REPORT

Consultation Basic Assessment Report for the Proposed Culvert Rehabilitation Along Provincial Road P230 from km37,0 to km47,0, Empangeni within the Umhlathuze Local Municipality, KwaZulu-Natal

Client:	KwaZulu-Natal Department of Transport
Reference:	MD1729_R01_D04_P230 Rehab
Revision:	04/Draft
Date:	17 July 2017

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Enhancing Society Together

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Document short title:	Consultation BAR_P230 Rehab
Reference:	MD1729_R01_D04_P230 Rehab
Revision:	04/Draft
Date:	17 July 2017
Project name:	MD1729
Project number:	MD1729
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Classification
Project related

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Executive Summary

This project forms part of the Empangeni Road Rehabilitation Programme and covers the rehabilitation of the provincial road P230 between km 37,0 and km 47,0 within the uMhlathuze Local Municipality, which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal.

Provincial Road P230 from the intersection with P393 at km 37,0 to km 47,0 near Empangeni is defined as an undivided two lane road, and has been classified as a Class R1 Rural Arterial Road (in terms of the TRH26). The P230 forms part of the R34 long distance heavy haul freight route which connects the harbour of Richards Bay and the surrounding industrial and commercial areas, with inland provinces. This route will be downgraded from a Class R1 to a Class R2 Rural Arterial Road when the planned Empangeni bypass is implemented. Therefore the design will be assessed for a Class R2 Rural Arterial Road.

The cumulative length of the project is approximately 10,0 km of single carriageway road having an existing surfaced width of approximately 9,0 m. The portion between km 37 to km 47,0 will be rehabilitated to a Class 2 single carriageway with a 10,0 m wide surfaced road including 1,5 m wide surfaced shoulders which will be trimmed on the road edges with gravel rounding's which are 1,0 m and 0,5 m wide in fill and cut conditions respectively including adequate stormwater drainage facilities.

The proposed rehabilitation comprises the relocation of services, the construction of bulk earthworks required for the horizontal and vertical alignment of the existing road formation and the construction of road layer-works and surfacing, including the associated ancillary works for the construction of the access roads off this main road to neighbouring communities as well as the replacement of one culvert at km 41,8.

Royal HaskoningDHV has been appointed by the KwaZulu-Natal Department of Transport (KZN DoT) 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).

The proposed culvert upgrade associated with the rehabilitation of the P230 from km 37,0 to km 47,0, stands to measurably impact only a channelled valley bottom wetland (W01) and weakly seasonal river system (R01), triggering a water use and the need for impact assessment.

Given the current moderately modified to largely modified habitat condition and low ecological importance and sensitivity (EIS) rating for the wetland 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 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 temporary reduction in wetland / riverine habitat condition (PES), 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 this 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 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.

A single protected plant species (*Crinum* sp.) was identified within Wetland Unit W01. In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974 an Ordinary Permit is required to handle the *Crinum* sp. An ordinary permit can be obtained from *eZemvelo* KZN Wildlife (EKZNW).

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 on 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 proposed Activity(ies) 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 it 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 EMPr, 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: 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	or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	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 runoff 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

	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.
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: 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

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

This project forms part of the Empangeni Road Rehabilitation Programme and covers the rehabilitation of the provincial road P230 between km 37,0 and km 47,0 within the uMhlathuze Local Municipality which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal.

Provincial Road P230 from the intersection with P393 at km 37,0 to km 47,0 near Empangeni is defined as an undivided two lane road, and has been classified as a Class R1 Rural Arterial Road (in terms of the TRH26). The P230 forms part of the R34 long distance heavy haul freight route, which connects the harbour of Richards Bay and the surrounding industrial and commercial areas, with inland provinces.

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The cumulative length of the project is approximately 10,0 km of single carriageway road having an existing surfaced width of approximately 9,0m. The portion between km 37 to km 47,0 will be rehabilitated to a Class 2 single carriageway with a 10,0m wide surfaced road including 1,5 m wide surfaced shoulders which will be trimmed on the road edges with gravel rounding's which are 1,0 m and 0,5 m wide in fill and cut conditions respectively including adequate stormwater drainage facilities.

