

REPORT

Consultation Basic Assessment Report for the Proposed Rehabilitation of Three Culverts along the Provincial Road P449 from km 0,0 to km 6,0 near Jozini, KwaZulu-Natal

Client: KwaZulu-Natal Department of Transport

Reference: MD1687_R01_D05_P449 Rehab

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Executive Summary

The P449 is located approximately 2 km north of Jozini along the P522-1 between Jozini and Ingavuma in the uMkhanyakude District Municipality, KwaZulu-Natal. The road starts at the intersection of the P522-1 and ends at the intersection with the P444 and serves as the main arterial road for the local community and farmers outside the town of Jozini.

The total length of the road is 11,3 km, however the applicant, the KwaZulu-Natal Department of Transport (KZN DoT), proposes the rehabilitation of the first 6 km section of the road starting in the town of Jozini just off the P522 Road (km 0,0) and ends just past the T-junction with District Road D9 (km 6,0).

The proposed rehabilitation comprises the bulk earthworks, layerworks, surfacing, drainage, ancillary works and replacement of three (3) culverts requiring rehabilitation. As the rehabilitation of the road (i.e. bulk earthworks, layerworks, surfacing and ancillary works) did not trigger any listed activities, these activities could proceed whilst the Basic Assessment (BA) study for the culvert replacement is being undertaken.

Royal HaskoningDHV has been appointed by the KwaZulu-Natal Department of Transport to provide independent Environmental Consulting Services for the proposed project by conducting a Basic Assessment (BA) Study in terms of the Environmental Impact Assessment (EIA) Regulations of 2014 (GNR 982 of December 2014 as amended in 2017), as promulgated under the National Environmental Management Act (NEMA) (Act No. 107 of 1998).

Three (3) wetland units and a single riverine unit will be impacted upon by the proposed upgrade of three (3) road culverts. Given the current moderately modified to largely modified habitat condition and relatively low ecological importance and sensitivity (EIS) rating for the wetlands and river, the minimum recommended management objective for watercourses assessed, must be to 'maintain the current status quo of aquatic ecosystems without any further loss of integrity / condition or functioning'.

Based on the nature of the project and the receiving aquatic environment at the site, key impacts were identified, namely the physical destruction and / or modification of aquatic habitat, flow modifications and erosion / sedimentation impacts and water quality impacts. The following general conclusions apply to the project impacts:

- The proposed development is a non-water consuming activity and has a low risk of contaminating water resources in the local area.
- Whilst localised impacts to habitat, flow and water quality and local aquatic biota may result in a small reduction in wetland / riverine habitat condition (Present Ecological State), these localised impacts are unlikely to translate into a significant reduction in ecosystem related services and the ability to meet water resource management objectives at a broader scale should the mitigation measures recommended in the specialist report be applied reasonably and timeously.
- Although a number of species of provincially protected plants were recorded within the vicinity of the development footprint at culverts 2 and 3 (C3-W02 and C2-W01), these are species of least concern and are a sufficient distance away from the culverts to be replaced that these are unlikely to incur direct impacts.
- The expected disturbances associated with the proposed activities are also unlikely to result in the loss of important ecosystem services for local communities, with no perceived high levels of use of the wetlands / river by local people at present.

Most aquatic ecological impacts can be quite effectively mitigated through appropriate culvert design recommendations and supplemented by the application of on-site practical mitigation measures and

management principles. Should the recommended mitigation and management guidelines be implemented timeously and to specification, impacts can be potentially reduced to acceptably Low significance levels. This should be sufficient to protect the aquatic environment from further deterioration and can then be considered to be generally acceptable as no loss of critical resources, habitats, services or threatened/endangered species is likely to be associated with the development project.

Three (3) species of specially protected plants (protected under Schedule 12 of the Natal Nature Ordinance of 1974) were identified in the vicinity of Wetland Units C2-W01 and C3-W02, including *Aloe marlothii*, *Aloe parvibracteata*, *Crinum* sp. and one protected tree, *Sclerocarya birrea* subsp. *caffra*, which is a nationally protected tree under the provisions of the National Forest Act. An Ordinary Permit from eZemvelo KZN Wildlife (EKZNW) is required to handle the 3 protected plants. A Department of Agriculture, Forestry and Fisheries. (DAFF) permit is required for the rescue and relocation of the *Sclerocarya birrea* subsp. *caffra* that may potentially be impacted upon during construction.

This BA follows the legislative process prescribed in the Environmental Impact Assessment (EIA) Regulations (2014 as amended in 2017). This report constitutes the draft Consultation Basic Assessment Report (cBAR) which details the environmental outcomes, impacts and residual risks of the proposed activity. The report aims to assess the key environmental issues and impacts associated with the development, and to document Interested and Affected Parties' (I&APs) issues and concerns. Furthermore, it provides background information of the proposed project, a motivation and details of the proposed project, and describes the public participation undertaken to date.

The objective of this report is to provide the project's I&APs, stakeholders, commenting authorities, and the competent authority (CA), with a thorough project description and BA process description. The outcome being to engender productive comment / input, based on all information generated to date and presented herein.

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant portions of environmental legislation that were taken into consideration during this study and are elaborated on in this report.

The KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) is the lead / Competent Authority for this BA process and the development needs to be authorised by this Department.

This draft cBAR provides an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. Having duly considered the project, in the Environmental Assessment Practitioner's (EAP's) opinion, the project does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

The impacts identified and assessed by way of risk ratings, have been extensively reported herein. The report at hand (i.e. draft cBAR) will now be made available for comment and amended post comment period to form the final Consultation BAR (i.e. final cBAR). The final cBAR report will, together with a comprehensive issues trail, the final draft of the EMP, and all addenda as referred to, will be submitted to the KZN EDTEA, for decision making. The final cBAR report will thus be a culmination of scientific specialist studies' findings, public contribution via formal comment, and the drawing of conclusions by the EAP as the environmental specialist.

Acronyms

AMSL	Above Mean Sea Level
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CV	Curriculum Vitae
DAFF	Department of Agriculture, Fisheries and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
GA	General Authorisation
GIS	Geographic Information System
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management – Waste Act (Act No. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No 85 of 1993)
PES	Present Ecological State
PPE	Personnel Protective Equipment
PPP	Public Participation Process
REC	Recommended Ecological Category
RMO	Resource Management Objective
SACNASP	South African Council of Natural Science Professionals
SAHRA	South African Heritage Resource Agency
SWMP	Stormwater Management Plan
WUL	Water Use Licence

Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Buffer	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer is usually an artificially imposed zone included in a management plan.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecological Reserve	The water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
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: <ul style="list-style-type: none"> i. the land, water and atmosphere of the earth; ii. micro-organisms, plants and animal life; iii. any part or combination of (i) and (ii), and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental	An authorisation issued by the competent authority in respect of a listed activity,

Authorisation Environmental Assessment Practitioner (EAP)	or an activity which takes place within a sensitive environment. The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
Environmental Control Officer (ECO)	An individual nominated through the Client to be present on site to act on behalf of the Client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Impact Assessment (EIA)	In relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in NEMA.
Environmental Issue	A concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.
Environmental Management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental Management Programme (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
Groundwater	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater run-off are supplied.
Hazardous Waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A – Hazardous Waste.
Hydrology	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.
Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level – that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected Party (I&AP)	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
Method Statement	A method statement is a written submission by the Contractor to the Engineer in

	<p>response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.</p>
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Pollution	The National Environmental Management Act, No. 107 of 1998 defines pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
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.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Significance	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
Stakeholder Engagement	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.
Sustainable Development	Development which meets the needs of current generations without hindering future generations from meeting their own needs.
Visual Contrast	The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.
Watercourse	Defined as: <ul style="list-style-type: none"> i. a river or spring; ii. a natural channel or depression in which water flows regularly or intermittently; iii. a wetland, lake or dam into which, or from which, water flows; and iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
Water Pollution	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the

Wetland

welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property”.

Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1 INTRODUCTION

The P449 is located approximately 2 km north of Jozini along the P522-1 between Jozini and Ingavuma in the uMkhanyakude District Municipality, KwaZulu-Natal. The road starts at the intersection of the P522-1 and ends at the intersection with the P444. This road serves as the main arterial road for the local community and farmers outside the town of Jozini.

The total length of the road is 11,3 km. However the applicant, the KwaZulu-Natal Department of Transport (KZN DoT), proposes the rehabilitation of the first 6 km section of the road starting in the town of Jozini just off the P522 Road (km 0,0) and ends just past the T-junction with District Road D9 (km 6,0).

The existing road is surfaced from Jozini up to km 9,7, where after it becomes a gravel road. The road width is 6,8m on average, varying in surfaced width due to severe edge distress due to the action of vehicles entering and exiting various forms of formal and informal accesses. Due to an elevation close to the surrounding ground surface severe damage has also been caused due to poor drainage conditions.

The proposed rehabilitation comprises the bulk earthworks, layerworks, surfacing, drainage, ancillary works and replacement of three (3) culverts required for the rehabilitation (Figure 1).

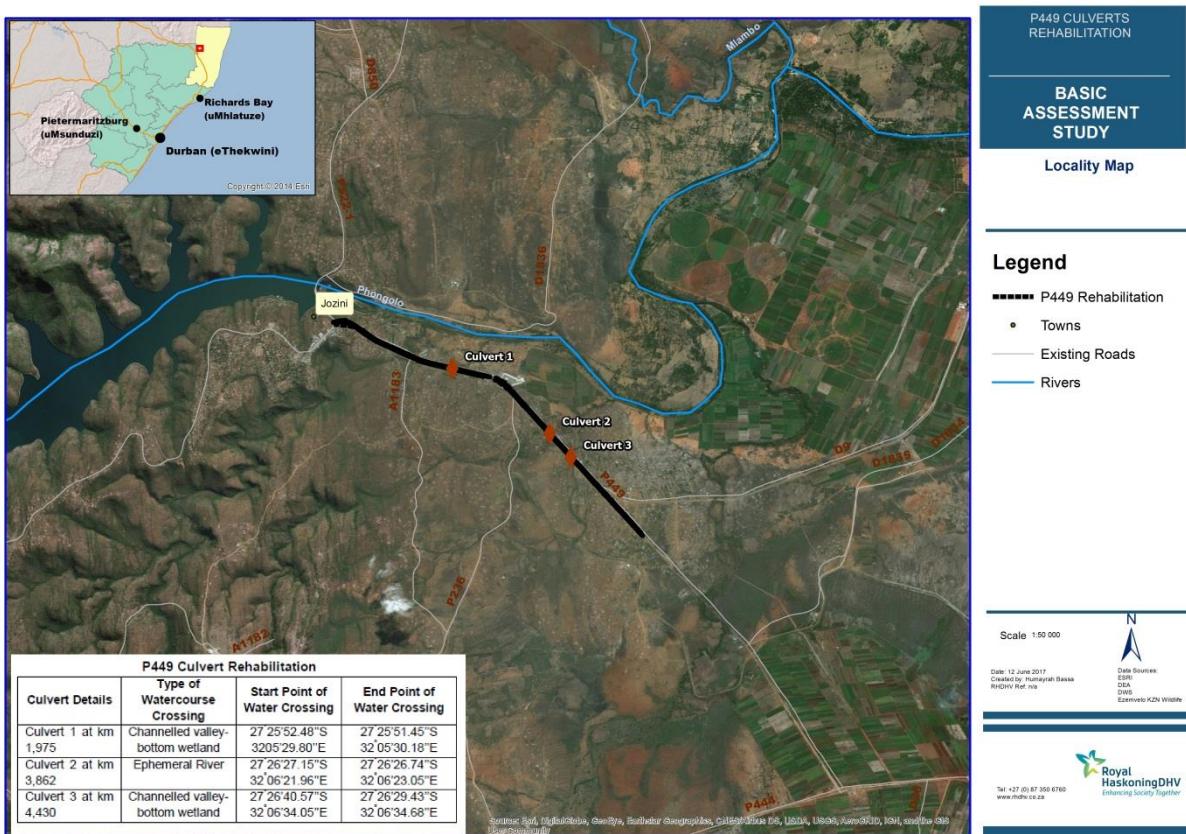


Figure 1: Locality map

1.1 Approach to the Study

1.1.1 Desktop Screening Assessment

During the desktop screening assessment to determine listed activities applicable to the project, the following were noted:

- The P449 is not located within a Protected Area (PA), and is approximately 6 km away from the boundary of a formally PA (i.e. the Phongola Nature Reserve) - Figure 2.
- The P449 rehabilitation project does not traverse any Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) and the ecosystem is not considered threatened (Figure 2).
- The P449 rehabilitation project is not located near Community Conservation Areas; Biodiversity Stewardship Programme Biodiversity Agreement areas; World Heritage Sites or Biodiversity Corridors.
- Thirteen (13) watercourse units including ten (10) wetland units and three (3) river units occurring within a 500 m radius of the three (3) planned culvert upgrades were identified and mapped at a desktop level (Figure 3 and Figure 4).

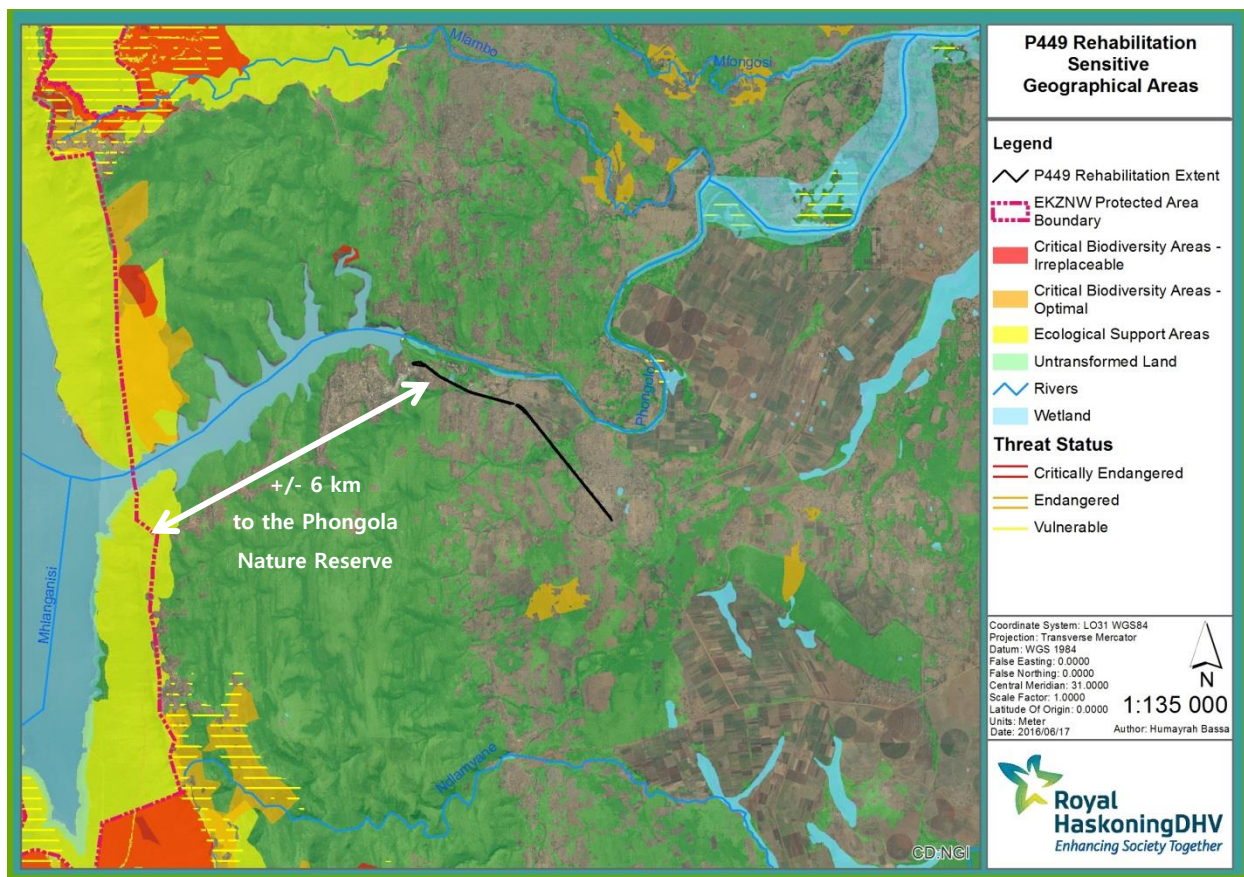


Figure 2: Sensitive geographical areas

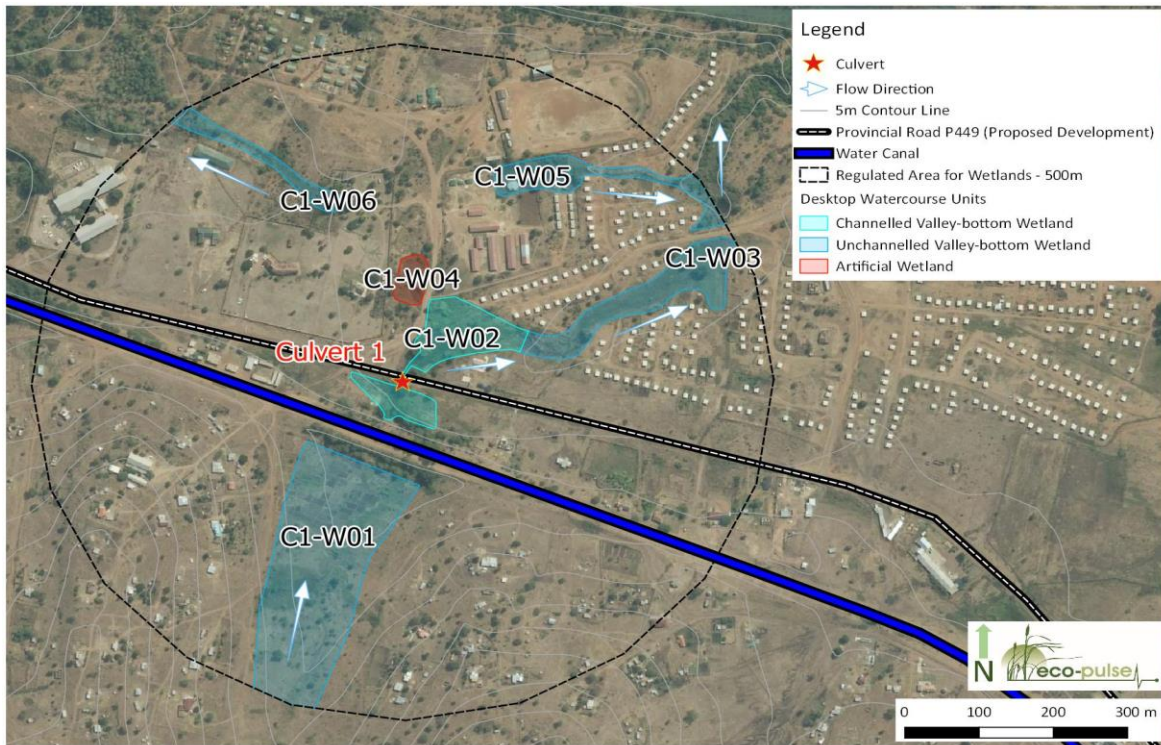


Figure 3: Desktop delineation of watercourses within the 500 m regulated area for wetlands associated with culvert 1

