# REPORT

# White Mfolozi Bridge and L2598 Link Road

**Environmental Management Programme** 

Client: KZN Department of Transport

Reference: MD2485\_R001\_D04

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# **Table of Contents**

1	INTRODUCTION	1
1.1	Project Background	1
1.2	Project Description	1
1.2.1	Link Road	1
1.2.1.1	Bridge	2
1.2.1.2	Culvert Upgrade	2
1.3	Purpose of the Environmental Management Programme (EMPr)	3
1.4	Objectives of the EMPr	4
1.5	Scope of the EMPr	5
1.6	Structure of the EMPr	6
1.7	The EMPr as a "Live" Document	6
1.7.1	Plan	7
1.7.2	Do	7
1.7.3	Check	7
1.7.4	Act	7
1.8	Project Team Details	8
1.8.1	Project Developer	8
1.8.2	Details of the Environmental Assessment Practitioner	9
2	SITE DESCRIPTION	11
2 2.1	SITE DESCRIPTION Site Description and Ownership	11 11
2 2.1 2.2	SITE DESCRIPTION Site Description and Ownership Co-ordinates	11 11 11
2 2.1 2.2 2.2.1	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road	11 11 11 11
2 2.1 2.2 2.2.1 2.2.2	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert	11 11 11 11 11
2 2.1 2.2 2.2.1 2.2.2 2.2.2 2.2.3	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits	11 11 11 11 11 11
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.3 2.2.4	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction	11 11 11 11 11 11 12
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp	11 11 11 11 11 11 12 12
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.3 2.2.4 2.2.5 2.3	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments	11 11 11 11 11 11 12 12 12
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses	11 11 11 11 11 11 12 12 12 12
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees	11 11 11 11 11 11 12 12 12 12 12 12 12
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household	11 11 11 11 11 11 12 12 12 12 12 12 13 13
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage	11 11 11 11 11 11 12 12 12 12 12 12 13 13 13
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts	11 11 11 11 11 11 12 12 12 12 12 12 12 1
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5 2.3.6	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts Shembe Site of Worship	11 11 11 11 11 12 12 12 12 12 12 12 13 13 13 14 14
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5 2.3.6 2.3.7	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts Shembe Site of Worship Early Iron Age	11 11 11 11 11 11 12 12 12 12 12 12 12 1
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5 2.3.6 2.3.6 2.3.7 2.3.8	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts Shembe Site of Worship Early Iron Age Graves	11 11 11 11 11 12 12 12 12 12 12 12 12 1
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5 2.3.6 2.3.7 2.3.8 2.3.8.1	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts Shembe Site of Worship Early Iron Age Graves Cultural Landscapes	11 11 11 11 11 12 12 12 12 12 12 12 12 1
2 2.1 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4 2.3.5 2.3.6 2.3.7 2.3.8 2.3.8.1 2.3.8.2	SITE DESCRIPTION Site Description and Ownership Co-ordinates Bridge and Link Road Culvert Borrow Pits Water Abstraction Construction Camp Description of the Sensitive Environments Watercourses Provincially Protected Plants and Protected Trees Affected Household Heritage Early Stone Age Artefacts Shembe Site of Worship Early Iron Age Graves Cultural Landscapes	11 11 11 11 11 12 12 12 12 12 12 12 12 1



2.4	Sensitivity Map	21
3	LEGAL FRAMEWORK	23
3.1	Legal Framework	23
3.1.1	EIA Regulations (2014 as amended in 2017)	23
3.2	National Water Act (Act No. 36 of 1998)	23
3.3	Other Relevant Legislation / Policies / Guidelines	23
3.4	Applicable Documentation	26
4	ENVIRONMENTAL CODE OF CONDUCT	27
5	MANAGEMENT AND MONITORING PROCEDURES	28
5.1	Organisational Structure and Responsibilities	28
5.2	Monitoring	30
5.3	Reporting Procedures	31
5.3.1	Documentation	31
5.3.2	Environmental Register	31
5.3.3	Non-Conformance Report	32
5.3.4	Environmental Emergency Response	32
5.3.5	Public Communication and Liaison with I&APs	33
6	ENVIRONMENTAL AWARENESS PLAN	34
6.1	General Topics	34
6.2	Activity Specific Topics	34
6.3	Take-home Topics	35
7	IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)	36
7.1	Pre-Construction (Planning & Design) Phase	37
7.1.1	Authorisations, Permits and Licences	37
7.1.2	Appointment of Contractor	37
7.1.3	Appointment of an ECO	37
7.1.4	Preparation of Method Statements	37
7.1.5	Public Communication	37
7.1.6	Protected Flora	38
7.1.7	Affected Household and Fence Lines	38
7.1.8	Demarcation of the Construction Corridor and NO-GO Areas	38
7.1.9	Relocation of Services	39
7.2	Construction Phase	39
7.2.1	Site Establishment	39
7.2.2	Pollution Prevention Measures	40
7.2.3	Worker Conduct	41
7.2.4	Clearing and Protection of Vegetation and Fauna	41
7.2.5	Heritage & Palaeontology	42
7.2.6	I rattic	43



7.2.7	Safety	43
7.2.8	Construction Vehicles	44
7.2.9	Topsoil	44
7.2.10	Soil Erosion and Sedimentation	44
7.2.11	Waste Management	45
7.2.12	Wastewater	46
7.2.13	Watercourse Management	46
7.2.14		47
7.2.15	Air Quality Pollution Management and Odour Control	48
7.2.16	Dust Control	48
7.2.17	Stormwater Management	40
7.2.10	Social	49
7.2.13	Post Construction Phase	49
7.3		49
7.3.1	Construction areas	49
733	Materials and Infrastructure	50
7.3.3	Rehabilitation	50
7.3.5	End of Contractor Services	51
7.3.6	Waste Management	52
8	METHOD STATEMENT FOR WATERCOURSE CROSSINGS	53
8.1	General Guidelines	53
8.2	Site Preparation Activities	54
8.3	Site Establishment	56
8.4	Site Access	56
8.5	Road Construction	57
8.6	Excavations	57
8.7	River Crossing	58
8.8	Specific Measures for Working within or Near Rivers and Streams	60
8.8.1	Working Servitude Clearing:	60
8.8.2	Culvert Watercourse Crossing	63
8.9	Piling	63
8.10	Abutment and Pier Construction	64
8.11	Deck Construction	65
8.12	Rehabilitation Activities	65
8.12.1	Site Preparation Prior to Re-vegetation	65
8.12.2	Conceptual Rehabilitation Strategy	65
8.12.2.1	Crossings, Road Batters and Roadside Drains	68
8.12.2.2	Re-vegetation of Disturbed Areas	69
8.12.2.3	Road Batters, Road Reserve and Roadside Drains	69



9	METHOD STATEMENT FOR INVASIVE ALIEN PLANT ERADICATION	71
9.1	Guidance on Invasive Alien Plant Control	71
9.2	Eradication Strategy for Famine Weed	74
10	COMPLIANCE WITH THE ENVIRONMENTAL SPECIFICATION	76
10.1	Penalties	76
10.2	Removal from Site and Suspension of Works	77

# **Table of Tables**

6
8
9
11
11
11
17
23
28
36
62
66
76

# **Table of Figures**

Figure 1: Locality of the proposed bridge and culvert in relation to the L2598 (link road) and D2047 road	d 3
Figure 2: Mitigation Hierarchy	4
Figure 3: Deming Cycle of Continuous Improvement	6
Figure 4: Likelihood of impact rating for the desktop mapped watercourses	12
Figure 5: Location of nationally and provincially protected plant species identified within the study corric	lor
	13
Figure 6: Location of residence to be displaced	14
Figure 7: Early Stone Age Artefacts	14
Figure 8: Shembe Site	15
Figure 9: Grave Sites and Potential Grave Sites	16
Figure 10: Palaeontological sensitivity for the study area	21
Figure 11: Sensitivity map	22



# **Appendices**

Appendix A: EAP's CVs Appendix B: Stormwater Management Plan Appendix C: Spill Contingency Plan Appendix D: Construction Method Statement Appendix E; Chance Find Protocol Appendix F: Conceptual Rehabilitation Plan



# Acronyms

CBACritical Biodiversity AreaDoTDepartment of TransportDWADepartment of Water AffairsDWSDepartment of Water and SanitationEAEnvironmental AuthorisationEAEnvironmental Assessment PractitionerECOEnvironmental Control OfficerEDTEADepartment of Economic Development, Tourism and Environmental AffairsEKZNWeZemvelo KwaZulu-Natal WildlifeEMPrEnvironmental Management ProgrammeERPEmergency Response PlanESAEcological Support AreaGISGeographic Information SystemsGNRGovernment Notice RegulationHIAHeritage Impact AssessmentIAPPInvasive Alien PlantIBAPIntegrated Development PlanIERIntegrated Development PlanIEMPRIntegrated Davelopment PlanIEMIntegrated Davelopment PlanIEMIntegrated Environmental ManagementITBIngonyama Trust BoardKZNKwaZulu-NatalMMPMaitenance Management PlanMSDSMaterial Safety Data SheetLUSMLand Use and Soil ManagementNCRNon-Conformance ReportNEM:AQANational Environmental Management: Air Quality Act (Act No. 39 of 2004)NEM:AQANational Environmental Management: Biodiversity Act (Act No. 10 of 2004)
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EAEnvironmental AuthorisationEAPEnvironmental Assessment PractitionerECOEnvironmental Control OfficerEDTEADepartment of Economic Development, Tourism and Environmental Affairs <i>EKZNWeZemvelo</i> KwaZulu–Natal WildlifeEMPrEnvironmental Management ProgrammeERPEmergency Response PlanESAEcological Support AreaGISGeographic Information SystemsGNRGovernment Notice RegulationHIAHeritage Impact AssessmentIAPInvasive Alien PlantISAInterested and Affected PartyIDPIntegrated Development PlanIEMIntegrated Environmental ManagementITBIngonyama Trust BoardKZNKwaZulu-NatalMMPMaintenance Management PlanMSDSMaterial Safety Data SheetLUSMLand Use and Soil ManagementNCRNon-Conformance ReportNEM:AQANational Environmental Management: Air Quality Act (Act No. 39 of 2004)NEM:BANational Environmental Management: Biodiversity Act (Act No. 10 of 2004)
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NEM:PAA National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA National Environmental Management: Waste Act (Act No. 36 of 1998) (as amended)
NEMA National Environmental Management Act (Act No. 107 of 1998) (as amended)
NFEPAs National Freshwater Ecosystems Priority Areas
NHRA National Heritage Resources Act (Act No. 25 of 1999)
NWA National Water Act (Act No. 36 of 1998)
PM Project Manager
RoW Right of Way
SANBI South African National Biodiversity Institute
SANParks South African National Parks
SARTSM South African Road Traffic Signs Manual
SDC Safe Disposal Certificate
obo dale Disposal Certificate
SDF Spatial Development Framework



SEMA	Suite of Environmental Management Acts
SEPA	State Environmental Policy Act
SHE	Safety, Health and Environmental
SHEQ	Safety, Health, Environment and Quality
SPCA	Society for the Prevention of Cruelty to Animals
ULM	Ulundi Local Municipality
WUL(A)	Water Use Licence (Application)



# Glossary

Accident	A road vehicle accident.
Alien Species	(a) A species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal
	without human intervention as set out in the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).
<b>Building and Demolition</b>	Building and demolition waste means waste, excluding hazardous waste,
Waste	produced during the construction, alteration, repair or demolition of any
	structure, and includes rubble, earth, rock and wood displaced during that
Oliont	construction, alteration, repair or demolition.
Client	ownership.
Client's Project	The person appointed by the client who is responsible for the construction
Manager	site as a whole.
Contractor	Companies appointed on behalf of the Developer to undertake activities, as well as their sub-contractors and suppliers.
<b>Construction Project</b>	The team consists of a Project Manager as well as a Safety, Health and
Management Team	Environmental (SHE) Officer.
Culvert	A pipe or box intended to convey water under a highway, railroad, canal, or similar facility.
Degradation	The lowering of the quality of the environment through human activities e.g. river degradation, soil degradation.
Domestic Waste	Domestic waste means waste, excluding hazardous waste, that emanates
	from premises that are used wholly or mainly for residential, educational,
	health care, sport or recreation purposes.
Emergency	An undesired event that results in a significant environmental impact and
	requires the notification of the relevant statutory body such as a local or provincial authority.
Environment	In terms of the National Environmental Management Act (NEMA) (Act No.
	107 of 1998)(as amended), "Environment" means the surroundings within
	which humans exist and that are made up of:
	(i) the land, water and atmosphere of the earth;
	(ii) micro-organisms, plants and animal life;
	(iii) any part or combination of (i) of (ii) and the interrelationships among and between them; and
	(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Aspect	An environmental aspect is any component of a Contractor's construction
Environmental Central	An individual nominated through the Developer to be present on site to get an
Environmental Control	An individual nominated through the Developer to be present on-site to act on



Officer	behalf of the Developer in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.
Environmental	A detailed plan of action prepared to ensure that recommendations for
Management	enhancing or ensuring positive impacts and, limiting or preventing negative
Programme	environmental impacts are implemented during the life-cycle of a project. It is
	an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, long-term maintenance, and, decommissioning of a project are prevented and that positive benefits of the projects are enhanced.
General Waste	General waste means waste that does not pose an immediate hazard or
	threat to health or to the environment, and includes -
	(i) domestic waste;
	(ii) building and demolition waste;
	(iii) business waste; and
	(iv) inert waste.
General Waste Landfill	A waste disposal site that is designed managed and permitted to allow for the
Site	disposal of general waste.
Hazardous Waste	A waste disposal site that is designed managed and permitted to allow for the
Landfill Site	disposal of hazardous waste.
Impact	A description of the potential effect or consequence of an aspect of the
	development on a specified component of the biophysical, social or economic
	environment within a defined time and space.
Maintenance Activities	For the purpose of this document, maintenance refers to the relocation of the existing services, the provision of subsoil drainage, replacement of three culvert, the widening of the road to accommodate sidewalks in some areas, the provision of surface drainage facilities, and the rehabilitation of the upgraded road layer works and surfacing, including the associated ancillary works. There will also be an increase in the elevation of the existing road.
Mitigation	Measures designed to avoid, reduce or remedy adverse impacts.
Principal Agent	The principal agent is appointed by the Developer to oversee the overall project management and the management of the professional project team.
Re-use	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles
Recycle	A process where waste is reclaimed for further use this involves the
	separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.
Rehabilitation	Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post- reinstatement re-vegetation of a disturbed area and the insurance of a stable land surface. Re-vegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e.



	promote rapid vegetation establishment
Pood Posorvo	A corridor of land, defined by co-ordinates and proclamation, within which the
Road Reserve	A control of land, defined by co-ordinates and proclamation, within which the
	road, including access intersections or interchanges, is situated. A road
	reserve may, or may not, be bounded by a fence.
Road Width	For the purposes of this document, the road width is defined as the area
	within the road reserve i.e. fence line to fence line, but also includes all areas
	beyond the road reserve that are affected by the continuous presence of the
	road, e.g. a reach of a watercourse.
Safety, Health and	The SHE Officer is a Contractor representative, responsible for the safety,
Environmental (SHE)	health and environmental aspects during maintenance. The SHE Officer will
Officer	be responsible for the day-to-day monitoring of the EMPr and Health and
	Safety Plan
Waste	Waste means any substance, whether or not that substance can be reduced.
	re-used, recycled and recovered -
	(i) that is surplus unwanted rejected discarded abandoned or
	disposed of:
	(ii) which the generator has no further use of for the purposes of
	noduction:
	(iii) that must be treated or disposed of: or
	(iii) that must be treated of disposed of, of
	(IV) that is identified as a waste by the Minister by notice in the Gazette,
	and includes waste generated by the mining, medical or other sector,
	but—
	<ul> <li>a by-product is not considered waste; and</li> </ul>
	o any portion of waste, once re-used, recycled and recovered,
	ceases to be waste.
Waste Disposal Facility	Waste disposal facility means any site or premise used for the accumulation
	of waste with the purpose of disposing of that waste at that site or on that
	premises.
Workforce	The entire project team including people employed by the Principal Agent or
	the Contractor, persons involved in activities related to the project, or person
	present at or visiting the construction area, including permanent contactors
	and casual labour.



# **1** INTRODUCTION

## 1.1 **Project Background**

Royal HaskoningDHV were appointed by the Province of KwaZulu-Natal: Department of Transport (hereafter referred to as KZN DoT) to undertake the;

- engineering studies;
- preliminary design;
- environmental studies;
- detailed design, and;
- the construction supervision

of a new river crossing over the White Mfolozi River and linking up to an existing road i.e. the L2598.

The proposed bridge crossing is located approximately 12 km west of the town of Ulundi within the Ulundi Local Municipality, KwaZulu-Natal (*Figure 1*). The proposed bridge and link road infrastructure will serve to link the KwaMphothi and Mabedlana communities situated east of the White Mfolozi River to the KwaMbambo community situated west of the White Mfolozi River. The study area can be accessed off the Main Road P734 from Ngoma on the eastern side of District Road D2047 and via the P47-3 from Melmoth on the western side.

## 1.2 **Project Description**

#### 1.2.1 Link Road

The first 3.6 km of L2598 is an existing gravel road that starts on Main Road P734 between the Mabedlana Mountains on the Ulundi side near the Mphothi Primary School. Thereafter the route is made up of tracks that traverse through the KwaMphothi area until the proposed site for the new river crossing (White Mfolozi River Bridge) is reached. The route then continues in a north western direction where it intersects with District Road D2047. The link road has a total length of approximately 6.956 km.

Three (3) link road alternatives were investigated. The existing portion (first 3.6 km) of all 3 options is similar as this is an existing road and the proposed upgrades are restricted by the residential properties that lie directly adjacent to the road. The remaining greenfield (undeveloped) sections of the link road were split into three alternatives:

- **Option 1** (Preferred) deviates from the existing track on the eastern approach.
- **Option 2** similar to Option 1 on the eastern approach, however, the link road has to traverse through a hilltop on the western approach resulting in large cut operations.
- **Option 3** follows an existing track.

*Link Road Option 1* is the preferred option and the subject of this EMPr.

The proposed link road is currently a Class 4 Gravel Rural Collector Road with a 20 m road reserve. It is proposed to re-declare the whole route from P47-3 through to P734 as District Road D2047. The existing L2598 will be included in the re-declaration. The cross section for this class of road according to KZN DoT standards (as per SD210 Type 6) is a 6 m road carriageway on a 7 m wide pavement, comprising two 3 m lanes and two (2) 0.45 m shoulders.



#### 1.2.1.1 Bridge

The proposed bridge must have a carriageway width commensurate with the approach road i.e. two 3 m wide lanes with 0.5 m wide shoulders on either side (these edge details for the kerb and channel at the bridge are in accordance with the KZN DoT design standard (2016) details. This configuration results in a total of 7 m carriageway. For a design speed of 60 km/hr (over a 180 m long bridge), a 1.5 m wide raised pedestrian sidewalk is required on the up-stream side. This provides an overall surfaced road width of 8.5 m inclusive of the 1.5 m sidewalk and is a proposed Class 4 bridge cross-section.

