend on the nature and properties of the material, on the physical environment on which it has been spilled and on the severity of the spillage.</p>	Throughout Construction and post construction phase.	At the time of the spill	Contractor	Supplier	ECO	EA EM PM
Operational Phase								
None								

7.5 Water Management (including Storm Water, Water Sources, Wet Areas)

Table 6: Environmental Management Measures for the Water Management during the upgrade of bridge.

Objectives.	Storm-water Management							
	<ul style="list-style-type: none"> Effectively control storm water runoff to ensure that impacts to surface water resources are controlled, and erosion is not present on site. 							
	River Crossings							
	<ul style="list-style-type: none"> Minimise damage to river and stream embankments; No access roads through river and stream banks; No visible erosion scars on embankments once construction is completed; and Minimise erosion of embankments and subsequent siltation of rivers, streams and dams. 							
Wetlands								
<ul style="list-style-type: none"> No pollution or effluent is to come in contact with wetland areas. 								
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Storm water management	Section 30 of NEMA and Section 20 of the National Water Act make provision that anyone who causes degradation or pollution to the environment is responsible for preventing impacts from occurring, continuing, recurring and for the costs of the repair of the environment.	Throughout Construction	Daily	Contractor and ECO	SM	ECO	EA EM PM
		All waste water and contaminated run-off from the storage and working areas of the site must be channelled into existing waste water management system.	Throughout Construction	Daily	Contractor	SM	ECO	EA EM PM
		Contaminated liquids and sediments from the wastewater management system must	Throughout	Once-off	Contractor	SM	ECO	EA EM PM

		be disposed of at an appropriate permitted disposal site.	Construction					
2	Water Sources	Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the stakeholder involved.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		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. No construction shall take place in the wetland, streams and other river courses without the necessary water license from the Department of Water Affairs and Forestry;	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Water Sources	Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
2	Wetlands	No construction is to take place in wetland areas. Including no vehicular traffic in wet areas / wetlands.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM

		Only existing roads through such areas may be used with the approval of Eskom.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		The contractor shall use alternative methods of construction in such areas.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Berms should be created not closer than 10m from identified wetland areas, so as to ensure that no construction material and/or waste flow into wetland systems.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
3	Dust control	The dust control measures, such as watering, chemical stabilisation and the reduction of surface wind speed through the use of windbreaks and source enclosures must be put in place during construction activities. Emission control efficiencies of 50% can readily be achieved through the implementation of effective watering programme for unpaved roads and material handling points.	During construction	Monthly	C CECO	SM	ECO	EA EM PM
4	Storm water Management	Storm water shall be channelled away from construction activities.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM

	No storm water may be discharged into areas where construction is taking place.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
	Storm water flowing from the footprint of the proposed development may not be contaminated by any substances, whether the substance is solid, liquid or vapour or any combination thereof.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
	During construction, the Contractor will protect areas susceptible to erosion by installing necessary temporary and / or permanent drainage works as soon as possible and by taking suitable measures to prevent surface water concentration into nearby roadways or river courses.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
	Silt trap mechanisms will be installed on all temporary storm water channels. These silt traps will be regularly checked and serviced as required.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
	All excavated and filled slopes and stockpiles must be of a stable angle and capable of accommodating normal	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM

		expected flows.						
		Stabilisation of cleared areas to prevent and control erosion will be actively managed. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to specifics and ensure acceptable rehabilitation.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Traffic and movement over stabilised areas will be restricted. Any damage to stabilised areas will be repaired and maintained to the satisfaction of the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Where erosion and sedimentation occur, rectification will be carried out in accordance with details specified by the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Storm water Management	Any runnels or erosion channels will be backfilled and compacted, and the areas restored to a proper condition.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
None								

7.6 Fire Prevention

Table 7: Environmental Management Measures for fire prevention during the upgrade of bridge.