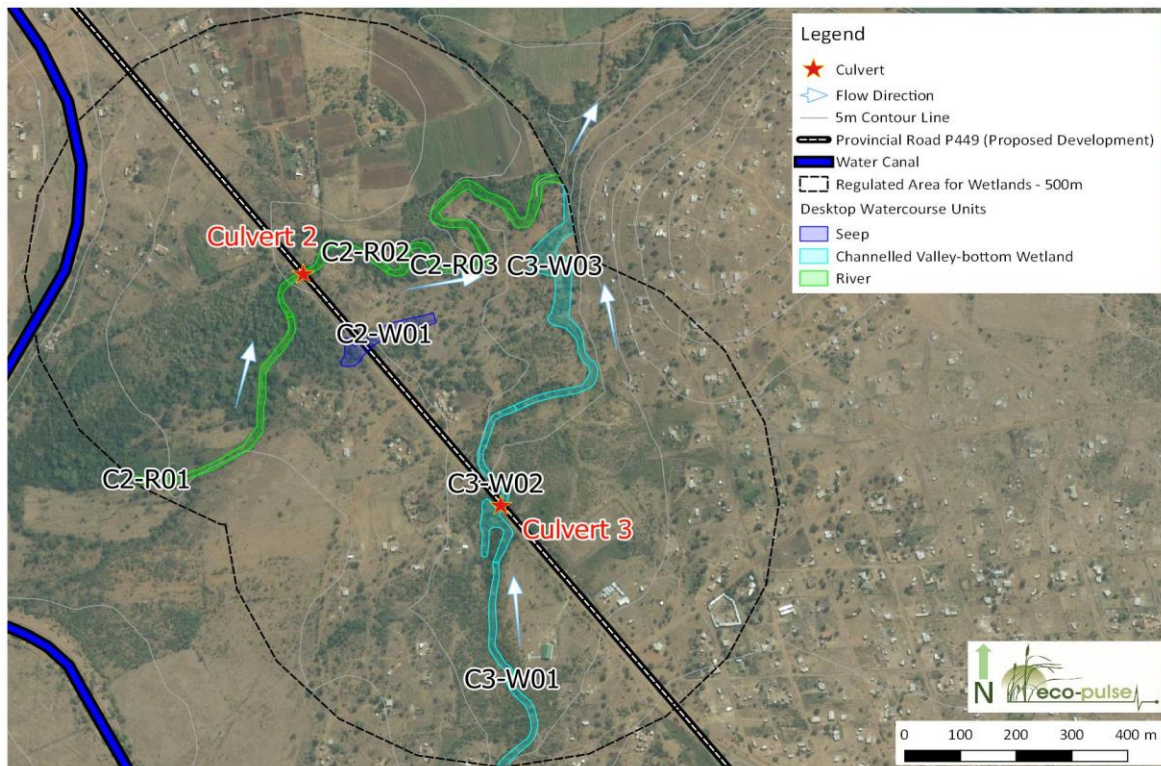


Figure 4: Desktop delineation of watercourses within the 500 m regulated area for wetlands associated with culverts 2 and 3

1.1.2 Pre-application Consultation

An Interpretation Query was lodged with the Competent Authority, the Department of Economic Development, Tourism and Environmental Affairs (EDTEA), uMkhanyakude District on 11 July 2016 to obtain clarity on whether the rehabilitation of the P449 would constitute an activity identified in terms of the Section 24(2) and 24D of the National Environmental Management Act (Act No. 107 of 1998) - NEMA (as amended) or the Applicant could provide the Department with a Maintenance Management Plan (MMP) and undertake rehabilitation works within the ambit of the approved MMP.

On 04 August 2016, EDTEA confirmed that since Activity 19 of Government Notice Regulation (GNR) 983 – Listing Notice 1 is triggered by the proposed replacement of the three (3) culverts, an application for Environmental Authorisation must be lodged (**Appendix A**) with the Department.

It was further confirmed with EDTEA that since the rehabilitation of the road (i.e. bulk earthworks, layerworks, surfacing and ancillary works) did not trigger any listed activities, these activities could proceed whilst the Basic Assessment (BA) study for the culvert replacement is being undertaken.

An additional pre-application meeting and site visit was held with the KZN EDTEA on 07 June. Minutes of the meeting as well as confirmation that the three culverts can be subject to one (1) combined application for EA is included in **Appendix A**.

1.1.3 Basic Assessment Study

A BA is the level of environmental assessment applied to activities listed in Listing Notices 1 and 3. A BA is applied to activities that are considered less likely to have significant environmental impacts and, therefore, unlikely to require a detailed EIA. The BA Report (BAR) is a more concise analysis of the environmental impacts of the proposed activity/development than a Scoping and EIA Report.

The BA aims to achieve the following:

- Determine the policy and legislative context within which the proposed activity is undertaken and how the activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed project;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Undertake an impact and risk assessment process inclusive of cumulative impacts (where applicable). The focus being; determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the project and the risk of impact of the proposed activity on the these aspects to determine the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and the degree to which these impacts:
 - can be reversed;
 - may cause irreplaceable loss of resources; and
 - can be avoided, managed or mitigated.

This BAR has been compiled in accordance with the stipulated requirements in **GNR 982 Appendix 1** of the EIA Regulations (2014 as amended in 2017), which outlines the legislative BA process and requirements for assessment of outcomes, impacts and residual risks of the proposed development. The BAR further incorporates the findings and recommendations of the freshwater specialist study conducted for the project.

An EMPr (**Appendix B**) has been compiled according to **Appendix 4 of GNR 982** of the EIA Regulations (2014 as amended in 2017) for the construction and rehabilitation phases of the project. The EMPr has been compiled as a stand-alone document from the BAR and will be submitted to the EDTEA along with

the BAR. The EMPr provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and/or eliminate any anticipated negative environmental impacts and to enhance positive impacts. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

1.2 Structure of the Basic Assessment Report (BAR)

The BAR is structured as follows:

Table 1: Structure of the report

Chapter	Description
1	Introduction – Provides the background to the project as well as details of the specialist studies conducted and contact details for the project proponent and EAP
2	Environmental Legislative Context – Details the pertinent environmental legislation and the applicability to the project
3	Project Context & Motivation – Provides the site locality, project description and need and desirability of the project
4	Project Alternatives – Describes the alternatives considered, including the ‘no-go’ option
5	Description of the Baseline Environment – Describes the pre-development context of the site
6	Public Participation Process – Explains the public consultation undertaken
7	Specialist Assessments – Describes the impact assessment and findings of the specialist studies
8	Impact Assessment – Details the impact assessment methodology and quantifies the impacts anticipated
9	Environmental Impact Statement – Provides the EAP opinion and summarises the impact assessment and outlines conclusions and recommendations

1.3 Specialist Assessment¹

To ensure the scientific vigour of the BA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned a Freshwater Habitat Impact Assessment (undertaken by Eco-Pulse Environmental Consulting Services) in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the project, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts. The specialist studies can be found in **Appendix C**.

1.3.1 Peer Review

In addition to the above, the EIA Regulations (2014 as amended in 2017) requires the Environmental Assessment Practitioner (EAP) to be independent, objective and have expertise in conducting EIA's. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity. To ensure a lack of bias and to ensure transparency an external technical peer


¹ The Freshwater Habitat Assessment has included an assessment of terrestrial vegetation that can potentially be impacted by the culvert replacements. A Heritage Assessment has not been conducted as the work is confined to the existing road reserve.

review will be undertaken prior to the public review during the formal BA process. This peer review has been conducted by Dr. Richard Kinvig (*Pr.Sci.Nat.*) of Kinvig & Associates Environmental Consultants.

1.4 Details of the Project Developer

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

Table 2: Applicant details

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

1.5 Details of the Environmental Assessment Practitioner

The environmental team of Royal HaskoningDHV have been appointed as an independent Environmental Assessment Practitioner (EAP) by the KZN DoT to undertake the appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV has considerable experience in the environmental management field. Royal HaskoningDHV been involved in and/or managed several of the largest EIAs undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), mixed-use developments, bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, urban, rural and township developments, environmental aspects of Local Integrated Development Plans, as well as general environmental planning, development and management.

Table 3: EAP details

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
Contact Persons	Humayrah Bassa (EAP)	Prashika Reddy	Clive Zwane (PPP Consultant)
Postal Address	PO Box 1243 Umhlanga Rocks 4320	PO Box 25302 Monument Park 0105	PO Box 1243 Umhlanga Rocks 4320
Telephone	087 350 6760	012 367 5973	087 350 6783
E-mail	humayrah.bassa@rhdhv.com	prashika.reddy@rhdhv.com	clive.zwane@rhdhv.co
Qualification	MSc Environmental Science	BSc (Hons) Geography	BA (Hons) Geography and Environmental Management
Expertise	Humayrah Bassa is an Associate with 7 years'	Prashika Reddy is a Principal Associate with 15	Clive is an Environmental Consultant at Royal



Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
	<p>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 environmental control officer duties; and conducting legal compliance audits. She is a Professional Natural Scientist (400032/15) with the South African Council for Natural Scientific Professions.</p>	<p>years' experience in various environmental fields including: EIAs, EMPs, PPP and environmental monitoring and audits. She is/has been part of numerous multi-faceted large-scale projects, including the establishment of linear developments (roads and power lines), industrial plants, electricity generation plants, mixed-use developments and mining projects. She is a Professional Natural Scientist (400133/10) with the South African Council for Natural Scientific Professions.</p>	<p>HaskoningDHV with 4 years' experience as an ECO and Public Participation consultant.</p>

The Environmental Management and Planning Knowledge Group Profile for Royal HaskoningDHV and the Curriculum Vitae (CV) of the respective Consultants can be found in **Appendix D**.

2 ENVIRONMENTAL LEGISLATIVE CONTEXT

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that need to be considered during this study.

This section outlines the legislation that is applicable to the proposed project and has been considered in the preparation of this report.

Table 4: Key legislation considered

Acts	Objectives, important aspects, associated notices and regulations
<p>National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended</p>	<p>Objectives: To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state.</p> <p>Relevant Notices and Regulations:</p> <ul style="list-style-type: none"> • Environmental Impact Assessment Regulations, 2014 (GNR 982 in GG 38282 of 4 December 2014 as amended in 2017) • Listing Notice 1 (GNR 983 in GG 38282 of 4 December 2014 as amended in 2017) • Listing Notice 2 (GNR 984 in GG 38282 of 4 December 2014 as amended in 2017) • Listing Notice 3 (GNR 985 in GG 38282 of 4 December 2014 as amended in 2017) <p>Relevance to the proposed project:</p> <ul style="list-style-type: none"> • Development must be socially, environmentally and economically sustainable. • Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated; the social, economic and environmental impacts of activities including disadvantages and benefits, must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration. • 'Polluter Pays' principle. • Any activity that is proposed and which is listed in the NEMA EIA Regulations, requires environmental authorisation.

Acts	Objectives, important aspects, associated notices and regulations
	<p>Listed Activity/ies & Applicability: Activity 19 - The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse. The proposed infrastructure (3 culverts) will cross watercourses and will thus require infilling or depositing of material of more than 10 m³ or the dredging, excavation, removal or moving of soil, sand or rock of more than 10 m³ from / into a watercourse. The construction activities will include the removal of material and infilling for the box culverts as well as the infilling of material for the temporary road diversions.</p>
<p>National Water Act (Act No. 36 of 1998) (as amended)</p>	<p>Objectives: The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations.</p> <p>Relevance to the proposed project:</p> <ul style="list-style-type: none"> • Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems. • Defines 11 water uses and provides licencing procedures. <p>Notices and Regulations:</p> <ul style="list-style-type: none"> • General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (a) and (b) (GN in GG 40243 of 02 September 2016). • General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (c) and (i) (GN in GG 40229 of 26 August 2016). <p>Water uses triggered: As the proposed development involves the crossing of three wetlands and one small seasonal river, a Water</p>

Acts	Objectives, important aspects, associated notices and regulations
	<p>Use Authorisation is required in terms of Section 21 (c) and (i) of the NWA:</p> <ul style="list-style-type: none"> • Section 21(c) - <i>impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and</i> • Section 21 (i) - <i>altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).</i>
<p>National Forests Act (Act No. 84 of 1998)</p>	<p>Purposes: The purposes of this Act are to: promote the sustainable management and development of forests for the benefit of all; create the conditions necessary to restructure forestry in State forests; provide special measures for the protection of certain forests and trees; promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.</p> <p>Notices and Regulations: In terms of the NFA and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act, 1984 (Act No. 122 of 1984) for protected tree species, the removal, relocation or pruning of any protected plants will require a licence.</p> <p>Relevance to the proposed project:</p> <ul style="list-style-type: none"> • <i>The Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that: ‘no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister’.</i> <p>Permitting requirements:</p> <ul style="list-style-type: none"> • One protected tree, <i>Sclerocarya birrea</i> subsp. <i>caffra</i>, has been found in close proximity to the project site. A licence will have to be obtained from the Department of Agriculture, Forestry and Fisheries. (DAFF) for the rescue and translocation of species potentially impacted during construction.

2.1 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Right Section 24 – Environmental Rights
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	<p>Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation.</p> <p>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.</p> <p>A permit must be obtained from <i>eZemvelo</i> KZN Wildlife for the relocation of three (3) species of specially protected plants (protected under Schedule 12) in the vicinity of Wetland Units C2-W01 and C3-W02, including <i>Aloe marlothii</i>, <i>Aloe parvibracteata</i> and <i>Crinum</i> sp.</p>
<p>National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations:</p> <ul style="list-style-type: none"> • Threatened or protected species (GN 388) • Lists of species that are threatened or protected (GN 389) • Alien and invasive species regulations (GNR 506) • Publication of exempted alien species (GNR 509) • Publication of National list of invasive species (GNR 507) • Publication of prohibited alien species (GNR 508) 	Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) - NEMPAA	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 Environmental Management: Waste Act (Act No. 59 of 2008)	Section 17 - Every attempt must be made to reduce, recycle or re-use all waste before it is disposed. Section 25 - All waste (general and hazardous) generated

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
	during construction may only be disposed of at appropriately licenced waste disposal sites.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Section 32 - Control of dust. Section 34 - Control of noise. Section 35 - Control of offensive odours.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Section 22 - Application for a mining permit / right. Section 39 - Environmental management programme and environmental management plan.
National Heritage Resources Act (Act No. 25 of 1999)	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 palaeontological site. 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.
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 8 - General duties of employers to their employees. Section 9 - General duties of employers and self-employed persons to persons other than their employees.
Construction Regulations (2014)	Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.
By-laws	
uMkhanyakude District Municipality IDP (2014 – 2015) uMkhanyakude District-wide Reviewed Spatial Development Framework (2016/2017) Jozini Local Municipality IDP (2015 – 2016)	

2.2 Sustainable Development

The principle of Sustainable Development has been established in the Constitution of the Republic of South Africa (Act No. 108 of 1996) and given effect by NEMA. Section 1(29) of NEMA states that

sustainable development means the integration of social, economic and environmental factors into the planning, implementation and decision-making process so as to ensure that development serves present and future generations.

Therefore, Sustainable Development requires that:

- *The disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
- *That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
- *The disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;*
- *Waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;*
- *A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and*
- *Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.*

2.3 Climate Change Consideration

The proposed project will take into account energy efficient technologies and consider international best practice in terms of the construction methodologies and management of finite resources.

Since climate change concerns include unpredictability and severity in weather patterns, the provision of basic human needs, such as road infrastructure, is considered critical.

3 PROJECT CONTEXT & MOTIVATION

3.1 Site Description and Ownership

The site comprises all the land within the proclaimed limits of the road reserve along the extent of the works, stockpile areas, locations set aside for construction and supervision accommodation and any other location required for the execution of the works.