Three (3) bridge crossing options were considered during the Basic Assessment (BA) study i.e.:

- Option 1 (Preferred) This crossing alignment has fairly well defined banks. The channel depicts visible rock with rock foundations at deeper levels on the D2047 side. On the P734 side there are Eskom power lines which have been avoided by moving the structure up-stream, the alignment also avoids the game fence on this bank. On the D2047 side, the alignment negotiates between dwellings encroaching onto dwellings fences. The steep slopes on either bank results in the need for big cuts and the bridge height is determined by the roads vertical alignment not by hydrological requirements. The bridge length at this alignment is 180 m. This is the preferred crossing point; the bridge on this alignment is at right angles to the river.
- Option 2 This option is along a rocky ridge in the river and runs directly under Eskom power lines. This ridge would impede water flow and militates against this site. On the P734 side, the abutment would be in the exact position of the current Eskom power line. On the D2047 side, the road will be at the tip of a very steep hill and would require expropriation of dwellings on either side of the hill.
- Option 3 The Main Road P734 banks on Option 3 are well defined but are erodible as seen on Google imagery. The D2047 side banks are not so well defined. The waterway has an overgrown island which would impede flow and possibly trap debris under the bridge. To get the abutments out of the main channel, the bridge required for this alignment is 240 m.

This EMPr focuses on the preferred bridge crossing i.e. Option 1.

#### 1.2.1.2 Culvert Upgrade

The bridge design team received a request by the community to upgrade one (1) culvert at the Mooti River crossing on an existing gravel road linking onto the existing L2598 (the proposed link road) due to the following reasons:

- This road is overtopped during heavy rainfall events and the community cannot cross over the Mooti River.
- The over-topping will make the proposed link road and bridge structure inaccessible to the community during heavy rains.
- The community want the existing pipe to be replaced by a larger pipe as part of the White Mfolozi and Link Road contract.
- There will be no temporary deviation of the road to allow for the construction works.
- The construction work will be less than 30 days.

It is proposed that this culvert replacement is included as part of the BA study and the EMPr for the White Mfolozi Bridge and L2598 link road.





Figure 1: Locality of the proposed bridge and culvert in relation to the L2598 (link road) and D2047 road

## **1.3** Purpose of the Environmental Management Programme (EMPr)

In terms of The Constitution of the Republic of South Africa (1996), everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for benefit of present and future generations, through reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (Section 24). The needs of the environment as well as affected parties should thus be integrated into overall project management.

The Constitution is underpinned by the suite of Specific Environmental Management Acts (SEMAs) – including the National Environmental Management Act (Act No. 107 of 1998, NEMA), National Environmental Management Waste Act (Act No. 59 of 2008, NEM:WA), National Environmental Management Air Quality Act (Act No. 39 of 2004, NEM:AQA), National Environmental Management Biodiversity Act (Act No. 10 of 2004, NEM:BA), National Environmental Management Integrated Coastal Management Act (Act No. 24 of 2008, NEM:ICMA), National Environmental Management Protected Area Act (Act No. 57 of 2003, NEM:PAA), as well as the National Water Act (Act No. 36 of 1998, NWA) – which combined, serve to control all relevant facets of the environment so as to ensure that Section 24 of the Constitution is ensured.



The EMPr is developed in terms of the SEMAs and ensures that construction activities meet the requirements of existing environmental legislation and good environmental practice in terms of local and international standards and guidelines. This is achieved by identifying those construction activities for the proposed development that may have a negative impact on the environment; outlining the mitigation measures that will need to be taken and the steps necessary for their implementation and describing the reporting system to be undertaken during construction.

It is noted that protection of the environment is enshrined in the Duty of Care requirement of the NEMA (as amended), which thus means that it is the duty of all landowners and users to ensure that the activities they carry out on a site do not cause detriment to the environmental facets thereof. The EMPr thus functions as a programme which can be monitored and audited that will allow the Developer the ability to ensure that all that operate on the site do so in an environmentally safe manner. It is also structured in such a way that the conditions may be linked to a standard construction contract. It is essential that the EMPr requirements be carefully studied, understood, implemented, and adhered to at all time. Each action within the EMPr is supported by the priority of when the specific action will need to be implemented.

Core to the purpose of the EMPr is to implement the 'mitigation hierarchy' (DEA *et al.*, 2013), which is illustrated in *Figure 2*.



#### **Figure 2: Mitigation Hierarchy**

## 1.4 Objectives of the EMPr

The EMPr has the following objectives:

• To ensure compliance with regulatory authority stipulations and guidelines; which may be local, provincial, national, and / or, international.



- To outline functions and responsibilities of responsible persons.
- To state standards and guidelines, which are required to be achieved / complied with in terms of environmental legislation.
- To outline mitigation measures and environmental specifications which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the proposed project.
- To identify measures that could optimise beneficial impacts.
- To prevent long-term or permanent environmental degradation.
- To establish a method of monitoring and auditing environmental management practices during all phases of development.
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project.
- Ensure that the safety recommendations are complied with.
- Propose mechanisms for monitoring compliance with the EMPr and reporting thereon.
- Specify time periods within which the measures contemplated in the EMPr must be implemented, where appropriate.
- To provide an environmental awareness plan.
- Provide rational and practical environmental conditions / requirements to:
  - Minimise disturbance of the natural environment;
  - Ensure water resource protection;
  - Prevent or minimise all forms of pollution;
  - Protect indigenous flora and fauna;
  - Prevent soil and sand erosion and facilitate the re-vegetation of affected areas;
  - Maintenance of newly re-vegetated areas;
  - Restrict noise disturbance;
  - Ensure compliance with all applicable laws, regulations, standards and guidelines for the protection of the environment;
  - Adopt the best practical means available to prevent or minimise adverse environmental impacts;
  - Develop waste management practices based on prevention, minimisation, recycling, treatment or disposal of waste; and
  - Train the Developer, their employees and contractors (including all sub-contractors) with regard to their environmental obligations.

The EMPr is essentially, a written programme of how the environment is to be managed in practical and achievable terms.

An independent Environmental Control Officer (ECO) must be appointed by the Developer (i.e. KZN DoT), to ensure compliance with the EMPr.

## 1.5 Scope of the EMPr

In accordance with the requirements of the NEMA, this EMPr is to be implemented by the Developer as well as any employee, contractor, agent, or sub-contractor appointed to act on behalf of the Developer in the execution of the project, in order to ensure environmental compliance on site.

The specifications outlined in this EMPr are thus applicable to all activities undertaken by the Developer as well as their appointed contractors and all persons involved in the execution of the works, including sub-contractors, the workforce, suppliers, and volunteers, for the duration of construction, operation and future maintenance.



Included within the EMPr is guidance for on-going training with respect to the implementation of the conditions included therein, including induction by all new people coming onto site to carry out work, and 'top-up' activities such as regular 'toolbox talks' on specific key issues.

An Environmental Code of Conduct has also been developed that provides a simplified set of rules that must be adhered to by all persons involved with the project at all times. This is to be displayed at strategic points to ensure constant environmental awareness.

The effectiveness of the EMPr is limited by the level of adherence to the conditions set forth in the EMPr by the Developer, the Contractor and Sub-contractors. It is further assumed that compliance with the EMPr will be monitored and audited as set out in this EMPr and contractual clauses.

## **1.6 Structure of the EMPr**

The EMPr provides proposed mitigation and management measures for the following phases of the project (*Table 1*).

PHASE	DESCRIPTION
Pre-Construction (Planning & Design)	This section provides guidelines on pre-construction activities including site establishment and clearance; environmental induction and training and awareness; site access and health and safety.
Construction	This section provides guidelines on construction methods and considerations.
Post-Construction; Rehabilitation	This section of the EMPr provides management principles for the rehabilitation, maintenance and operational phases of the project. This will include best practice, procedures and responsibilities as required for various associated activities.

#### Table 1: Different phases of the project construction

## 1.7 The EMPr as a "Live" Document

The approach adopted for this EMPr is derived from the Deming Cycle (*Figure 3*) a cycle of continuous improvement that entails the reiterative actions of plan, do, check, act, and critically to then return to the planning phase.



#### Figure 3: Deming Cycle of Continuous Improvement



## 1.7.1 Plan

Project-specific planning for the proposed project involves consideration of the legal triggers, the specifics of the proposed development, and the nature of the receiving environment. This provides a starting point for targeted environmental management objectives.

Environmental performance indicators are then determined with measurable targets prescribed to monitor the environmental performance of the project. Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.

## 1.7.2 Do

Throughout the development's life-span, the Developer will be required to develop and maintain a Quality Management System (QMS) – designed to ensure that best management practices are implemented in day-to-day management.

Such a QMS must at least include the following information:

- Location and extent of associated infrastructure;
- Associated activities, such as the transportation of people and equipment;
- Resources and experience required (staffing);
- Materials and equipment to be used;
- Management actions;
- Human resources used;
- Construction-monitoring activities;
- Emergency / disaster incident and reaction procedures; and
- Rehabilitation procedures for the impacted environment.

These topics will be cross-linked into the contracts related to the development of the project.

#### 1.7.3 Check

A system of assessing monitoring results has been developed to check the environmental management performance. Continuous assessment facilitates proactive management of the environmental issues. Mitigation measures can then be successfully implemented on an on-going basis to keep environmental indicators within their target thresholds. Moreover, the assessment system also enables the assessment of the efficacy of the EMPr. Regular auditing of environmental performance is prescribed to prove and preserve accountability.

## 1.7.4 Act

The assessments and monitoring of the results and findings of the regular audits must be documented within a reporting system. Precautionary mitigation measures and corrective actions will be prescribed and instructions will be given in order to implement these in the field. The findings of monitoring and auditing programmes can also be used to update the EMPr. Although the EMPr is a project-specific document, it is dynamic and must be updated regularly to address the changing circumstances of the scheme.



## 1.8 **Project Team Details**

## 1.8.1 Project Developer

The Developer is the KZN DoT and the details of the responsible person are listed in *Table 2*.

#### Table 2: Details of the developer

Applicant	KwaZulu-Natal Department of Transport		
Representative	Ms Khumbu Sibiya		
Physical Address	172 Burger Street, Pietermaritzburg, 3200	et, Pietermaritzburg, 3200	
Postal Address	Private Bag X9043, Pietermaritzburg, 3200 033 355 0594		transport
Telephone			Transport Province of KwaZulu-Natal
Facsimile	033 345 7537		
E-mail	Khumbu.Sibiya@kzntransport.gov.za		



## 1.8.2 Details of the Environmental Assessment Practitioner

The team responsible for the preparation of the EMPr is presented in *Table 3* below.

#### Table 3: Details of the environmental team

	Environmental Assessment Practitioners					
Contact Persons	Humayrah Bassa (EAP)	Prashika Reddy	Clive Zwane (PPP Consultant)	Venessa Nkosi		
Postal Address	PO Box 1243, Umhlanga Rocks, 4320	PO Box 25302, Monument Park, 0105	PO Box 1243 Umhlanga Rocks 4320	PO Box 1243 Umhlanga Rocks 4320		
Telephone	087 350 6760	012 367 5973	087 350 6783	087 357 7502		
Facsimile	N/A	012 367 5878	N/A	N/A		
E-mail	humayrah.bassa@rhdhv.com	prashika.reddy@rhdhv.com	clive.zwane@rhdhv.co	Venessa.nkosi@rhdhv.com		
Qualification	MSc Environmental Science	BSc (Hons) Geography	BA (Hons) Geography and Environmental Management	BSc Geology		
Expertise	Humayrah Bassa is an Associate with 7 years' experience in various facets of environmental management. These include conducting environmental impact assessments and the public participation process (PPP); compiling environmental impact reports; developing environmental management programmes; compiling water use licence applications; conducting	Prashika Reddy is a Principal Associate (Pr Sci Nat 400133/10) with a BSc Honours in Geography and Botany. Ms Reddy has 15 years' experience in various environmental fields including: environmental monitoring and anagement plans/programmes, public participation and environmental monitoring and auditing. Ms Reddy has extensive experience in	Clive is an Environmental Consultant at Royal HaskoningDHV with 4 years' experience as an ECO and Public Participation consultant.	Venessa is a Junior Environmental Consultant at Royal HaskoningDHV with 3 years' experience as a Junior Environmental Consultant, Environmental Control Officer and Public Participation consultant. In addition, she has experience in compiling water use licence applications. She is a Certified Natural Scientist (116174) with the South African Council for Natural Scientific Professions.		



Environmental Assessment Practitioners				
environmental control officer compiling environmental reports				
duties; and conducting legal (Screening, Scoping, EIA and				
compliance audits. She is a Status Quo Reports). Ms Reddy				
Professional Natural Scientistis/has been part of numerous				
(400032/15) with the Southmulti-faceted large scale				
African Council for Natural projects, including the				
Scientific Professions. establishment of linear				
developments (roads, and power				
lines); industrial plants; electricity				
generation plants and mining-				
related projects.				

CVs of the Environmental Team are provided in *Appendix A*.



## 2 SITE DESCRIPTION

## 2.1 Site Description and Ownership

The proposed activity is situated in Wards 17 and 23 of the Ulundi Local Municipality, within the Zululand District Municipality. The land is owned by the Ingonyama Trust Board (ITB). *Table 4* indicates the cadastral information associated with the affected properties.

#### Table 4: Cadastral Information of the affected properties

21 Digit Reference	Portion Number, Farm Number, Farm Name
N0GU0000001584000008	Portion 8 of Farm 15840, Reserve No 220
N0GU0000001584000017	Remainder of 17 of Farm 15840, Reserve No 220
N0GU0000001584000051	Portion 51 of Farm 15840, Reserve No 220
N0GU0000001584000107	Portion 107 of Farm 15840, Reserve No 220
N0GU0000001650500000	Remainder of Farm 16505, Nobamba

## 2.2 **Co-ordinates**

## 2.2.1 Bridge and Link Road

#### Table 5: Bridge and link road co-ordinates

	Link Road – Western Side		Brid	dge	Link Road – Eastern Side			
	Start	Middle	End	Start	End	Start	Middle	End
Option 1	28°17'36.22" S 31°20'57.81" E	28°18'41.86" S 31°19'50.23" E	28°19'22.84" S 31°18'11.00" E	28°19'22.84" S 31°18'11.00" E	28°19'23.34" S 31°18'03.72" E	28°19'23.34" S 31°18'03.72" E	28°19'20.25" S 31°17'57.22" E	28°19'22.62" S 31°17'50.11" E

## 2.2.2 Culvert

#### Table 6: Details of the proposed culvert

Culvert Details	Watercourse(s)	Culvert location
Three (3) pipes of 1200 mm	Mooti River	Start Point of Water Crossing 28°18'20.08" S 31°20'42.34" E End Point of Water Crossing 28°18'20.16" S 31°20'42.32" E

## 2.2.3 Borrow Pits

The project must only utilise existing legal (permitted) sources of material.



#### 2.2.4 Water Abstraction

It is anticipated that 4 703 kl of water per annum will be required during the construction phase for construction activities and dust suppression. This water will be abstracted by a water tanker(s) from various points along the White Mfolozi River. Expected abstraction points are as follows:

- 28° 19' 23.72"S and 31° 18' 10.50"E;
- 28° 19' 24.06"S and 31° 8' 5.69"E.

A Water Use Authorisation must be obtained for this activity.

## 2.2.5 Construction Camp

A construction camp must be located at least 100 m away from the White Mfolozi River and outside of environmentally sensitive areas. The location of the construction camp must be approved by the Engineer, with comments from the Environmental Control Officer (ECO) prior to implementation.

## 2.3 Description of the Sensitive Environments

## 2.3.1 Watercourses

One (1) perennial river (White Mfolozi River), one (1) seasonal river (Mooti River), eight (8) ephemeral streams and one (1) seep wetland were assessed as being at a high 'likelihood of impact' – indicated in red in *Figure 4*.



Figure 4: Likelihood of impact rating for the desktop mapped watercourses



## 2.3.2 Provincially Protected Plants and Protected Trees

A total of nine (9) protected plant species were identified including seven (7) species of specially protected forbs under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974. In addition two (2) species of nationally protected trees under Section 15(1) of the National Forest Act were identified. Specially protected forbs include *Aloe marlothii, A. parvibracteata, Ceropegia racemosa* subsp. *setifera, Dietes iridoides, Gladiolus* cf. *crassifolius, Ledebouria asperifolia* and *L. zebrina*. In accordance with Section 200, sub-section 5(1) of the Natal Nature Conservation Ordinance, No. 15 of 1974, an Ordinary Permit is required from *eZemvelo* KZN Wildlife if provincially protected species listed are to be handled in any manner during construction of the proposed road.

Nationally protected trees include *Sclerocarya birrea* subsp. *caffra* and *Sideroxylon inerme* and these require a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) if these trees need to be removed during construction.



Figure 5: Location of nationally and provincially protected plant species identified within the study corridor

#### 2.3.3 Affected Household

The link road (**Option 1**) routing design reveals that a single home will be impacted (28°17'57.55" S; 31°20'44.80" E - *Figure 6*) to the extent that it will be required to be expropriated and will have to be constructed outside of the proposed road alignment. The traditional leader must advise the owner of a new location (within the community) where the residence can be rebuilt. Additionally, the KZN DoT has its own protocols that are utilised for physical displacement scenarios (and economic, in the case of loss of



assets / land only). The relocation and compensation method must be applied, ensuring full engagement with the owner and the traditional leader throughout the process. Relocation must take place in the preconstruction phase. All records of the relocation and the interactions must be placed within the environmental site file for record purposes.



Figure 6: Location of residence to be displaced

#### 2.3.4 Heritage

#### 2.3.5 Early Stone Age Artefacts

Some Early Stone Age tools occur in erosion dongas directly adjacent to the L2598 in the vicinity of the proposed bridge crossing (**Option 1**). These tools, however, are out of context and they have little research value. Consequently they have a low heritage rating.



Figure 7: Early Stone Age Artefacts



## 2.3.6 Shembe Site of Worship

A Shembe Site consisting of a stone circle (painted white) with a diameter of approximately 25 m occurs further than 50 m from **Option 3** (*Figure 8*). Modified trees also painted partially white and placed in the centre of the stone circle. This is a recent feature and has been in existence for the last 6 years. However, it is a place of worship combining indigenous with Christian elements. This site is of local significance (Local grade 111B. It is still in use and therefore has living heritage values. It is therefore protected by the relevant heritage legislation.



#### Figure 8: Shembe Site

## 2.3.7 Early Iron Age

The expansive flat areas adjacent to the White Mfolozi River are potentially ideal Early Iron Age locales but none of those in the near environs of the proposed development contain any archaeological material.

#### 2.3.8 Graves

Some contemporary homesteads occur adjacent to **Option 1** on the western side of the White Mfolozi River. However, none of these had graves situated closer than 50 m to the proposed link road alignment. No grave sites were observed along **Option 2**. However, graves not in association with any particular homestead do occur within the near environs of the preferred link road option (i.e. Option 1). Furthermore, three (3) grave sites, Grave Sites 6, 7 and 8 are directly impacted on by **Option 3** (*Figure 9*). A description of these follows in *Table 7*.

## Project related





#### **Figure 9: Grave Sites and Potential Grave Sites**



#### 2.3.8.1 Cultural Landscapes

The cultural heritage survey suggests that the cultural landscape of the project area has been modified in terms of traditional settlement patterns from the Nguni settlement pattern distinguished by semi-circular patterning of huts around a central cattle byre to modern linear spatial arrangement. This linear spatial arrangement is observed along the L2598 track. Given these changes in settlement layout it is unlikely that the area forms part of any cultural landscape.

#### 2.3.8.2 Sense of Place

The observed modifications in traditional settlement patterns, presence of Eskom power lines crossing the White Mfolozi River suggest that the proposed development will not be an intrusion on the 'sense of place' of the area.

In summary, the cultural heritage survey identified the following heritage sites located within the project area tabulated in *Table 7* below.