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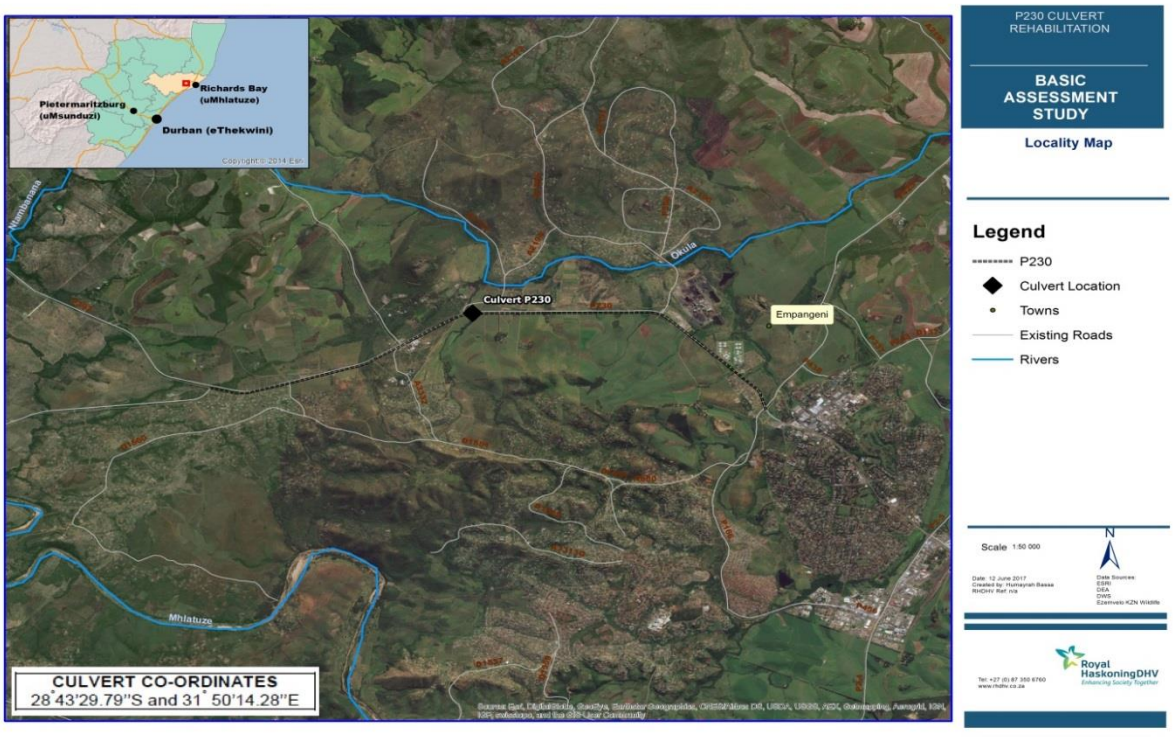

Figure 1-1: Locality map

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:

- **Vegetation** - As indicated in **Figure 1-2**, the majority of the road rehabilitation project falls within the historical extent of the Zululand Coastal Thornveld vegetation type, which is considered to be Critically Endangered due to the small extents which remain. This vegetation is associated with gently rolling landscapes supporting wooded grasslands dominated by Red grass (*Themeda triandra)* and with strong bush clump areas. As noted in **Low & Rebelo (1996)** the vegetation type is highly transformed, mostly by cultivation, sugar cane or communal lands. This is coupled with urban sprawl moving into these areas as at the eastern end of the road (Empangeni).

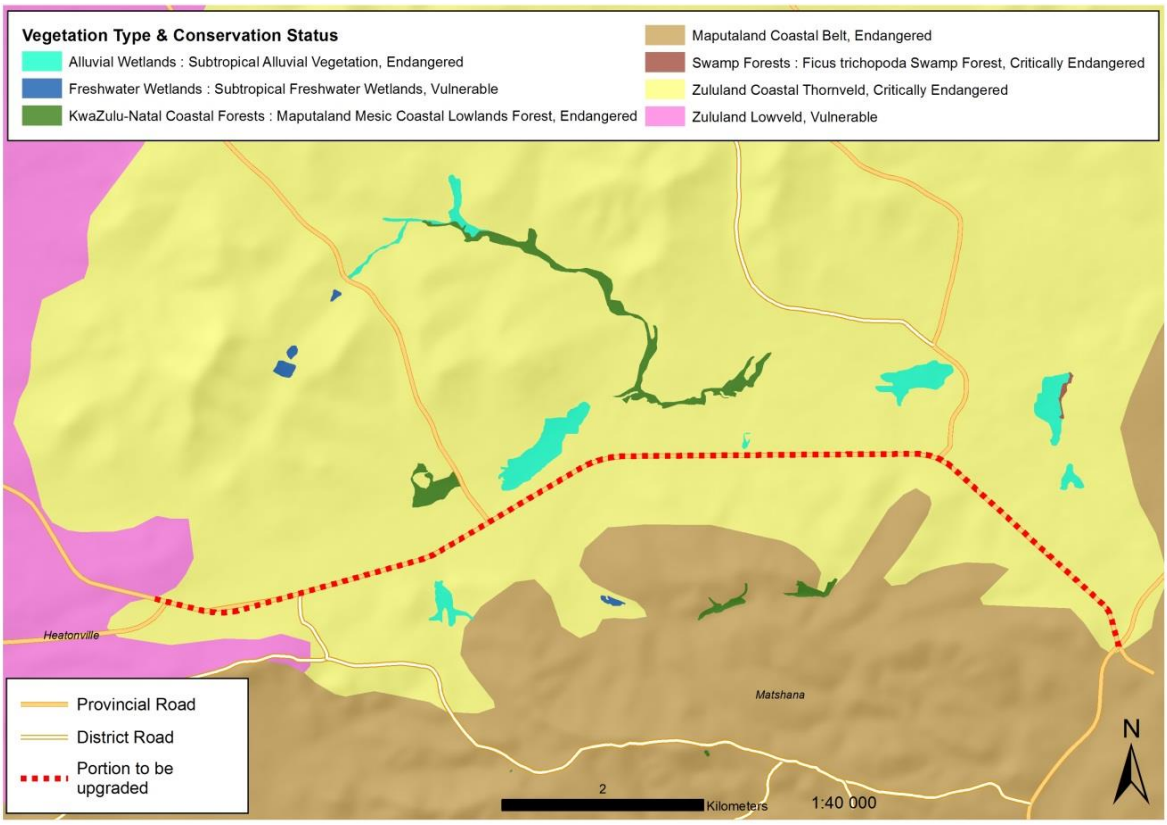

Figure 1-2: Historical extent of vegetation type and conservation status (*eZemvelo* BGIS 2016)