3.2 Co-ordinates

3.2.1 Culverts

Table 5: Co-ordinates of the culverts to be replaced

Culvert Details	Type of Watercourse Crossing	Start Point of Water Crossing	End Point of Water Crossing
Culvert 1 at km 1,975	Channelled valley-bottom wetland	27°25'52.48"S 32°05'29.80"E	27°25'51.45"S 32°05'30.18"E
Culvert 2 at km 3,862	Ephemeral River	27°26'27.15"S 32°06'21.96"E	27°26'26.74"S 32°06'23.05"E
Culvert 3 at km 4,430	Channelled valley-bottom wetland	27°26'40.57"S 32°06'34.05"E	27°26'29.43"S 32°06'34.68"E

3.2.2 Surrounding Land Uses

Table 6: Surrounding land uses

Description	Y/N	Description	Y/N
Natural area	Y	Light industrial	N
Low density residential	N	Medium industrial	N
Medium density residential	N	Heavy industrial	N
High density residential	N	Power station	N
Informal residential	Y	Military or police base/station/compound	N
Retail commercial & warehousing	N	Spoil heap or slimes dam	N
Office/consulting room	N	Dam or reservoir	N
Quarry, sand or borrow pit	N	Hospital/medical centre	N
School	N	Tertiary education facility	N
Church	N	Old age home	N
Sewage treatment plant	N	Train station or shunting yard	N
Railway line	N	Major road (4 lanes or more)	N
Harbour	N	Plantation	N
Sport facilities	N	Agriculture	Y

Description	Y/N	Description	Y/N
Golf course	N	River, stream or wetland	Y
Polo fields	N	Nature conservation area	N
Filling station	N	Mountain, koppie or ridge	N
Landfill or waste treatment site	N	Museum	N
Historical building	N	Protected Area	N
Graveyard	N	Archaeological site	N
Airport	N	Other:	N

EIA Regulations (2014 as amended in 2017): Listing Notice 1 triggers due to the culvert replacement

Activity 19 - The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse

Section 21 water use triggers

Section 21(c) - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses)

Section 21 (i) - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses)

Other potential permits & licences

Department of Agriculture, Forestry and Fisheries (DAFF) for the rescue and translocation of species potentially impacted during construction (i.e. *Sclerocarya birrea subsp. caffra*)
eZemvelo KZN Wildlife permit for the relocation of three (3) species of protected plants (*Aloe marlothii*, *Aloe parvibracteata* and *Crinum* sp.)



Key: Y = Yes P = Possibly N = N


3.3 Project Description

3.3.1 Culvert Replacement

The main structural work required between km 0,0 and km 6,0 comprises the replacement of three culverts at km 1,975 (Figure 5); km 3,862 (Figure 6) and km 4,430 (Figure 7).

Table 7: Description of activities at each culvert crossing

Culvert Name	Existing Structure	Replacement Structure	Total Extent
Culvert at km 1,975	<ul style="list-style-type: none"> - Consists of 750 mm diameter concrete pipes. - Structure will be demolished and entirely replaced. 	<ul style="list-style-type: none"> - Cast <i>in situ</i> reinforced cellular structure. - 10.5 m long, three cells of 1.2 m wide and 1.8 m high. - Constructed with 30/19 MPa structural concrete. - Trial pits and boreholes were dug in the vicinity of the existing culvert and the material discovered is clayey, sandy gravel. It is therefore anticipated that about 1 m of this material will be removed and replaced by engineered rock fill. 	68.25 m ²
Culvert at km 3,862	<ul style="list-style-type: none"> - Consists of two (2) 900 mm diameter concrete pipes. - Structure will be demolished and entirely replaced. 	<ul style="list-style-type: none"> - Cast <i>in situ</i> reinforced cellular structure. - 11 m long, six cells of 1.8 m wide and 1.8 m high. - Constructed with 30/19 MPa structural concrete. - Trial pits and boreholes were dug in the vicinity of the existing culvert and the material discovered is clayey, sandy gravel. It is therefore anticipated that about 1m of this material will be removed and replaced by engineered rock fill. 	143 m ²

Culvert Name	Existing Structure	Replacement Structure	Total Extent
Culvert at km 4,430	<ul style="list-style-type: none"> - Consists of 750 mm diameter concrete pipe. - Structure will be demolished and entirely replaced. 	<ul style="list-style-type: none"> - Cast <i>in situ</i> reinforced cellular structure. - 13,5 m long, six cells of 1.8 m wide and 1.8 m high. - Constructed with 30/19 MPa structural concrete. - Trial pits and boreholes were dug in the vicinity of the existing culvert and the material discovered is clayey, sandy gravel. It is therefore anticipated that about 1m of this material will be removed and replaced by engineered rock fill. 	175.5 m ²

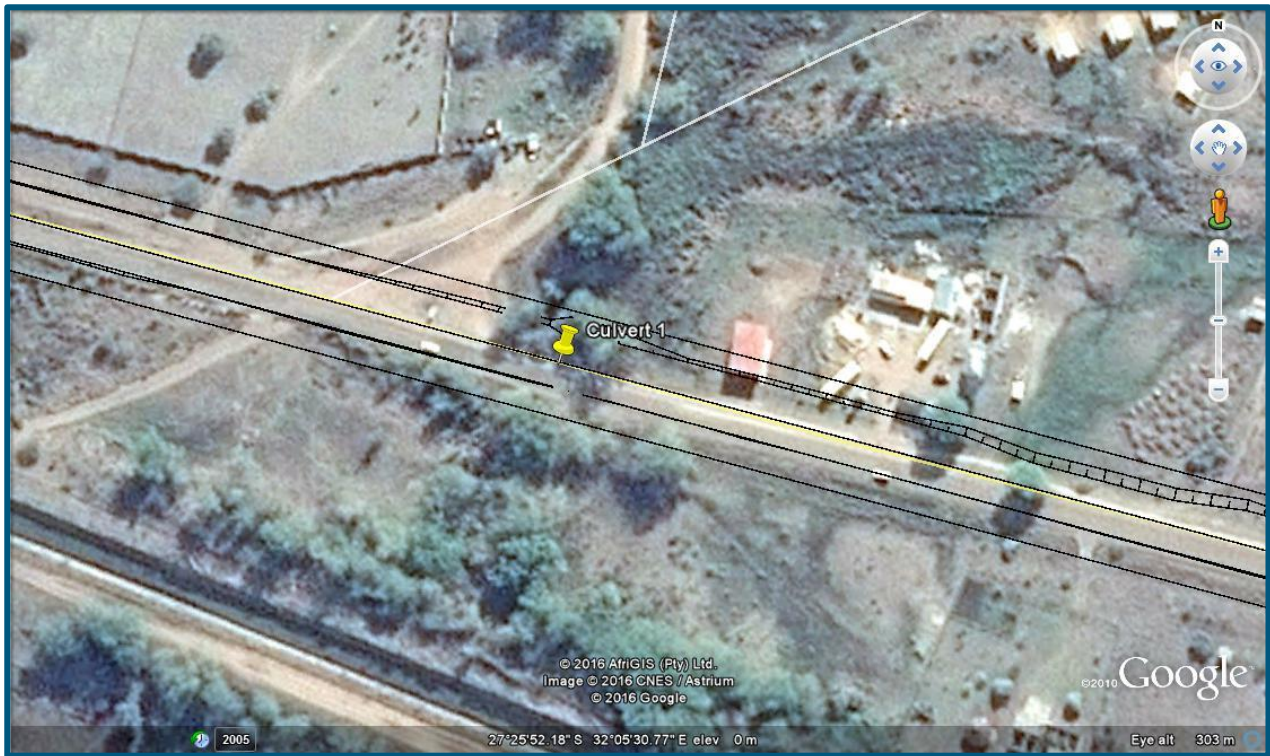


Figure 5: Aerial image of culvert 1

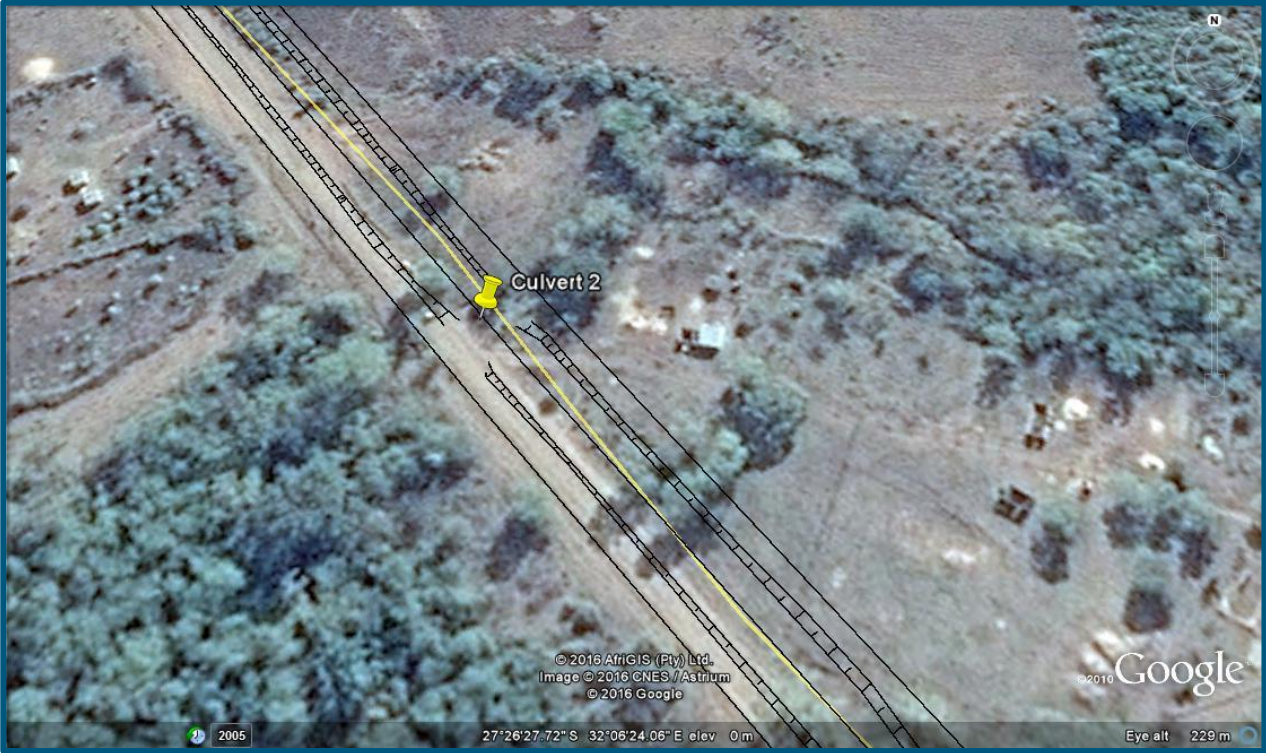


Figure 6: Aerial image of culvert 2

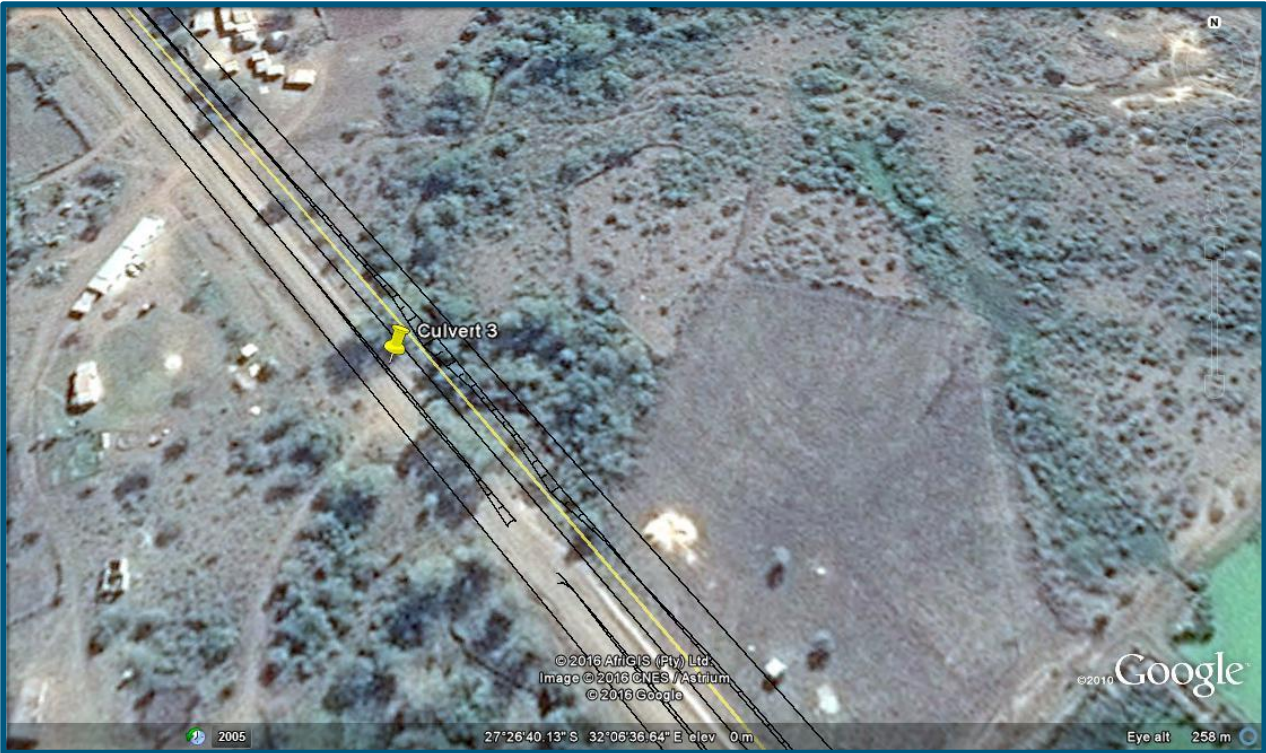


Figure 7: Aerial image of culvert 3

3.3.3.1 Access and Traffic Accommodation

Access to the culvert site will be relatively easy, down gentle slopes. The accommodation of traffic will be required during construction, to divert the traffic around the construction works. This will involve temporary diversions within the watercourse whilst the culvert is being replaced. These diversions will be addressed in the EMPr and in the impact assessment below.

3.3.2 Road Rehabilitation

The bulk of the earthworks required are in cut. This material will be used for fill material. Excavated material will comprise of hard excavation, including boulder excavation. Drilled and blasted hard rock material from the cuttings will meet the bulk fill requirements.

Subsoil drains shall be constructed along the road between km 0,0 and km 0,8 to remove groundwater from the cuttings and from any other areas where groundwater problems arise.

Along the 6,0 km route, the road typically comprises a surfaced width of 8,5 m, with 1,5 m wide concrete v-drains provided in cuts and 0,5 m kerb and channel side drains provided along various sections of fill. Guardrail protection is provided where required on the higher fills. Numerous side inlet structures will be required for drainage purposes.

Numerous prefabricated pipe culverts provide drainage at the minor stream crossings and under the road accesses. Inlet and outlet structures for these pipe culverts shall be constructed using brickwork in order to provide training and work opportunities for the local community.

Gabion box and mattress protection shall be constructed at the inlets and outlets of the drainage structures and along the cut embankments where the existing embankment is being eroded away.

The new layerworks shall comprise a G8 lower selected subgrade layer (new material and G10 in situ subgrade layer (reconstructed in situ wearing course material where suitable and required in accordance with the new geometric alignment), G7 upper selected subgrade layer, G5 sub-base (stabilised to C4 strength) and G5 base (stabilised to C3 strength).

The G8 and G7 selected subgrade materials shall be material obtained from suitable hard rock excavated from the necessary cuttings and crushed on site where necessary to a nominal maximum size of 75mm.

The G5 subbase and base material shall be material either obtained from suitable hard rock excavated from the necessary cuttings and crushed and screened on site to a G4 grading, or crushed stone obtained from commercial sources (licenced) to make up any shortfall in the material obtained from the crushing operation on site. The stabilised C3 (G5) base shall be primed then paved with a 40 mm asphalt surfacing. The access points to the properties on either side of the road shall generally be formalised by means of concrete edge beams.

Ancillary roadworks required shall include the construction of guardrails, the erection of road signs, the installation of road marking, and grass sodding and hydroseeding to protect the cut and fill slopes where required and to reinstate the vegetation at spoil and stockpile areas.

EIA Regulations (2014 as amended in 2017): Listing Notice 1 triggers due to road rehabilitation works

No activities applicable as rehabilitation works will be conducted within the road reserve

3.3.2.1 Access and Traffic Accommodation

Provision of traffic accommodation facilities includes the use of half-width construction methods with STOP/GO traffic control. The traffic accommodation facilities shall also include the use of traffic signals when the half-width under construction is to remain closed between sunset and sunrise from the start of construction on any half-width work zone until such time as the surfacing has been constructed above the base on that half-width work zone.

3.4 Project Motivation

3.4.1 Need & Desirability

Table 8: Project need, desirability and benefits

Project Need			
1.	Was the relevant provincial planning department involved in the application?	YES	
2.	Does the proposed land use fall within the relevant provincial planning framework? As the project is a rehabilitation of the existing P449, it does not constitute a new land use and is therefore considered to be in line with the provincial framework.	YES	
3.	If the answer to questions 1 and / or 2 was NO, please provide further motivation / Explanation – N/A.		
Desirability			
1.	Does the proposed land use / development fit the surrounding area?	YES	
2.	Does the proposed land use / development conform to the relevant structure plans, SDF and planning visions for the area?	YES	
3.	Will the benefits of the proposed land use / development outweigh the negative impacts of it? The current road is in need of repair and rehabilitation, and therefore the benefits of rehabilitating this road to ensure it will continue to be safe to its users outweighs any impacts which are expected to be most prevalent during the temporary construction phase.	YES	
4.	If the answer to any of the questions 1-3 was NO, please provide further motivation / Explanation – N/A.		
5.	Will the proposed land use / development impact on the sense of place? The P449 is an existing road.		NO

6.	Will the proposed land use / development set a precedent? The project is limited to the rehabilitation of an existing road.		NO
7.	Will any person's rights be affected by the proposed land use / development?		NO
8.	Will the proposed land use / development compromise the "urban edge"? The area is completely rural in nature and will have no effect on the urban edge.		NO
9.	If the answer to any of the question 5-8 was YES, please provide further motivation / explanation – N/A.		
Benefits			
1.	Will the land use / development have any benefits for society in general?	YES	
2.	Explain: The rehabilitation of km 0,0 to km 6,0 of the P449 will ensure that the road is safe for users and can cater to the traffic needs of the surrounding communities.		
3.	Will the land use / development have any benefits for the local communities where it will be located?	YES	
4.	Explain: The existing road is surfaced from Jozini up to km 9,7, after which it is of gravel construction. The road width is 6,8 m on average, varying in surfaced width due to severe edge distress caused by the action of vehicles entering and exiting various the road through formal and informal accesses. As a result of the road being slightly elevated above the surrounding ground surface, severe damage has also been caused due to poor drainage conditions. The rehabilitation of this road will ensure that the road is safe for users.		