	Heritage Site Category	Brief description	Rating	Mitigation	Geographic Coordinates
1	Grave Site 1	Informal and unmarked grave. Covers an area of approximately 2 m X 1.5 m. The grave is situated approximately 10 m from the proposed link road ( <b>Option 1</b> ). It appears to be older than 60 years.	High Significance Locally	Maintain a 2 m buffer zone around the grave. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange for potential grave exhumation and reburial.	S 28º 19' 20.04" E 31º 17' 54.23"
2	Grave Site 2	Two Informal graves indicated by stone heaps. The grave site covers an area of approximately 7 m X 4 m. The graves are situated approximately 35 m from the proposed link road ( <b>Option 1</b> ). They appear to be younger than 60 years.	High Significance Locally	Maintain a 10 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange for potential grave exhumation and reburial.	S 28º 19'20.04" E 31º 17'54.23"
3	Grave Site 3	An informal grave indicated by a raised sol profile and a heap of stones. The grave covers an area	High Significance Locally	Maintain a 10 m buffer zone around the grave site.	S 28° 19'19.29" E 31° 17'55.00"

Table 7: Heritage sites identified within the project area



	Heritage Site Category	Brief description	Rating	Mitigation	Geographic Coordinates
		of approximately 1.8 m X 1.3 m. The Grave Site is situated approximately 50 m from the proposed link road ( <b>Option 1</b> ). It appears to be younger than 60 years old.		Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange or potential grave exhumation and reburial.	
4	Grave Site 4	A small cluster of 5 graves (indicated by informal stone heap structures). The grave site covers an area of approximately 12 m X 15 m. It is situated approximately 40 m from the proposed link road ( <b>Option 1</b> ). It appears to be younger than 60 years old.	High Significance Locally	Maintain a 10 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange or potential grave exhumation and reburial.	S 28º 19'20.75" E31º 18'12.05"
5	Grave Site 5	Singular grave indicated by informal stone heap. It covers an area of approximately 1 m X 1.5 M. The grave is situated approximately 42 m from the proposed link road ( <b>Option 1</b> ). The grave appears to be older than 60 years.	High Significance Locally	Maintain a 10 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange or potential grave exhumation and reburial.	S 28º 19' 20.68" E 31º 18' 12.64"
6	Grave Site 6	Singular grave indicated by informal stone heap. It covers an area of approximately 1.2 m X 1.8 m. The grave is situated approximately 16 m from the proposed link road ( <b>Option 1</b> ). The grave appears to be older than 60 years	High Significance Locally	Maintain a 2 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation	S 28º 19" 20.93" E 31º 18' 47.28"



	Heritage Site Category	Brief description	Rating	Mitigation	Geographic Coordinates
				process will have to be initiated to arrange or potential grave exhumation and reburial.	
7	Grave Site 7	A small cluster of 5 graves (indicated by informal stone heap structures). The grave site covers an area of approximately 10 m X 20 m. It is situated approximately 3 m from the proposed link road ( <b>Option 1</b> ). It appears to be older than 60 years	High Significance Locally	Maintain a 2 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange or potential grave exhumation and reburial.	S 28°19'19.63 "S E 31° 18' 50.15"
8	Grave Site 8	A grouping of 2 graves (indicated by informal tone heap structures). The grave site covers an area of approximately 4 m X 25 m. It is situated approximately 30 m from the proposed link road ( <b>Option 1</b> ). It appears to be older than 60 years	High Significance Locally	Maintain a 10 m buffer zone around the grave site. Alternatively motivate for a second phase heritage impact assessment, by a grave relocation expert. A comprehensive community consultation process will have to be initiated to arrange or potential grave exhumation and reburial.	S 28° 19' 8.47' E 31° 19' 21.32"
9	Shembe 'Site of Worship'	A stone circle (pained white) with a diameter of approximately 25 m. Modified trees, also painted partially white, are placed in the centre of the stone circle. This is a recent feature and has been in existence for the last 6 years. However, it is a place of worship combining indigenous with Christian elements. The site has living heritage values.	This site is of local Significance . It is still in use and has living heritage values. It is therefore protected by heritage legislation.	There is no need for mitigation as this site occurs outside of the project area near alternative route 3. However, it would be wise to respectfully maintain a buffer zone of 20 m around this site.	S28°18'13.08" E 31° 20' 51.46"
10	Early Stone Age "tool	A thin scatter of Early Stone Age tools occurs approximately 30 m –	The site has a low	As this site has a low rating there is no need	



Heritage Site Category	Brief description	Rating	Mitigation	Geographic Coordinates
scatter	200 m from the edge of the White Mfolozi River directly adjacent to the L2589. Stone tools include choppers, cleavers, and associated flakes. Most of the tools are made from quarzitic sandstone. However, these stone tools are all out of context and some has clearly been washed down from a higher altitude locality. As they are not in context they are of little research value. Nevertheless, they may have some educational value and they should be collected, under the auspices of AMAFA, before the construction of the link road commences.	heritage rating as it is out of context and of little research value. In addition, similar sites occur widely in parts of Zululand and in similar settings	for formal mitigation before destruction. However, it is suggested that a surface collection of all the Stone Tools be made before development commences. The collecting should be done by a heritage consultant under the supervision of AMAFA. The collection can be used for teaching purposes.	

## 2.3.9 Palaeontology

The desktop investigation confirms that the study area is underlain by relatively deep (>2 m) clay soil associated with the ancient granites and metamorphic rocks of the Natal Metamorphic Belt and the Karoo Supergroup.

The excavations for the construction of the infrastructure cutting into the Swazian aged Stromatolitic dolomite of the Chobeni Formation will undoubtedly expose significant ancient stromatolites that are very important indicators of palaeo-environments. Swazian aged sediments of the Thembeni and Carboniferous to Permian aged rocks of the Dwyka Group will have a moderate likelihood of exposing significant fossils.

Due to the deep weathering it is highly unlikely that any trace and other fossils will be exposed before deep (>1.5 m) excavations into the Chobeni and Thembeni Formations and the Dwyka Group are undertaken.

Refer to *Figure 10* for the palaeontological sensitivity and significance of the study area.





Figure 10: Palaeontological sensitivity for the study area

## 2.4 Sensitivity Map

The composite annotated sensitivity map is included in *Figure 11*.





Figure 11: Sensitivity map



## 3 LEGAL FRAMEWORK

## 3.1 Legal Framework

#### 3.1.1 EIA Regulations (2014 as amended in 2017)

The potential environmental impacts associated with this proposed project are required to be considered in compliance with (EIA) Regulations (2014 as amended in 2017) made under Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

## 3.2 National Water Act (Act No. 36 of 1998)

As the proposed development crosses the White Mfolozi River, a Water Use Authorisation is required in terms of Section 21 (a), (c) and (i) of the National Water Act (Act No. 36 of 1998):

- Section 21 (a) taking water from a water resource (applicable for water for construction purposes);
- Section 21 (c) impeding or diverting the flow of water in a watercourse (applicable for the construction / expansion within watercourses); and
- Section 21 (i) altering the bed, banks, course or characteristics of a watercourse (applicable for the construction /expansion within watercourses).

## 3.3 Other Relevant Legislation / Policies / Guidelines

Legislation	Sections	Relates to
The Constitution (No. 108 of	Chapter 2	Bill of Rights.
1996)	Section 24	Environmental rights.
	Section 2	Defines the strategic environmental management goals and objectives of the government. Applies through-out the Republic to the actions of all organs of state that may significantly affect the environment.
National Environmental Management Act (Act No. 107 of 1998 [as amended])	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The Developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
	GNR327	Activities requiring a Basic Assessment study to be undertaken.
EIA Regulations (2014 as amended in 2017)	GNR325	Activities requiring a Scoping and Impact Assessment study to be undertaken.
	GNR324	Activities in special geographical areas requiring a Basic

#### Table 8: Legislative Requirements<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> It is noted that the legal framework provided in this document relates to the most recent legislation at the time of compiling this document. It is noted that legislation changes continuously and it is the Developer's responsibility to ensure that they are compliant with the most relevant legislation at any given time.



Legislation	Sections	Relates to
		Assessment study to be undertaken.
National Forests Act (Act No. 84 of 1998) and Regulations	Section 7	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	Schedule 12	Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. In KwaZulu-Natal the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from <i>eZemvelo</i> KZN Wildlife to remove or destroy any plants listed in the Ordinance.
NationalEnvironmentalManagement:BiodiversityAct (Act No. 10 of 2004)Threatenedorprotectedspecies (GN 388)Listsofspecies that arethreatened orprotected (GN389)Alienandandinvasivespecies(GNR 506)Publication ofexempted alienspecies (GNR 509)Publication ofNationalPublication ofprohibited alienspecies (GNR 507)Publication ofprohibited alienspecies (GNR 508)		Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
	Section 53	Protection of threatened or protected ecosystems.
	Section 65	Control of alien species.
	Section 71	Control of invasive species.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) – NEM: PAA		Creates a legal framework and management system for all protected areas in South Africa as well as establishing the South African National Parks (SANParks) as a statutory board. Each conservation area will have its own set of land use restrictions or regulations that stem either from generic restrictions under NEM: PAA, or customized regulations for individual protected areas.
National Waste Act (Act No. 59 of 2008) and List of Waste Activities (November 2013)		Provides for specific waste management measures and the remediation of contaminated land.
Norms and Standards for the Storage of Waste, 2013	GNR 926 – Sections 7 – 20	Provides specific guidelines for the operational procedures for a facility for the storage of waste.


Legislation	Sections	Relates to
	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
National Heritage Resources Act (Act No. 25 of 1999) and regulations	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), not already covered under the environmental law. Where covered under such law the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The HIA is thus approved under the environmental authorisation, which must take into account the provincial heritage resources authorities' comments prior to making a decision on the HIA.
National Environmental	Section 34	Control of noise.
Management: Air Quality Act (Act No. 39 of 2004)	Section 35	Control of offensive odours.
National Dust Control Regulations (GNR 827 of November 2013)		Control of dust.
Occupational Health and	Section 8	General duties of employers to their employees.
Safety Act (Act No. 85 of 1993)	Section 9	General duties of employers and self-employed persons to persons other than their employees.
Minerals and Petroleum Resources	Section 22 / 27	Application for a mining right / permit.
Development Act (Act No. 28 of 2002)	Section 39	Environmental management programme and environmental management plan.
Hazardous Substances Act (Act No. 15 of 1973) and regulations		Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.
National Road Traffic Act (Act No. 93 of 1996)		Road safety.



Legislation S		Sections	Relates to	
SANS Regulatior	10103 าร)	(Noise		The measurement and rating of environmental noise with respect to annoyance and to speech communication.

Relevant By-laws

Zululand District Municipality IDP Review (2016 – 2017)

Ulundi Local Municipality Spatial Development Framework (SDF) (2016)

Ulundi Local Municipality IDP - 2016

Ulundi Local Municipality, IDP Main Document - 18 April 2016-2017

Ulundi Local Municipality, Annexure 3. Provincial Service Delivery Plan, 2016-2017

Ulundi Local Municipality, Annexure 5. Ward Based Community Needs, 2016 -2017

## 3.4 Applicable Documentation

The following environmental documentation is applicable for the project, and must be read in conjunction with this EMPr:

- Environmental Authorisation (EA) once issued;
- Final Consultation Basic Assessment Report for the project and all associated specialist studies;
- Water Use Authorisation– once issued;
- eZemvelo KZN Wildlife Permits for the removal / relocation of indigenous plants once issued;
- DAFF licence to remove protected tree species once issued;
- Construction Method Statement;
- Conceptual Rehabilitation Plan;
- Spill Contingency Plan;
- Chance Find Protocol for high palaeontological sensitive areas; and
- Stormwater Management Plan.

Once the relevant authorisations and / or permissions have been obtained, these must be kept on site.



## 4 ENVIRONMENTAL CODE OF CONDUCT

One of the objectives of the EMPr is to ensure that all the workforce, contractors, sub-contractors and construction staff have an understanding of environmental issues and potential impacts on-site activities. This environmental code of conduct provides the basic rules that must be strictly adhered to.

It is the responsibility of the Site Environmental Officer, the Environmental Officer and ECO (as appointed) to ensure that each contractor, sub-contractor and workforce understand and adhere to the Code of Conduct.

#### All persons are obliged to keep to the rules of this Code of Conduct

Ignorance, negligence, recklessness or a general lack of commitment resulting in environmental degradation or pollution must not be tolerated!

## **Environmental Rules**

- Do not waste electricity, water or consumables;
- Only use authorised accesses;
- Do not litter;
- Dispose solid waste to the correct waste containers provided;
- Prevent pollution;
- Use the toilet facilities provided;
- Do not dispose contaminated wastewater to the stormwater or the environment;
- Immediately report any spillage from containers, plant or vehicles;
- Do not burn or bury any waste in the sand;
- Do not trespass onto private properties;
- Strictly leave all animals alone. Never tease, catch or set devices to trap or kill any animal;
- Never damage or remove any trees, shrubs or branches unless it forms part of working instructions;
- Do not deface, draw or cut lettering or any other markings on trees, rocks or buildings in the area;
- Know the firefighting procedure and locations of firefighting equipment; and
- Know the environmental incident procedures.



# 5 MANAGEMENT AND MONITORING PROCEDURES

## 5.1 Organisational Structure and Responsibilities

KZN DoT is the Primary Developer for the Project. It is noted that KZN DoT and their respective professional project teams, are responsible for the rehabilitation works. Each of the team roles are elaborated on in terms of their specific duties hereafter.

The following outlines the defined and specific roles and responsibilities of each team member:

#### Table 9: Roles and responsibilities

#### **ROLES AND RESPONSIBILITIES**

DEVELOPER

The Developer is ultimately responsible for ensuring compliance with the environmental specification and upholding KZN DoT's environmental commitment to 100% compliance with all National, Provincial and local legislation that relates to management of the environment.

The Developer must:

- Appoint a Project Manager (PM) to assume ultimate project responsibility;
- Be familiar with the contents of the EMPr;
- Ensure the EMPr is in the tender documentation issues to prospective Contractors;
- Request for, review and approve the method statements prepared by the Contractor;
- Review and comment on environmental assessments and / or reports produced by the Contractor and ECO;
- Undertake regular site visits and ensure environmental specifications are implemented;
- Discuss with the ECO the application of penalties for the infringement of the Environmental Specifications, another possible enforcement measures necessary;
- Issue penalties as and when necessary;
- Arrange information meetings for or consults with I&APs about the impending construction activities;
- May on the recommendation of the engineer and / or SHE Officer order the Contractor to suspend any or all works on-site if the Contractor or his sub-contractor / supplier fails to comply with the said specifications;
- Maintain a register of complaints and queries by members of the public at the site office; and
- Ensure the EMPr is implemented as well as revised and updated as and when required.

#### ENGINEER

#### The Engineer must:

- Enforce the environmental specification on site;
- Be familiar with the contents of the EMPr;
- Ensure the EMPr is in the tender documentation issued to prospective Contractors;
- Request for, review and approve the method statements prepared by the Contractor;
- Review and comment on environmental assessments and / or reports produced by the Contractor and ECO;
- Undertake regular site visits and ensure environmental specifications are implemented;
- Monitor compliance with the requirements of the specification;
- Assess the Contractor's environmental performance in consultation with the SHE Officer from which a brief monthly statement of environmental performance is drawn up for record purposes and to be reported to project meetings; and
- Ensure the documentation, in conjunction with the Contractor, the state of the site prior to construction activities commencing. This documentation will be in the form of photographs or video record.



#### ROLES AND RESPONSIBILITIES

**CONTRACTOR (INCLUDING SUB-CONTRACTORS)** 

The Contractor must:

- Be fully conversant with the EMPr;
- Implement, manage and maintain the EMPr for the duration of the contract;
- Appoint a suitably qualified SHE Officer whose responsibility includes on-going monitoring and control of all construction activities concerning minimisation of environmental impact and adherence to the EMPr for the duration of the project;
- Provide information on previous environmental management experience and company environmental policy in terms of the relevant forms contained in the Contract Document.
- Supply method statements timeously for all activities requiring special attention as specified and / or requested by the Developer, SHE Officer and / or engineer during the duration of the Contract.
- Comply with requirements of the EMPr and any subsequent revisions in terms of this specification and the project specification, as applicable, within the time period specified.
- Ensure any sub-contractors / suppliers who are utilised within the context of the contract comply with the environmental requirements of the project, in terms of the specifications. The Contractor will be held responsible for non-compliance on their behalf;
- Provide appropriate resources budgets, equipment, personnel and training for the effective control and management of the environmental risks associated with the construction of the development;
- Bear the cost of any delays, with no extension of time granted, should he / she or his / her subcontractors / suppliers contravene the said specifications such that the engineer orders a suspension of work. The suspension will be enforced until such time as the offending party(ies), procedure, or equipment is corrected;
- Bear the costs of any damages / compensation resulting from non-adherence to the said specifications or written site instructions;
- Review ECO reports and take cognisance of the information / recommendations contained therein;
- Comply with all applicable legislation;
- Ensure that he /she informs the Engineer timeously of any foreseeable activities which will require input from the SHE Officer;
- Notify the ECO and PM, verbally and in writing at least 10 working days in advance of any activity he / she has reason to believe may have significant adverse environmental impacts, so that mitigatory measures may be implemented timeously;
- Ensure environmental awareness among his / her employees, sub-contractors and workforce so that they are fully aware of, and understand the Environmental Specifications and the need for them;
- Maintain a register of environmental training for site staff and sub-contractor's staff for the duration of the contract; and
- Communicate and liaise frequently and promptly with the ECO and the PM to ensure effective, proactive environmental management with the overall objective of preventing or reducing negative environmental impacts while enhancing positive environmental impacts.

The Contractor will conduct all activities in a manner that minimises disturbance to the natural environment as well as directly affected residents and the public in general.

The primary Contractor assumes responsibility and accountability of all appointed sub-contractors and must ensure their compliance with this EMPr.

#### ENVIRONMENTAL CONTROL OFFICER

The ECO must:

Be familiar with the recommendations and mitigation measures of the associated EMPr for the



#### **ROLES AND RESPONSIBILITIES**

#### project;

- Monitor the implementation of the EMPr during the pre-construction, maintenance and rehabilitation phases;
- Ensure site protection measures are implemented on-site;
- Monitor that the Principal Contractor, sub-contractors, construction teams and the Developer are in compliance with the EMPr at all times during the pre-construction, maintenance and rehabilitation phases of the project;
- Monitor all site activities monthly for compliance;
- Conduct monthly audits of the site according to the EMPr, and report findings to the Developer / Contractor;
- Attend monthly site meetings;
- Recommend corrective action for any environmental non-compliance at the site;
- Compile a monthly report highlighting any non-compliance issues as well as progress and compliance with the EMPr prescriptions; and
- Conduct once-off training with the Contractor on the EMPr and general environmental awareness.

# It must be noted that the responsibility of the ECO is to monitor compliance and give advice on the implementation of the EMPr and not to enforce compliance. Ensuring compliance is the responsibility of the Developer, Contractor and the SHE Officer.

#### SAFETY, HEALTH AND ENVIRONMENTAL (SHE) OFFICER

The Safety, Health and Environmental Officer must:

- Be fully conversant with the EMPr;
- Be fully conversant with all relevant environmental legislation applicable to the project, and ensure compliance with them;
- Compilation of method statements together with the Principal Contractor that will specify how
  potential environmental impacts in line with the requirements of the EMPr will be managed, and,
  where relevant environmental best practice and how they will practically ensure that the objectives
  of the EMPr are achieved;
- Convey the contents of this EMPr to the construction-site staff and discuss the contents in detail with the Contractor;
- Undertake regular and comprehensive inspection of the site and surrounding areas in order to monitor compliance with the EMPr;
- Take appropriate action if the specifications contained in the EMPr are not followed;
- Monitor and verify that environmental impacts are kept to a minimum, as far as possible;
- Order the removal from the construction site of any person(s) and / or equipment in contravention
  of the specifications of the EMPr;
- Report any non-compliance or remedial measures that need to be applied to the appropriate environmental authorities, in line with the requirements of the EMPr;
- Submitting a report at each site meeting which will document all incidents that have occurred during the period before the site meeting;
- Ensuring that the list of transgressions issued by the ECO is available on request; and
- Maintain an environmental register which keeps a record of all incidents which occur on the site during construction.