Objectives	<ul style="list-style-type: none"> No veld fires started by the Contractor's work force. No claims from Landowners for damages due to veld fires. No litigation. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Fire Prevention	The Contractor shall have fire fighting equipment on all vehicles working on site, and fire extinguishers will be placed in conspicuous areas that are in close proximity to possible sources of fire. The contractor must ensure that all workers on site are aware of the fire fighting equipment and trained to use them.	Construction	Throughout the construction phase.	C CECO	SM	ECO	EA EM PM
		The Contractor shall document a fire reduction management plan. The plan will identify sources of fire hazard, and appropriate measures to reduce the identified risk. The relevant authority will be notified of such potential fire hazards.	Prior to commencement of construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Fire	No fires are to be lit on site. Fires will only be allowed in demarcated areas within the PSS	Throughout	Daily	C CECO	SM	ECO	EA EM PM

Prevention	construction village. A fire will be constantly monitored if present.	Project					
	In terms of the Atmospheric Pollution Prevention Act (APPA), burning is not permitted for waste disposal.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Suitable precautions will be taken (e.g. suitable for fire extinguishers, welding curtains) when working with welding or grinding equipment near sources of combustion.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	All fire control mechanisms (fire fighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services. Such mechanism will be present and accessible at all times.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
	All staff on site will be made aware of general fire prevention and the name of the responsible person to alert to the presence of a fire.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
	The Contractor will advise the relevant authority of a fire outside of the demarcated area as soon as it starts and will not wait until he can no longer control it.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

Rehabilitation Phase	None
Operational Phase	None

7.7 Waste Management

Table 8: Environmental Management Measures for waste management during the upgrade of bridge.

Objectives	<ul style="list-style-type: none"> To keep the construction site and servitude neat and clean. Disposal of rubble and refuse in an appropriate manner Minimise litigation Minimise neighbour complaints No visible concrete spillage on the servitude 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Refuse and rubble removal	A method statement is required from the Contractor that includes the layout of the camp, management of ablution facilities and waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	
		The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of the construction.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	
		The Contractor shall provide a waste management system that will comply with the	Prior to construction	Weekly inspection	C CECO	SM	ECO	EA EM PM	

		legal requirements and be acceptable to Eskom.						
		The Contractor will supply waste collection bins where such is not available and all solid waste collected shall be disposed of at a registered disposal facility.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		A certificate of disposal shall be obtained by the Contractor and kept on site.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		In the case where a registered site is not available close to the construction site, the Contractor will be responsible to provide a method statement with regard to waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The disposal of waste shall be in accordance with all relevant legislation.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Refuse and rubble removal	The Contractor shall dispose all excess material on site in an appropriate manner and at a designated area.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All packaging material shall be removed from site and disposed of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

	No landfill may be used without the consent from the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Should a landfill be used for bio-degradable materials only, the rubble shall be compacted and at least 1m of the soil shall cover the waste material.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No Hazardous material e.g. oil or diesel fuel shall be disposed of in any unregistered waste site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No material shall be left on site that may harm man or animals.	Throughout Project	Weekly inspection	C CECO	SM	ECO	EA EM PM
	Any broken insulators shall be removed and all shards picked.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	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 on to foundations. Any spilled concrete shall be cleaned up	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

	immediately.						
	Under no circumstances shall solid waste be burned on site unless a suitable incinerator is available.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	The Contractor shall dispose all excess material on site in an appropriate manner and at a designated area.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	All packaging material shall be removed from site and disposed of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No material shall be left on site that may harm man or animals.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Any broken insulators shall be removed and all shards picked.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

	The washing of concrete trucks is prohibited on site. Any spilled concrete shall be cleaned up immediately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	The Contractor must provide DEAT with proof of confirmation of service provision from waste service providers for the removal of waste.	Throughout Project		C CECO	SM	ECO	EA EM PM
	A general site wide litter clean up will occur at least once a week.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
	Waste will be collected from site by a licensed contractor and removed to an appropriate waste disposal facility.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
	Wherever possible, materials will be recycled via a "Greens waste site". To this end, containers for glass, paper, metals, plastics, organic waste and hazardous wastes (e.g. oil, rags, paint containers, thinners) will be provided in sufficient quantity on the site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
	Waste will be removed during off-peak to minimise impacts on local traffic patterns traffic periods	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
	All waste generated during construction and operation of the facility must be removed and	Throughout	Weekly	C CECO	SM	ECO	EA EM PM

		disposed of at a waste facility permitted in terms of section 20 of the Environment Conservation Act, 1989(Act 73 of 1989)	Project					
		All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
Same as construction								
Operational Phase								
Same as construction								

7.8 Flora Management (including Vegetation Clearing, General, and Herbicides)

Table 9: Environmental Management Measures for vegetation clearing for the Upgrade of Ingula Bridge.