3.4.2 Socio-economic Value

Table 9: Socio-economic Details

What is the expected capital value of the activity on completion?	R 18 million
What is the expected yearly income that will be generated by or as a result of the activity?	N/A
Will the activity contribute to service infrastructure?	Yes
Is the activity a public amenity?	Yes
How many new employment opportunities will be created in the development phase of the activity?	60
What is the expected value of the employment opportunities during the development phase?	R 0.9 million
What percentage of this will accrue to previously disadvantaged individuals?	100%
How many permanent new employment opportunities will be created during the operational phase of the activity?	N/A

What is the expected current value of the employment opportunities during the first 10 years?	N/A
What percentage of this will accrue to previously disadvantaged individuals?	N/A

4 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014 as amended in 2017) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the NEMA (Act No. 107 of 1998) (as amended).

An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity which may include alternatives to:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

4.1 Site Alternatives

The project involves the rehabilitation to a portion of the existing P449, therefore no off-site or other site-specific alternatives have been investigated.

4.2 Layout / Route Alignment Alternatives

As the project proposes to rehabilitate the existing P449 from km 0,0 to km 6,0, the existing layout or alignment will be followed and work will be undertaken within the road reserve.

4.3 Design Alternatives

Box culverts are preferred over pipe culverts for the proposed project. The advantages and disadvantages of pipe versus box culverts is provided in **Table 10** below.

Table 10: Advantages and disadvantages of pipe vs box culverts

Design Alternatives	Advantages	Disadvantages
Pipes	<ul style="list-style-type: none"> • Pipe culverts provide low clearance. • More aesthetically pleasing. • They require less road fill. • Lower cost. 	<ul style="list-style-type: none"> • Prone to high siltation issues causing restricted flow which can cause overtopping of the road. • Badly designed and poorly installed pipes can be impassable to riverine fauna. Increased water velocities combined with shallow water depth, pipe entrances and smooth uniform surfaces creates barriers to fauna

Design Alternatives	Advantages	Disadvantages
		<p>migration.</p> <ul style="list-style-type: none"> • Piping results in the loss of natural in-stream and bank-side habitats through direct removal and loss of daylight. • The piping of watercourses leads to fragmentation and loss of wildlife corridors in agricultural environments. • Piped sections may create or exacerbate downstream or up-stream bank and bed erosion as well as sediment deposition, as a result of altered water velocities and disruption to the natural transport of sediment. • Pipes are prone to blockage by debris, both natural wood and litter, leading to localised flooding during periods of high river flow.
<p>Box culverts</p>	<ul style="list-style-type: none"> • Smaller footprint plan area. • Large openings allowing debris to pass through culvert. • Better long term durability. • Less susceptible to being washed away during extreme flood events. 	<ul style="list-style-type: none"> • Higher costs.

4.3.1 Design Criteria for Box Culverts

For the P449 rehabilitation for km 0,0 to km 6,0, the existing pipe culverts will be replaced with box culverts. The following best-practice environmental design considerations will need to be considered in culvert design and construction:

- Selection of culvert shape should be based on water depth, roadway embankment height, hydraulic performance, and allowing for species movement.
- Culverts should ideally be sized to transport not only water, but other materials (debris) that might be mobilized, as well as provide passage of aquatic species such as fish.
- Best management practices for road engineering includes designing stream crossing culverts to convey a minimum discharge equal to the 100-year flow.
- The culvert outlet apron must be established at the same level as the river bed.
- Contrary to the principle for piers of ‘fewer and smaller is better’, many large culverts are preferred over fewer small culverts. This ensures that these structures cater for the maximum flow volumes

experienced by the river. To prevent culvert plugging, one large culvert is typically more effective than several smaller ones².

- Appropriate measures to dissipate flow velocity, below the structures must be considered and designed for pre-construction.
- Erosion protection measures (e.g. Reno-mattresses) or energy dissipaters must be established below all culvert outlets.
- The base (invert) of the new portal / box culvert must be at the exact same elevation as the existing one, so that there are no significant up-stream and downstream adjustments in channel form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be onsite to guide the setting of the foundation.
- The inlet of the culvert base must match the elevation of the river bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than river bed).
- The culvert must be designed to adequately allow for natural through flows without impeding and focusing flows. Road-stream crossings with undersized culverts can cause large inputs of sediment to streams if the culvert inlet is plugged and stream-flow overtops the road fill³.
- Coarse stone material should be incorporated into culverts to mimic natural riffle / run river biotopes. Furthermore, coarse culvert beds will reduce scoring downstream by reducing flow velocities through increased surface roughness.
- A headwall should be installed at the inlet of the culvert to protect crossing fill from saturation and scour and direct flow into the culvert. The stream should flow straight into the culvert inlet at all stream discharges without any ponding, eddying or abrupt changes in flow path which could result in increased potential for culvert blockage by woody material⁴.
- In situations where the base of the culvert is below natural ground level, a concrete drop inlet structure or chute must be constructed at the inlet of the culvert to drop the water level without cause headcut erosion of the wetland upstream.

4.4 NO-GO Alternative

The NO-GO alternative will see the *status quo* of the P449 remain. The poor conditions associated with the road due to severe edge distress resulting from the action of vehicles entering and exiting the road via various forms of formal and informal accesses. The current condition also compromises the safety of the current road users.

Due to an elevation close to the surrounding ground surface severe damage has also been caused due to poor drainage conditions.

Should the *status quo* remain, the culverts will not be replaced and will continue to experience hydraulic capacity challenges, which will lead to continued degradation of the roadway in the vicinity of the culverts.

² Furniss, M.J., Ledwith TS., Love MA., McFadin BC. And Flanagan SA. 1998. Responses of Road-Stream Crossings to Large Flood Events in Washington, Oregon, and Northern California. San Dimas Technology and Development Centre, San Dimas, California.

³ Furniss, M.J., Ledwith TS., Love MA., McFadin BC. And Flanagan SA. 1998. Responses of Road-Stream Crossings to Large Flood Events in Washington, Oregon, and Northern California. San Dimas Technology and Development Centre, San Dimas, California.

⁴ Cafferata, P., Spittler, T., Wopat, M., Bundros, G., and Flanagan, S., 2004, Designing watercourse crossings for passage of 100 year flood flows, wood, and sediment, California Department of Forestry and Fire Protection, Sacramento, CA. Available at: <http://www.fire.ca.gov/ResourceManagement/PDF/100yr32links.pdf>.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

5.1 Drainage and Biophysical Context

The key biophysical features associated with the study area are summarised in **Table 11**.

Table 11: Key biophysical details of the study area

Biophysical Aspects	Desktop Biophysical Details	Source
Elevation a.m.s.l.	Approx. 96 – 187m a.m.s.l.	Google EarthTM
Rainfall distribution	Early Summer to Mid-Summer	DWAF, 2007
Mean annual precipitation (MAP)	610.9mm	Schulze, 1998
Mean annual temperature	16 – 22°C	DWAF, 2007
Potential Evaporation (mm) Mean Annual A-pan Equivalent	1975.6mm	Schulze, 1998
Median annual simulated runoff (mm)	68.4mm	Schulze, 1998
Geology and soils	Rhyolite (acidic lavas) of the Lebombo Group (Karoo Supergroup)	KZN Geology dataset
Water management area	Mvoti to Umzimkulu	DWA, 1995
Quaternary catchment/s	W45A	DWA, 1995
Main collecting river in the catchment	Phongolo River (downstream of Pongolapoort Dam)	CSIR, 2011
Location in the quaternary catchment	Upper reach of the catchment	CSIR, 2011
DWA Ecoregion (Level 2)	Lowveld (3.08) and Lebombo Uplands (12.01)	DWA, 2007

5.2 Conservation Context

Understanding the conservation context and importance of the study area and surrounds is important to inform decision making regarding the management of the resources in the area. In this regard, national, provincial and regional conservation planning information available was interrogated to obtain an overview of the study site in terms of conservation. Key findings that have a bearing on the proposed development include the following:

5.2.1 National and Provincial Vegetation Type (Mucina & Rutherford, 2006)

- In terms of both the national and provincial reference vegetation type, the study area falls within the Southern Lebombo Bushveld (SVI 16 & 44) which is considered **Least Threatened** and the Western Maputaland Clay Bushveld (SVI 20 & 50) which is considered **Vulnerable**.

5.2.2 National Freshwater Ecosystem Priority Area (NFEPA) Assessment (CSIR, 2011)

- No wetland FEPA has been identified within the impact zone of the proposed development.
- Two (2) reference wetland vegetation types are represented in the study area: the Lowveld Group 9 (**Vulnerable**) and the Lowveld Group 10 (**Endangered**).

5.2.3 KwaZulu-Natal Aquatic / Freshwater Conservation Plan (EKZNW, 2007)

- The study area falls within catchments (No. 4456) classified as “Available” with no specific conservation priorities set for aquatic ecosystems in these catchment areas. This means the catchments are available to meet water resource targets but are currently not critical to meet water resource targets.

5.2.4 KwaZulu-Natal Terrestrial Systematic Conservation Plan (EKZNW, 2010)

- The study area has not been identified as a Biodiversity Priority Area and is therefore not currently considered critical for the maintenance of biodiversity (**Figure 8**).

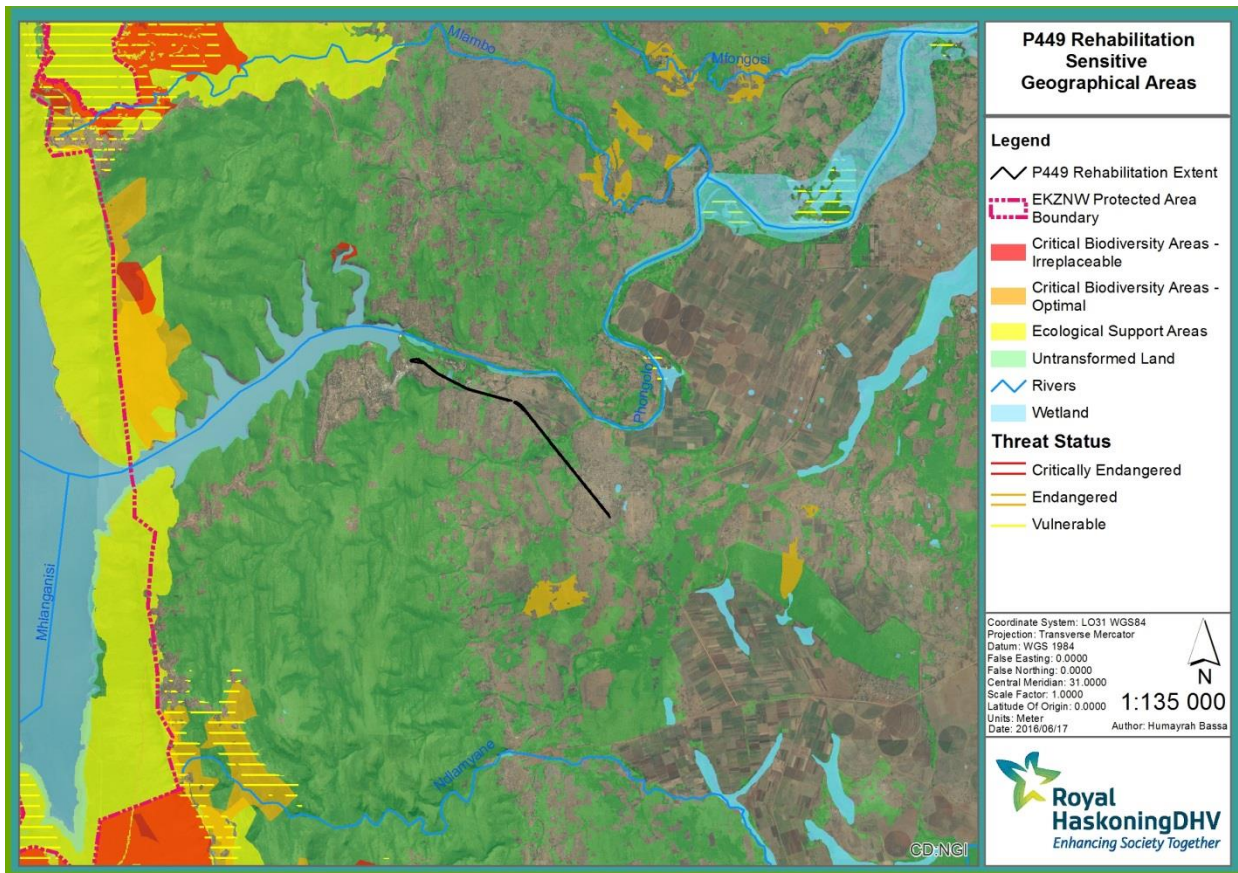


Figure 8: Sensitive geographical areas in relation to the P449 rehabilitation project

5.3 Desktop Watercourse Delineation

Thirteen (13) watercourse units including ten (10) wetland units and three (3) river units occurring within a 500m radius of the three (3) planned culvert upgrades were mapped at a desktop level. Furthermore, they were classified in terms of their HGM (Hydro-Geomorphic) type. The desktop mapped watercourses are shown in Figure 3 and Figure 4 and are as follows:

- Culvert 1 (C1)
 - Wetland Unit C1-W01: Unchannelled Valley-bottom wetland
 - Wetland Unit C1-W02: Channelled Valley-bottom wetland
 - Wetland Unit C1-W03: Unchannelled Valley-bottom wetland
 - Wetland Unit C1-W04: Artificial wetland
 - Wetland Unit C1-W05: Unchannelled Valley-bottom wetland
 - Wetland Unit C1-W06 Unchannelled Valley-bottom wetland

- Culvert 2 (C2)
 - River Unit C2-R01: Ephemeral River
 - River Unit C2-R02: Ephemeral River
 - River Unit C2-R03: Ephemeral River
 - Wetland Unit C2-W01: Wetland Seep

- Culvert 3 (C3)
 - Wetland Unit C3-W01: Channelled Valley-bottom wetland

- Wetland Unit C3-W02: Channelled Valley-bottom wetland
- Wetland Unit C3-W03: Channelled Valley-bottom wetland

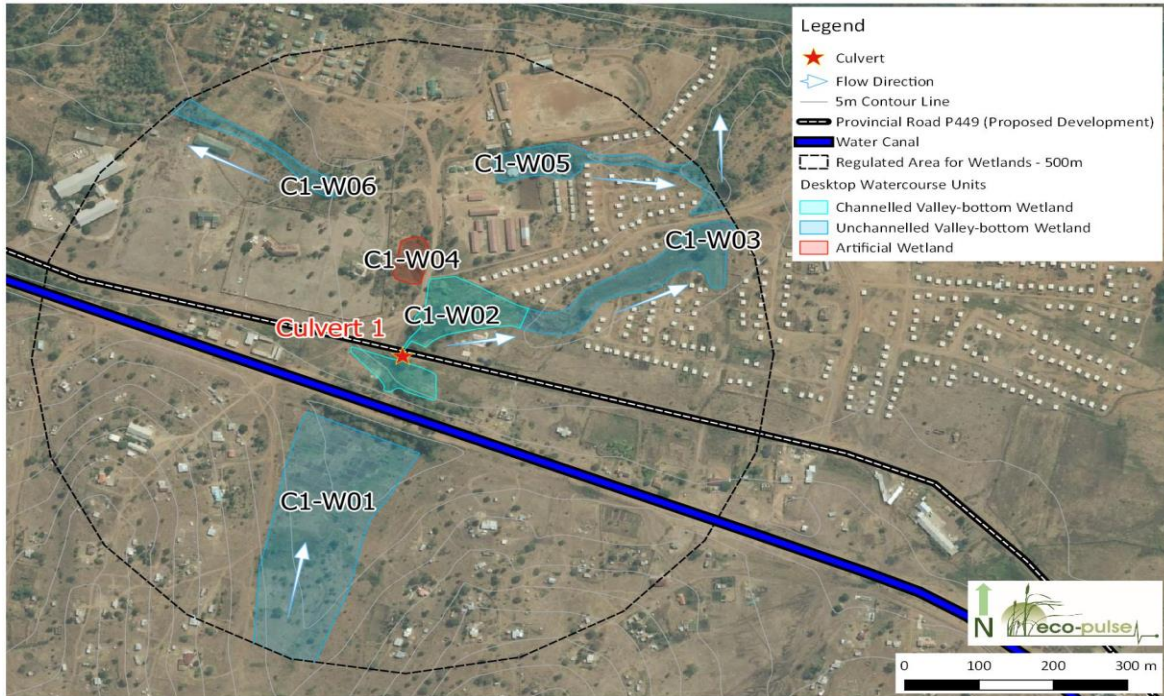


Figure 9: Desktop delineation of watercourses within the 500m regulated area for wetlands associated with culvert 1

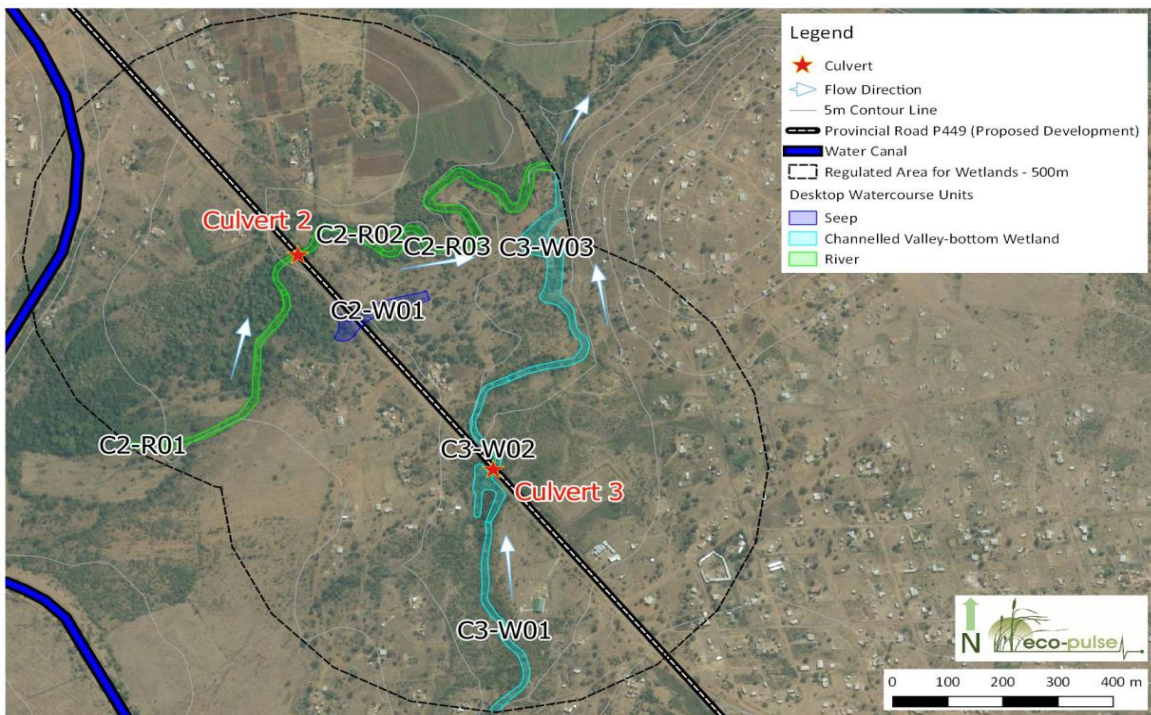


Figure 10: Desktop delineation of watercourses within the 500m regulated area for wetlands associated with culverts 2 and 3

5.4 Geology, Soils and Topography

The founding material is a clayey, sandy gravel for about 2.0 metres in depth. The foundation recommendation is to excavate 1.0 metres of the clayey, sandy gravel and replace it with an engineered rock fill.