## 5.2 Monitoring

A monitoring programme must be in place not only to ensure compliance with the EMPr through the contract / work instruction specifications, but also to monitor any environmental issues and impacts which



have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required.

A monitoring programme must be implemented for the duration of the construction phase of the project. This programme will include:

- Monthly audits must be conducted by the ECO for the duration of the maintenance activities including rehabilitation – the ECO must undertake this environmental monitoring with the audits considering compliance with the EMPr.
- On-going monitoring is to be undertaken by the Contractor's SHE Officer this must include notification to the ECO should an incident take place.
- External auditing may take place at unspecified times by the authorities and / or other relevant authorities.
- The Contractor's SHE Officer must undertake regular site inspections (at least twice weekly) to ensure all legislative requirements are adhered to.

## 5.3 Reporting Procedures

#### 5.3.1 Documentation

The following documentation must be kept on site in order to record compliance with the EMPr:

- An Environmental File which includes:
- Copy of the EMPr;
- All specialist studies undertaken during the Basic Assessment Process
- All relevant permits, licences, for example; WUL, DAFF Licence, *E*KZN Wildlife permit, etc.
- o information pertaining to material sourcing and relevant licences
- Copy of relevant legislation;
- Environmental Policy of the main Contractor;
- Environmental method statements compiled by the Contractor;
- Non-conformance Reports;
- o Environmental register, which shall include:
  - Communications Register including records of Complaints, and, minutes and attendance registers of all environmental meetings;
  - Monitoring Results including environmental monitoring reports, register of audits, nonconformance reports; and
  - Incident book including copies of notification of Emergencies and Incidents, this must be accompanied by a photographic record.
- Waste Documentation such as, but not necessarily limited to: Waste Manifest Documents, Safe Disposal Certificates (SDCs) and Sewerage Disposal Receipts;
- o Material Safety Data Sheets (MSDSs) for all hazardous substances;
- Dust suppression register;
- o Written Corrective Action Instructions; and
- Notification of Emergencies and Incidents.

#### 5.3.2 Environmental Register

The Developer must put in place an Environmental Register. The Contractor will ensure that the following information is recorded for all complaints / incidents:

- Nature of complaint / incident.
- Causes of complaint / incident.
- Party / parties responsible for causing complaint / incident.
- Immediate actions undertaken to stop / reduce / contain the causes of the complaint / incident.



- Additional corrective or remedial action taken and / or to be taken to address and to prevent reoccurrence of the complaint / incident.
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions.
- Procedures to be undertaken and / or penalties to be applied if corrective or remedial actions are not implemented.
- Copies of all correspondence received regarding complaints / incidents.

The above records must form an integral part of the Contractor's records. These records must be kept with the EMPr, and must be made available for scrutiny if so requested by the Developer.

#### 5.3.3 Non-Conformance Report

A Non-Conformance Report (NCR) must be issued to the Contractor as a final step towards rectifying a failure in complying with a requirement of the EMPr. This must be issued by the ECO to the Contractor in writing. Preceding the issuing of an NCR, the Contractor must be given an opportunity to rectify the issue. Should the ECO assess an incident or issue and find it to be significant (e.g. non-repairable damage to the environment), it will be reported to the relevant authorities and immediately escalated to the level of a NCR. The following information must be recorded in the NCR:

- Details of non-conformance;
- Any plant or equipment involved;
- Any chemicals or hazardous substances involved;
- Work procedures not followed;
- Any other physical aspects;
- Nature of the risk;
- Actions agreed to by all parties following consultation to adequately address the non-conformance in terms of specific control measures and must take the hierarchy of controls into account;
- Agreed timeframe by which the actions documented in the NCR must be carried out; and
- ECO must verify that the agreed actions have taken place by the agreed completion date, when completed satisfactorily; the ECO and Contractor must sign the Close-Out portion of the Non-Conformance Form and file it with the contract documentation.

## 5.3.4 Environmental Emergency Response

The Contractor's environmental emergency procedures must ensure appropriate responses to unexpected / accidental actions / incidents that could cause environmental impacts. Such incidents may include:

- Accidental discharges to water (i.e. into the watercourse) and land;
- Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- Accidental damage to existing utilities e.g. sewer and water pipelines;
- Accidental toxic emissions into the air; and
- Specific environmental and ecosystem effects from accidental releases or incidents.

The Environmental Emergency Response Plan is separate to the Health and Safety Plan as it is aimed at responding specifically to environmental incidents and must ensure and include the following:

- Construction employees must be adequately trained in terms of incidents and emergency situations;
- Details of the organisation (i.e. manpower) and responsibilities, accountability and liability of personnel;
- A list of key personnel and contact numbers;
- Details of emergency services (e.g. the fire department / on-site fire detail, spill clean-up services) must be listed;



- Internal and external communication plans, including prescribed reporting procedures;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures to be implemented; and
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.

The Contractor and their sub-contractor(s) must comply with the environmental emergency preparedness and incident and accident-reporting requirements as per the relevant legal requirements.

## 5.3.5 Public Communication and Liaison with I&APs

The Developer must ensure that the adjacent landowners are informed and updated throughout the construction phases.

Sufficient signage must be erected around the site (including at the entrance), informing the public of the construction activities taking place. The signboards must include the following information:

- The name of the Contractor; and
- The name and contact details of the site representative to be contacted in the event of emergencies or complaint registration.



# 6 ENVIRONMENTAL AWARENESS PLAN

The Developer is committed to promoting and implementing sustainability throughout their operations. As part of this commitment, the Developer recognises the importance of making all employees aware of the potential environmental impacts that could result from conducting their jobs and how this potential can be minimised through effective training. Environmental awareness to the employees of the project must be provided by implementing environmental awareness training in the following forums:

- Toolbox Talks (Weekly)
- Environmental Awareness Courses (Ad hoc)
- EMPr Awareness (as and when required)

The above mentioned awareness activities must be used to share information and to ensure that all personnel are aware of the environment in which they operate and what environmental aspects require attention during their daily operations / activities / tasks. Additionally, personnel awareness training must be undertaken if and when required to strengthen the personnel's understanding of environmental issues.

The method and medium of communication during the environmental meetings must be determined by the SHE Officer facilitating the meetings. The topics discussed in meetings must be recorded, with all employees present signing an attendance register. As potential environmental impacts differ in each department of the operation, the environmental topics selected for discussion can either be:

- General topics that are applicable to the entire activity;
- Area specific topics as identified in the impacts on the receiving environment;
- Topics that can be "taken home" and implemented off-site.

## 6.1 General Topics

There are a number of environmental impacts resulting from the proposed project. General topics include, but are not limited to, the following:

- Water consumption and conservation;
- Dust generation related impacts (including health-related) ;
- Noise generation and related impact (including health-related);
- Domestic waste minimisation and recycling;
- Practical training regarding the clean-up of major and minor hydrocarbon spills / use of spill management kit;
- Practical training on using a fire extinguisher;
- Social awareness and HIV / AIDS education; and
- Alien vegetation identification and removal, and the importance of indigenous vegetation.

## 6.2 Activity Specific Topics

Some activities have environmental impacts that are unique to each area. These must be addressed in the SHEQ meetings. Area specific topics include and some of these topics must be a repeat of those covered under general topics:

- Protection of water resources;
- Stormwater management;
- Potential for water pollution and the related impacts;
- Identification and management of erosion;
- Vehicle emissions and related impacts (including health related);
- Practical training regarding the clean-up of major and minor hydrocarbon spills;
- The importance of the waste management system and implementing good housekeeping;
- Dust generation and why and how to reduce dust; and



Biodiversity interaction awareness.

## 6.3 Take-home Topics

Environmental awareness should not stop at the work place. Many of the concepts learned at work can be applied to employees' life style at home. Topics that can be covered under "take home topics" include, but are not limited to:

- Water consumption and conservation, and;
- Domestic waste minimisation and recycling "Reduce, Reuse and Recycle.



# 7 IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

The EMPr specifies the minimum requirements to be implemented by the Developer as per the scope of works, in order to minimise and manage the potential environmental impacts and ensure sound environmental management practices. It also provides the framework for environmental monitoring throughout the maintenance activities including rehabilitation.

The provisions of this EMPr are binding on the Developer and their teams during the maintenance activities including rehabilitation. The EMPr must be binding to KZN DoT or any authority to which responsibility for the construction activities has been delegated to.

It is essential that the EMPr requirements be carefully studied, understood, implemented, and adhered to at all times.

To simplify the EMPr requirements, each aspect related to the EMPr has been addressed in the tables hereafter.

Each action within the EMPr is supported by the priority of when the specific action will need to be implemented. Each of these aspects is briefly described below (*Table 10*) for ease of reference.

Table 10: Summary of aspects included in the EMPr tables

#### **ENVIRONMENTAL MEASURES, ACTIONS AND CONTROLS:**

This section indicates the actions required to either prevent and / or minimise the potential impacts on the environment that is associated with the project.

#### **RESPONSIBILITY:**

This section indicates the party responsible for implementing the environmental measures and action plans laid out in the EMPr.

#### **MONITORING FREQUENCY:**

This section indicates when the actions for that specific aspect must be implemented and / or monitored.



# 7.1 **Pre-Construction (Planning & Design) Phase**

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
7.1.1 Authorisations, Permits and Licences		
<ul> <li>All necessary authorisations, permits and licences must be obtained by the Developer prior to the commencement of construction (if required).</li> </ul>	Developer	Once-off and On-going
7.1.2 Appointment of Contractor		
<ul> <li>This EMPr must form part of any contractual agreements with a Contractor(s) and sub-contractors for the execution of the proposed project. The Contractor must make provision in their budgets for the implementation of the EMPr.</li> </ul>		
<ul> <li>The principal Contractor (including sub-contractors and suppliers) must comply with the relevant provisions of the EMPr, applicable environmental legislation, by-laws and associated regulations promulgated in terms of these laws.</li> </ul>	Developer	Once-off
<ul> <li>Tender documents must include statements which include the use of local communities or local community organisation(s) in supplying services and labour for the construction activities.</li> </ul>		
7.1.3 Appointment of an ECO		
<ul> <li>An Independent ECO must be appointed at the Developer's cost to monitor the implementation of the EMPr.</li> <li>The ECO must undertake monthly site inspections and provide monthly audit reports for the duration of the construction and rehabilitation phases.</li> </ul>	Developer Engineer Contractor	Once-off
7.1.4 Preparation of Method Statements		
<ul> <li>Method Statements must be submitted by the Contractor to the Developer's SHE Manager for approval and the ECO for comment prior to an activity being undertaken and must be adhered to by the Contractor and Project Engineer.</li> </ul>	Contractor Developer ECO	Once-off with updating if required
7.1.5 Public Communication		
<ul> <li>The Developer must ensure that the adjacent landowners are informed and updated throughout the construction phases.</li> <li>Sufficient signage must be erected around the site (including at the entrance), informing the public of the construction activities taking place.</li> <li>The signboards must include the following information: <ul> <li>The name of the Contractor.</li> <li>The name and contact details of the site representative to be contacted in the event of emergencies or complaint registration.</li> </ul> </li> <li>The Contractor must appoint a CLO (Community Liaison Officer).</li> </ul>	Contractor / ECO	Once-off



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY		
7.1.6 Protected Flora				
<ul> <li>Prior to commencement of construction, an ecologist must be appointed to survey the construction footprint and working servitude for protected and important species, mark these species and apply for necessary permits and licences to destroy or relocate them.</li> <li>In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974, an Ordinary Permit from the <i>eZemvelo</i> KZN Wildlife (EKZNW) is required to handle the seven (7) protected plant species.</li> <li>A licence with regards to nationally protected trees is required to handle the <i>Sclerocarya birrea</i> subsp. <i>caffra</i> and <i>Sideroxylon inerme</i>. The licence must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) prior to construction.</li> <li>The commencement of construction must be preceded by a plant rescue programme which must be conducted after receipt of the permits issued by <i>E</i>KZNW.</li> <li>No clearing of vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).</li> <li>Prior to the stripping, infilling, excavation and re-shaping of the aquatic habitat within the development footprint / corridor, a plant search and rescue must be undertaken prior to habitat destruction. This must be followed by harvesting of all robust indigenous hygrophilous vegetation for later use during revegetation. In this regard, a wetland / aquatic ecologist must guide the contractor on the plants to rescue prior to clearing.</li> </ul>	Contractor, ECO, Ecologist, Aquatic Ecologist	Once-off		
7.1.7 Affected Household and Fence Lines				
<ul> <li>An approved compensation process which details the values and asset relocation process must be offered for the single home that will be affected by physical displacement.</li> <li>The potential for impact on fence lines must also be offered a compensation settlement. This process must be undertaken with the consent of the household owner, under the guardianship of the traditional leader.</li> <li>A record of all agreements and actions must be kept within the Environmental Site File.</li> </ul>	Developer Traditional Authority	Once-off		
7.1.8 Demarcation of the Construction Corridor and NO-GO Areas				
<ul> <li>Link Road:</li> <li>The width of the construction corridor through the Mixed Tall Bushveld vegetation type must be restricted to a 3 m construction working corridor / right-of-way (RoW) along one side of the road footprint for access and haulage purposes and a 1 - 2 m construction working corridor along the other side (i.e. maximum of 4 - 5 m working area outside of the road footprint.</li> <li>The full 20 m road servitude must not be cleared.</li> <li>Site camps, laydown and storage, and soil / road material stockpile areas must not be located within the Mixed Tall Bushveld community.</li> </ul>	Contractor ECO	Once-off		



	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
•	The width / extent of the construction corridor must be finalised prior to construction commencing and must form part of the EMPr.		
Bri	dge and culverts:		
•	For the Mfolozi River Bridge crossing the construction corridor must be limited to the pier construction areas separated by access tracks to and from these areas.		
•	Pier construction areas must comprise the pier footprint buffered by a 3 m working area. Between these areas a $3 - 4$ m running track must be established for vehicular access only.		
•	For the new and existing tributary stream crossings the construction corridor must be limited to the development footprint and a 3 m working servitude either side thereof.		
•	Materials stockpiling and storage must be done outside of the watercourses		
•	The construction corridor must be clearly demarcated using orange hazard bonnox fencing or brightly coloured shade cloth which should be erected and approved by the ECO prior to the commencement of any construction activities.		
•	All freshwater habitat outside of the demarcated areas must be considered as NO-GO areas for the duration of the construction phase.		
•	Any contractors found working inside the NO-GO areas must be fined as per fining system setup for the project.		
•	Prior to any construction commencing, the width of the construction corridor for each of the watercourse crossings must be finalised and approved by the Engineer with comments from the ECO.		
7.	1.9 Relocation of Services		
•	Eskom officials must be brought onto site to demarcate the Eskom pylons that must be relocated prior to construction commencing. Eskom must relocate the pylons and the KZN DoT must compensate Eskom for the relocation.	Contractor Engineer	Once-off

# 7.2 Construction Phase

	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
7.2	.1 Site Establishment		
•	Prior to the establishment of the site camp / office, the Contractor must produce a site layout plan showing the positions of all equipment storage, waste stockpiling, fuel storage areas and other infrastructure for approval of the ECO. The camp must be located on a disturbed site that does not require the removal of vegetation, i.e. protected trees or plants. The site camp must be located at least 100 m away from any watercourses. The location of the site camp must be approved by the ECO prior to implementation.	Contractor SHE Officer ECO	Once-off
	Unauthorised entry, stockpiling, dumping or storage of equipment, material or waste must be strictly prohibited in identified NO-GO areas. Unauthorised access onto / into private properties is strictly	Contractor	Weekly



ENVIRONMENTAL SPECIFICATION RESPONSIBILITY FF			
	prohibited.		
7.2	2.2 Pollution Prevention Measures		
•	Hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) must be stored in a bunded area or within drip trays. Storage containers must be regularly inspected (once a week) to check for leaks. Material Safety Data Sheets (MSDSs) must be readily available		
-	on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes. Mixing and / or decanting of all chemicals and hazardous substances must take place on trays, shutter boards or on impermeable surfaces and must be protected from the ingress and egress of stormwater. Drip trays should be utilised at all dispensing areas		
•	No refuelling, servicing or chemical storage should occur within 100 m of the delineated watercourse habitat or within the 1: 100-year flood line, whichever is the greatest.		
•	The washing of concrete trucks on-site is prohibited.		
•	Vehicle maintenance must not take place on-site unless in a		
	specific bunded area with an oil filter trap.		
	site staff must be made aware of the health risks associated with any hazardous substances used and must be provided with protective clothing / equipment in case of spillages or accidents and must receive the required training.		
•	If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage. The drip tray must be lined with absorbent pads and checked daily while in	Contractor SHE Officer	Daily
•	All equipment to be used within the sensitive working areas (within the watercourses) must be checked daily for oil and		
	diesel leaks before gaining access to these working areas.		
•	Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered		
	waste contractor. Workers must use the toilet facilities provided		
	and not the natural environment.		
	watercourse or closer than 100 m or from any natural water		
	bodies including rivers, streams, riparian areas and wetlands.		
•	Any spill incident, which may occur, must be investigated and		
	immediate action must be taken. This must also be reported to the ECO and SHE Officer		
	An emergency spill response procedure must be formulated and		
	staff must be trained in spill response. In the case of a spill of		
	hydrocarbons, chemicals or bituminous material in the		
	construction camp or on the construction-site / bunding area,		
	the spill must be contained and cleaned up and the material		
	as hazardous waste to a licenced facility		
Sh	ould a pollution incident occur on-site, the Contractor must:		
•	Implement reasonable measures immediately to contain and		
	minimise the impacts of the incident;		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul> <li>Contain the spill;</li> <li>Notify all persons whose health may be affected by the incident;</li> <li>Undertake clean up procedures immediately;</li> <li>Notify the Contractor of the incident immediately who must advise the employee as to the measures that must be implemented;</li> <li>Record the incident in the Environmental Incident Register; and</li> <li>Implement measures to prevent similar incidents from occurring in the future.</li> <li>The Spill Contingency Plan (<i>Appendix C</i>) must be implemented.</li> </ul>		
7.2.3 Worker Conduct		
<ul> <li>No alcohol / drugs are allowed on-site.</li> <li>No firearms are allowed on-site or in vehicles transporting staff to and from site, unless used by security personnel.</li> <li>Bringing pets onto the site is prohibited.</li> <li>No harvesting of firewood from the site or from the areas adjacent to it.</li> <li>Construction staff must make use of the facilities provided for them, as opposed to <i>ad hoc</i> alternatives (e.g. fires for cooking, the use of surrounding bush for toilet facilities).</li> <li>No trespassing on private properties adjacent to the construction areas.</li> <li>Driving under the influence of alcohol is prohibited.</li> </ul>	Contractor SHE Officer	Daily
7.2.4 Clearing and Protection of Vegetation and Faul	na	
<ul> <li>No natural vegetation must be used as firewood.</li> <li>Protected and conservation important plants falling outside of the construction corridor that are accidentally disturbed (infilled, cut down etc.) must be replaced by plants of the same species.</li> <li>No animals must be disturbed unnecessarily and no animals must be shot, trapped or caught for any reason.</li> <li>Any wildlife that is injured or killed on the site by accidental means i.e. hit by a vehicle, must be reported to the Developer, who must take appropriate action to facilitate the recovery of the animal where possible i.e. take the animal to the SPCA.</li> <li>Before any work commences, sediment control / silt capture measures (e.g. bidim / silt curtains) must be installed downstream of the working areas, specifically above the pool habitats. A minimum of 3 rows of silt fences / curtains must be installed across the river / stream channel established at regular intervals.</li> <li>All Invasive Alien Plants (IAPs) found, must be immediately removed and disposed of responsibly in accordance with the requirements of the ECO. No alien plants are permitted to be brought to site.</li> <li>All alien invasive vegetation that has colonised the constructionsite must be removed, preferably by uprooting. The contactor must consult the ECO regarding the method of removal.</li> <li>All bare surfaces across the construction-site must be checked for IAPs every 2 weeks and alien plants removed by hand pulling / uprooting and adequately disposed</li> </ul>	Contractor	Daily