Objectives	<ul style="list-style-type: none"> • Minimise damage to vegetation by only clearing 8m vegetation along the centre of the servitude for access purposes. • Keep servitude as natural looking as possible. • No vegetation interfering with structures and statutory safety requirements upon completion of the contract. • Minimise possibility of erosion due to removal of vegetation by not de-stumping vegetation on river and stream embankments. • Minimise removal of plant material on river and stream embankments. • Eradication of alien invader and densifier species that cause a 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. 							
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted
Pre-Construction Phase								
1	Vegetation Clearing	The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM

		before such vegetation is removed.						
		No vegetation shall be pushed into heaps or left lying all over the servitude.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Stumps shall be treated with herbicide.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river and stream banks.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		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.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		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.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Upon completion of the bridge construction operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the bridge shall be removed / cut down.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. The	Throughout construction	Weekly	C CECO	SM	ECO	EA EM PM

		<p>application shall be according to set specifications and under supervision of a qualified technician.</p> <p>The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used.</p>						
		<p>It is recommended that a contractor or ecologist appointed for vegetation clearing should comply with the following parameters:</p> <ul style="list-style-type: none"> • The contractor must have the necessary knowledge to be able to identify protected species as well as species not to be interfering with; • The contractor must also be able to identify declared weeds and alien species that can be totally eradicated; and • The contractor must be in possession of a valid herbicide 	<p>Throughout construction</p>	<p>Throughout</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>

		applicators license.						
2	Harvesting of Medicinal Plants	The removal of protected vegetation and medicinal plants during construction must be done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Should Medicinal Plants be found on site, these plants will be demarcated and cordoned off.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Once demarcated, they will be removed and translocated to an established nursery. The plants shall be removed by a certified Nursery with experience in the handling and translocation of plants. The South African National Biodiversity Institute (SANBI) shall be contacted for assistance should a certified nursery not be available.	Throughout construction	When necessary		SM	ECO	EA EM PM
3	Protection of Indigenous Vegetation	Removal of indigenous plant material from the site or surrounding and adjacent land will not be	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		allowed.						
		Only indigenous vegetation is to be used in any landscaping which may be undertaken.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
4	Search and Rescue of Endangered Plant Species	<p>Should Protected or Endangered Plant Species be found on site they will be demarcated and cordoned off. An Ecological Management Plan will be compiled and submitted to DEAT for approval. The Ecological Management Plan will include the following:</p> <ul style="list-style-type: none"> • Ensure the persistence of the plant species; • Include a monitoring programme that monitors the size, stage structure and vigour of the plant species population and threats to the population; • Facilitate/augment natural ecological processes such as fire and herbivory; • Provide for the habitat and life history needs of important pollinators; • Minimise artificial edge effects (e.g. water runoff from developed areas and application of chemicals); • Include an ongoing monitoring and eradication programme for non-indigenous/alien invasive 	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		<p>species;</p> <ul style="list-style-type: none"> • Result in a Report to be submitted to the relevant authority (KZN DAEA, DEAT, etc) • Where feasible, appropriate genetic material such as seeds or propagules of the plant species shall be collected and stored at a licensed facility. 						
		<p>In situ conservation of Protected and Endangered Plant Species is preferable to ex situ conservation. Thus, should the plant species not “interfere” with the construction of a structure, the area surrounding the plant species shall be declared a “no-go” area as outlined in the Ecological Management Plan; and</p>	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		<p>The area surrounding the plant species shall be declared a “No-go” area and a buffer zone will be applied as outlined in the Ecological Management Plan;</p>	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
5	Alien Plant Control and Monitoring	<p>The Developer will be responsible for controlling all alien invasive species, as per the requirements of the Conservation of Agricultural Resources Act (CARA), during the contract and vegetation establishment</p>	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		period;						
		If exotic trees are identified they must be marked.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will be preferentially removed in entirety through mechanical means (e.g. chainsaw, bulldozer, hand-pulling of smaller specimens).	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The exotic trees must be cut down leaving the stumps behind to ensure that soil erosion is prevented; The trees can be chipped on site and the chips seeded with indigenous vegetation and spread over the site to allow for re-growth and to reduce erosion potential.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Immediately after being cut, a herbicide solution must be applied to the exotic trees to ensure no further growth. The person applying the herbicide must have read and understood the instructions. Care must be taken that there is no spillage of solution in the wetland and that the correct protective equipment	After being cut - immediately	Throughout	C CECO	SM	ECO	EA EM PM