- **Threatened Ecosystems & Areas of Conservation Importance** - when considering the current vegetation extents, it is apparent that the level of modification of the vegetation is high (present and past). It is evident from **Figure 1-3** that no threatened ecosystems occur near the road rehabilitation project. This is supported by the fact that the nearest area that is deemed of conservation importance (**Figure 1-4**), is a landscape corridor between two key areas of importance, namely; Ngoye and Fundimvelo Forest Reserves, and is more than 10 km to the west of the proposed road rehabilitation project.

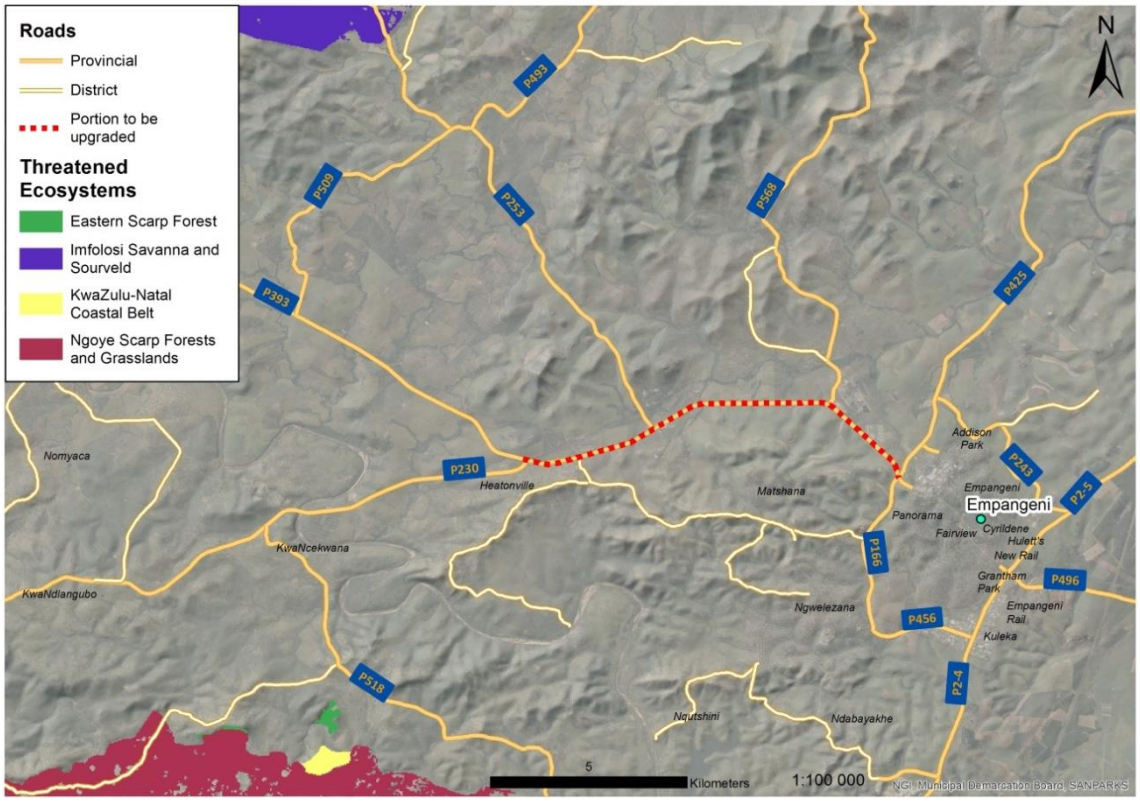

Figure 1-3: Threatened ecosystem status (*eZemvelo* BGIS 2016)