	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul> <li>Her pos in w ECC</li> <li>Whe and</li> <li>The imp</li> </ul>	bicides must be utilised where hand pulling / uprooting is not sible. Only herbicides which have been certified safe for use vetlands by independent testing authority must be used. The O must be consulted in this regard. ere IAPs have been introduced on to the site during clearing infilling, they must be removed. IAP Eradication Programme contained in this EMPr must be lemented.		
In the emitigation Pull place and Bur Alter reginner	event that Famine Weed is recorded on site, the following on measures must be undertaken: I the entire plant out including roots before flowering and ce it in a bin bag. The use of protective gloves, facemasks good clothing at all times is essential. In all uprooted plants once dry in a controlled environment. Internatively, spray all emerging plants and leaves with a stered herbicide such as <i>Access 240 SL</i> . The application of bicide must be controlled.		
7.2.5	Heritage & Palaeontology		
<ul> <li>Gra m. I zon</li> <li>Gra thei traje grav</li> <li>If gr con relo</li> <li>In tt stop resu and</li> <li>A b Site</li> <li>A b Site</li> <li>A so be con</li> <li>If an mus</li> <li>The pers imm Eng regi</li> <li>Wo arch</li> <li>No to b AM.</li> <li>The Pala und</li> </ul>	<ul> <li>ve Sites 2, 3, 4, 5, 7 &amp; 8 must have buffer zone of at least 10 No development or alteration may take place within this buffer e.</li> <li>ve Sites 1 &amp; 6 must have a buffer zone of at least 2 m due to r close proximity to the proposed link road (and existing road actory). The grave must be fenced and protection of the ves ensured at all times.</li> <li>raves need to be exhumed and relocated the Developer must duct a Phase Two Heritage Impact Assessment by a grave cation specialist.</li> <li>ne event that any 'hidden graves' are encountered, work must b immediately and AMAFA must be contacted. Work may only ume once clearance is given in writing by an archaeologist / or AMAFA.</li> <li>uffer zone of 20 m must be maintained around the Shembe e of Worship.</li> <li>urface collection of all the Early Stone age site artefacts must conducted by a heritage consultant or AMAFA prior to any struction activities.</li> <li>n artefact on-site is uncovered, work in the immediate vicinity st be stopped immediately.</li> <li>e Contractor must take reasonable precautions to prevent any son from removing or damaging any such article and must hediately, upon discovery thereof, inform the Construction jineer of such discovery whom in turn must contact a stered archaeologist and AMAFA.</li> <li>rk must only resume once clearance is given in writing by the haeologist and / or AMAFA.</li> <li>structures older than sixty years or parts thereof are allowed be demolished altered or extended without a permit from AFA.</li> <li>e EAP and ECO must be informed of the fact that a High aeontological Sensitivity is allocated to the study area lerlain by the Chobeni Formation and the Dwyka Group.</li> </ul>	Contractor Developer	Daily
A " (Ap	pendix E).		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul> <li>A Phase 1 PIA document and revision of the "Chance Find Protocol" must be prepared in all areas where excavation will exceed 1.5 m in the sensitive formations.</li> <li>If fossils are recorded, a revised "Chance Find Protocol" must be prepared by a suitably accredited Palaeontologist and recommendations contained in the Phase 1 PIA must be approved by AMAFA.</li> </ul>		
7.2.6 Traffic		
<ul> <li>Temporary loading and off-loading areas must be designed prior to construction activities.</li> </ul>		
<ul> <li>Ensure that there are flag men and signs in place at access points to the construction-site.</li> </ul>		
<ul> <li>Warning and reduced speed signage must be erected where necessary.</li> </ul>		
<ul> <li>Maintaining a safe flow of traffic during construction must be carefully planned and executed. Due to the numerous rural settlements along the existing section of the L2598 it is strongly advised that the local community is engaged in all planning relating to accommodation of traffic.</li> <li>The existing section of the L2598 must be constructed using half width construction methods.</li> <li>Keep to a safe speed limit of 40 km/hr maximum when driving on the gravel road to site.</li> <li>Traffic calming measures must be implemented.</li> <li>Bridge design must make provision for a pedestrian sidewalk and guardrails.</li> <li>A speed of 60 km / hr must be obeyed on the link road and bridge.</li> <li>The layout of construction areas and detours in the use of delineators and warning devices must be in accordance to the latest South African Roads and Traffic Signs Manual. The establishment of areas for contractor operations is necessary to minimise the impact on the safety of motorists, pedestrians and workers.</li> </ul>	Contractor	Daily
7.2.7 Safety		
<ul> <li>When encountering any livestock on the road, drivers must slow down and stop and sound the hooter.</li> <li>Drivers are not permitted to use their vehicles to push the livestock off the road.</li> <li>When approaching any pedestrians / scholars appropriate action must be implemented which will include the following:         <ul> <li>If roads are dry, slow down when travelling past any pedestrians to mitigate the dust exposure.</li> <li>If roads are wet, drive slowly past any pedestrians to prevent the splashing of water / mud.</li> <li>If any pedestrian is walking on the road allow them to move to a safe section of the road as there are no sidewalks before passing them.</li> <li>If pedestrians are identified on the road from a distance, sound the hooter to warn them.</li> </ul> </li> </ul>	Contractor Health and Safety Officer	Daily



	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
•	Road signs for all lane closures must be done in accordance to		
	the South African Road Traffic Signs Manual (SARTSM, 1999).		
•	Construction routes must be clearly defined.		
•	All contractors must ensure that their employees and in		
	particular, construction vehicle drivers / operators comply with		
	the safe access and egress plans that are to be put in place		
	during the construction process. Appropriate warning and reduced speed signage must be erected where pecessary		
	reduced speed signage must be elected where hecessary.		
7.2	2.8 Construction Vehicles		
•	Access of all construction and material delivery vehicles must be strictly controlled		
	Vehicles and equipment must be serviced regularly (at least		
	monthly) to avoid the contamination of the area from oil and		
	hydraulic fluid leaks, etc.		
	Servicing of vehicles must be done off-site.		
	All speed limits must be adhered to. Within site, a speed limit of		
	40 km/hr maximum must be implemented.		
•	Machinery or equipment used on-site must not constitute a		
I.	pollution nazard.	Contractor	Daily
1.	withdrawn from use if they consider the equipment or machinery		-
	to be polluting and irreparable		
	New plant entering site must be washed prior to entering the site		
	to prevent the spread of Famine Weed from other sites.		
	Covered receptacles must be available at all times and placed		
	for the disposal of waste.		
•	All used oils, grease or hydraulic fluids must be placed therein		
	and these receptacles will be removed from the site on a regular		
	basis for disposal at a registered or licenced disposal facility.		
7.2	2.9 Topsoil		
•	The Contractor must strip and stockpile all topsoil within the		
	construction servitude, a minimum of 32 m away from any		
	watercourses, for use at a later stage.		
•	The removal of any topsoil from site is prohibited and this must		
	be stockplied and used solely in the renabilitation of the works		
	Tonsoil is to be bandled twice only - once to strip and stocknile		
<b>_</b>	and once to replace and level		
	All stockpile areas must be established on disturbed flat ground	Contractor	Daily
	or within the construction corridor or designated areas outside of		,
	the construction servitude.		
•	Stockpiles must be located outside of the 32 m watercourse		
	buffer. Stockpiles must be protected from wind and rain with the		
-	use of tarpaulins where necessary.		
	The slope and neight of stockpiles must be limited to 2 m to		
-	Avoid Soil Compaction and destruction of Soil Microbes.		
-			
7.2	2.10 Soil Erosion and Sedimentation		
•	Construction activities must take place in a phased manner i.e.		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	<b>FREQUENC</b> Y
only remove vegetation as the construction face proceeds		
• All bare slopes and surfaces that are exposed to the elements		
during clearing and earthworks must be protected against		
erosion using rows of silt fences and sandbags. A minimum of		
two (2) rows are required.		
- Sediment barriers such as bernis, sanubays and / or sill rences		
phase and repaired immediately when damaged		
<ul> <li>Sediment barriers must only be removed once vegetation cover</li> </ul>		
has successfully re-colonised the embankments.		
• After every rainfall event, the contractor must check the site for		
erosion damage and rehabilitate this damage immediately.		
• Where required sandbags must be used to retain banks		
vulnerable to collapse.	-	
<ul> <li>The natural flow of rivers or streams must not be permanently</li> </ul>		
diverted of blocked.	-	
<ul> <li>Infough flows to downstream aquatic ecosystems must be maintained to protect aquatic life, and provent the interruption of</li> </ul>		
existing downstream uses. The entire river must not be closed at		
any one time.		
<ul> <li>Clearing activities must only be undertaken during agreed</li> </ul>		
working times and permitted weather conditions. If heavy rains		
are expected, clearing activities must be put on hold. In this		
regard, the contractor must be aware of weather forecasts.		
7.2.11 Waste Management		
General Waste:		
<ul> <li>General waste produced on-site must be collected in skips for diagonal at a projection of the state of the st</li></ul>		
disposal at a registered landfill site. Hazardous waste must not		
at the municipal landfill site		
<ul> <li>Valid disposal certificates for all waste must be obtained and</li> </ul>		
placed within the Environmental Site File for record keeping		
purposes.		
• Eating areas must not be located within 100 m of the		
watercourse habitats. Waste bins must be provided at the eating		
areas.		
• Waste must not be burnt or buried on-site. The excavation and		
use of rubbish pits on-site is prohibited.	Contractor	
- waste bins must be cleaned out on a regular basis (weekly) to		Weekly
<ul> <li>All general waste must be removed from the construction areas</li> </ul>		
on a daily basis and disposed of in suitable waste receptacles.		
Construction rubble:		
Rubble generated from demolishing of existing infrastructure		
must be loaded onto a dump truck as soon as it is generated. A		
dump truck must be on standby while the culvert is being		
demolished.		
<ul> <li>No building material, soils or rubble must be disposed of within</li> </ul>		
any watercourse (wetland or river).		
<ul> <li>Once loaded onto a truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe dispess!</li> </ul>		
<ul> <li>Should rubble be required as a raw material for the construction</li> </ul>		
it must be taken to a designated stockpile area which must be		
approved by the ECO		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
Hazardous waste:		
- Hazardous waste must be disposed of at a licenced hazardou	s	
waste landfill site.		
<ul> <li>Mixing and / or decanting of all chemicals and hazardou</li> </ul>	s	
substances must take place on travs, shutter boards or o	n	
impermeable surfaces and must be protected from the ingres	s	
and egress of stormwater.	-	
<ul> <li>No refuelling, servicing or chemical storage should occur within</li> </ul>	n	
100 m of the delineated aquatic habitat or within the 100-yea	nr l	
flood line whichever is applicable		
<ul> <li>SDCs must be obtained from the waste removal company a</li> </ul>	s	
evidence of correct disposal and kept on-site within the Sit	о Д	
Environmental File	<b>°</b>	
<ul> <li>Transport of bazardous materials must be done in accordance</li> </ul>		
with legislative control and Relevant SARS Codes of Practic		
must be adhered to		
7212 Wastewater		
1.2.12 Wastewater		
All wastewater generated at the proposed development must be		
disposed of so as not to cause any surface or subsurface wate	r l	
pollution or health hazard. Wastewater must be removed off sit		
to an appropriate facility		
Wastewater including coment-contaminated water must no	Contractor	Daily
optor any watercourse. Used oil and wastewater must b		Daily
diapopped of at a registered facility A SDC is to be obtained b		
the Centrester and kept on site within the Site Environment	y N	
	1	
7.2.13 watercourse management		
Watercourses outside of the construction servitude that an	e	
disturbed during the construction phase must be rebabilitate	ď	
immediately		
<ul> <li>All disturbed areas must be propared and then re-vegetated t</li> </ul>		
the satisfaction of the ECO		
Where stream channels have been disturbed, the channels must	<b>.</b>	
- where stream chames have been disturbed, the champers accelering		
and re-vegetated		
Mater abstraction and use:		
Valer austration and use.		
- No water is to be abstracted from the fiver for use in construction	n	
terms of section 21 (a) of the Netional Water Act		
The Contractor must only be allowed to draw water from the		
- The Contractor must only be allowed to draw water from th		
source / s indicated in the WULA.		
<ul> <li>Abstraction points (as identified within the BAR) must be utilise to minimize imports to quantified within the BAR)</li> </ul>	u	
to minimise impacts to sensitive river biotopes.		
• Care must be taken not to disturb the channel bed of	T	
watercourses during abstraction of water using suction pumps.		
The suction pump inlet must be located at a sufficient height	nt	
above the channel bed / floor where bed-load sediment	S	
accumulate.		
<ul> <li>A suitable sediment filter / screen must be installed in front of th</li> </ul>	e	
suction pump inlet to remove undesirable sediments, particle	S	
and debris from entering the pump.		
<ul> <li>Employees must not make use of any natural water sources (e.g.</li> </ul>	J.	



	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
	rivers) for the purposes of swimming, bathing or washing of		
	equipment, machinery or clothes.		
1	labourers must be discouraged from drinking directly from the		
	river.		
•	It is recommended that construction take place in the winter / dry		
	months to reduce erosion and sedimentation risks associated		
	with high summer rainfall in this region.		
•	Stormwater and erosion control measures must be implemented		
	sedimentation impacts to the river including in-stream habitats		
	are minimised and avoided. In this regard, the following		
	measures must be implemented:		
	- The natural flow of rivers or streams must not be		
	permanently diverted or blocked.		
	- Clearing activities must only be undertaken during agreed		
	rains are expected, clearing activities must be put on hold. In		
	this regard, the contractor must be aware of weather		
	forecasts.		
A	method statement for working in watercourses in provided in		
500	cuon 6.		
7.2	2.14 Noise		
•	Neighbouring landowners must be notified (within 48 hours) of		
	noisy construction activities (blasting, excavations and piling		
-	All construction vehicles and equipment must be kept in good		
	repair and must be fitted with standard silencers prior to		
	construction.		
•	Where possible, stationary noisy equipment (for example		
	compressors, generators etc. must be encapsulated in acoustic		
	used in the case where poisy equipment is not stationary (for		
	example drills, angle grinders, chipping hammers).		
•	Construction activities, and particularly the noisy ones, must be		
	contained to reasonable hours during the day and early evening.		
•	Machines in intermittent use must be shut down in the		
	intervening periods between WOrk or throttled down to a	Contractor	Daily
	In general, operations must meet the noise standard		
	requirements of the Occupational Health and Safety Act (Act No.		
	85 of 1993).		
•	Construction staff working in areas where the 8-hour ambient		
-	Noise levels exceed 75 dBA must wear ear protection equipment.		
	All noise and sounds generated must adhere to SANS 10103		
	specifications for maximum allowable noise levels for rural areas		
•	No pure tone sirens or hooters must be utilised except where		
•	No pure tone sirens or hooters must be utilised except where required in terms of SANS standards or in emergencies.		
•	No pure tone sirens or hooters must be utilised except where required in terms of SANS standards or in emergencies. Noisy operations must be combined so that they occur where		
•	No pure tone sirens or hooters must be utilised except where required in terms of SANS standards or in emergencies. Noisy operations must be combined so that they occur where possible at the same time.		



	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
	the Contractor must be instructed to remove the offending		
	vehicle or machinery from site.		
•	The Contractor must take measures to discourage workers from		
	loitering in the area and causing noise disturbance. Where		
	possible labour must be transported to and from the site by the		
	Contractor or his sub-contractors by the contractors own		
	transport.		
	Construction activities must be contained to reasonable hours		
	during normal working hours.		
•	A Complaints Register must be kept at the Site Office at all		
	times.		
7.2	2.15 Air Quality Pollution Management and Odour C	ontrol	
•	Portable toilets must be cleaned on a regular basis (weekly).		
	Servicing receipts must be maintained and kept on site within the		Weekly
	Site Environmental File.		
•	All mobile plant and equipment must be in good working order.		
•	All mobile plant that are unable to be repaired immediately must	Contractor	Daily
	be removed from service until such time as they are in good		Daily
	working condition.		
7.2	2.16 Dust Control		
	Dust must be suppressed on the construction site during dry		
	periods by the regular application of water.		
•	Water used for this purpose must be used in quantities that will		
	not result in the generation of runoff.		
	If water is abstracted from a water resource for dust suppression,	Contractor	
	a WULA must be obtained from the DWS.	SHE Officer	Daily
	Speed limits of a maximum of 40 km/hr must be implemented on-	ECO	,
	Site and enforced by the Contractor.		
	A dust suppression register as well as a complaints register must		
_	De kept.		
1.	All complaints received must be investigated with remedial action		
-	Currence fill material sites and stackniles must be positioned such		
17.	that they are not vulporable to wind crosion		
	All stockpiles must be maintained for their lifetime, and retained		
1	for as short a time as possible. Stockpiles should be opelesed by		
	wind-breaking enclosures of a similar height to the stocknile		
7.2	2.17 Stormwater Management		
•	All erosion protection measures (e.g. Reno-mattresses) must be		
	established to reflect the natural slope of the surface and located		
	at the natural ground-level.		
•	All stormwater discharge points must have erosion protection		
	and energy dissipation measures	Contractor	
•	Outlet erosion structures must be properly installed along the	Engineer	Daily
	grade and elevation of the slope.	Lightoor	
•	When the gradient is more than 10%, the side drain must be		
	concrete lined in order to prevent scouring and siltation		
•	All side drain outlets (chutes) must be selected based on the fill		
	condition onto which the water will discharge.		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul> <li>The Stormwater Management Plan (<i>Appendix B</i>) and stormwater designs (culverts) must be adhered to and implemented.</li> </ul>		
7.2.18 Fire Management		
<ul> <li>No open fires to be permitted on construction sites. Fires must only be made within the construction camp and only in areas and for purposes approved by the ECO.</li> <li>Fire prevention facilities must be present at all hazardous storage facilities.</li> <li>Adequate fire-fighting equipment must be available and workers must be trained on how to use it.</li> <li>Workers must be trained in the proper procedure in case of a fire occurring on site.</li> <li>Smoking must not be permitted in areas considered to be a fire hazard.</li> </ul>	Contractor Engineer	Daily
7.2.19 Social		
<ul> <li>The particular health and social ills that may become more predominant at this time may relate to the spread of HIV / AIDs, unplanned pregnancies, and the pronounced use of alcohol, etc. Since freedom of movement of the (residential, on-site) construction workers cannot be controlled, it is important that the construction company put in place ethical codes of behaviour – which will guide the interaction of the on-site labour population with the local population. This must be monitored and any indiscretions must be addressed.</li> <li>A formal recruitment policy must be formulated that will ensure fair access to jobs, especially for local residents. This must be a requirement to be met by companies working in the construction phase</li> <li>A Community Liaison Officer (CLO) must be appointed by the contractor to assist with employing of local community members and to ensure that the employment thereof is fair and equitable.</li> <li>This project does not anticipate considerable procurement of goods and services, however, a Contractor Procurement Policy must be maintained</li> </ul>	Contractor Engineer	Daily