5.5 Land Cover and Agricultural Potential

The key drivers of the local economy of the uMkhanyakude DM has been identified as tourism and retail, and to a lesser extent agriculture and processing. Therefore, most of the development plans for this DM are focussed at stimulating growth and development in these sectors. Deforestation is one of the identified major environmental problems affecting most areas in the municipality. This is a problem affecting almost every forest or veld in the municipality. This problem is caused by the wood carvers, fire wood collectors, farmers and villagers residing around deforested areas. This can be attributed to poverty, lack of knowledge, unemployment, unclear land policy, traditional practices and economic gains.

5.6 Cultural Heritage

As the proposed culvert replacement is a replacement of an existing culvert and occurs within a watercourse, within a road reserve, no heritage considerations are expected.

Border Cave is situated on the western face of the Lebombo Mountains north of Ingwavuma. It is an important archaeological and palaeontological site of world significance as it contains human remains and a large number of stone implements dating back to the middle and late stone ages. Apart from human remains from the Middle Stone Age, there are remains of at least 43 other mammal species in the cave, including the existent giant Cape Horse, bastard hartebeest and Bond's springbok (Studies on the Ecology of Maputaland, **Bruton & Cooper, 1980**). The KZN Tourist Authority is in the process of developing the Border Cave site as a tourist attraction. An interpretative centre has been designed to blend into the rocky hillside and will have a mock-up of the archaeological dig with fibreglass replicas of artefacts around the walls. It is hoped that the centre will generate opportunities for local community. The site has a very good tourism potential.

6 PUBLIC PARTICIPATION PROCESS

Public participation is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and/or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

I&APs include all interested stakeholders, technical specialists, and the various relevant organs of state who work together to produce better decisions.

The primary aims of the public participation process are:

- to inform I&APs and key stakeholders of the proposed application and environmental studies;
- to initiate meaningful and timeous participation of I&APs;
- to identify issues and concerns of key stakeholders and I&APs with regards to the application for the development (i.e. focus on important issues);
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information used for decision-making;

- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

The public participation process must adhere to the requirements of Regulations 41 and 42 (GNR 982) under the NEMA (as amended).

The public participation process for proposed P449 rehabilitation project will be undertaken according to the stages outlined below.



Figure 11: Responsibilities of I&APs

In order to achieve a higher level of engagement, a number of key activities have taken place and will continue to take place. These included the following:

- The identification of stakeholders is a key deliverable at the outset, and it is noted that there are different categories of stakeholders that must be engaged, from the different levels and categories of government, to relevant structures in the non-governmental organisation (NGO) sector, to the communities of wards of residential dwellings which surround the works;
- The development of a living and dynamic database that captures details of stakeholders from all sectors;
- The fielding of queries from I&APs and others, and providing appropriate information;
- The convening of specific stakeholder groupings/forums as the need arises;
- The preparation of reports based on information gathered throughout the BA via the PPP and feeding that into the relevant decision-makers;
- The PPP includes distribution of pamphlets or Background Information Documents (BIDs) and other information packs; and
- Where appropriate site visits may be organised, as well as targeted coverage by the media.

The proposed P449 PPP has entailed the following activities.

6.1 Authority Consultation

The competent authority, the KZN EDTEA, is required to provide an EA (whether positive or negative) for the project. The KZN EDTEA was consulted from the outset of this study, and has been engaged throughout the project process.

Authority consultation included the following activities:

- Pre-application consultation with Ms F Mdamba KZN EDTEA on 22nd July 2016 and 7th June 2017.
- Submission of an application for environmental authorisation in terms of **section 26** of the EIA Regulations (2014 as amended in 2017) on 07 August 2017.

6.2 Consultation with Other Relevant Stakeholders

Consultation with other relevant key stakeholders were, and will continue, to be undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project during the BA process.

Relevant key stakeholders were consulted and sent pamphlets or BIDs and other information packs (where requested).

All relevant stakeholders will be allowed an opportunity to comment on the draft Consultation BAR.

The identified stakeholders of this project are provided in Table 12.

Table 12: Key stakeholders

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE	
Traditional Authority – A. Nkosi Ingonyama Trust Board – Sue Ellis	
LOCAL AUTHORITY	
Siboniso Myeni Gcinani Ndaba	Jozini Local Municipality uMkhanyakude District Municipality
B. Mahaye and N. Gumbi	Councillor
STATE DEPARTMENTS	
Ms. Weziwe Tshabalala	AMAFA KwaZulu-Natal
Mrs. Felicia Mdamba	KwaZulu-Natal Department of Economic Development and Environmental Affairs
Ms. Modise	KwaZulu-Natal Department of Agriculture, Forestry and Fisheries
Mr. Andy Blackmore	eZemvelo KZN Wildlife
Ms. Shameela Ramburan	National Department of Water and Sanitation

6.3 Site Notification

The EIA Regulations (2014 as amended in 2017) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates

and at points of access or high through traffic. The purpose of this is to draw people's attention to the project and make them aware that they are able to play a role in the project.

I&APs were identified primarily from responses received from the notices that were placed, notifying the public of the project and the invitation for the public to register as stakeholders and inform them of the PP Process.

Royal HaskoningDHV erected a number of notices at various noticeable locations along the road alignment (refer to **Appendix E**).

6.4 Identification of Interested and Affected Parties

E-mails and letters were sent to key stakeholders and other known I&APs, informing them of the application for the project, the availability of the draft Consultation BAR for review and indicating how they could become involved in the project.

The contact details of all identified I&APs are updated on the project database, which is included in **Appendix E**.

This database will be updated on an on-going basis throughout the BA process.

6.5 Briefing Paper

A Background Information Document (BID) BID for the proposed project was compiled in English and isiZulu (refer to **Appendix E**) and distributed to key stakeholders.

The aim of this document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the BA process, and explains how I&APs could become involved in the project.

The briefing paper was distributed to all identified I&APs and stakeholders, together with a registration / comment sheet inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

6.6 Focus Group Meeting

A public meeting was not held for the project as the impacts regarding the project are predictable and can be mitigated effectively through the implementation of an EMP. A Focus Group Meeting will be held should significant interest / issues arise in the project.

6.7 Advertising

In compliance with the EIA Regulations (2014 as amended in 2017), notification of the commencement of the BA process for the project was advertised in a local newspaper as follows:

- The Isolezwe on 03 August 2017 (refer to **Appendix E**).

I&APs were requested to register their interest in the project and become involved in the BA process. The primary aim of these advertisements was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project.

6.8 Issues Trail

Issues and concerns raised in the public participation process during the BA process have been and will continue to be compiled into an Issues Trail.

The Issues Trail is attached as **Appendix E**, in which all comments received and responses provided have been captured.

6.8.1 Key Issues Raised by the Public

The Ward Councillors and representative of the Traditional Authority have expressed support for the project. As it is upgrade to existing infrastructure, no concerns were raised as the councillor indicated that he hopes the upgrade will prevent the road from overtopping during heavy rain events.

6.9 Public Review of the draft Consultation BAR

The draft Consultation BAR (cBAR) will be made available for authority and public review for a total of 30 days from 07 August 2017 to 06 September 2017.

The report will be made available at the following public locations within the study area, which are all readily accessible to I&APs:

- Jozini Public Library, Municipal Street, Jozini
- Electronically on the Royal HaskoningDHV Website: www.rhdhv.co.za.

6.10 Final Consultation BAR

The final stage in the BA process entails the capturing of responses and comments from I&APs on the cBAR in order to refine the BAR, and ensure that all issues of significance are addressed.

The final cBAR (i.e. final cBAR) will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

6.11 PPP Summary

A summary of the PPP is provided in **Table 13** below, with the documents provided in **Appendix E**.

Table 13: Summary of Public participation process

Activity	Description
Identifying stakeholders	Stakeholders were identified and a database of all I&APs were compiled.
Publishing newspaper adverts	The Isolezwe.
Distribution of a BID	BIDs were distributed electronically and by hand to I&APs.
Erection of site notices	A number of A2 site notices were erected on the proposed extent.
Preparation of an on-going Issues Trail	Comments, issues of concern and suggestions received from stakeholders thus far have been captured in an Issues Trail.
Release of Draft Report	The draft Consultation Basic Assessment Report (cBAR) has been advertised and made available for a period of 30 days for public review and comment.

	This cBAR is now available for review until 06 September 2017.
Focus Group Meeting	Not expected.
Release of final Report	The final cBAR will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

7 SPECIALIST ASSESSMENTS

7.1 Geotechnical Assessment

The foundation investigations consisted of trial pits at the inlet and outlet sides of each culvert crossing which was inspected and interpreted by the Geotechnical Engineer (**Mr. Robby Dunbar**).

The founding material and foundation improvement recommendations for the three culverts were similar. The founding material is a clayey, sandy gravel for about 2.0 metres in depth. The foundation recommendation is to excavate 1.0 metres of the clayey, sandy gravel and replace it with an engineered rock fill.

7.2 Freshwater Habitat Assessment

This study was undertaken by an independent specialist: **Eco-Pulse Environmental Consulting Services**.

7.2.1 Screening

A qualitative screening assessment of the potential impact of the development on each watercourse identified and mapped at a desktop level (in **section 5.3** and **Figure 9 - Figure 10**) was undertaken to identify watercourses that are likely to be measurably negatively affected by the proposed culverts replacement and/or likely to trigger a water use as contemplated in terms of Section 21 c and i of the National Water Act (Act No. 36 of 1998).

The principle ecological risks relevant to the construction and operation of the proposed culvert upgrades were deemed to include:

- Direct physical modification / destruction of aquatic habitat within the development site during the construction phase of the development;
- Indirect modification of aquatic habitat during the operational phase due to poor placement of the culvert; and
- Concentration or impoundment of flows during construction (short-term) and the operational phase (longer term).

Based on the above-mentioned risks, two Wetland Units C1-W02, C3-W02 and River Unit C2-R02 (**Figure 12**) were assigned impact ratings of 'definite' in terms of risk of being measurably impacted by the proposed development, whilst wetland unit C2-W01 (**Figure 13**) was assigned an impact rating of 'probable'. These watercourses were thus subjected to further assessment and impact assessment.

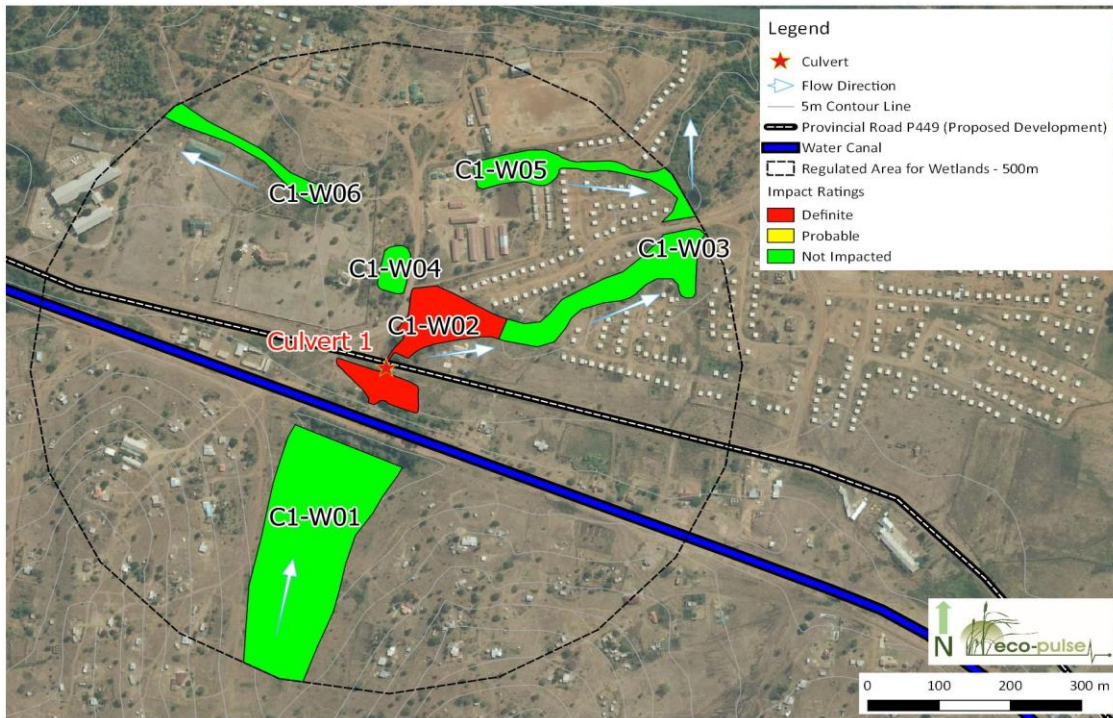


Figure 12: Impact screening and rating of desktop mapped watercourses within the 500m regulated area for wetlands in terms of Section 21 c and/or i water use (National Water Act) for culvert 1

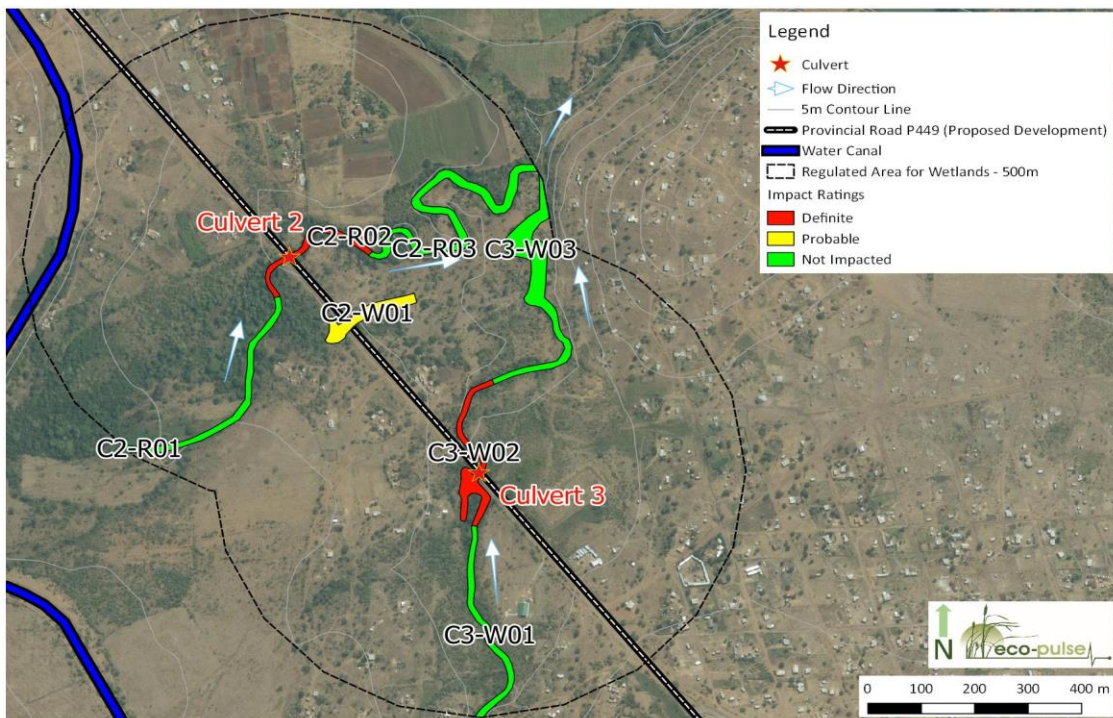


Figure 13: Impact screening and rating of desktop mapped watercourses within the 500m regulated area for wetlands in terms of Section 21 c and/or i water use (National Water Act) for culvert 2 & 3

A summary of the key biophysical characteristics of the watercourse units assessed for culvert upgrades 1-3, is provided in Table 6 below

7.2.2 Biophysical Characteristics of Wetland and River Habitats

Table 14: Summary of the biophysical characteristics of wetland and river habitats sampled