		must be used.						
		If plants are not removed in entirety but cut-back and systematically treated with approved herbicides, then remaining plant will be monitored for re-growth / re-establishment.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Herbicides used must be approved by authorities and as per the supplier's specifications.	When necessary	Once-off	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will not be stockpiled. All such material removed will be removed from the site and dumped at an approved disposal site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		If during the establishment period any noxious or excessive weed growth occurs, such vegetation will be removed; and	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		It is the Developer's responsibility to implement a monitoring programme that will be instituted to ensure that re-growth of alien invasive plants species does not occur, or that such re-growth is controlled.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

Rehabilitation Phase								
1	Traffic on rehabilitated areas.	If disturbed areas are left to rehabilitate naturally, they must be frequently monitored and interventions put in place immediately should it become necessary. Special attention must be given to the potential for soil erosion and the associated environmental degradation. It is also essential to undertake alien vegetation control and management.	Post construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only persons / equipment required for maintenance thereof will be allowed to operate on such areas.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	Plant Material	All plant material used on site will be obtained from an approved nursery;	Post construction	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will remove plants containing any diseases and/or pests from the site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		Propagation of suitable indigenous vegetation that is quick to establish such as grasses, should be encouraged in areas where vegetation has been removed	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		On planting, there will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist; and	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Each plant brought onto site will be handled and packed in an approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on the site in a proper condition for successful growth (e.g. good plant specimens chosen, disease and/or pest free, potting material weed free, plants covered during transportation, containers in good condition);	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
3	Reseeding of Disturbed Areas	All reseeded activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for	Throughout construction	Wet Season	C CECO	SM	ECO	EA EM PM

		germination and rapid vegetation establishment;						
		The seed mix will be approved by the ECO prior to seeding;	Throughout construction	Wet Season once-off	C CECO	SM	ECO	EA EM PM
		Seeds should be covered by use of an agricultural roller or similar mechanism;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures; and	Throughout construction	Three monthly interval	C CECO	SM	ECO	EA EM PM
		Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident within the first two growing seasons.	Throughout construction	Growing seasons	C CECO	SM	ECO	EA EM PM
4	Alien Plant Control and Monitoring	Alien plant control will be conducted for a period of two years after the rehabilitation phase is completed.	Throughout construction	Monthly for two years	C CECO	SM	ECO	EA EM PM
5	Soil and Land Capability	All excess building material and rubble must be collected and disposed of at a suitably registered landfill site.	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM

		Soils must be ripped to refusal or a minimum of 300mm prior to seeding.	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM
		All areas must be profiled to tie in with adjacent terrain. Where necessary suitable soil must be imported to obtain a suitable profile.	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM
		Suitable erosion control measures must be installed in areas where erosion may occur;	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM
		Apply a suitable mixture of N:P:K fertiliser prior to seeding;	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM
		Harrow the disturbed areas after spreading the topsoil and fertilizer uniformly;	Throughout construction	Once-off	C CECO	SM	ECO	EA EM PM
		Rehabilitated and profiled areas must be inspected for erosion every three months for the first two years. Additional measures must be implemented to remediate erosion where it is observed.	Throughout construction	Every three months for two years	C CECO	SM	ECO	EA EM PM
6	Vegetation Clearing	The Contractor will remove plants containing any disease and/ or pests from the site.	Prior to construction	Weekly	C CECO	SM	ECO	EA EM PM