# 7.3 Post Construction Phase

	ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
7.	3.1 Construction areas		
•	All structures comprising the construction camp must to be removed from the site and disposed of at a registered facility.		
•	The area that previously housed the construction materials must be checked for spills of substances such as oil, paint, diesel, etc.	Contractor	Post-
•	All hardened surfaces within the construction affected area must be ripped, all imported materials removed, and the area must be top-soiled and re-grassed accordingly with indigenous species.	Developer	Construction
	The Contractor must arrange the cancellation of any temporary		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
services.		
7.3.2 Vegetation		
<ul> <li>All areas that have been disturbed by construction activities (including the construction affected areas) must be cleared of alien vegetation.</li> <li>All vegetation that has been cleared during construction must be removed from site or used as mulch, (except for vegetation which may result in inadvertently seeding alien vegetation).</li> </ul>	Developer	Post- Construction
7.3.3 Materials and Infrastructure		
<ul> <li>All residual stockpiles must be removed to spoil or spread on- site as directed by the Developer and / or Engineer.</li> <li>All leftover building materials must be removed from the site.</li> <li>The Contractor must repair any damage that the construction works has caused to neighbouring properties.</li> <li>Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Developer.</li> </ul>	Developer Engineer Contractor	Post- Construction
7.3.4 Rehabilitation		
<ul> <li>The Developer is responsible for compliance with the provisions for Duty of Care and Remediation of Damage in accordance with section 28 of National Environmental Management Act (NEMA), Act No. 107 of 1998.</li> <li>All disturbed surfaces compacted by maintenance activities including the ablutions and loading areas must be ripped to a minimum depth of 30 cm to allow organic contaminants to breakdown and promote vegetation establishment.</li> <li>The Contractor is required to rehabilitate all impacted areas according to the approved Method Statement for the Rehabilitation of Modified Environments.</li> <li>Final rehabilitation must be completed within a period specified by the Engineer.</li> <li>Surfaces must be checked for waste products from activities such as concreting or asphalting.</li> <li>All embankments must be trimmed, shaped and replanted to the satisfaction of the ECO.</li> <li>Immediately after construction disturbed areas must be revegetated and supplemented with transplants from adjoining like habitats if required. Alternatively, reseeding via broadcasting using an indigenous seed mix reflecting the general species composition of the area and grown nearby for later revegetation using plugs / sprigs.</li> <li>A biodegradable geo-fabric mat (or vegetation blanket) must be utilized to protect the topsoil on steep slopes from water and wind erosion during re-vegetation. Alternatively, the plants can be secured using a coarse mesh (steel wire or plastic). The mesh or mat is placed over the vegetation securing it until it can fully establish. The plants must be able to grow unhindered</li> </ul>	Contractor Engineer Developer ECO	Post- Construction



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12.1
tion



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
7.3.6 Waste Management		
The site must be kept void of litter.		
<ul> <li>Waste management at the site must subscribe to the principles of sustainable waste management.</li> <li>This includes: <ul> <li>Waste prevention - the prevention and avoidance of the production of waste at source;</li> <li>Waste reduction - the reduction of the volume or hazardous nature of the waste during production;</li> <li>Resource recovery - recycling or re-use of the waste;</li> <li>Waste treatment - the treatment of waste to reduce volume or risk to human and environmental safety and health to reduce the degree of hazard when waste is disposed of in a landfill or discharged into a water source; and</li> <li>Waste disposal - the environmentally acceptable and safe disposal or discharge of waste, (e.g. encapsulation, incineration, landfill or discharge to a water source).</li> </ul> </li> </ul>	Developer	On-going
These principles must be practiced to the greatest extent possible.		



## 8 METHOD STATEMENT FOR WATERCOURSE CROSSINGS

This method statement applies to the crossing of rivers, streams and wetlands and must be read in conjunction with the Construction Method Statement (*Appendix D*).

The construction methodology adopted for each individual watercourse will be dependent on:

- the season within which construction arrives; and
- the permanent / semi-permanent saturation status of the watercourse.

At this stage, the Contractor proposes that the construction methodologies applied to watercourses will depend on the above factors, and the approaching construction stage. Ultimately, the method to be adopted by the approaching construction stage will be dictated by the saturation status of the wetland (wet or dry), in order to protect and preserve existing hydrological functionality. Some stages of construction e.g. works within the river bed for the purposes of constructing the bridge, will be undertaken according to the season within which construction arrives. At all times, the Contractor will take cognisance of the measures detailed within White Mfolozi River Bridge and Link Road. Freshwater Habitat Assessment, (**EcoPulse, 2017**), White Mfolozi River Bridge and Link Road, Conceptual Rehabilitation Plan (**EcoPulse, 2017**), White Mfolozi River Bridge and Link Road Terrestrial Vegetation Assessment (**EcoPulse, 2017**), as well as the Environmental Management Programme (EMPr), and all other relevant documentation.

It has been noted by the Engineer (**Royal HaskoningDHV**) that some mitigation measures are commonly applied to every wetland, as detailed in the wetland and aquatic assessment study, and as such, become standard to all wetlands regardless of its saturation status. Only general mitigation measures for construction of the bridge and access road through the stream and wetland crossings shall be discussed in this Construction Work Method Statement. For site specific mitigation measures consult the above-mentioned wetland and aquatic assessment study and this EMPr as submitted as part of the Basic Assessment Study undertaken by the Environmental Assessment Practitioner (EAP), namely Royal HaskoningDHV, on behalf of the Developer.

General guidelines for construction of a bridge, road and culverts within a watercourse are provided below, following which the sequence to be followed by the Contractor is elaborated upon.

The key impact minimisation measure for watercourse crossings (both existing and new) is the establishment of an adequate number of box culverts to ensure that the culverts span the entire width of the channel being crossed to minimise flow concentration / constriction as far as practically possible.

## 8.1 General Guidelines

The Contractor must, where applicable create, flume ditches, canals, small streams and drains so as not to interfere with or cause pollution of the water flow and to avoid damage to stream banks.

Personnel, equipment and materials must be moved across or around all crossings, which may require the construction of temporary bridges. No ditches, canals, streams or drains must be filled, bridged or otherwise obstructed without written approval of the Project Manager, and the relevant Competent Authorities having effective control over such watercourses. The Environmental Control Officer must have input into these decisions and provide commentary as to the correct approach to follow for each site specific intervention.

The following principles will be observed:

• The Contractor must ensure that the construction footprint is kept to a minimum in these areas;



- River / stream flow will be maintained at all times through fluming or damming / over-pumping, with sufficient pump capacity available in case of flooding;
- Should water be pumped from the dry working space within any watercourses, this water must be pumped into a retention dam / silt lagoon (or similar structure) to ensure sediment settles and clean water is released back into the watercourse;
- All necessary material for silt and pollution control will be installed at the watercourse crossing, including, but not limited to, silt fences, filtering material, Geotextile;
- Should there be any watercourse crossings (as at the White Mfolozi River, Mooti River, etc.) within
  the wetland then soil / topsoil stockpiles shall be kept away from the banks to avoid silt run-off. Soil /
  topsoil stockpiles shall be appropriately protected using silt fences, sand bag barriers and other
  methods as required;
- No refuelling or fuel storage will be allowed within 100 m of water bodies or wetland areas;
- Specific oil spill response equipment must be kept on-site for intervention purposes. Where required, bunds, grips and other measures must be implemented adjacent to watercourses to prevent silt / pollutants ingress from the construction spread;
- Wherever possible, and in case work during the dry season cannot be achieved, work in-stream channels will be carried out without the use of 'in-river' techniques, instead using techniques that divert the flow around the works through flumes or by damming and pumping. This will minimise sediment release;
- If wet cement and / or concrete works are necessary, ready-mix is to be preferred and care should be taken not to spill any product. All priming of hoses for concrete pours must be done away from sensitive areas in a manner that reduces environmental impacts to the bare minimum and can be cleared from site easily, for safe disposal to a licensed waste landfill site;
- Full reinstatement of the beds must be undertaken upon completion of the necessary works within any watercourses;
- The pre-construction profile must be restored, and the banks must not be steeper than at preconstruction;
- The pre-construction gradient of the drainage line must be reinstated as exactly as possible, without humping or hollowing over the construction right of way (ROW) so as to limit erosion or replaced material and possible creation of knick-points;
- All surplus, and especially loose, materials must be removed from the watercourse to preserve water quality and avoid sedimentation of downstream riverine habitat;
- Banks must be re-vegetated as soon as construction works are completed. Standard grassing procedures must be used, except in the wetland and except if there is significant risk of fertilizer entering the channel when transplanting local plants, as for wetlands, must be undertaken. The sourcing of transplants must be careful and scattered so as not to create new problems.
- During site establishment, where watercourses will cross the construction site (regardless of whether they are crossed by the bridge or road) it may be necessary to minimise pollution by:
- Temporarily diverting watercourses around the working area (i.e. over-pump);
- Temporarily culvert the watercourse through the working area (i.e. flume through).
- Where site traffic has to cross watercourses, temporary bridges or culverts / flumes with retaining boards will be installed.
- Non-project related vehicles or persons must be prohibited from using the Construction ROW.
- Construction personnel must be made aware (through training) and reminded of all project-related environment requirements.

## 8.2 Site Preparation Activities

The method adopted during the preparation activities, specifically the Construction ROW phase of construction, must depend on the saturation status of the wetland.



Prior to any construction activity, the boundary of each wetland crossed by the proposed bridge and access road/s must be demarcated in the field.

A 32 m buffer area must be maintained around each water course that will not be directly impacted on by the development and for which a Water Use Licence (WUL) has not been granted, and will be dependent on site specific conditions, topography and construction requirements.

Within this buffer zone a setback buffer area must be preserved where vegetation and root systems will remain undisturbed. Topsoil will only be removed from any temporary accesses (where applicable) and within the construction footprint.

The footprint of the construction area as it traverses wetlands must be kept as narrow as possible.

Demarcation of wetlands within the ROW must be undertaken by trained environmental personnel as per this EMPr. The ROW working width must be reduced where possible to minimise effects of the works on the wetlands which it passes through. During this phase protected species must be identified and relocated / removed if present under the appropriate permits as obtained by the Employer, or through a sub-contracted ecological specialist.

Where the wetland is deemed to be permanent (written decision undertaken in agreement with the Wetland Specialist and / or ECO present), or is encountered in a saturated state during the demarcation, topsoil stripping width must be minimised. The stripping operation must subsequently allow the installation of a temporary load spreading access, and allow construction operations to proceed with limited damage to the topsoil or underlying soils.

However, if in the opinion of the site supervisor responsible for ROW preparation, stripping the topsoil would be detrimental to the wetland and hamper construction progress, the topsoil may remain in place. Only the ROW preparation crew must pass through the wetland, until a temporary access can be laid. Topsoil and vegetation left in-situ would add structural integrity within the wetland, and support the temporary access. It is widely regarded that this aids reinstatement and avoids heavy disturbance to the wetland.

Topsoil stripped from the ROW must be windrowed on the opposite side of the ROW to the storage of subsoil arising from stripping operations (if applicable), and suitably protected from washout and compaction through soil retention curtains and sandbags where necessary; to retain the functionality of the wetlands uppermost stratum.

Planning of crossings must incorporate the location of all environmental and pollution prevention devices and equipment. This includes: location of parking and refuelling areas (if any), location of environment equipment storage where appropriate, of spill response equipment, silt control measures, retention dams (silt lagoons), etc.

Buffer zones of natural vegetation must be kept at watercourse crossings. The nature of these buffer zones must be determined by the site specific conditions and topography.

Protected vegetation must be identified at the pegging out phase, and removed under the applicable permits, in close liaison with the Contractor and the Employers environmental team.

It is envisaged that the working width with regards to topsoil, sub-soil, temporary access (running track) and general construction can be maintained within a an approved ROW.



## 8.3 Site Establishment

This must include the establishment of the Contractor's site camp, including offices, services and amenities. The project team will ensure that work is competently supervised with respect to managing environmental impacts, as well as health, safety and quality aspects. A detailed environmental risk assessment must be produced and construction monitored accordingly.

The site camp must be securely fenced to prevent unauthorised access and will have:

- Approval from the ECO for the location and layout of the site camp;
- A designated bunded plant refuelling area situated a minimum of 100 m away from any watercourse; and
- Emergency spill kits will be available and maintained at all times.

In addition to this all plant must be inspected on a daily basis for fluid leaks and must not be allowed to be used if a leak is identified until it is repaired.

A separate Beam Casting Yard shall be established for the construction of the precast concrete beams that will need to be cast. This facility could either be located on or off-site depending on the appointed contractor. If located on site, the Engineer in conjunction with the ECO must be required to furnish approval for the location and layout of the facility. Once approved by the Engineer and the CA the area must be cleared and grubbed, topsoil must be removed and a concrete slab must be constructed to provide a level platform.

All other requirements contained in the Environmental Authorisation (EA), EMPr, and all other relevant permits and licenses (where required), related to site establishment, shall be adhered to at all times for the duration of the project.

## 8.4 Site Access

Access to the bridge is required for the transport of plant, machinery and materials during construction and must be via the proposed link road. Access to the bridge site must be required from both the eastern and western approaches.

Where machinery is to be used, the necessary precautionary mitigation measures must be implemented to minimise their environmental impact, especially when this involves entering a watercourse. Vehicles with tracks (as opposed to tyres) are preferable – the wider the track the more load spreading and therefore less compaction there is.

Clearing and grubbing works must be undertaken over the full extent of the works area, but not all at the same time, including access roads. This must result in the removal of vegetation, topsoil and sods, all of which must be used for the sole purpose of rehabilitation.

The method adopted during this phase of construction must depend on the saturation status of the *watercourse*.

The temporary access in a saturated *watercourse* will comprise a geotextile, which must underlie an amount of locally sourced stone-material appropriately wide to allow subsequent construction operations to proceed in a safe manner, providing a safe stable working platform to support plant during construction. Alternatively the Contractor must consider gaining access to saturated wetland areas via suitable bogmats.



Where a dry **watercourse** is encountered, topsoil stripping must be minimised and stored in a similar manner to protect it from vehicular compaction and washout. In this situation, no locally sourced stone-material must be laid to complement the temporary access, as a safe working platform can be provided on the dry stable underlying strata.

If precipitation is encountered, access through such areas must be restricted, to prevent compaction of soils. Access must be restored once the soil conditions permit. Furthermore, if access is urgently required, or rainfall is encountered during a vital phase of construction, the method employed for a saturated wetland must be implemented to protect the underlying geology and permit construction to proceed in a safe manner.

## 8.5 Road Construction

Piped cross drainage must be placed under the roads to preserve the continuity of the existing drainage; these must be placed deep enough and at an angle so as to avoid scouring at the outfall point.

Layer works must then be constructed. Final profiles must be completed with material graded to form the required profile, before backfilling of the abutments commences.

All excess material must be re-used within the construction works or must be hauled and disposed of at a recognised landfill site.

## 8.6 **Excavations**

Where material is excavated from the works area at a saturated wetland / watercourse, the excavations must be side dug from the temporary access, with careful separation of soil types / strata as identified. Where a previously dry wetland is saturated, a temporary access must be installed to prevent rutting and degradation of the exposed subsoil, to permit construction to proceed.

Where excavating operations arrive at a dry seasonal watercourse, the excavation must be dug on-line, creating a much narrower excavation, with less subsoil removed as a result, and at a greater speed. The soils must be removed in such a way that they can be easily reinstated (if required) in the reverse order as detailed below.

A common approach is to be applied to all watercourses, with regard to removal of excavated material, whether side dug or on-line. The soil that is removed from the excavation at its deepest point must be laid closest to the excavation. The first layer of topsoil must be laid furthest away from the excavation. This approach ensures that soil layers (strata) are well separated and can be more successfully re-used for rehabilitation elsewhere.

Subsoil must not be stored on geotextile, but instead must be laid directly on the un-stripped topsoil.

As a result of the standard approach to excavations, whereby separate strata as identified are removed and stored to one side in the order in which they were removed, rehabilitation operations elsewhere are somewhat simplified.

Where special conditions occur, such as the presence of an impermeable clay layer, the foreman must be advised accordingly on site by an Environmental Representative of the Contractor, and must be instructed *via* signage at the entrance to the wetland area to ensure it is clearly returned to the same depth and compaction as the surrounding layer (if the intention is to return the soil to the area excavated).



Where trench breakers are required, these must be imported appropriately and installed by a suitably qualified and experienced crew, as instructed by the Engineer, using information provided in the relevant specialist reports.

However, if a saturated watercourse is encountered, it is essential to ensure that any backfill (where required) to excavations is not overly compacted, such that it creates a subsurface dam. In these areas, the Engineer proposes that mechanical compaction must be minimised as far as possible. The principal aim must be to restore the backfilled material to a compaction resembling that of the trench walls and existing strata.

Where a dry watercourse is encountered, backfill (where required) must be done to the standard specification using mechanical aids, if and when practicable.

Depending on the type of material removed from the excavated area, it is going to be necessary to import amounts of layering material. This is typically defined by the Engineer according to the Clients specifications.

Any large boulders encountered during excavations must not be returned to the excavation, but removed off site to a registered landfill site.

Excess soil material must be temporarily windrowed and used within the rehabilitation phase elsewhere on site.

During excavation, piling or any other relevant works, the watercourse and its banks must be continually monitored.

## 8.7 River Crossing

It is envisaged that temporary restriction of the watercourse will be required during the construction of the bridge sub-structure, which includes the bridge piers and abutments. As per the proposed programme this portion of the works must take place in the dry season which would result in reduced risk and associated impacts on the watercourse because of the substantially lower flow. In the event of a storm during the dry season, overtopping of the working platform must permit the storm flow to be contained within the normal river profile. River/ stream flow must be maintained at all times through fluming or damming by constructing a cofferdam and over-pumping, with sufficient pump capacity available in case of flooding.

Only non-erodible material may be used to create the cofferdam to divert waters away from the works area.

River/ stream flow must be maintained at all times through fluming or damming / over-pumping, with sufficient pump capacity available in case of flooding.

Wherever possible, and in case work during the dry season cannot be achieved, work in-stream channels must be carried out without the use of 'in-river' techniques, instead using techniques that divert the flow around the works through flumes or by damming and pumping. This will minimise sediment release.

Should water be pumped from the dry working space within the river, this water must be pumped into a retention dam / silt lagoon (or similar structure) to ensure sediment settles and clean water is released back into the water course.



No fuel may be stored within the (dry) bund area inside the river, or anywhere else within 50 m of a watercourse.

The onus is on the Contractor to routinely check weather forecasts (on a daily basis) to prepare for inclement weather conditions, including possible flood events. All tools, equipment and machinery that could potentially have an adverse effect of the environment must be removed from the works area before the arrival of inclement weather with the potential for flooding. Appropriate spill response material must be available on site.

All petrochemical, cement and / or concrete and other hazardous spillages must be reported to the ECO, the Project Manager and any of the relevant authorities. Incidents are to be captured on the environmental incidents register when they occur and must be closed-out by the ECO following corrective action, where applicable, by the Contractor.

Prefabricated elements must be used where practicable in order to minimise construction duration and potentially environmental impacts associated to fabricating elements on site.

If wet cement and / or concrete works are necessary, ready-mix is to be preferred and care should be taken not to spill any product. All priming of hoses for concrete pours must be done away from sensitive areas in a manner that reduces environmental impacts to the bare minimum and can be cleared from site easily, for safe disposal to a licensed waste landfill site.

Waste management and house-keeping must be maintained at all times during construction. Sufficient waste receptacles must be available in the laydown area/s for containment of all waste produced on site. As a minimum requirement, general and hazardous waste must be separated and kept within sealed receptacles which do not allow for the ingress of water.

No material may be stored for longer than 24-hours within the working area within the river. Material sufficient for the day's work may only be allowed within the working area within the river.

Where the Contractor wishes to deviate from this prescribed construction method statement, he must draft a site specific method statement for the approval of the Project Manager and ECO, and must ensure the method statement complies in its entirety with the Environmental Authorisation, EMPr and all applicable licenses and permits for the project.

Monitoring must be undertaken as per the requirements stipulated in the Environmental Authorisation, EMPr and all applicable license and permits, including the Water Use Licence.

The envisaged procedure and method of work for carrying out the construction of the bridge is provided in more detail below.