Culvert to be Upgraded	Unit	Watercourse Classification	Habitat Description & Existing Impacts
Culvert 1	C1-W02	Channelled valley-bottom wetland	<p>Hydrology: This wetland unit commences at the toe of an existing water canal embankment and terminates at a point downslope where the artificial channel created loses confinement and creates an area of wetland habitat. Water inputs are mainly in the form of overland flow with some sub-surface interflow from the upstream catchment supporting the wetland, and seepage from the leaking water canal infrastructure (water supply canal from Pongolapoort Dam). Water generally moves through the wetland system as concentrated / channelled flow via a central channel.</p> <p>Vegetation/Habitat: The wetland comprised a secondary, short herbaceous plant community dominated by rhizomatous native grasses. Inundated areas were generally characterised by typical emergent wetland vegetation (hydrophytes), mainly <i>Typha capensis</i>. Also recorded were a few solitary trees within the wetland area.</p>
	C2-R02	Small, seasonally intermittent River	<p>Hydrology: The river is characterised by a dry river bed and active channel that was void of vegetation, with no clearly visible flood bench or terrace. The river is small, with an active channel measuring up to 4 m wide and 1 – 1.5 m deep. Water inputs are mainly in the form of concentrated flows from the upstream catchment. Flows are thought to be seasonally intermittent, with lack of flows at the time of sampling compounded by the recent drought that the region has faced.</p> <p>Vegetation/Habitat: The instream habitat was found to be largely devoid of vegetation growth, with limited pioneer and ruderal forbs established where water still collects. The riparian habitat was limited, with some solitary riparian tree species with no understorey growth.</p>
Culvert 2	C2-W01	Seep	<p>Hydrology: The small seepage wetland is currently sustained largely by groundwater inputs and water moves through the wetland as both surface and sub-surface flows (interflow).</p> <p>Vegetation/Habitat: Wetland vegetation was found to be secondary in nature and comprised of short hydric grassland species dominated by a rhizomatous grass, <i>Cynodon dactylon</i>. Solitary trees were recorded along the edge of the wetland sampled.</p>
	C3-W02	Channelled valley-bottom wetland	<p>Hydrology: Water inputs are mainly in the form of concentrated flows from the up-stream river channel and its tributaries. The wetland is likely sustained by regular overtopping of the channel during rainfall events. Water generally moves through the wetland system as concentrated/channelled flow via a central channel.</p>

Culvert to be Upgraded	Unit	Watercourse Classification	Habitat Description & Existing Impacts
			<p>Vegetation/Habitat: Wetland vegetation was found to be characterised by a short herbaceous wetland plant community established on the channel flood bench with a transitional dryland bushveld community along the fringe of the wetland. The herbaceous community comprised mainly short rhizomatous grasses dominated by <i>Cynodon dactylon</i> and a mix of various weedy / pioneer forbs.</p>

A selection of digital photographs showing some of the habitat and vegetation / soil characteristics of the riparian / in-stream and wetland habitats sampled has been provided below.



Photo 1: Soil sample extracted from Wetland Unit C1-W02 during the wetland delineation undertaken. Note the grey/gleyed soil matrix and abundance of orange mottles indicating alternating anaerobic and aerobic conditions typical of a seasonally saturated wetland soil.



Photo 2: View showing the edge of Wetland Unit C1-W02 which has been infilled with earth and rock to construct a housing platform.



Photo 3: Seasonal wetland soil sample extracted from wetland C2-W01.



Photo 4: View looking up-stream of the culvert showing the dry river bed.



Photo 5: View looking downstream of the wetland showing an active, flowing channel (culvert 3)

Photo 6: Outlet of culvert 3 to be replaced.

7.2.3 Present Ecological State (PES)

PES for the Wetland Units

The results of the PES assessment suggests that the two wetland units associated with culverts 1 and 2 (C1-W02 & C2-W01) were found to be Largely Modified (PES category “D”), with a large change in ecosystem processes and loss of natural habitat and biota having occurred. Wetland Unit C3-W02 associated with culvert 3 was assessed as Moderately Modified (PES category “C”), which indicates that a moderate change in ecosystem processes and loss of natural habitats has taken place.

PES for the River Unit C2-R02 at Culvert 2

For the purposes of assessing river PES, the Index of Habitat Integrity (IHI) was used⁵. The assessment of habitat integrity of the in-stream and riparian zone of River Unit C2-R02 indicates that the in-stream habitat is currently Moderately Modified (PES category “C”) and the riparian habitat is Largely Modified (PES category “D”). Overall, the river unit can be considered to be in an overall Largely Modified state (PES category “D”), with a large loss of natural habitat, biota and basic ecosystem functions having occurred as a consequence of anthropogenic impacts at the site, and within the upstream catchment to a degree.

7.2.4 Ecosystem Services Assessment

The findings of the assessment reveal that most ecosystem goods and services are of low to moderately low importance for all three wetland units assessed, with the following exceptions:

- The channelled valley-bottom wetland C1-W02 was estimated to be moderately important in terms of providing a range of key regulating and supporting services, including flood attenuation, stream flow regulation, erosion control and water quality enhancement benefits. This can be linked to the wetland gentle slope and functional / habitat characteristics that support the supply of these services, and associated local demand for key services.

⁵ Kleyhans, C. J. 1996. A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River (Limpopo System, South Africa). *Journal of Aquatic Ecosystem Health* 5:41-54.

- The small hillslope seepage wetland C2-W01 showed overall low levels of service supply which can be attributed to the wetlands small size and diminished functional / habitat characteristics, apart from having a moderately important function in terms of controlling erosion and enhancing water quality at a local scale perhaps.
- The channelled valley-bottom wetland C3-W02 was not considered as important as wetland C1-W02 in terms of providing key regulating and supporting services, however, the wetlands role in providing provisioning services such as water supply and harvestable natural resources was regarded as being of a moderate to moderately-high importance, linked to both potential perennial supply of water, presence of woody plants which can be used for construction or fuel and the anticipated local demand for resource use by communities.

7.2.5 Ecological Importance and Sensitivity (EIS) Assessment

All wetland units (C1-W02, C2-W01 and C3-W02) were found to be of Moderately-Low ecological importance and sensitivity (EIS) whilst the river unit (C2-R02) was found to be of Very Low EIS. These scores are attributed to increased habitat destruction, increased anthropogenic pressures and the resulting loss of biota. Overall, all watercourse units are of limited importance in terms of contributing towards the maintenance of biodiversity and of limited sensitivity to any edge disturbances.

7.2.6 Recommended Ecological Category (REC) and Maintenance Objectives for Watercourses

The recommended ecological category (REC) is the target or desired state of resource units required to meet water resource management objectives and quality targets. It is determined through the consideration of the PES, EIS and realistic opportunities to improve the PES that is driven by the context / setting.

The management objective for all three wetlands and the river unit assessed should be to 'maintain the current state and functioning,' with the REC set as per Table 15, below. The nature and extent of the proposed project does not warrant a directive to improve the current state of these ecosystems.

Table 15: Summary of REC and RMO for all watercourses assessed based on their PES and EIS ratings

Unit	Type	PES	EIS	REC	RMO
C1-W02	Channelled Valley-bottom Wetland	D: Largely Modified	Moderately-Low EIS	D: Largely Modified	Maintain PES/EIS
C2-W01	Seep	D: Largely Modified	Moderately-Low EIS	D: Largely Modified	
C3-W02	Channelled Valley-bottom Wetland	C: Largely Modified	Moderately-Low EIS	C: Largely Modified	
C2-R02	Ephemeral River	D: Largely Modified	Very-Low	D: Largely Modified	

7.3 Potential Impacts

7.3.1 *Physical Destruction and / or Modification of Aquatic Habitat*

Construction Phase Impacts

Direct impacts to wetland / aquatic vegetation/habitat caused by construction taking place within a wetland will likely include the following:

- Destruction or modification of habitat.
- Destruction or modification of wetland / riparian vegetation and river banks (bank modification).
- Unintentional physical destruction or modification of wetland or riparian habitat outside of the construction zone caused by machinery and construction staff accessing areas upstream or downstream of the road crossing and culvert.
- Sedentary (slow moving) fauna such as invertebrates, slow moving reptiles and amphibians may be killed within the construction servitude or forced to migrate into adjoining habitats.

Indirect/secondary impacts to aquatic vegetation / habitat caused by construction within and across the river channel and riparian zone may include the following:

- Temporary noise, dust and light disturbance which will cause local fauna to move away from the construction zone in the short-term.
- Temporary in-stream habitat fragmentation impacts from coffer dams and / or temporary diversions which can inhibit / reduce the mobility of aquatic fauna between successive river reaches in the short-term.

Operational Phase Impacts

During the operational phase of the project (i.e. once construction upgrades cease, flows are reinstated and the new culvert structure becomes operational) any disturbance caused during construction is likely to promote the establishment of disturbance-tolerant species, including Invasive Alien Plants (IAPs), weeds and pioneer species within riverine habitats. Encroachment by alien plants will result in the deterioration of freshwater habitat integrity if rehabilitation and monitoring are not implemented correctly.

7.3.2 *Flow Modification and Erosion/Sedimentation Impacts*

Construction Phase Impacts

Temporary direct flow modifications likely to take place during culvert replacement may include:

- Cofferdams and / or temporary diversions can result in a reduction in flows downstream if environmental flows are not catered for, thus affecting the maintenance of river biotopes directly downstream.
- Inundation or back-flooding upstream of cofferdams altering naturally occurring wetland and instream habitats.
- It is expected that abstraction will occur below the GA limits, where this does occur, abstraction can potentially result in the reduction of flows downstream, potentially affecting the maintenance of key wetland / river biotopes on which species rely.

Indirect flow related erosion and sedimentation / turbidity impacts may include:

- Disturbance of bed and bank profiles associated within construction is likely to render soil particles (i.e. sand, clay and silt) susceptible to suspension and transport downstream, resulting in the sedimentation and increased turbidity of downstream river reaches.
- Diversion of flows around instream work areas (usually required to ensure a 'dry working area') can focus flows downstream, thus altering the rate and distribution of flows and resulting in

potential bed / bank scouring / erosion. This may also disconnect instream habitat reaches or microhabitats from flow or change the nature of flows in these biotopes.

- Flow related erosion (i.e. scouring) and/or sedimentation and turbidity impacts will be more pronounced during rainfall events and higher rainfall periods of the year and are directly linked with flow volumes and velocities.

Operational Phase Impacts

Key flow modifications during the operation of the road culvert may include:

- Box or portal culverts (where employed) can result in concentrated flows and a subsequent increase in flow velocity and increase the erosivity of flows downstream, which may result in scouring and possible long-term channel incision. Channel incision lowers the local water table causing desiccation (drying) of the riparian zone and a shift in plant communities. Incision is quite unlikely in this case due to the presence of shallow underlying bedrock and the relatively gentle longitudinal gradient of the river bed.
- Undersized or blocked culverts may cause impoundment (increased saturation or inundation) on the upstream side of the road crossing and reduce water inputs downstream. This may alter instream biotopes upstream (causing pooling) and compromise sensitive riffle habitat downstream.
- Installation of culverts above or below the natural bed level may cause an increase or decrease in longitudinal profile of a watercourse and an increase or decrease in flow velocities at crossing points. This may result in sedimentation upstream if installed above the bed level and headward erosion if installed below the bed level. Incision is quite unlikely in this case due to the presence of shallow underlying bedrock and the longitudinal gradient of the river bed.

7.3.3 Water Quality Impacts

Construction Phase Impacts

Pollutants / contaminants associated with construction projects vary and may enter the watercourses during construction activities and have the capacity to negatively affect receiving water resource integrity / quality, the direct result of which is reduced suitability for consumption (humans and livestock).

Secondary to the direct use value of the water resource is the sensitivity of aquatic biota to changes physico-chemical water quality. Where significant changes in water quality occur, a shift in species composition will result, favouring tolerant species, and potentially resulting in the localised reduction of sensitive species. Sudden drastic changes in water quality can also have chronic effects on aquatic biota such as fish, invertebrates and amphibians which have specific pollution tolerances. Where these tolerances are exceeded localised extinctions may result. While water quality impact are possible and may have a measurable effect of water resource quality and aquatic biota sensitive to water quality modifications, these impacts are unlikely and in the event that they do occur will probably be short-lived.

Potential construction phase contaminants and their relevant sources may include:

- Hydrocarbons – leakages from petrol/diesel stores and machinery/vehicles, spillages from poor dispensing practices.
- Oils and grease - leakages from oil / grease stores and machinery / vehicles, spillages from poor handling and disposal practices.
- Cement - spillages from poor mixing and disposal practices.
- Bitumen - spillages from poor application, handling and disposal practices.
- Sewage – leakages from and / or poor servicing of chemical toilets and/or informal use of surrounding bush by workers.

- Suspended solids – suspension of fine soil particles as a result of soil disturbance and altered flow patterns (covered above).
- Workers are likely to generate solid waste during construction which could easily end up contaminating the riparian zone and river water, and would migrate downstream to disturb downstream ecosystems.

Operational Phase Impacts

Potential operational phase contaminants and their relevant sources can be variable but are likely to be considerably fewer and of less concern than construction phase contaminant risks. Pollutants will however accumulate on the road surface where they will be flushed into adjacent / downstream watercourses after rainfall events albeit at a very low level. Operational phase water quality impacts are therefore likely to be of very low intensity or significance for a project of this nature and are unlikely to have a negative biotic response within the receiving river habitat.

Operation phase contaminants/pollutant may include:

- Suspended solids (turbidity) – should scouring and channel erosion result from poor culvert design and installation leading to sedimentation and increased water turbidity downstream.
- Heavy metals – from car engine wear and fluid leakage.
- Hydrocarbons, oils and grease – from petrol/ diesel leakages from vehicles or incomplete fuel combustion.
- Solid waste - from littering associated with vehicle drivers.

8 IMPACT ASSESSMENT

8.1 Introduction

Impact assessment must take account of the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A brief discussion of the impact and the rationale behind the assessment of its significance is provided in this Section.

The EIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment is focussed on the following phases of the project namely:

- Planning Phase;
- Construction Phase; and
- Operational Phase.

As the project entails rehabilitation of existing infrastructure which will be permanent, decommissioning is not applicable to this project, however, impacts associated with post construction clean-up are considered.

8.2 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature:** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- **Extent:** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration:** Indicates what the lifetime of the impact will be;
- **Intensity:** Describes whether an impact is destructive or benign;
- **Probability:** Describes the likelihood of an impact actually occurring; and
- **Cumulative:** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The criteria to be used for the rating of impacts are provided in **Table 16**.

Table 16: Criteria to be used for the rating of impacts

Criteria	Description			
EXTENT	National (4) The whole of South Africa	Regional (3) Provincial and parts of neighbouring provinces	Local (2) Within a radius of 2 km of the construction site	Site (1) Within the construction site
DURATION	Permanent (4) Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	Long-term (3) The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	Medium-term (2) The impact will last for the period of the construction phase, where after it will be entirely negated	Short-term (1) The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
INTENSITY	Very High (4) Natural, cultural and social functions and processes are altered to extent that they permanently cease	High (3) Natural, cultural and social functions and processes are altered to extent that they temporarily cease	Moderate (2) Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	Low (1) Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILITY OF OCCURRENCE	Definite (4) Impact will certainly occur	Highly Probable (3) Most likely that the impact will occur	Possible (2) The impact may occur	Improbable (1) Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 17: Criteria for the rating of classified impacts

	Class	Description
+	Any value	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.
-	Low impact (4 -6 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	Medium impact	Mitigation is possible with additional design and construction inputs.

Class	Description
(7 -9 points)	
High impact (10 -12 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
Very high impact (12 - 14 points)	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a “very high impact” is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMP.

8.3 Potential Impacts and Significance

The following sections will provide a description of the potential impacts as identified by the specialist assessment, EAP and through the PPP as well as the assessment according to the criteria described in **Table 16** and **Table 17**.

All potential impacts associated by the proposed development through the construction and operation of the development life-cycle have been considered and assessed in the following sections. As the infrastructure is expected to be permanent, the decommissioning phase impacts have not been considered.

8.3.1 Planning Phase Impacts

Table 18: Planning phase impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Planning & Design	Aspect: Construction of three culverts. Impact: Impact on protected tree species (<i>Sclerocarya birrea</i> subsp. <i>caffra</i>) and provincially protected plants (<i>Aloe marlothii</i> , <i>Aloe parvibracteata</i> and <i>Crinum</i> sp.)	Without	2	1	3	2	-8	Medium
		With	2	1	1	1	-5	Low
	Key mitigation measures: <ul style="list-style-type: none"> ▪ 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 re-vegetation. In this regard, a wetland / aquatic ecologist must guide the contractor on the plants to rescue prior to 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). ▪ In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974, an Ordinary Permit from EKZNW is required to handle the <i>Aloe marlothii</i>, <i>Aloe parvibracteata</i> and <i>Crinum</i> sp. ▪ A licence with regards to nationally protected trees is required to handle <i>Sclerocarya birrea</i> subsp. <i>caffra</i>. The licence must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) prior to construction. 							
	Aspect: Design of culverts. Impact: Impact on watercourses.	Without	2	2	3	3	-10	High
With		1	1	1	1	-4	Low	
Key mitigation measures: <ul style="list-style-type: none"> ▪ Selection of culvert shape should be based on water depth, roadway embankment height, hydraulic performance, and allowing for species movement. ▪ Culverts should ideally be sized to transport not only water, but the other materials that might be mobilized, as well as provide passage for aquatic species such as fish. 								



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> ▪ Best management practices for road engineering includes; designing stream crossing culverts to convey a minimum discharge equal to the 100-year flow. ▪ The culvert outlet apron must be established at the same level as the river bed. ▪ Appropriate measures to dissipate flow velocity below structures must be considered and designed prior to construction commencing. ▪ Erosion protection measures (e.g. Reno-mattresses) or energy dissipaters must be established below all culvert outlets. ▪ The base (invert) of the new portal / box culvert must be at the exact same elevation as the existing one so that there are no significant upstream and downstream adjustments in channel form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be on-site to guide the setting out of the foundation. ▪ The inlet of the culvert base must match the elevation of the river bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than river bed). ▪ The culvert must be designed to adequately allow natural through flows without impeding and focusing flows. ▪ A headwall should be installed at the inlet of the culvert to protect crossing fill from saturation and scour and direct flow into the culvert. ▪ In situations where the base of the culvert is below natural ground level, a concrete drop inlet structure or chute must be constructed at the inlet of the culvert to drop the water level without cause headcut erosion of the wetland upstream. This is likely to be required for Wetland Units C1-W02 and C3-W02. 					