Operational Phase

None

7.9 Fauna Management**Table 10: Environmental Management Measures for Fauna Management for the upgrade of bridge.**

Objectives	<ul style="list-style-type: none"> Minimise disruption of farming activities (No stock losses where construction is underway); Minimise disturbance of animals; Minimise interruption of breeding patterns of birds; and No litigation concerning stock losses and animal deaths. 							
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted
Pre-Construction Phase								
1	Planning	Construction planning must be undertaken prior to construction to ensure that it does not conflict with breeding seasons.	One week	Once off	C CECO	SM	ECO	EA EM PM
		The breeding sites of raptors and other wild bird species shall be taken into consideration during the planning of the construction programme.	One week	Once off	C CECO	SM	ECO	EA EM PM
		The Contractor shall take all the necessary precautions and it is recommended that sites on parallel existing lines be noted, i.e. tower numbers. This information must then	When necessary	When necessary	C CECO	SM	ECO	EA EM PM

		be given to the avian specialist via the Environmental Advisor so that the necessary action can be taken timeously.						
2	Fencing	Ensure that suitable fencing is erected prior to the commencement of construction to ensure that live stock does not wonder into dangerous areas.	Throughout the project.	Weekly inspections.	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction	The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM

		of a written note from the Landowner.						
		Should any new sites or nests be found, during the construction process, that was not known or have been noted before, each site shall be assessed for merit and the necessary precautions be taken to ensure the least disturbance.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
2	Aquatic Ecology	Flow continuity was be maintained in the Braamhoekspruit River throughout the construction phase. This is essential to ensure the ongoing viability of aquatic communities downstream.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		No construction vehicles are to be allowed to indiscriminately drive through the riparian areas.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		No dumping of waste should take place in the riparian zone.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		The characteristics of the stream bed are likely to be altered locally. Rough rocks easily abrade and damage fish	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		skin, and are a common cause of skin infections among fish. It is likely that any rubble left in the stream will lead to chronic (low-level) skin infections among fish for a long period. This must be mitigated by ensuring that the rock and rubble is removed upon completion of construction.						
		Throughout the construction phase bio-monitoring must be implemented.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Aquatic Ecology	All areas affected by construction shall be rehabilitated upon completion of the construction phase. Areas should be reseeded with indigenous grasses as required.	Post construction	Post construction	C CECO	SM	ECO	EA EM PM
Operational Phase								
Same as construction phase.								

7.10 Erosion, Donga and River Crossings

Table 11: Environmental Management Measures for the management of Erosion, Donga and River Crossings for the upgrade of bridge.

Objectives	<ul style="list-style-type: none"> • Minimise erosion damage on donga crossings and embankments. There should be no visible damage caused by construction activities. • Minimise impeding the natural flow of water • Minimise initiation of erosion through donga embankments 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Erosion and donga Crossings	Crossing of dongas and eroded areas shall be thoroughly planned.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	
2	River Crossings	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.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	
		New drifts and bridges shall only be constructed with the approval of Eskom and the Landowner and at the discretion of the Environmental Control Officer.	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM	
		All structures constructed for access purposes shall be properly designed and drawings of such structures	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM	

		shall be available for record purposes.						
Construction Phase								
1	Erosion and Donga Crossings	Water diversion berms shall be installed at donga crossings to ensure runoff water on the servitude does not run into dongas and cause an erosion hazard.	Throughout construction	Monthly	C			
		Suitable erosion containment structures shall be constructed at donga crossings where required and viable.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No unplanned / improperly planned cutting of donga embankments is allowed as this leads to erosion and degradation of the environment.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	River Crossings	No roads shall be cut through river and stream banks as this may lead to erosion causing siltation of streams and downstream dams.	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM
3	Aquatic Ecology	The bridge design must ensure the creation of turbulent flow in the system is minimised to prevent downstream erosion. Both support pillars should be constructed within the active channel.	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM
		The duration of impacts on the stream should be minimised as far as possible by ensuring that the duration of time in which flow alteration and	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM