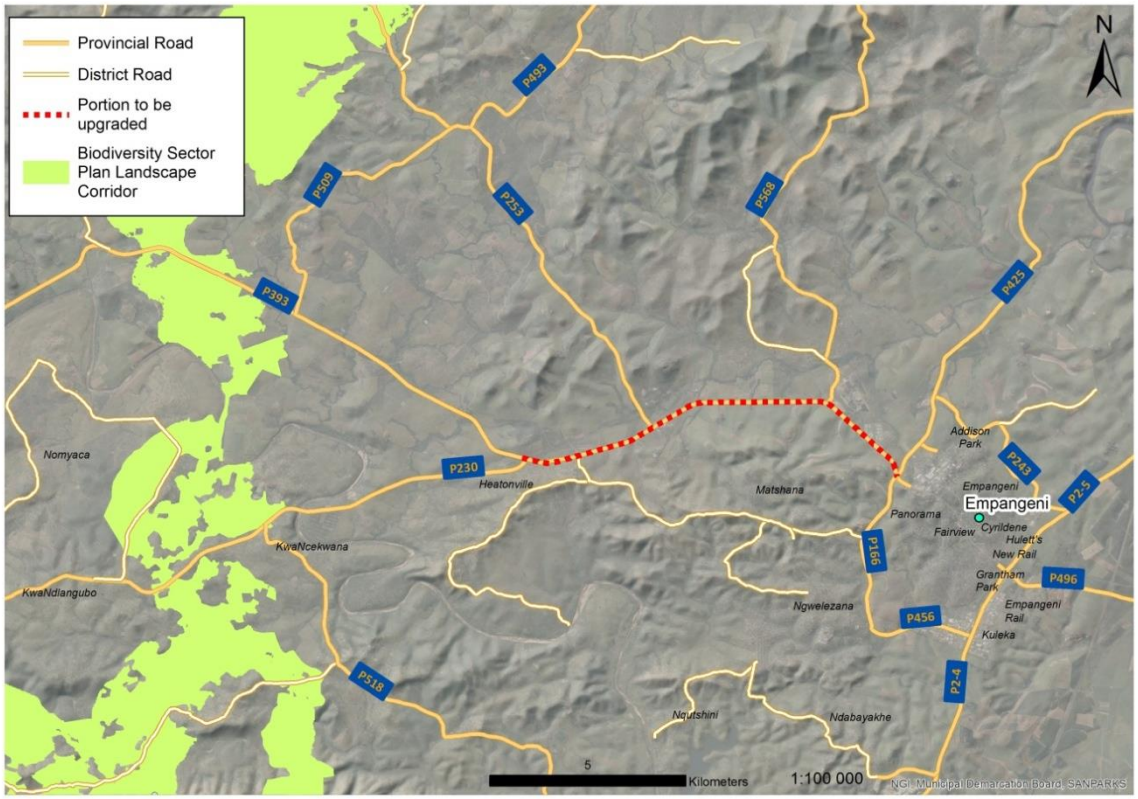

Figure 1-4: Biodiversity Sector Plan areas of significance (*eZemvelo* BGIS 2016)

- **Critical Biodiversity Areas (CBAs)** - CBAs are areas deemed crucial to meet biodiversity targets for ecosystems, species and ecological processes in terms of systematic conservation planning. The nearest CBAs to the road in this respect are more than 2 km away from the road rehabilitation project, and in most cases, more than 5 km away.

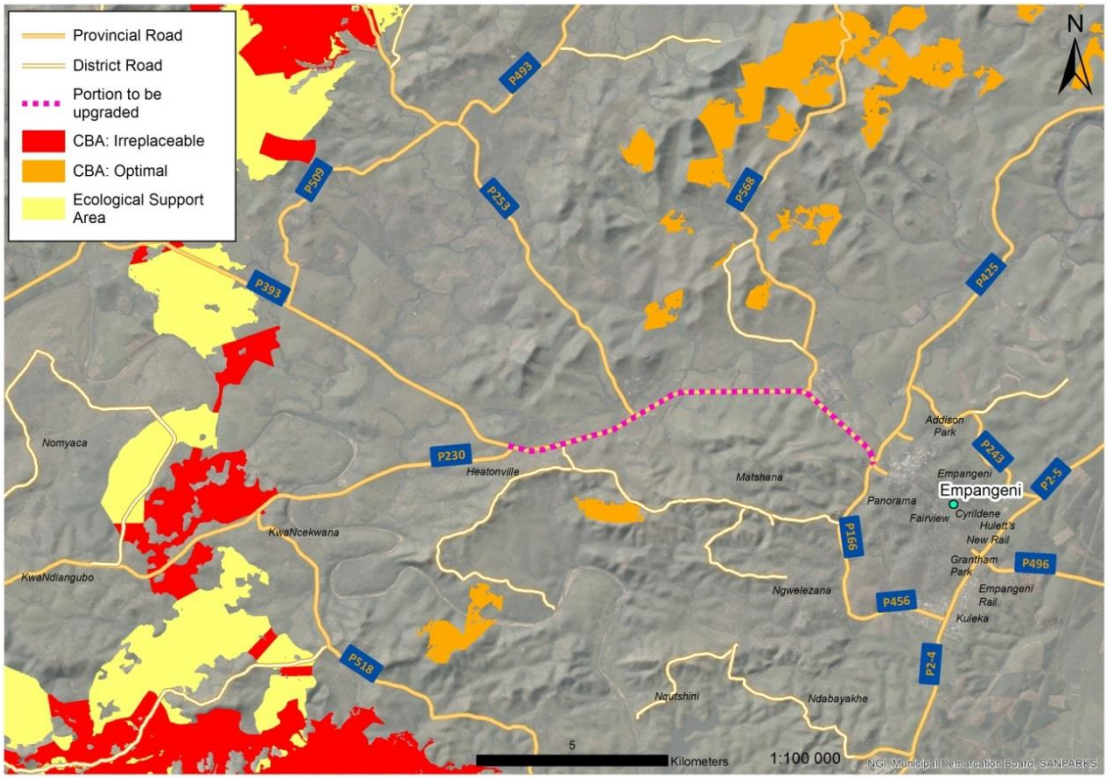

Figure 1-5: Critical Biodiversity Areas (eZemvelo BGIS 2016)