The natural downstream flow of the river is to be maintained during construction. This must be achieved by employing flumes and concrete culverts within the cofferdam to direct flows away from the immediate works areas around the base of each of the instream piers. The flume pipes must be removed from the channel when the cofferdam is removed and the original flow patterns re-instated on completion of construction and removal of the cofferdam.

Turbidity curtains must be erected to limit downstream impacts of bridge building activities. These floating barriers are designed to control sediment and run-off at construction sites and usually comprise of vertical liners with floats at the top and a ballast chain at the bottom. These will only be required during the most



high risk activities relating to the, cofferdam construction, dredging of the river bottom for the foundation and abutment construction and the removal of the cofferdam structure.

During bridge construction, place debris catch netting / containment system under the bridge structure to ensure that no building materials fall into the river and contaminate same. See EMPr for more detail.

It is recommended that construction take place ONLY during the dry / winter months to reduce risk of erosion and sedimentation associated with summer rainfall in the region. This is particularly relevant for construction works within/across the White Mfolozi River, which if timed correctly can reduce the intensity of sedimentation impacts to downstream river reaches. This could potentially even negate the need for instream coffer dams and temporary diversions in some instances, which themselves pose the risk of inherent negative ecological impacts. This will also reduce the risks to human safety associated with flooding of the large White Mfolozi River.

## 8.8 Specific Measures for Working within or Near Rivers and Streams

#### 8.8.1 Working Servitude Clearing:

- No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).
- Before any work commences sediment control / silt capture measures (e.g. bidim / silt curtains) must be installed downstream / downslope of the active working areas. Quantities of silt fences / curtains must be decided on site with the engineer, contractor and ECO. The ECO should be present during the location and installation of the silt curtains.
- Silt fences / curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary.
- Movement of construction vehicles across watercourses must be minimised as much as possible.
- Excavated rock and sediments from the construction zone, and including any foreign materials, should not be placed within the delineated rivers and riparian areas or wetlands in order to reduce the possibility of material being washed downstream.
- No physical damage should be done to any aspects of the channel and banks of watercourses other than those necessary to complete the works as specified. Channel bed and bank materials are not to be removed from the watercourse or used for construction purposes. Bed material disturbed during construction should be stockpiled for use in rehabilitation.
- Prior to the stripping, infilling, excavation and re-shaping of the aquatic habitat within the development footprint / corridor, a search and rescue of indigenous flora and fauna must be undertaken prior to habitat destruction.
- Thereafter, any topsoil and vegetation from areas to be excavated should be stripped and stored at the designated soil stockpile area outside of the aquatic zone for use later in rehabilitation.

Diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Not more than one diversion is to be undertaken within any given watercourse at any given time. Re-directed flow must be accompanied by erosion protection measures at the outlet point to avoid scouring, gully erosion and sedimentation of downstream habitat.

Berms of sand bags or similar approved materials must be constructed to channel water away from portions where work activities will be taking place. Construction of these shall be done in a way which does not cause river pollution and siltation. Measures shall be taken to mitigate any spillage of concrete into the river. The contractor shall remove water diversion material to approved site under the supervision of the ECO.


The construction work method statement identifies the use of sandbags for diversion within the watercourse. These sandbags must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions must be removed to restore natural flow patterns.

In support of the sandbags proposed above, the following options are recommended for temporary diversion within a watercourse to ensure dry working conditions without compromising the natural characteristics of the watercourse.

Options for temporary flow diversion when working within channels may include:

- Diversion of the entire watercourse through use of a bypass large diameter pipe; the installation of removable coffer dams; and
- Use of removal sandbags.

Once the correct approach has been adopted for the type of construction, it must be ensured that the desired approach according to the best practise methods is utilised.



#### Table 11: Best practice methods for practical and full isolation





Method/Approach	Description
	pump pump Flow upstream barrior work area isolated from work area isolated from (not always required)
Isolation with silt curtain	In this case the works area still remains wet and a silt curtain is placed around the works area to minimise sediment being transferred downstream.

### 8.8.2 Culvert Watercourse Crossing

The following construction method guidelines are required:

- Ensure that site workers are well versed in the method statement and any other mitigation and management guidelines.
- Ensure that appropriate mitigation measures for site establishment are implemented.
- Ensure that mitigation measures for access control are implemented.
- Ensure that appropriate mitigation measures for site clearing and vegetation stripping are implemented.
- Ensure that appropriate stormwater management and erosion control measures are implemented.
- Trench for culvert through the existing road fill embankment to required depth.
- For culvert replacement: remove existing culvert.
- If it is required that the culvert invert be lowered further, carefully excavate by hand.
- Construct culvert bedding to correct fall and specification.
- Lay culvert to correct crossing angle and fall.
- Backfill according to the specifications indicated on the construction drawings with material approved by the engineer to the height of the fill.
- Perform required compaction tests on all backfill material.

## 8.9 Piling

Founding conditions at the site are considered to be poor, particularly in view of the likely thick alluvial deposits and boulder bed. All foundations are being designed to carry the load in end-bearing, founded in the underlying competent weathered bedrock. Due to the anticipated significant depth to bedrock, the presence of a shallow water table and prominent boulder beds across the site, piled foundations are the most feasible option for supporting the proposed bridge structure. Pressure Grouted Continuous Flight Auger (CFA) and Driven Cast In-situ (DCI) piles are not considered suitable for the project as they are likely to refuse on the boulders beds and ferricrete layer that was observed on site. The following types of piles are therefore being considered in the pile design:



- Oscillator piles; or
- Rotapiles.

The above mentioned pile types will utilize in-situ reinforced concrete which will cause less noise and vibration as compared to driven precast piles.

In order to create a stable platform for the piling rig it would be necessary to construct a temporary piling mat and cofferdam. The piling mat must be in the form of layers of compacted clean quarry rock to achieve a strong working platform. Flumes utilising suitable pipes must be installed in the piling mat to ensure that that the flow of the river is maintained at all times. Alternatively the contractor could opt for piling off a pontoon/barge but this is unlikely taking into account the remote location of the site and the scale of this project/crossing.

The piling rig must be set up in position on the pile mat and drilling will take place in the soil down to competent weathered bedrock. The ready-mixed concrete must be delivered by truck and must be poured into the newly bored holes from a position that must not allow any concrete to spill near to the watercourse or its banks. Any concrete that does spill must be disposed of in a specially designated skip and this skip must also be used to contain the water used for washing out the mixer. The skip's contents must be disposed of as inert waste when all the cement has cured. Reinforcement will be pushed into the wet concrete and the completed pile left to cure before the top is cut off to the correct level to suit the design and disposed of as inert waste at a licensed disposal facility.

When the piling is complete, a cofferdam must be constructed to allow the pile cap and pier / abutment to be constructed. This is critical as it must essentially provide a dry construction space within the White Mfolozi River. Should seepage occur and water is required to be pumped from the dry working space within the river, this water must be pumped into a retention dam/silt lagoon (or similar structure) to ensure sediment settles and clean water is released back into the water course; perhaps being allowed to build-up and flow over the top of the retention dam/silt lagoon (or similar structure) and cascade down the clean dump rock of the cofferdam.

On completion of construction the working platform of clean quarry rock and the cofferdam must be removed and the river bed and banks must be restored to the condition they were in prior to construction.

## 8.10 Abutment and Pier Construction

A layer of blinding concrete must be placed to provide a clean, level working surface on which to construct the reinforced concrete foundations for all piers and abutments. As with the piling operation and all forthcoming concrete placing operations, the same controls must be employed to prevent concrete being deposited in or near the watercourse. If, after thorough risk assessment, the level of risk to the watercourse from contamination from cement remains too high, fast setting concrete mixes may be specified.

Formwork / shutters and steel reinforcement must be erected in-situ to form the pier and abutment base and walls in a number of separate pours.

All backfilling behind the abutment and associated wing-walls must be carried out in a manner to limit the impact on the watercourse. Placement of fill layers must be undertaken in layers not exceeding 200 mm thick when placed loose and compacted using suitable compaction plant to achieve the required Modified AASHTO maximum dry density. Density control of placed fill material must be undertaken at regular intervals during fill construction.



The bridge bearings must be installed and fixed using a cementitious grout ensuring the same levels of environmental protection as for concrete pours.

Backfilling around the abutment and pier walls must be done in layers to ensure adequate compaction and with very great care to ensure that no fill material falls into the watercourse.

## 8.11 Deck Construction

Each of the 8 spans making up the bridge deck will comprise of precast longitudinal post tensioned beams. To mitigate any risk of materials contaminating the stream, pre-cast concrete will be used wherever practical.

The precast longitudinal beams must be erected using a mobile crane. Permanent shutter / formwork must be placed onto the top flanges of the beams and will span between the beams. Once this formwork is erected the steel reinforcement for the deck will be placed, deck shutter erected and the concrete deck slab will be poured using ready mix concrete. The concrete will be pumped with the wet concrete spread by hand tools and compacted using electric vibrating pokers.

Parapets will finally be installed together with bridge expansion joints. Once surfaced the bridge deck will be marked accordingly and all relevant signage would be erected.

## 8.12 Rehabilitation Activities

### 8.12.1 Site Preparation Prior to Re-vegetation

The following key rehabilitation objectives are proposed:

- To reshape, stabilise and re-vegetate (reinstate) wetland and riparian areas physically disturbed by construction activities, both planned and accidental. Rehabilitation must be pragmatic and focus on the stabilisation and re-vegetation of disturbed areas, with less focus on biodiversity aspects (i.e. reinstating reference species diversity).
- To remove all sediment and construction materials washed into wetlands / channels during construction and reshape and revegetate the affected surface (if applicable).
- To eradicate and control invasive alien plants and weeds that invade and colonise the watercourses post-disturbance; and
- To monitor the success of the rehabilitation actions and ensure that the above-listed objectives are achieved.

It must be emphasised however that these guidelines are not intended to be a detailed rehabilitation implementation plan for the site and detailed method statements, planting plans, bills of quantities and budget for rehabilitation must be developed based on these guidelines.

### 8.12.2 Conceptual Rehabilitation Strategy

Post-construction rehabilitation will aid the recovery of the disturbed ecosystems and is critical in preventing further impacts including those associated with IAP infestations, soil erosion and sedimentation. *Table 12* below provides guidance on the approach and basic methods for rehabilitating disturbed aquatic habitat during culvert replacement:



Rehabilitation Step	Rehabilitation Guidelines and Specific Actions
STEP 1: Initial planning and strategy	Upfront it is important to note that these guidelines do not constitute a detailed rehabilitation plan that includes detailed implementation measures and bills of quantities. As part of the approval of the final construction EMPr, a detailed plan should be compiled and appended to the EMPr.
	A budget including costing of all re-vegetation activities and equipment costs must be compiled prior to commencement of construction. A financial provision for all rehabilitation costs must be included in the contractual agreement for the project.
	Rehabilitation must target all areas to be physically disturbed by activities, planned and unplanned. These areas must be identified prior to the implementation of the Plan.
	It is important to keep in mind that the quantity of required geofabric and plant material must be ordered at the right time to ensure that adequate quantities of the materials are available during implementation.
	Rehabilitation of disturbed watercourses must ideally be initiated as soon as possible and occur as construction works progress.
	Whilst appointment of external landscapers is a feasible and acceptable option, a lot of preparation must be undertaken exclusively by the main contractor at the inception of the project. Preparation activities include correct stockpiling of topsoil needed for rehabilitation, harvesting of indigenous plants for use later on in rehabilitation, managing a nursery for rescued plants, etc.
	A suitably qualified aquatic / river ecologist with experience in rehabilitation must be utilised to provide practical input into the rehabilitation during implementation of the rehabilitation plan.
STEP 2:	Where indigenous vegetation can be harvested and retained for use in re-vegetation, this must be done. Retained vegetation must be kept moist at all times until replanting can be achieved.
Plant Rescue and Topsoil Management	Where applicable topsoil stripped from the construction zones within the construction footprint must be conserved, stored and used in rehabilitation. An effort must be made to ensure topsoil is not mixed with subsoils (to be kept separate).
	Pre-emergent herbicide may be applied to stockpiled topsoil to rid it of IAPs.
	All waste products (spoil, construction materials, hazardous substances and general litter) must be
STEP 3:	Minimise additional disturbance by limiting the use of heavy vehicles and personnel during clean-up
Remove any waste products	operations.
	Any large plumes of sediment washed into river from upslope must be removed, taking care not to remove or disturb the natural soil profiles including instream and riparian habitats.
	All exotic / alien plants and weeds must be removed and properly disposed of prior to the
STEP 4:	implementation of rehabilitation measures.
invasive alien	Note that frequent <u>hand removal is the most preferred option</u> and only in the event that this is not a viable means of control, should chemical means be considered. Only herbicides which have been
plants	certified safe for use in aquatic environments by an independent testing authority may be considered. The ECO must be consulted in this regard.
STEP 5:	A formal, detailed re-vegetation strategy must be formulated for the disturbed aquatic habitat, with some guidance on vegetation provided below:
Revegetation Strategy	<ul> <li>Based on the low diversity and existing disturbance at the site, we envisage a simple and functional re-vegetation strategy with the focus on achieving an adequate cover in the shortest time. A minimalistic approach to re-vegetation of the disturbed areas is thus proposed for this</li> </ul>



	site that will involve the rapid re-establishment of an indigenous pioneer plant dominated vegetation cover via a combination of cost-effective planting methods.
	<ul> <li>Planting of plugs has a high success rate and provides protection within a few weeks, while being comparatively cheaper than sods.</li> </ul>
	<ul> <li>Plugs should ideally be planted at a high density of 16 plugs / m<sup>2</sup>. This will ensure that a cover of 80% is achieved within 4 – 6 weeks (Granger, 2015). The planting density can be altered as required.</li> </ul>
	<ul> <li>The plugs must be sourced from an appropriate nursery with capacity to produce the required quantities of plugs.</li> </ul>
	<ul> <li>The planting of plugs should ideally be undertaken early in summer. However, as it is recommended that construction occur in winter months to avoid peak flows and associated erosion issues, hydroscopic gel with be required for the plugs</li> </ul>
	<ul> <li>Geofabric will generally be required for soil stabilisation on steep slopes.</li> </ul>
	<ul> <li>This strategy may be changed / revised following the finalisation of the detailed re-vegetation plan which will include the plating method, species and quantities / costs.</li> </ul>
	<ul> <li>Any erosion features created by construction activities must be stabilised.</li> </ul>
	<ul> <li>Exposed banks and slopes must be stabilized and re-vegetated as soon as practically possible.</li> </ul>
<b>STEP 6:</b> Stabilise, reshape and prepare soil profiles	<ul> <li>Erosion control measures such as geofabric, eco-logs and biodegradable silt fences must generally be installed prior to re-vegetation.</li> </ul>
	<ul> <li>Channel banks must be shaped to a stable angle of repose to avoid slumping and prepared for re-vegetation immediately.</li> </ul>
	Where significant soil compaction has occurred, the soil must be ripped in order to reduce the bulk density of the soil such that vegetation can become established at the site. Rip and / or scarify all disturbed and compacted areas of the construction site. The ECO with the assistance of the engineer must specify whether ripping and / or scarifying is necessary, based on the site conditions. Do not rip and / or scarify areas that are saturated with water, as the soil will not break up.
	<ul> <li>Stored topsoil must be re-spread across the reshaped surfaces prior to re-vegetation.</li> </ul>
	<ul> <li>Fertilizer / lime is not necessary nor is it permitted to be used for the re-vegetation of wetlands, rivers and riparian areas as this may promote increased weed growth and alter the soil structure.</li> </ul>
	<ul> <li>Weed-free mulch is recommended to help retain moisture for germination on channel banks. It is very important that mulch not be derived from stands of IAPs or weeds.</li> </ul>
	<ul> <li>Once construction is completed and alien vegetation and waste products have been removed and soils are prepared for planting, re-vegetation must commence as per the strategy in Step 5 above as soon as weather conditions allow for good plant growth.</li> </ul>
STEP 7:	<ul> <li>Re-vegetation must focus primarily on bare exposed / unstable soils. Key focal areas include channel banks / margins of the active channel and riparian areas.</li> </ul>
Re-vegetation of disturbed areas	<ul> <li>It would be advisable to plant at the onset of the wet season (early spring – August to October) so that watering requirements are minimal. This may however not coincide with the construction period and needs to be carefully planned.</li> </ul>
	<ul> <li>Do not use fertilizer or lime.</li> </ul>
	<ul> <li>A trained re-vegetation / rehabilitation expert must be contracted to oversee the rehabilitation of areas.</li> </ul>
STEP 8: Monitor re- vegetation progress and	<ul> <li>The first 6 weeks after re-vegetation are the most critical in terms of maintenance and monitoring and weekly audits by an ECO with the contractor must be undertaken to monitor re- vegetation success. Only once an adequate ground cover is established must the ECO sign-off on the completion re-vegetation. Targets for re-vegetation success include:</li> </ul>

### Project related



administer alien	<ul> <li>Low levels of Invasive Alien Plants (&lt;10% IAP cover).</li> </ul>
plant control	<ul> <li>&gt;90% indigenous vegetation cover.</li> </ul>
	Thereafter, monitoring visits by the ECO and contractor must be undertaken every 3 months for the first 6 months (two monitoring visits) after the completion of construction. At such visits the need for further re-vegetation, IAP clearing and erosion control / damage repair must be addressed where necessary. Any areas that are not progressing satisfactorily must be identified and an action plan must be implemented to actively revegetate these areas. If natural recovery is progressing well, no further intervention may be required.
	<ul> <li>The ECO must assess the need / desirability for further monitoring and control after the first 6 months and include any recommendations for further action to the relevant environmental authority.</li> </ul>

### 8.12.2.1 Crossings, Road Batters and Roadside Drains

The following are land preparation requirements for watercourse crossings, road batters and side drains that must to be taken into account:

- Road batters range from gentle to steep slopes on which vegetation must be established. Where
  slopes are gentle, general land preparation requirements must apply but where slopes are steep, soft
  intervention techniques must be employed to provide sufficient slope stabilisation.
- As a principle, soft interventions must be favoured over hard interventions wherever possible to ensure that the watercourse crossings retain their natural flow regimes and habitat.
- The following soft interventions are recommended for steep slopes:
  - o Soil savers;
  - Vegetation blankets or mats;
  - o Geo-cells; and
  - Fibre rolls or bags.
- It is important to note that bioengineering interventions are vulnerable to failure if not adequately implemented or poorly maintained.
- Retaining structures such as silt fences, sandbags, hay bales, brush packs, timber logs placed in continuous lines following the slope contours or cut-off trenches can be used across the entire slope to retain eroded sediment.
- Use sandbags or timber logs place at regular intervals along the contour of slopes to retain sediment and stabilize the soils.
- Temporary sediment barriers must remain in place until such time as re-vegetation and stabilization of disturbed areas is judged to be a success and the risk of erosion / sedimentation has been reduced to a respectfully low level.
- Note that care must be taken not to disturb the vegetation, river banks, soils or in-stream areas during site clean-up. No natural material (e.g. sediment, rocks, and stones) from the stream channel or river banks shall be removed during this activity.
- Slope instability or where slumping / erosion of stream banks has occurred be identified and recorded during and immediately after the initial clearing. These areas must then need to be stabilised / repaired using suitable interventions depending on the extent / intensity of erosion / destabilisation and risk of further bank instability. Potential measures suitable for bank stabilisation may include:
  - Compaction of soils on stream banks by hand (no machinery to be used within sensitive riparian areas);
  - o Planting of suitable indigenous ground-cover to stabilise soils on stream banks;
  - Use of rock pack for eroded banks; and
  - Use of gabion baskets for eroded banks.



### 8.12.2.2 Re-vegetation of Disturbed Areas

Once construction is completed and alien vegetation and waste products have been removed and soils are prepared for planting, vegetation must be reinstated as soon as weather conditions allow for good plant growth.