		sedimentation will take place is minimised.						
		During construction erosion berms shall be installed to prevent gully formation and siltation of the Braamhoekspruit river. This is essential to ensure the ongoing viability of the aquatic communities downstream of the proposed dam wall which are dependant on cobble substrates which are free of sediment deposition.	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
None.								
Operational Phase								
None.								

7.11 Claims from Damages

Table 12: Environmental Management Measures for Claims and Damages for the upgrade of bridge.

Objectives	<ul style="list-style-type: none"> • Minimise complaints from Landowners • Prevent litigation due to outstanding claims by ensuring that claims are settled within one (1) month. • Successful completion of the contract and all Landowners signing release forms within 6 months of completion of the project. 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
None.									
Construction Phase									
1	Claims from	All damage to Eskom property shall be recorded	Throughout	When	C CECO	SM	ECO	EA EM PM	

Damages	immediately.	construction	necessary				
	The Environmental Control Officer should also keep a photographic record of such damage.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
	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.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	All claims for damage should be directed to the Environmental Control Officer for appraisal.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	The Contractor shall be held liable for all unnecessary damage to Eskom property.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	A register shall be kept of all complaints from Landowners.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
	All claims shall be handled immediately to ensure timeous rectification / payment.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
None.							
Operational Phase							
None.							

7.12 Residential Property and Interaction with Adjacent Landowners

Table 13: Environmental Management Measures for Residential Property and Interaction with Adjacent Landowners for the upgrade of bridge.

Objectives	<ul style="list-style-type: none"> Control actions and activities in close proximity to inhabited areas; No complaints from Landowners; No damage to private property. 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Planning	All private residences will be demarcated on a site layout plan prior to construction phase commencing.	One day	Weekly Inspections	C CECO	SM	ECO	EA EM PM	
Construction Phase									
1	Construction execution	The Contractor shall under no circumstances interfere with the property of adjacent landowners.	Throughout project	Weekly Inspections	C CECO	SM	ECO	EA EM PM	
		If water is required, the Contractor shall negotiate with the relevant Landowner and a written agreement shall be drawn up	Throughout Project	Weekly Inspections	C CECO	SM	ECO	EA EM PM	
Rehabilitation Phase									
Same as construction phase.									
Operational Phase									
Same as construction phase.									

7.13 Noise / Working Hours

Table 14: Environmental Management Measures for Noise / Working Hours for the upgrade of bridge.

Objective	To ensure that noise is managed in such a manner that no complaints are received.								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
None									
Construction Phase									
1	Noise	In order to prevent noise impacts resulting from construction activities, working hours are to be limited to weekdays between 7h00 to 17h00.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM	
		All heavy transporting vehicles shall be fitted with noise dampening devices that are operating in good condition.	Pre-Construction phase only	Throughout	C CECO	SM	ECO	EA EM PM	
		If certain construction requires work outside of these hours, all adjacent landowners have to be informed prior to any construction outside of the specified hours commencing.	When necessary	Once – off, if necessary	C CECO	SM	ECO	EA EM PM	
		If there are complaints about low frequency noise after the refurbishment, Eskom would have to get a noise expert to do measurements and recommend mitigation.	When necessary	If necessary					
Rehabilitation Phase									

Same as Construction Phase.
Operational Phase
Same as Construction Phase

7.14 Archaeology

Table 15: Environmental Management Measures for Archaeology for the upgrade of bridge.