8.3.2 Soils

Table 19: Impact on soils

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction		Without	1	2	2	2	-7	Medium
		With	1	1	1	1	-4	Low
	Aspect: Construction activities (site clearing and establishing temporary road diversions within watercourses). Impact: Physical degradation due to the removal and compaction of soil during construction activities.	Key mitigation measures: <ul style="list-style-type: none"> Erosion / sediment control measures such as silt fences or bricks placed around the stockpiles to limit sediment runoff from stockpiles. Subsoil and topsoil must be stockpiled separately. Stockpiled soil must be replaced in the reverse order to which it was removed (subsoil first followed by topsoil). Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils. The stockpiles may only be placed within demarcated stockpile areas. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. Stockpiles shall be located outside of freshwater habitat (including riparian zones). Stockpiled soils must be kept free of weeds and must not be compacted. The stockpiled soil must be kept moist using some form of spray irrigation on a weekly to bi-weekly basis. The height of stockpiles must be limited to 2 m to avoid soil compaction and destruction of soil micro-organisms. 						
		Without	1	2	2	3	-8	Medium
Aspect: Construction activities (site clearing). Impact: Physical degradation due to soil: erosion as a result of exposed	Key mitigation measures: <ul style="list-style-type: none"> Construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially on steep slopes. The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes. 							
	With	1	1	1	2	-5	Low	

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	soil and topsoil.	<ul style="list-style-type: none"> All bare slopes and surfaces to be exposed to the elements of weather during clearing and earthworks must be protected against erosion using rows of silt fences and sandbags. Sediment barriers such as berms, sandbags and/or silt fences must be monitored for the duration of the construction phase and repaired immediately when damaged. Sediment barriers must only be removed once vegetation cover has successfully re-colonised the embankments. After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gully for additional protection until grass has re-colonised the rehabilitated area. Where required sand bags must be used to retain banks vulnerable to collapse. 						
	Aspect: Establishment of contractor laydown area (camp).	Without	1	2	2	2	-7	Medium
	Impact: Impact on land use and land capability – disturbance of soils to the location of the construction camp and associated infrastructure.	With	1	1	1	1	-4	Low
		Key mitigation measures: <ul style="list-style-type: none"> The contractor laydown area may not be placed in or in close proximity to any watercourse. No material may be stored or equipment repaired beyond the boundaries of the contractor laydown area. 						

8.3.3 **Geology**

Table 8-20: Geology and Topography Impacts – Preferred Alignment

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction		Without	1	2	3	3	-9	Medium
		With	1	2	1	2	-6	Low
	<p>Aspect: Foundations.</p> <p>Impact: Disturbance of surface geology and topography resulting in site instability due to inadequate drainage and / or inappropriate engineering planning and interventions.</p>	<p>Mitigation measures:</p> <ul style="list-style-type: none"> It is important to allow for on-site inspections and evaluations by an experienced engineering geologist / geotechnical engineer so that stability problems can be timeously identified and remedied. All earthworks should be carried out in a manner to promote stable development of all infrastructure. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version). Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites. The geology must be returned to its pre-construction condition. 						
	<p>Aspect: Construction activities (site clearing).</p> <p>Impact: Gully or ‘donga’ erosion by concentrated, uncontrolled water-flow.</p>	Without	1	2	2	2	-7	Medium
With		1	1	1	1	-4	Low	
		<p>Mitigation measures:</p> <ul style="list-style-type: none"> Cut embankments must be protected against surface erosion through the establishment of vegetation immediately after construction. Suitable subsoil drainage, stormwater control and preventable solutions to avoid soil erosion will be required in areas with sandy soils, and particularly in close proximity to watercourses. Adequate stormwater surface drainage as per the stormwater management plan must be adopted. 						

8.3.4 Geohydrology

Table 21: Geohydrology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		Without	2	2	3	2	-9	Medium
		With	1	1	1	2	-5	Low
Construction	<p>Aspect:</p> <ul style="list-style-type: none"> Improper storage of fuels, chemical etc. Construction equipment, vehicles, workshop and wash bay areas. Inadequate ablutions. <p>Impact: Groundwater contamination as a result of:</p> <ul style="list-style-type: none"> Spillage of fuels, lubricants and other chemicals. Construction equipment, vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source. Lack of provision of ablutions that may lead to the creation of informal ablutions. 	<p>Key mitigation measures:</p> <ul style="list-style-type: none"> Potentially hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time. Material safety data sheets (MSDSs) are to be clearly displayed for all hazardous materials. The integrity of the impervious surface and bunded area must be inspected regularly and any maintenance work conducted must be recorded in a maintenance report. Employees should be provided with absorbent spill kits and disposal containers to handle spillages. Train employees and contractors on the correct handling of spillages and precautionary measures that need to be implemented to minimise potential spillages. All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability. No repairs may be undertaken beyond the contractor laydown area. Immediate reporting and rectification of any incident that might lead to pollution. Implementation of best practice methods to prevent potential incidents from occurring e.g. an Environmental Management System (EMS) reporting and monitoring system. An Emergency Preparedness and Response Plan will be developed and implemented should an incident occur. Access to storage areas on-site must be restricted to authorised employees only. Contractors will be held liable for any environmental damages caused by spillages. The construction workforce must have adequate sanitation facilities. The sanitation facilities should be on-site before the extended workforce is employed to ensure that no unauthorised sanitation practices are undertaken on-site. 						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> Potential construction practices that might lead to groundwater contamination should be conducted on areas with impervious surfaces to avoid infiltration of contaminated substances into the groundwater aquifer. All contaminated stormwater should be treated before being discharged into the surrounding natural environment. 					

8.3.5 Vegetation

Table 22: Vegetation Impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	Aspect: Clearing of vegetation for the construction of the culverts and associated temporary road diversions. Impact: Loss / degradation of wetland habitat.	Without	1	1	3	3	-8 Medium
		With	1	1	1	1	-4 Low
		Key mitigation measures: <ul style="list-style-type: none"> The construction servitude should be limited to the proposed development footprint and a 10 m working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc. The outer edge of the construction servitude / working area (as defined above) must be clearly demarcated for the entire construction phase using a brightly coloured hazard fence. All areas outside (including upstream and downstream) of this demarcated construction servitude must be considered 'NO-GO' areas. 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 shall be installed across the river/stream channel established at regular intervals. 					
Operations	Impact: Alien invasive plant (IAP)	Without	1	2	2	3	-8 Medium
		With	1	1	1	1	-4 Low



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	encroachment.	Key mitigation measures: <ul style="list-style-type: none"> 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. Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment. 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. 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. 					

8.3.6 Watercourses

Table 23: Watercourse impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	Aspect: Construction activities within watercourses. Impact:	Without	1	2	2	4	-9 Medium
		With	1	1	1	2	-5 Low
		Key mitigation measures: <ul style="list-style-type: none"> It is recommended that construction within the river take place in the winter / dry months 					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>Physical destruction and / or modification of aquatic habitat including:</p> <ul style="list-style-type: none"> ▪ Destruction or modification of habitat. ▪ Destruction or modification of wetland/riparian vegetation and river banks (bank modification). ▪ Unintentional physical destruction or modification of wetland or riparian habitat outside of the construction zone caused by machinery and construction staff accessing areas upstream or downstream of the road crossing and culvert. ▪ Sedentary (slow moving) fauna such as invertebrates, slow moving reptiles and amphibians may be killed within the construction servitude or forced to migrate into adjoining habitats. 	<p>(June-September) to reduce erosion and sedimentation risks during the construction phase. If construction is timed correctly the risk and intensity of temporary flow diversion and sedimentation impacts to downstream river reaches will be greatly reduced.</p> <ul style="list-style-type: none"> ▪ The construction servitude should be limited to the proposed development footprint and a 10 m working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc. ▪ All areas outside (including upstream and downstream) of the demarcated construction servitude must be considered 'NO=GO' areas. ▪ Watercourses outside of the construction servitude that are disturbed during the construction phase must be rehabilitated immediately. ▪ All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO as per the rehabilitation strategy included in the EMPr (Appendix B). ▪ Where stream channels have been disturbed, the channels should be re-graded (where necessary) and stabilised using geofabric and re-vegetated as per the relevant re-vegetation / re-planting plan. ▪ Sediment barriers such as berms, sandbags and / or silt fences must be monitored for the duration of the construction phase and repaired immediately when damaged. ▪ Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gulley for additional protection until grass has re-colonised the rehabilitated area. 						
	Aspect:	Without	1	3	1	3	-8	Medium
	Construction activities within watercourses.	With	1	2	1	2	-6	Low
	Impact:	Key mitigation measures:						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>Flow modification and erosion/sedimentation impacts:</p> <ul style="list-style-type: none"> ▪ Cofferdams and / or temporary diversions can result in a reduction in flows downstream if environmental flows are not catered for, thus affecting the maintenance of river biotopes directly downstream. ▪ Inundation or back-flooding upstream of cofferdams altering naturally occurring wetland and instream habitats. ▪ Disturbance of bed and bank profiles is likely to render soil particles ((i.e. sand, clay and silt) susceptible to suspension and transport downstream, resulting in the sedimentation and increased turbidity of downstream river reaches. ▪ Flow -related erosion. 	<ul style="list-style-type: none"> ▪ One of two flow diversion methods is recommended for implementation during the construction phase: <ul style="list-style-type: none"> ○ Method 1: Full isolation gravity / flume pipe: A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area through gravity fed flumes/pipes. The flume(s) is normally placed on the bed of the watercourse through the works area and outfalls at the downstream barrier, if present, or far enough downstream to prevent the water backing up into the work area. ○ Method 2: Full isolation over pumping / siphon: A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area by mechanical assistance (pumping or siphon). The pump and associated pipe work need not be located in the isolated area. ▪ A method statement must be compiled by an aquatic specialist in conjunction with the appointed contractor to guide the flow diversion process from start to finish. ▪ Temporary diversions will need to be put in place to temporarily divert water away from activities and ensure a dry work area. ▪ Diversions shall be temporary in nature with no permanent walls, berms or dams being installed. ▪ Under no circumstances shall a new channel or drainage canal be excavated to divert water away from construction activities. ▪ Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns, and the channel and riparian zone rehabilitated/restored to their original configurations as soon as practically possible. 						
	Aspect:	Without	1	2	2	2	-7	Medium
	Construction activities within	With	1	1	1	2	-5	Low

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	<p>watercourses.</p> <p>Impact: Impacts on water quality due to potential contaminants (hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste) released into watercourses.</p>	<p>Key mitigation measures:</p> <ul style="list-style-type: none"> ▪ The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) needs to be administered. Storage containers must be regularly inspected to prevent leaks and all hazardous storage must take place in a bunded area or within drip trays to prevent soil/water contamination. ▪ 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 50 m of the delineated watercourse habitat or within the 100-year flood line, whichever is applicable. ▪ No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site. ▪ Vehicle maintenance should not take place on site unless a specific bunded area with an oil filter trap is constructed at the site camp for such a purpose. ▪ Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage. ▪ If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil/water contamination. The drip tray will need to be lined with absorbent pads and checked daily while in use. ▪ All equipment to be used within the sensitive working areas must be checked daily for oil and diesel leaks before gaining access to these working areas. ▪ An emergency spill response procedure must be formulated and staff is to be trained in spill response. All necessary equipment for dealing with spills of fuels / chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. ▪ 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 need to be encouraged to use toilet facilities provided and not the natural environment. ▪ Toilets must not be located within the 1:100 year flood line of a watercourse or closer than 50 m or from any natural water bodies including rivers, streams, riparian areas and wetlands. 					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Operations	Impact: Alien invasive plant (IAP) encroachment.	Without	1	3	2	3	-9	Medium
		With	1	1	1	1	-4	Low
	Key mitigation measures: <ul style="list-style-type: none"> 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. Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment. 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. It is recommended that bi-annual 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. 							
	Impact: In-stream infrastructure can alter the volume, timing and pattern of flows within the immediate river reach and downstream, ultimately affecting the rate of erosion and/or the distribution of sediment.	Without	2	3	2	2	-9	Medium
With		1	1	1	1	-4	Low	
Key mitigation measures: <ul style="list-style-type: none"> If planning and design recommendations for the culverts are strictly followed, these impacts are easily manageable and should not result extensive scouring, channel incision and sedimentation impacts in the long-term. Refer to the key mitigation measures presented in section 8.3.1 for the design 								

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		recommendations for culverts.						
	Impact: Impacts on water quality due to potential contaminants (hydrocarbons; heavy metals; suspended solids and solid waste) released into watercourses.	Without	1	1	1	1	-4	Low
		With	1	1	1	1	-4	Low
		Key mitigation measures: <ul style="list-style-type: none"> Proper culvert design to prevent scouring and channel erosion leading to sedimentation and increased water turbidity downstream. Responsible use of roads i.e. no littering, vehicles in road-worthy condition. 						
Cumulative	Impact: Downstream watercourse impacts due to: <ul style="list-style-type: none"> Coffer dams and / or temporary diversions that may result in a reduction in flows downstream if environmental flows are not catered for, thus affecting the maintenance of river biotopes directly downstream. Abstraction which may potentially result in the reduction of flows downstream, potentially affecting the maintenance of key wetland / river biotopes on which species rely. 	Without	2	3	2	2	-9	Medium
		With	2	2	1	1	-6	Low
		Key mitigation measures: <ul style="list-style-type: none"> With the implementation of good mitigation measures such as limited vegetation clearing only within the development footprint and the application of best practice temporary flow diversions (in addition to undertaking work during the dry / low rainfall season) this cumulative impact can be reduced from Medium to Low significance. No water is to be abstracted from the river for use in construction activities without a Water Use Authorisation in terms of section 21 (a) of the National Water Act. The Contractor shall only be allowed to draw water from the source / s indicated in the WUL. Abstraction points should be carefully selected to minimize impacts to sensitive river biotopes. Care is to be taken not to disturb the channel bed of watercourses during abstraction of water using suction pumps. Locate the suction pump inlet at a sufficient height above the channel bed/floor where bed-load sediments accumulate. Where necessary, install a suitable sediment filter / screen in front of the suction pump inlet to remove undesirable sediments, particles and debris from entering the pump. If planning and design recommendations for the culverts are strictly followed, downstream impacts are easily manageable and should not result extensive scouring, channel incision and sedimentation impacts in the long-term. 						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	<ul style="list-style-type: none"> In-stream infrastructure can alter the volume, timing and pattern of flows within the immediate river reach and downstream, ultimately affecting the rate of erosion and/or the distribution of sediment. 	<ul style="list-style-type: none"> Refer to the key mitigation measures presented in section 8.3.1 for the design recommendations for culverts. 					

8.3.7 Waste

Table 24: Waste impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	<p>Aspect: Construction activities including the removal of the existing culverts.</p> <p>Impact: Waste generation during the construction phase will have a negative impact on the environment, if not controlled adequately. Waste includes demolished culverts, general construction rubble and hazardous waste (used oil, cement and concrete etc.).</p>	Without	1	1	2	3	-7 Medium
		With	1	1	1	1	-4 Low
		<p>Key mitigation measures:</p> <ul style="list-style-type: none"> Eating areas must not be located within 30 m of the watercourse habitats. Waste bins must be provided at the eating areas. Bins and / or skips need to be supplied at convenient intervals on site for disposal of waste within the construction camp. The bins should have liner bags for easy control and safe disposal of waste. Bins should be provided to all areas that generate waste e.g. worker eating and resting areas and the camp site. General refuse and construction material refuse should not be mixed. Regular clearing of bins is required. 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 culverts are 					



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		being demolished. <ul style="list-style-type: none"> Once loaded onto a truck, the rubble must be taken to a registered landfill site and a waybill must be retained as proof of safe disposal. Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area - which must be approved by the ECO. 					

8.3.8 Air Quality

Figure 14: Air quality impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	Aspect: Construction activities (site clearing; operation of vehicles, equipment etc.). Impact: Fugitive dust emissions from debris handling and debris piles; mobile plant/machinery and general construction activities.	Without	1	2	1	2	-6 Low
		With	1	1	1	2	-5 Low
		Key mitigation measures: <ul style="list-style-type: none"> 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 run-off. Dust dispersion from construction activities, roads, soil stockpiles and other construction locations will be limited and suppressed to the maximum extent practical. Surplus fill material sites and stockpiles will be positioned such that they are not vulnerable to wind erosion. Cover skips and trucks which are loaded with construction materials. All stockpiles should be maintained for their lifetime, and retained for as short a time as possible. Stockpiles should be enclosed by wind-breaking enclosures of a similar height to the stockpile. Stockpiles should be situated away from the site boundary, watercourses and nearby 					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		receptors and should take into account the predominant wind direction. <ul style="list-style-type: none"> A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas or near stockpiles. Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary. 						
	Aspect: Construction activities (site clearing; operation of vehicles, equipment etc.). Impact: Generation of fumes from vehicle emissions may pollute the air.	Without	1	1	2	2	-6	Low
		With	1	1	1	2	-5	Low
		Key mitigation measures: <ul style="list-style-type: none"> All mobile plant and equipment must be in good working order. A register must be maintained for vehicle maintenance. All mobile plants that are unable to be repaired immediately must be removed from service until such time as they are in good working condition. 						
	Aspect: Chemical toilets. Impact: Release of odours as a result of the chemical toilets on-site.	Without	1	2	3	2	-8	Medium
		With	1	1	1	2	-5	Low
	Key mitigation measures: <ul style="list-style-type: none"> Chemical toilets must be provided and cleaned on a regular (weekly) basis. Servicing receipts must be maintained and kept on site within the site environmental file. 							