- **Watercourses** - Four (4) watercourse units including three (3) wetlands and a single weakly seasonal river occurring within a 500 m radius of the culvert upgrade were mapped at a desktop level, shown in **Figure 1-6** and as follows:
  - Wetland Unit W01: channelled valley-bottom wetland (8.2 ha in extent);
  - Wetland Unit W02: wetland seep (0.8 ha in extent);
  - Wetland Unit W03: channelled valley-bottom wetland (4.7 ha in extent); and
  - River Unit R01: weakly seasonal river.

  Two watercourses: Wetland Unit W01 and River Unit R01 will be impacted upon by the proposed development and / or triggering a water use. These watercourses will be subject to further impact assessment and will be investigated further in terms of water use and the need for a full water licence application or whether a General Authorisation (GA) in terms of Section 21 c and/or i water use would be appropriate.

  Wetland Unit W02 and W03 are either located in adjacent micro-catchments or some distance upstream of the zone of impact. No impacts resulting from the construction and operation of the culvert are likely to be incurred by these watercourses.

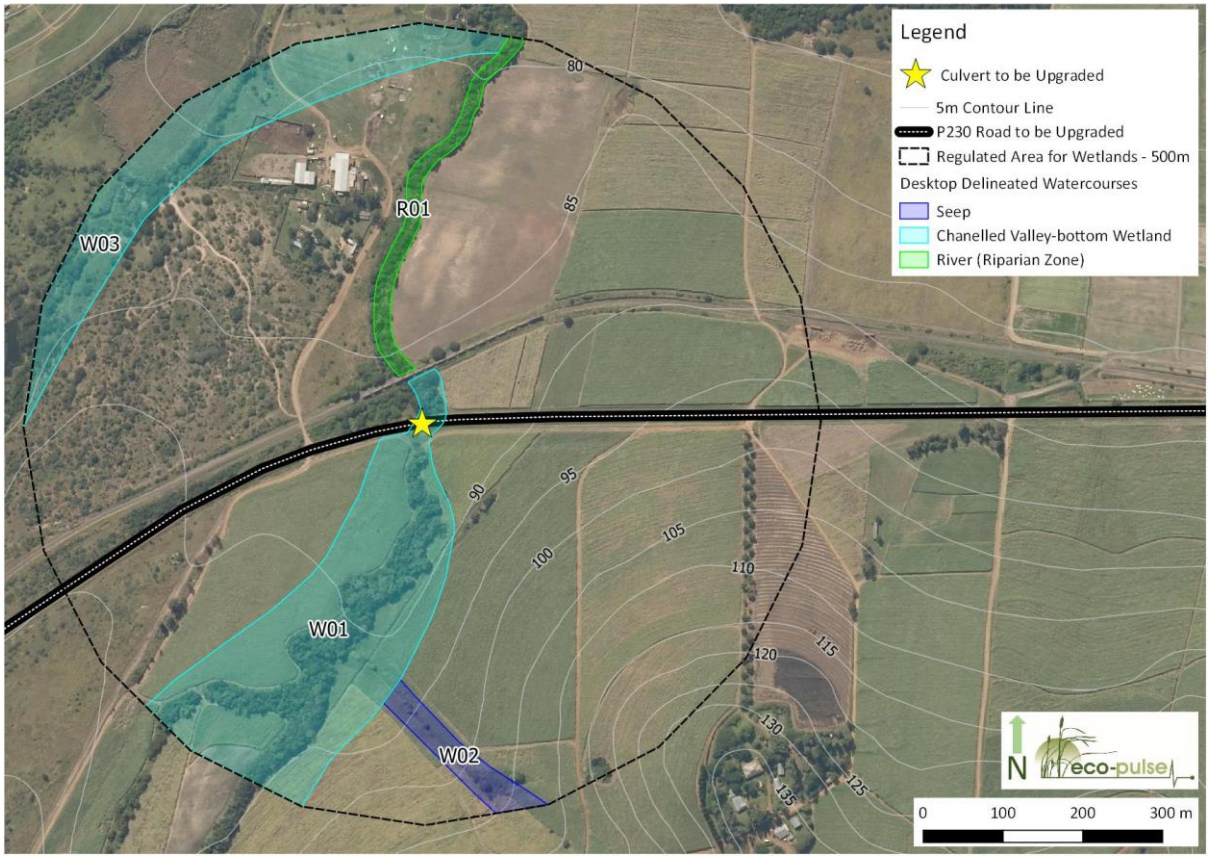

Figure 1-6: Desktop delineation of watercourses within the 500 m regulated area for wetlands

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), King Cetshwayo District on 29th November 2016 to obtain clarity as to whether the rehabilitation of the P230 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). A site visit was also conducted on 23rd January 2017 with Mr Muzi Mdamba.