Objective	<ul style="list-style-type: none"> • Protection of archaeological sites and land considered to be of cultural value; • Protection of known sites against vandalism, destruction and theft; and • The preservation and appropriate management of new archaeological finds should these be discovered during construction. 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Planning	Ensure all known sites of cultural, archaeological, and historical significance are demarcated on the site layout plan, and marked as no-go areas.	Throughout Project	Weekly Inspection	C CECO	SM	ECO	EA EM PM	
Construction Phase									
1	Emergency Response	Should any heritage resources be exposed during excavation for the purpose of construction, construction in the vicinity of the finding must be stopped.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM	
		Should any heritage resources be exposed during excavation or be found on site, a registered heritage specialist must be called to site for inspection.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM	
		Should any heritage resources be exposed during	When necessary	Throughout	C CECO	SM	ECO	EA EM	

	excavation or be found on site, the relevant heritage resource agency must be informed about the finding;						PM
	Under no circumstances may any heritage material be destroyed or removed from site;	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Should remains and/or artefacts be discovered on the site during earthworks, all work will cease in the area affected and the Contractor will immediately inform the Construction Manager. The Construction Manager will source services of a qualified archaeologist to undertake the necessary processes.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
	Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
Same as construction phase.							
Operational Phase							
Same as construction phase.							

7.15 Temporary Road Diversion

Table 16: Environmental Management Measures for the temporary road diversion for the upgrade of bridge.

Objectives	To provide an alternative route for the local and regional drivers during the construction of the bridge								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									
1	Mobilization of Equipment and transport of construction materials.	Vehicles transporting sand shall be covered with tarpaulin. Stockpiled sand shall be wetted particularly in windy conditions.	Pre-Construction phase only	Throughout	C CECO	SM	ECO	EA EM PM	
2	Procurement of Construction Materials	Adopt a competitive fair pricing among the hardware store owners within the project area	Pre-Construction phase only	Throughout	C CECO	SM	ECO	EA EM PM	
		Concrete will be required throughout the construction period. Demand will be greatest during the bridge construction works. Concrete may be ordered from local suppliers or batched on site. Movement of material, equipment and supply vehicles will generate	Pre-Construction phase only	Throughout	C CECO	SM	ECO	EA EM PM	

		<p>construction traffic; site personnel will generate a small amount of traffic.</p> <p>Access to and from the construction site will be controlled and restricted to appropriate and safe road that will be diverted.</p> <p>As with any major road diversion, the haulage of materials to and from the site will create a significant temporary impact to both road users and to residents living along the proposed temporary road diverted.</p>						
Construction Phase								
1	Operation of Quarry Sites on River Banks and near other water bodies.	No work will be permitted to quarry sites with fine sediment	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
		The depth of extraction from river will be limited.	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
		Identify the riverbed, which has excessive sediment, and limit the excavation to ideal section and	During construction	Throughout	C CECO	SM	ECO	EA EM PM

		depth of the river.	n only.					
		Locate quarry site away from the populated centres, drinking water intakes and tributaries used by the community for domestic purposes.	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
		Depth and area of extraction limitation should be imposed to prevent loose materials disturbance that may trigger siltation.	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
2	Application of Bitumen/ Asphalt Overlying	Avoid all possible spills wherever possible. Have emergency measures established in case of major spills and do not allow work during rainy days.	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
		Ensure that the contractor implement adequate safety and warning measures/ devices during construction/ maintenance activities	During construction only.	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Redirection of the by-pass road to its	Archaeological surveys and testing will be undertaken prior to the main works starting in order to	Pre-Construction	Before the operation of	C CECO	Throughout	ECO	EA EM PM

	original location.	resolve archaeological issues.	phase only	the bridge				
2	De-commissioning and abandonment of Auxiliary Facilities	All temporary structures shall be removed to prevent encroachment within the road right-of-way.	Pre-Construction phase only	Throughout	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Comfortable Travel	Responsible institutional order and existing regional development policies prevail;	For the life of the Bridge	Throughout	C CECO	SM	ECO	EA EM PM
		Adherence to land use and zoning regulation.	For the life of the Bridge	Throughout	C CECO	SM	ECO	EA EM PM

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Warren Kok

APPENDIX A

Project Management Schedule during the construction for the Upgrade of Ingula Bridge