### 8.12.2.3 Road Batters, Road Reserve and Roadside Drains

Immediately after preparing the soil, re-vegetation must commence in order to help bind the soil and prevent soil erosion and to inhibit IAP / weed establishment which will compete with the natural vegetation for space, light, nutrients and water. In this regard, the following mitigation measures must be implemented for road batters, roadside drains and general road reserves disturbed during construction:

#### Method 1: Sodding

- Runner grass sods comprising indigenous species must be laid out on all road batters and secured in place using wooden pegs. Use of grass sods is the most preferred re-vegetation method because it offers instant protection of vulnerable areas. It is best to install the sod as soon as it is delivered.
- No exotic / alien plants must be used in sodding.
- Prior to installing sods, rake or harrow to achieve a smooth, final grade.
- When sodding is carried out in alternating strips, or other patterns the areas between the sods must be seeded immediately after the sodding.
- Immediately after re-vegetation, the grass sods must be watered thoroughly. Watering must be undertaken on a daily basis until such time as the sod becomes well rooted within the soil.
- Thereafter, less frequent watering should be sufficient until such time as the vegetation is established to the satisfaction of the rehabilitation implementer and ECO / resident engineer.

#### Method 2: Hydroseeding

- Hydroseeding is the second preferred option to re-vegetating slopes. The advantages of hydroseeding include faster germination, increased plant survival, and the ability to cover large, often inaccessible areas rapidly.
- The slurry (basic materials) for hydroseeding must consist of water, seed, fertiliser, anti-erosion compounds (soil binders) and organic supplements to enhance grass growth.
- Prior to hydroseeding water must be sprayed over target area to provide added moisture.
- The target groundcover of re-vegetated areas shall be no less than 80% of specified vegetation and there must be no bare patches of more than 500 x 500 mm in maximum dimension.
- Ideal species for hydroseeding include runner and short tufted species, such as Cynodon dactylon or suitable alternative indigenous grasses species.
- No exotic / alien plants must be used in hydroseeding.

Active re-vegetation refers to the manual planting / seeding of vegetation within a riparian area and is considered important if there are risks involved in waiting for natural recruitment to occur or in situations where re-vegetation may be useful or even necessary, depending upon the objectives of rehabilitation or the particular conditions at a site<sup>2</sup>. Re-vegetation of different riparian areas is likely to require planting mixes and planting strategies specific to a particular bioregion, or even at a local site level<sup>3</sup>. Planting the "wet zone" can be a complicated task that requires consideration of water management levels, restrictions

<sup>&</sup>lt;sup>2</sup> Russell, W.B., 2009. WET-Rehab Methods: National guidelines and methods for wetland rehabilitation. WRC Report No. TT 341/09. Water Research Commission, Pretoria.

<sup>&</sup>lt;sup>3</sup> Jacobson, R.L., 2006. Restoring & Managing Native Wetland & Upland Vegetation. Minnesota Board of Soil & Water Resources Minnesota Department of Transportation. January 2006.



on use of herbicides, equipment limitations, site preparation and a good understanding of the "wetness requirements" for various wetland plants<sup>4</sup>.

<sup>&</sup>lt;sup>4</sup> Clarkson, B. and Peters, M., 2012. Wetland Restoration: A handbook for New Zealand Freshwater Systems. Chapter 10: Revegetation. NSW Murray Wetlands Working Group Inc., Albury NSW.



# 9 METHOD STATEMENT FOR INVASIVE ALIEN PLANT ERADICATION

It is the responsibility of the Developer to eradicate and control alien invasive plants that invade all areas disturbed by the construction and operation of the proposed development. In terms of section 75 of NEM:BA, the following applies to the control and eradication of invasive species:

- The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs (see Box 1 below for guidance on alien plant control methods);
- Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that must cause the least possible harm to biodiversity and damage to the environment; and
- The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

The applicant must undertake bi-annual annual alien plant clearing for the first year post-rehabilitation. Thereafter, alien plant clearing must be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.

## 9.1 Guidance on Invasive Alien Plant Control

### Box 1. Guidance on Invasive Alien Plant Control

There are various means of controlling invasive alien plants in South Africa. The primary methods are discussed below. The suitability of control methods depends on a number of factors, including practical constraints, economic constraints and applicability of methods for particular species of alien plants. It is generally advised that a form of integrated control be implemented; however the final selection of the appropriate methods of control should be based on the following criteria:

- **Species to be controlled:** herbicides are registered for specific species. Selection should be based on "*A Guide to the use of Herbicides*" issued by the Directorate: Agricultural Production Inputs and labels and information brochures provides by herbicide suppliers.
- Size / age of target plants:
  - For seedlings: hand-pulling or hoeing and foliar applications of herbicides for dense stands.
  - For saplings: hand-pulling or hoeing, foliar applications of herbicides for dense stands, basal stem treatments and cut stump treatments recommended.
  - For mature trees: ring barking, frilling, basal stem treatments and cut stump treatments recommended.
- Density of stands: Overall applications of herbicide can be made to dense stands of seedlings or saplings. Where dense stands of large trees are present, treatment of standing trees may be appropriate to obviate the problem of disposing felled trees.
- Accessibility of terrain: In inaccessible areas, methods that rely on the minimum amount of transportation of equipment and chemicals should be given preference.
- Environmental considerations: Riparian/wetland areas require a careful approach to treatment/control. Only herbicides approved for use in wetland/riparian areas are to be considered. Washing of equipment or disposal of any chemical substances is prohibited in or near areas where there is a potential risk of contamination of wetlands / riparian areas.
- **Desirable vegetation:** Control methods that will cause the least damage to desirable vegetation must be considered. Selective herbicides or mixes that will not damage other desirable vegetation should be applied where relevant.
- **Disposal of dead vegetation:** Where possible, utilizable wood must be removed after tree felling. This is also the case for trees that could cause the blockage of watercourses. Brushwood must be spread rather



- than stacked to limit soil damage in instances where burning is planned.
- **Cost of application:** the cost of application and re-treatment must be taken into consideration when selecting methods/herbicides, etc.

The control methods detailed below have been adapted from the ARC-PPRI (Agricultural Research Commission: Plant Protection Research Institute) Weed Research Programme (online at <u>www.arc.agric.za/arc-ppri/</u>), the DWA Working for Water Programme ((http://www.dwaf.gov.za/wfw/Control/) and eThekwini Municipality's *Practical tips on the management and eradication of invasive alien plants* (EcoFiles Sheet 4. Local Action for Biodiversity).

#### 1. Mechanical control

Mechanical control entails physically damaging or removing the target alien plant. Mechanical control is generally labour intensive and therefore expensive, and can also result in severe soil disturbance and erosion. Different techniques can be applied and include uprooting/hand-pulling, felling, slashing, mowing, ring-barking or bark stripping. This control option is only really feasible in sparse infestations or on a small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice (e.g. *Eucalyptus spp., Melia azedarach)* need to have the cut stumps or coppice growth treated with herbicides following mechanical treatment.

Examples of mechanical controls include:

- Hand pulling / uprooting: should be reserved for small plants and shrubs with shallow root systems (not recommended for trees with a stem diameter of more than 10 cm). Grip the young plant low down and pull out by hand (using gloves). Uprooting is similar but is undertaken on slightly older individuals
- **Chopping/ cutting / slashing:** This method is most effective for plants in the immature stage, or for plants that have relatively woody stems/trunks. An effective method for non-re-sprouters or in the case of resprouts (coppicing). It must be done in conjunction with chemical treatment of the cut stumps. Cut/slash the stem of the plant as near as possible to ground level. Paint re-sprouting plants with an appropriate herbicide immediately after they have been cut.
- Strip bark: Using a bush knife, strip bark away from tree from waist height down to soil. Cambium is stripped with the bark. No herbicide used.
- **Felling:** Large trees can be cut-down in their entirety, however, this is often not recommended unless absolutely necessary as large trees can play a pivot role in soil protection and biodiversity maintenance.
- **Girdling:** Girdling involves cutting a groove or notch into the trunk of a tree to interrupt the flow of sap between the roots and crown of the tree. The groove must completely encircle the trunk and should penetrate into the wood to a depth of at least 1.5 centimetres on small trees, and 2.5 to 4 centimetres on larger trees.

#### 2. Chemical control

Chemical control involves the use of registered herbicides to kill the target weed. The use of herbicide is often essential to the success of an eradication/control programme as it greatly reduces the re-growth potential of alien plants. Unfortunately, if the wrong herbicide is chosen, one can potentially cause more harm than good to the environment.

Some additional recommendations regarding herbicide use include:

- Herbicides must only be applied during the active growing season.
- Always observe all safety precautions printed on the labels and manufacturer's instructions when mixing and applying herbicide.
- Herbicides can be applied in various ways. They can be sprayed onto dense infestations or painted onto the main stem of the plant or cut stump.
- Spraying herbicide on small infestations is not recommended, rather cut and apply herbicide to the stumps with a brush.
- Spraying should be restricted to windless days when there is less risk of droplets drifting onto non-target species.
- Pressure or flow regulators should be fitted to sprayers for overall application. Spraying should be
  restricted to plants waist height or lower, but also ensuring there is sufficient foliage to carry the applied
  herbicide to the root system of the target plant.
- For water-based applications, Actipron Super Wetter should be added where recommended on the herbicide label, at a rate of 1.75 litres / ha for dense-closed stands of alien vegetation.



- For all water-based treatments, a suitable brightly coloured dye should be added to the mix to ensure that all target plants are treated. For diesel-based applications, Sudan Red Dye should be added.
- Chemical control of IAPs is not recommended in aquatic systems due to the risk of water pollution, but may be used in conjunction with cutting or slashing of plants.
- Chemicals should only be applied by qualified personnel.
- Only herbicide registered for use on target species may be used.
- Follow the manufacturer's instructions carefully.
- Appropriate protective clothing must be worn.
- Only designated spray bottles to be used for applying chemicals.
- The number of herbicides for safe use under wet conditions is very limited.

#### 3. Biological control

Biological weed control involves the releasing of natural biological enemies to reduce the vigor or reproductive potential of an invasive alien plant. Research into the biological control of invasive alien plants is the main activity of the Weeds Research Programme of ARC-PPRI and a list of biocontrol agents released against invasive alien plants in South Africa can be downloaded from their website. To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF).

#### 4. Mycoherbicides

A mycoherbicide is a formulation of fungal spores in a carrier, which can be applied to weeds in a similar way as a conventional chemical herbicide (using herbicide application equipment). The spores germinate on the plant, penetrating plant tissues and causing a disease which can eventually kill the plant. Mycoherbicides are indigenous to the country of use and therefore are already naturally present in the environment and do not pose a risk to non-target plants. Under natural conditions they do not cause enough damage to the weed to have a damaging impact and are therefore mass produced and applied in an inundative inoculation, which leads to an epidemic of the disease knocking the weed population down. Mycoherbicides need to be re-applied at regular intervals.

#### 5. Integrated control

It is frequently advisable to use a combination of two or more of the control method mentioned above, which is referred to as *integrated control*. Killing plants without cutting down causes the least disturbance to the soil and is the ideal.

The following integrated control options are available:

- **Basal bark and stem application:** apply recommended herbicide mixed in diesel carrier to the base of the stem of trees (<25 cm stem height) and saplings. This method is appropriate for plants with thin bark or stems up to 25 cm in diameter. Do not cut the bark. Apply herbicide mix with paintbrushes or using a coarse droplet spray from a narrow angle solid cone nozzle at low pressure. For multi-stemmed plants, each stem must be treated separately.
- **Ring barking:** Invasive trees growing away from any structures or roads can be ring-barked, poisoned and left standing rather than felled. They will slowly collapse over time and can establish habitat for birds, etc. Strip all bark and cambium from a height of 75 cm to 100 cm down to just below soil level. Cut a ring at the top and pull strips. All bark must be removed to below ground level for good results. Where clean debarking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Bush knives or hatchets should be used for debarking.
- **Frilling:** Using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to effect the cuts around the entire stem and apply herbicide into the cuts.
- Cut stump treatment: This is a highly effective and appropriate control method for larger woody vegetation that has already been cut off close to the ground. The appropriate herbicide should be applied to the stump using a paintbrush within 30 min of being cut. Apply recommended herbicide mixture to the cut surface with hand sprayers, a paintbrush or knapsack sprayer at low pressure. Apply only to the cambium or outer layer of large stumps and the entire cut surface of small stumps. Ensure the stumps are cut as low to the ground as practically possible (about 10 15 cm or as stipulated on specific herbicide label). Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel



should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

- Scrape and paint: This method is suitable for large vines and scrambling plants i.e. creepers. Starting from the base of the stem, scrape 20-100 cm of the stem to expose the sapwood just below the bark. Within 20 seconds apply the herbicide to the scraped section. Do not scrape around the stem. Stems over 1cm in diameter can be scraped in 2 sides. Leave the vines to die in place to prevent damaging any indigenous plants they may be growing over.
- Foliar spray: This is not an advocated method of application by unqualified applicators due to the danger of spraying indigenous species. Should be restricted to droplet application made directly on the leaves on plants that are no higher than knee height. Use a solid cone nozzle that ensures an even coverage on all leaves and stems to the point of runoff. Do not spray just before rain (a rainfall-free period of 6 hours is recommended) or before dew falls. Avoid spraying in windy weather as the spray may come into contact with non-target plants. Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.
- **Burning:** Spindly invasive alien plant species, such as Triffid Weed (*Chromolaena odorata*), growing on sandy soils, where there is between 30-40% grass still present, can be eradicated using annual controlled burns. Moderate to low infestations in wetland areas can be treated by controlled burning at the beginning of autumn, followed by mechanical removal or herbicide application in mid spring. *Note that burning would generally not be acceptable in an urban area due to fire hazard/risk and nuisance.*

Note that no heavy machinery should be used to remove invasive alien plants, no matter how high the infestation, without prior authorization from relevant government departments when operating in wetlands and riverine areas.

#### 6. Disposal of alien plant material

Treated / removed alien plant material will need to be removed from the site and disposed of at a proper/registered receiving area such as a local registered land fill site.

## 9.2 Eradication Strategy for Famine Weed

Famine weed a Category 1B IAP (NEM: BA), is a major problem along roads located north of the Tugela River (Invasive Species South Africa: Famine weed)<sup>5</sup>. *P. hysterophorus* is a fast growing ruderal that is characterised by a large seed production and long-lived and rapidly germinating seeds. In addition, P. *hysterophorus* is allelopathic and has not natural enemies being alien / exotic. These characteristics make it a formidable pioneering competitor in disturbed areas, particularly areas that are left bare or are subjected to ongoing disturbance. *P. hysterophorus* also poses a major health problem to humans and livestock During field work, *P. hysterophorus* was not observed along the existing road reserve and in the surrounding landscape indicating that, at worst, it is likely only present in low abundances and thus the risk of its invasion of the road servitude as a result of disturbance during the construction phase will likely be low. However, as the assessment focussed on a narrow corridor of vegetation and much of the degraded wooded grassland community is associated with subsistence cultivation, where *P. hysterophorus* is known to proliferate. *P. hysterophous* could be present in the surrounding landscape and its invasion of the road servitude is a possibility (*eZemvelo* KZN Wildlife (*E*KZNW) Presentation, 2016<sup>6</sup>).

In the event that Famine Weed is recorded on site, the following mitigation measures must be undertaken:

- Pull the entire plant out including roots before flowering and place it in a bin bag.
- The use of protective gloves, facemasks and good clothing at all times is essential.
- Burn all uprooted plants once dry in a controlled environment.
- Alternatively, spray all emerging plants and leaves with a registered herbicide such as Access 240 SL.
   Take care not to contaminate water resources.

<sup>&</sup>lt;sup>5</sup> Invasive Species South Africa: Famine weed (http://www.invasives.org.za/legislation/item/295-famine-weed-partheniumhysterophorus)

<sup>&</sup>lt;sup>6</sup> Presentation conducted by EKZNW during a public participation meeting



Further mitigation includes:

- Equipment used on site must be seed free and vehicles must be properly washed before moving onto site.
- All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting.
- All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling / uprooting and adequately disposed.
- Herbicides should be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority are to be used.
- Soil for construction activities must be sourced from a source free of Famine Weed.
- It is recommended that bi-annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.



## 10 COMPLIANCE WITH THE ENVIRONMENTAL SPECIFICATION

The EMPr forms part of the Contract Documentation and is thus a legally binding document. It is also necessary for the contractor to make provisions as part of their budgets for the implementation of the EMPr. In terms of *Polluter Pays Principle*. Section 28 of the NEMA, an individual responsible for environmental damage must pay the costs for both environmental and human health damage. As far as possible preventative measures must be in place to reduce or prevent additional pollution and / or environmental damage from occurring.

The Contractor is deemed not to have complied with the Environmental Specification / EMPr if:

- There is evidence of contravention of clauses within the boundaries of the site, site extensions and haul/ access roads;
- Environmental damage ensues due to negligence;
- The contractor ignores or fails to comply with corrective or other instructions issued by the Developer, ECO or Engineer within a specified time; or
- The contractor fails to respond adequately to complaints from the public.

### 10.1 Penalties

Application of a penalty clause must apply for incidents of non-compliance. The contractor must be allowed one offence and a written warning must be issued to the Contractor's SHE Officer. Failure to rectify the offence within one (1) working week of the issue of the warning or a repeat offence must result in a penalty.

The penalty must be issued by a representative of the Developer. The penalty imposed must be per incident at the discretion of the Developer's SHEQ Manager or any other duly authorised representative. The value of the penalty imposed must be as defined in the contract and enforcement must be at the discretion of the Developer. Such fines must be issued in addition to any remedial costs incurred as a result of non-compliance with the EMPr. The Developer must inform the contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract.

The penalty monies must become the property of the Developer to be used for rehabilitation and maintenance of the site. Unless stated otherwise in the project specification, the penalties imposed per incident or violation must be:

#### Table 13: Penalties Applicable

OFFENCE	AMOUNT
Failure to demarcate working areas	R10,000
Working outside of demarcated areas	R30,000
Failure to strip topsoil with intact vegetation	R50,000
Failure to stockpile topsoil correctly	R30,000
Failure to stockpile materials in designated areas	R10,000
Failure to take measures to prevent soil contamination	R10,000
Failure to take measures to control dust dispersion on-site	R10,000
Washing of vehicles on-site	R10,000



OFFENCE	AMOUNT
Pollution of water bodies and / or groundwater	R20,000
Failure to implement stormwater management provisions during construction	R20,000
Failure to control stormwater run-off	R30,000
Downstream erosion	R30,000
Failure to provide adequate sanitation	R10,000
Failure to erect temporary fences around trenches	R10,000
Failure to provide adequate waste disposal facilities and services	R50,000
Failure to reinstate disturbed areas within the specified time-frame	R30,000
Any other contravention of the project specific specification	R10,000

The Developer must be responsible for the implementation of the EMPr and for compliance monitoring of the EMPr.

The EMPr must be made binding on all contractors (including sub-contractors) operating on the site and must be included with the Contract.

Non-Compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. Non-compliance with the conditions of the EMPr constitutes a breach of Contract.

## **10.2** Removal from Site and Suspension of Works

Failure to remediate after the issue of a financial penalty, depending on the severity and significance of the impact related to non-compliance, the ECO must undertake to report directly to KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA) (Compliance) recommending that for:

- High impact: to issue a notice to cease construction;
- Medium impact: to issue a notice instructing the Developer to implement recommended remedial action; or
- Low impact: ECO to notify, but up to discretion of EDTEA to apply sanction.

The Developer, at the direction of the ECO, or of his own conviction, has the power to remove from site any person who is in contravention of the EMPr, and if necessary, the Developer can suspend part or the whole of the works, as required.



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