8.3.9 Noise

Table 25: Noise impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	Aspect:	Without	1	1	3	3	-8 Medium

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>Constructions staff, vehicles and equipment.</p> <p>Impact: Increase in noise pollution from construction vehicles and construction staff.</p>	With	1	1	1	2	-5	Low
		<p>Key mitigation measures:</p> <ul style="list-style-type: none"> All construction activities must be undertaken according to daylight working hours. The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order. All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability. Construction staff working in an area where the 8-hour ambient noise levels exceed 75 dBA must have the appropriate Personal Protective Equipment (PPE) (earmuffs). All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993). Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities (blasting and excavations). A Complaints Register is to be kept at the Site Office at all times. 						

8.3.10 Socio-economic & Health

Table 26: Socio-economic impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<p>Aspect: Construction activities.</p> <p>Impact: Expected to provide in excess of 60 jobs during the construction phase.</p>	Without	2	2	2	2	+8	Medium
		With	2	2	2	2	+8	Medium
		<p>Key mitigation measures:</p> <ul style="list-style-type: none"> All labour (skilled and unskilled) and Contractors should be sourced locally where possible. A labour and recruitment policy will be developed, displayed and implemented by the contractor. 						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<ul style="list-style-type: none"> A CLO (Community Liaison Officer) must be appointed to handle the labour recruitment and to interface with the community at large. Recruitment at the construction site will not be allowed. Where possible, labour intensive practices (as opposed to mechanised) should be implemented. The principles of equality, BEE, gender equality and non-discrimination will be implemented. 						
	Aspect: Construction activities.	Without	2	2	3	2	-9	Medium
		With	2	2	1	1	-6	Low
	Impact: Contractors, the influx of people and potential job creation will result in the proliferation of social ills and issues such as crime, prostitution, the spread of HIV / AIDS, informal settlements etc. Lack of provision of ablutions that may lead to the creation of 'informal ablutions' within or close to a surface water resource.	Key mitigation measures: <ul style="list-style-type: none"> The developers need to be actively involved in the prevention of social ills associated with contractors. If possible all labour should be sourced locally. Contractors and their families may not stay on-site. No informal settlements will be permitted. Contractors must be educated about the risk of prostitution and spread of HIV and AIDS. Strict penalties will be included into tenders to deal with issues such as petty crime, stock theft, fence cutting, trespassing etc. No poaching of wildlife or selling of firewood will be allowed. 						
	Aspect: Construction activities.	Without	2	2	2	1	-7	Medium
		With	1	2	1	1	-5	Low
	Impact: Public and construction staff safety during construction.	Mitigation measures: <ul style="list-style-type: none"> Members of the public adjacent to the construction-site should be notified of construction activities in order to limit unnecessary disturbance or interference. Construction activities will be undertaken during daylight hours, only. Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction. 						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> All construction staff must have the appropriate PPE. The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents. Report and record any environmental, health and safety incidents to the responsible person Implement traffic accommodation measures during construction of the culverts. 					

9 ENVIRONMENTAL IMPACT STATEMENT

9.1 Key Findings

Three (3) wetland units and a single riverine unit will be impacted upon by the proposed upgrade of three (3) road culverts on the P449 Provincial road near Jozini. Given the current **moderately modified** to **largely modified** habitat condition and relatively **low ecological importance and sensitivity (EIS)** rating for the wetlands and river, the minimum recommended management objective for watercourses assessed should be to '*maintain the current status quo of aquatic ecosystems without any further loss of integrity / condition or functioning*'.

Based on the nature of the project and the receiving aquatic environment at the three (3) sites, key impacts were identified, namely the physical destruction and / or modification of aquatic habitat, flow modifications and erosion / sedimentation impacts and water quality impacts. With good environmental management and adequate mitigation of potential ecological impacts at the site, the overall impact of the proposed culvert upgrade on the ecological condition and functioning of the wetlands and riverine habitat is unlikely to be of such an intensity and extent that the Present Ecological State (PES) will be significantly altered and it is therefore unlikely that the proposed development activities will compromise the ability to meet the water resource management objectives, as defined by the Recommended Ecological Category (REC). Residual impacts in terms of meeting ecosystem conservation targets are likely to be negligible, as will the impact on potential species of conservation concern, which were not flagged as being of particular importance for the habitats assessed. The expected disturbances associated with the proposed activities are also unlikely to result in the loss of important ecosystem services for local communities and biodiversity.

Nevertheless, managing impacts such as the direct disturbance of aquatic vegetation / habitat, pollution and erosion / sedimentation risks will be necessary to maintain the current level of integrity and functioning of aquatic ecosystems (i.e. the management objective set for watercourses assessed).

Most aquatic ecological impacts can be quite effectively mitigated through appropriate culvert design recommendations and supplemented by the application of on-site practical mitigation measures and management principles to control direct wetland / riverine habitat destruction, soil erosion and sedimentation, flow modification and pollution impacts and risks in conjunction with post-construction rehabilitation and ecological monitoring recommendations. Should the recommended mitigation and management guidelines be implemented timeously and to specification, impacts can be potentially reduced to acceptably **Low** significance levels. This should be sufficient to protect the aquatic environment from further deterioration and can then be considered to be generally acceptable as no loss of critical resources, habitats, services or threatened/endangered species is likely to be associated with the development project.

Three (3) species of specially protected plants (protected under **schedule 12** of the Natal Nature Ordinance of 1974) were identified in the vicinity of Wetland Units C2-W01 and C3-W02, including *Aloe marlothii*, *Aloe parvibracteata*, *Crinum* sp. and one protected tree, *Sclerocarya birrea* subsp. *caffra*, which is a nationally protected tree under the provisions of the National Forest Act. In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974, an Ordinary Permit from eZemvelo KZN Wildlife (EKZNW) is required to handle the *Aloe marlothii*, *Aloe parvibracteata* and *Crinum* sp. and a licence with regards to nationally protected trees is required to handle *Sclerocarya birrea* subsp. *caffra* which can be obtained from the Department of Agriculture, Forestry and Fisheries. (DAFF) for the rescue

and relocation of species potentially impacted during construction, which is recommended by the specialists.

The sensitivity map presented in **Figure 15** must be considered when determining if the proposed project should be authorised.

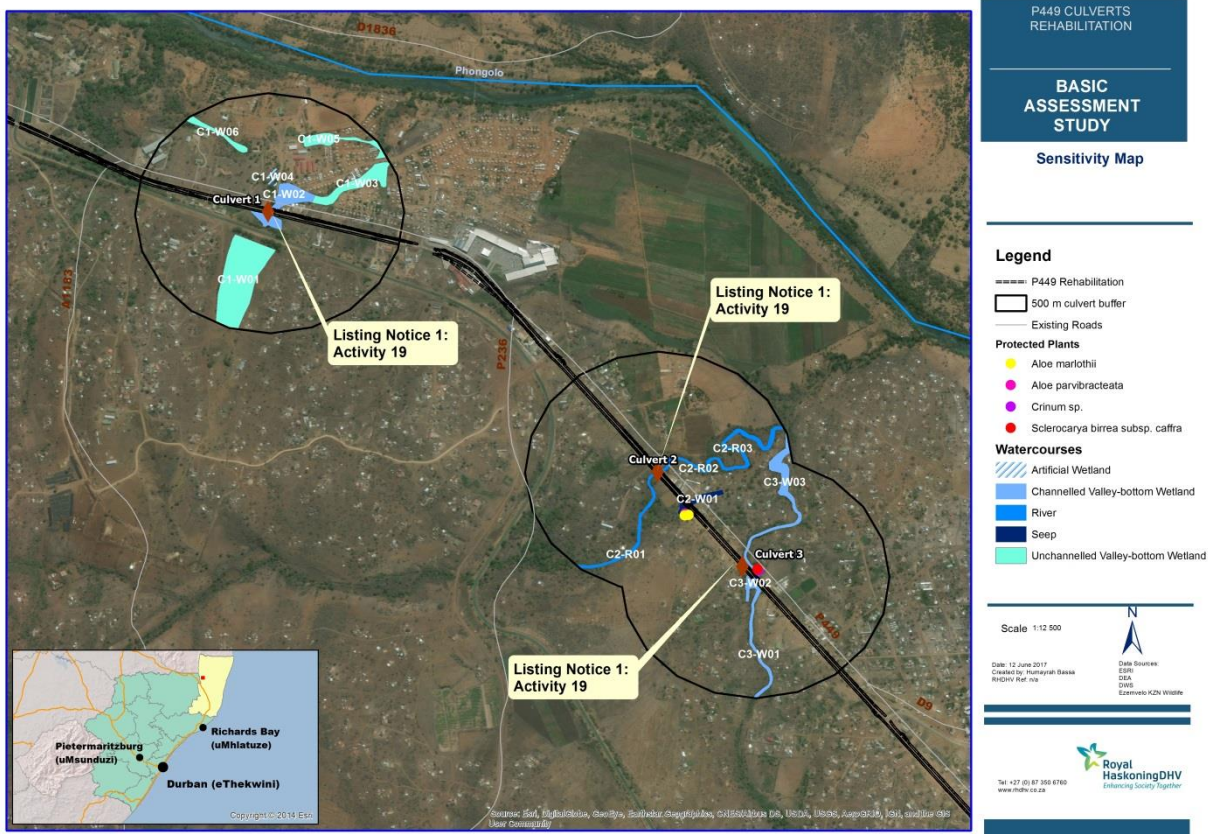


Figure 15: Sensitivity map⁶

A summary of the impacts is provided in Table 27.

Table 27: Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
Planning Phase		
Impact on protected tree species (<i>Sclerocarya birrea</i> subsp. <i>caffra</i> and provincially protected plants (<i>Aloe marlothii</i> , <i>Aloe parvibracteata</i> , <i>Crinum</i> sp.)	Medium (-8)	Low (-5)
Inadequate culvert design and construction	High (-10)	Low (-4)
Construction Phase		
Physical degradation of soils due to removal and compaction	Medium (-7)	Low (-4)
Erosion as a result of exposed soil and topsoil	Medium (-8)	Low (-5)

⁶ An enlarged map is included in Appendix F.

Impacts	Without Mitigation	With Mitigation
Establishment of camp infrastructure and impact on soils	Medium (-7)	Low (-4)
Groundwater contamination (spillage of fuels, chemicals and lubricants; lack of ablution facilities; wash bay areas)	Medium (-9)	Low (-5)
Clearance of vegetation for the construction of culverts	Medium (-8)	Low (-4)
Physical destruction and /or modification of aquatic habitat (wetland/riparian vegetation and river banks (bank modification); unintentional physical destruction or modification of wetland or riparian habitat outside of the construction zone; impact on sedentary (slow moving) fauna may be killed within the construction servitude or forced to migrate into adjoining habitats)	Medium (-9)	Low (-5)
Flow modification and erosion / sedimentation impacts (establishment of coffer dams and/or temporary diversions; inundation or back-flooding upstream of coffer dams altering naturally occurring wetland and instream habitats; disturbance of bed and bank profiles resulting in the sedimentation and increased turbidity of downstream river reaches; flow -related erosion)	Medium (-8)	Low (-6)
Impact on water quality (potential contaminants i.e. hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste released into watercourses)	Medium (-7)	Low (-5)
Waste generation (demolished culverts, general construction rubble and hazardous waste (used oil, cement and concrete etc.).	Medium (-7)	Low (-4)
Fugitive dust emissions from debris handling and debris piles; mobile plant/machinery and general construction activities	Low (-6)	Low (-5)
Generation of fumes from vehicle emissions may pollute the air	Low (-6)	Low (-5)
Release of odours as a result of the chemical toilets on-site	Medium (-8)	Low (-5)
Noise pollution from construction vehicles and construction staff	Medium (-8)	Low (-5)
Job creation	Medium (+8)	Medium (+8)
Proliferation of social ills and issues such as crime, prostitution, the spread of HIV/AIDS, informal settlements	Medium (-8)	Low (-6)
Public and construction staff safety during construction	Medium (-7)	Low (-5)
Operational Phase Impacts		
Alien invasive plant encroachment	Medium (-8)	Low (-4)
Erosion and sedimentation impacts	Medium (-9)	Low (-4)

Impacts	Without Mitigation	With Mitigation
Water quality	Low (-4)	Low (-4)
Cumulative Impacts		
Downstream impacts as a result of temporary diversions, abstraction, erosion and sedimentation	Medium (-9)	Low (-6)

9.2 Conclusion and Recommendations

The BA Study has been undertaken in accordance with the EIA Regulations (2014 as amended in 2017) in terms of Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

In order to protect the environment and ensure that the culvert replacement as part of the P449 rehabilitation is constructed and operated in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that have been taken into account during this study. These include:

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations (2014 as amended in 2017)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Environmental Management: Air Quality Act (Act No. 39 of 2004)
National Water Act (Act No. 36 of 1998) (as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
KZN Nature Conservation Ordinance (Ordinance No.15 of 1974)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)

This relevant legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.

The conclusions of this BAR including comments and concerns from I&APs are as a result of a comprehensive BA study. The public consultation process has been inclusive, and every effort has been made to include representatives of all stakeholders within the process.

The project is envisaged to have a **“Negative Low”** significance rating post application of mitigation measures proposed.

9.3 Assumptions, Uncertainties or Gaps in Knowledge

The BA process followed the legislated process required and as governed and specified by the EIA Regulations (2014 as amended in 2017). Inevitably, when undertaking scientific studies, challenges and limitations are encountered. For this specific BA, the following challenge was encountered:

- All information provided by the Engineering team to the EAP was correct and valid at the time it was provided.
- The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process.
- All data from unpublished research is valid and accurate.
- The scope of this investigation is limited to assessing the potential environmental impacts associated with the culvert replacement associated with the P449 rehabilitation.

In addition to the assumptions above, the following assumptions and limitations were noted by the specialist team:

9.3.1 *Freshwater Habitat Assessment*

- This assessment deals exclusively with a defined study area and the extent and nature of aquatic ecosystems in that area.
- The wetland and riparian zone boundaries delineated are based on sampling points obtained at regular intervals given access challenges. Thus the outer boundary of riparian areas between the sampling points was extrapolated using knowledge of the site, aerial photography, contours and the author's experience.
- All boundaries are based largely on the GPS locations of key morphological features (e.g. top of an active / macro channel bank) and soil sampling points. GPS accuracy will therefore influence the accuracy of the mapped sampling points and therefore water resource boundaries, and an error of 1-5 m can be expected.
- In-field soil and vegetation sampling was only undertaken at strategic sampling points within the habitats likely to be negatively affected.
- The vegetation information provided is based on on-site / infield observations and not formal vegetation plots. As such, the species list provided only gives an indication of the dominant and/or indicator species and only provides a general indication of the composition of the vegetation communities.
- No aquatic faunal sampling or faunal searches were conducted. The assessment was purely habitat based.
- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked.
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. We have made an effort to substantiate all claims where applicable and necessary.
- The EIS assessment did not specifically address in detail all the finer-scale ecological aspects of the water resources such as a list of aquatic fauna likely to occur (i.e. invertebrates, amphibians and fish) within and make use of these systems.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the Province at the time of the assessment.

9.4 Recommendations

9.4.1 Recommendations to the CA

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. Therefore, the EAP recommends the replacement of the three culverts.

Construction is expected to commence in November 2017 and last 12 months. An EA with a validity of 2 years is recommended.

The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this BA study are included within an EMPr (refer to **Appendix B**).

The EMPr must be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the construction phase of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, the following key conditions should be included as part of the authorisation:

- a) The Developer is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:
 - i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);
 - ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);
 - iii. Provisions of the National Forests Act (Act No. 84 of 1998); and
 - iv. Provisions KwaZulu-Natal Nature Conservation Ordinance (Ordinance No. 15 of 1974);
- b) The Developer must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.
- c) A Stormwater Management Plan must be complied with.
- d) An Ordinary Permit from the *eZemvelo* KZN Wildlife (EKZNW) is required to handle the *Aloe marlothii*, *Aloe parvibracteata* and *Crinum* sp. and a licence is required to handle *Sclerocarya birrea* subsp. *caffra* which can be obtained from the Department of Agriculture, Forestry and Fisheries. (DAFF) for the rescue and relocation of this species which may potentially be impacted upon during construction.
- e) All necessary permits, licences and approvals must be obtained prior to the commencement of construction.

9.4.2 Recommendations to the Applicant

The Applicant must adhere to the recommendations provided by the specialist and the EAP. The EMPr summarises these recommendations. The Applicant must take full responsibility for the execution of the project in a manner which does not negatively impact on the environment by ensuring that responsible decisions are made.

9.5 Declaration by the EAP

The following is hereby affirmed by the EAP to be included in this report:

- the correctness of the information provided in the reports;
- the inclusion of all comments and inputs from stakeholders and I&APs;
- the inclusion of all inputs and recommendations from the specialist reports where relevant; and
- any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by interested and affected parties.



Signed: Humayrah Bassa *Pr.Sci.Nat.*



Appendix A

Minutes of the EDTEA Pre-application Meeting



Appendix B

Environmental Management Programme

Appendix C

Specialist Studies



Appendix D

EAP CV and Knowledge Group Profile



Appendix E

Public Participation Summary



Appendix F

Maps & Facility Illustrations

Appendix G

Photographs



Appendix H

Other Items



With its headquarters in Amersfoort, The Netherlands, Royal HaskoningDHV is an independent, international project management, engineering and consultancy service provider. Ranking globally in the top 10 of independently owned, nonlisted companies and top 40 overall, the Company's 6,500 staff provide services across the world from more than 100 offices in over 35 countries.

Our connections

Innovation is a collaborative process, which is why Royal HaskoningDHV works in association with clients, project partners, universities, government agencies, NGOs and many other organisations to develop and introduce new ways of living and working to enhance society together, now and in the future.

Memberships

Royal HaskoningDHV is a member of the recognised engineering and environmental bodies in those countries where it has a permanent office base.

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