On 3rd February 2017, EDTEA confirmed that since Activity 19 of Government Notice Regulation (GNR) 983 – Listing Notice 1 of the EIA Regulations 2014 (as amended n 2017) would be triggered by the proposed replacement of a culvert, an application for Environmental Authorisation must be lodged (***Appendix A***) with the Department as there is no existing maintenance management plan in place.

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.

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 the potential impacts and outcomes are known.Therefore, it would be 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 1-1: 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

Chapter	Description
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 including conclusion and recommendations

1.3 Specialist Assessment[1]

To ensure the scientific rigour 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 proposed culvert replacement, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts.

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 EIAs. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity. To ensure that there is no bias and that the process has been transparent an external technical peer review will be undertaken prior to the public review during the formal BA process. This peer review has been conducted by 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 1-2 below.

Table 1-2: Applicant details

Applicant	KwaZulu-Natal Department of Transport	
Representative	Ms Khumbu Sibiya	transport Department: Transport Province of KwaZulu-Natal
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] *The Freshwater Habitat Assessment has included an assessment of terrestrial vegetation that can potentially be impacted upon by the culvert replacement. A Heritage Assessment has not been conducted as the work is confined to the existing road reserve.*

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 have 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 1-3: 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' 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.	Prashika Reddy is a Principal Associate with 15 years' experience in various environmental fields including: EIAs, EMPrs, 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	Clive is an Environmental Consultant at Royal HaskoningDHV with 4 years' experience as an ECO and Public Participation consultant.

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
		Professions.	

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 portions 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 2-1: Key legislation considered

Acts	Objectives, important aspects, associated notices and regulations
National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended	***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. ***Relevant Notices and Regulations:*** • 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 (GN R984 in GG 38282 of 4 December 2014 as amended in 2017) ***Relevance to the proposed project:*** • 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. ***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 (1 double-cell in-situ culvert) will be constructed within the watercourse and will thus require infilling or depositing of material of more than 10 m^3 or the dredging, excavation, removal or moving of soil,

Acts	Objectives, important aspects, associated notices and regulations
	sand or rock of more than 10 m^3 from / into a watercourse.
National Water Act (Act No. 36 of 1998) (as amended)	***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. ***Relevance to the proposed project:*** • Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems. • Defines 11 water uses and provides licencing procedures. ***Notices and Regulations:*** • 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). ***Water uses triggered:*** As the proposed development involves the crossing of three wetlands and one small seasonal river, a Water Use Authorisation is required in terms of Section 21 (c) and (i) of the NWA: • Section 21(c) - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and • Section 21 (i) - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).

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)	Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
	In KwaZulu-Natal the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from *Ezemvelo* KZN Wildlife to remove or destroy any plants listed in the Ordinance. ***A single protected plant species (Crinum sp.) was identified within Wetland Unit W01 (GPS coordinates 28° 43' 29.46" S, 31° 50' 14.89" E). In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974 an Ordinary Permit is required to handle the Crinum plant (i.e. to handle, remove, destroy, damage, and relocate the specimen). An ordinary permit can be obtained from Ezemvelo KZN Wildlife (EKZNW) for this purpose.***
National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations: • 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 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	Section 22 - Application for a mining permit / right.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
Development Act (Act No. 28 of 2002)	Section 39 - Environmental management programme and environmental management plan. ***Material for construction will be obtained from commercial sources.***
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	
King Cetshwayo District Municipality IDP (2016 – 2017) uMhlathuze Local Municipality Final IDP review 2016/2017 uMhlathuze Local Municipality Spatial Development Framework (2016/2017)	

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 existing road cross-section is a single carriageway with 3,5 m wide lanes in each direction and 1,2 m wide shoulders on both sides. The existing road reserve is 30 m wide and all rehabilitation work will be undertaken within the current road reserve.

3.2 Co-ordinates

3.2.1 Culvert

Table 3-1: Co-ordinates of the culvert to be replaced

Culvert Details	Type of Watercourse Crossing	Coordinates
Culvert 1 at km 41,8	Channelled valley-bottom wetland	28˚43'29.79"S 31˚ 50'14.28"E

3.2.2 Road Rehabilitation

Table 3-2: Co-ordinates of the road rehabilitation project

	Latitude	Longitude
Start	28˚44'16"S	31˚ 47'49"E
End	28˚44'30"S	31˚52'56"E

3.2.3 Surrounding Land Uses

Table 3-3: 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

Description	Y/N	Description	Y/N
Harbour	N	Plantation	N
Sport facilities	N	Agriculture	Y
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

Key: Y = Yes P = Possibly N = N

3.2.4 Material for Construction

Material will be sourced from licenced commercial sources.

3.3 Project Description

3.3.1 Major Culvert Replacement

The double-cell in-situ box culvert at km 41,8 has been hand measured during site inspections as a 2 x 1500 x 1500 culvert with a skewed angle of approximately 40 degrees. The rehabilitation of the P230 is planned to incorporate wider shoulders and thus will impact the existing structure, requiring a lengthening on one or both sides of the culvert.

- **Structural Capacity of Existing Structure**
  Site inspections have revealed that the existing culvert at km 41,8 has been retrofitted in the past. The headwalls and wing walls have all been increased in height, presumably to accommodate minor realignments (**Figure 3-1**). The retrofitting is significantly more pronounced and of a lower construction quality at the outlet face. It is also worth noting that the inlet of the culvert is largely blocked with soil and vegetation suggesting that the wing walls constructed are not of adequate length to prevent sediment and vegetation from blocking the culvert.

Figure 3-1: Inlet vegetation (left) and failed outlet apron slab (right)

The outlet apron slab is damaged and undermined, as a result of water that has scoured back under the slab as a result of the slab at the outlet not being constructed at the natural ground level. The 75 mm to 100 mm slab is currently suspended in the air.

Significant failure cracks are easily visible on the outlet side of the culvert structure. A 30mm wide crack has formed at the top of the left wing wall and extends into the barrel. A portion of the culvert barrel has cracked and fallen off of the structure revealing an approximately 100 mm of depth into the culvert structure, with no indication of rebar being present. The crack extends into the base of the culvert.

A similar crack is located at the adjacent right culvert cell outlet. A 30 mm crack extends from the outlet wall up into the haunch where the crack terminates (**Figure 3-2**). Another crack of approximately 0,2 mm to 1 mm is located in the right cell at the outlet top slab.

Figure 3-2: Cracks in the culvert barrel and wing walls

Based on these observations, it is evident that the existing 2 x 1500 x 1500 culvert has failed structurally and has been partially undermined at the outlet. The lack of reinforcement evident at a spalled section suggests that the structure has either been under designed or insufficiently specified for the road type that it is being utilised for.

A new culvert structure is proposed to be inserted in order to replace the existing damaged structure whilst ensuring that the hydraulic capacity of the P230 is maintained. A structural design including hydraulic and hydrological analysis has been undertaken to determine the optimal structural solution for the site taking into account the future capacity needs of the P230.

- **Culvert Replacement Design**
  The replacement culvert has been designed using the latest edition of the SANRAL Drainage Manual (**version 6**). The headwater to depth ratios for inlet control and outlet control, including the free board requirements, were assessed to check the hydraulic capacities of the structure.

The estimated flood peaks were based on the Rational Method as the catchment area for the culvert was less than 15 km^2. The principal catchment parameters for the culvert are shown in Table 3-4 below.

Table 3-4: Culvert catchment parameters

Catchment Area (km^2)	Longest Collector (km)	10/85 Height Difference (m)	Run Off Coefficient (C_{1D})	Time of Conc. (hrs)
4.41	3.55	52.5	0.522	0.798

The peak flow for the return period calculated using Utility Programs for drainage is summarise in Table 3-5.

Table 3-5: Flood peak estimates

Calculation Method	Return Period: 10yrs (Q_{10})	Return Period: 20yrs (Q_{20})	Return Period: 50yrs (Q_{50})	Return Period: 100yrs (Q_{100})
Rational	18.06	24.85	39.92	59.03

The P230 is being designed as a Class 2 (R2 Rural major arterial) according to TRH 26. For drainage purposes (i.e. the hydraulic capacity of the culverts) the road is also classified as a Class 2.

In accordance with paragraph 8.2 of SANRAL Drainage Manual, the culvert's hydraulic capacity has been measured against the Class 2 road classification requirements. Figure 8.2 of the SANRAL Drainage Manual was used to determine the design flood frequency based on a Q_{20} peak flow rate. The Rational Method flood peak estimates for Class 2 are summarized in Table 3-6 below.

Table 3-6: Class 2 flood peak estimates (Rational method)

Q20 (m^3/s)	Design Flood QT		Design Flood Q2T	
	Return Period (yrs)	Peak Flow (m^3/s)	Return Period (yrs)	Peak Flow (m^3/s)
24.85	20	24.9	40	34.9

The Rational Method estimated flood peak values were used in the hydraulic assessment for the proposed culvert. Royal HaskoningDHV investigated three culvert size configurations. The results are provided in Table 3-7 below.

Table 3-7: Hydraulic assessment results for a Class 2 road

Culvert ID	H_w/D from Q_T	H_w/D from Q_{2T} (≤1.2)	FD Calc (≥0.3) (m)	F_{SBP} Calc (≥0) (m)	Hydraulic Assessment
5x1500x1500	1.12	1.48	-0.18	1.06	Adequate Hydraulic Capacity however, does not meet the required 0.3 m freeboard not met for Q_T, but meets SBP freeboard requirement
3x1800x1800	1.17	1.57	-0.31	0.76	Adequate Hydraulic Capacity however does not meet the required 0.3m freeboard not met for Q_T, but meets SBP freeboard requirement
2x2400x2400	0.92	1.19	0.2	1.32	Adequate Hydraulic Capacity and does not meet the required 0.3 m freeboard not met for Q_T, but meets SBP freeboard requirement.

The proposed culverts have adequate hydraulic capacities for a Class 2 road but the minimum freeboard requirement is not met (i.e. freeboard FD for Q_T > 0.3 m required) for the 1500 and 1800 culvert options. Site inspections did not identify a significant risk of debris which would require the 0.3 m minimum freeboard but neither of the 1500 or 1800 culvert options met the Hw/D ≤1 .2 requirement for culverts with a negative freeboard. All three options investigated satisfy the shoulder breaking point freeboard requirements

Due to the Hw/D ≤1 .2 requirement, the 1500 and 1800 culvert options were deemed as less favourable options to the 2400 culvert. The debris that was visible at the culvert site is not believed to be sizeable enough to cause obstruction in a culvert. Thus the 0.3 m positive freeboard requirement is not applicable for this location.

Royal HaskoningDHV thus recommends that the 2 x 2400 x 2400 culvert option be adopted as the preferred replacement for the damaged culvert at km 41,8 on the P230. As a result of the requirement to replace the culvert a number of activities and legislated requirements will be triggered and they are summarised in the Text Box below.

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

eZemvelo KZN Wildlife permit *for the handling, removal, destroying, damaging, and relocation of the Crinum sp.*

3.3.2 Road Rehabilitation

- **Typical and Standard Cross-section**
  The proposed cross section to be implemented on the P230 rehabilitation sections from km 37,0 – km 47,0 is a Type 2C Rural Primary as per the KZN DOT Standard Detail Drawing SD 0206/B.

  The typical cross-section of P230 shall be comprised as shown in Table 3-8.

  Sidewalks will not be incorporated as the pedestrian traffic volumes on P230 do not warrant the construction of sidewalks. There are not many community service centres adjacent to P230. Hence, the very low pedestrian traffic volumes along its length.

Table 3-8: Typical Road cross-section of P230

Subject	Composition
Lane widths	2 x 3,5 m
Surfaced shoulders widths	2 x 1,5 m
Rounding widths	1,0 m (fill) and 0,5 m (cut)
Concrete lined side drains (shallow cut < 5,0 m)	0,8 m deep
Concrete line side drain (deep cut > 5,0 m)	0,33 m deep

- **Horizontal Alignment:** An appropriate horizontal and vertical alignment was best fitted to the topographical surveyed data received. The project starts at km 37,0 and increase in an easterly direction proceeding to km 47,0.

- **Design Speed:** P230 is a Class R2 Rural Primary Arterial road. It is therefore proposed to aim for a design speed of 80 km/h.

- **Vertical Alignment:** In general the road alignment will be raised by 280 mm in accordance with the pavement rehabilitation strategy. This will improve free drainage through this terrain. The amended vertical alignment maximum gradient of 6, 0 % along P230 will not be exceeded as the grades varies from 0, 5 % to a maximum of 5, 0 %.

- **Passing Lanes:** Due to the flat terrain and restricted geometric alignment, passing opportunities on this road are limited and on the steeper grades there is a speed differential between light and heavy vehicles. The combination of a speed differential between vehicles and the limited passing opportunities results in driver frustration. For this reason it is proposed that passing lanes be constructed at various positions with the chainage and total length of these passing lanes quantified in Table 3-9. The installation of the proposed passing lanes between km 37,0 and km 47,0 will be implemented under a separate contract.

Table 3-9: Proposed passing lanes

P230: Proposed Passing Lanes			
LHS – Proposed km	**Length (m)**	**RHS – Proposed km**	**Length (m)**
37, 407 - 39, 000	1593		
		39, 000 – 41, 000	2000

P230: Proposed Passing Lanes			
41, 000 - 43, 000	2000		
		43, 000 – 45, 000	2000
45, 000 – 47, 125	2125		
TOTAL LHS	**5718**	**TOTAL RHS**	**4000**

- **Side Drains:** Generally the road will be raised 280 mm above the existing road level to ensure free drainage. There will be no interference with proposed pavement layers as concrete lined side drains will be used to channel the stormwater away from the road prism. Gabion boxes and Reno mattresses will be used to retard the velocity of the stormwater and will allow the ground water to recharge and prevent scouring at outlet structures. In addition, stone pitching will be constructed at outlet structures to mitigate the scouring of the natural ground and simultaneously ensuring efficient drainage of stormwater runoff from the outlet structures.

- **Other Services:**
  - Due to raising the road alignment by 280 mm, care needs to be taken in order to ensure that adequate clearance remains between the final road level and overhead electrical, telecommunication cables and other affected services.
  - The existing guardrails should be evaluated with regards to height and location. The shaping of the shoulder break point (SBP) must be carefully considered in order to prevent the creation of steep batter slopes, which would undermine guardrails posts and create erosion problems.
  - The road signage will be carried out in accordance with the latest edition of the South African Road Traffic Signs Manual (SARTSM) and comply with the latest editions of the Southern African Development Community (SADC) Road Traffic Signs Manual.
  - Due to pedestrian activity it is proposed that adequate warning signs and warning road markings are introduced on P230.

All of the above mentioned activities are viewed as maintenance and rehabilitation works and will be undertaken within the existing road reserve and sphere of influence and therefore they will not trigger any listed activities as summarised in the Text Box below.

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

3.3.3 Accommodation of traffic during construction:

Maintaining a safe flow of traffic during construction is to be carefully planned and executed. Although detours may be considered, construction will predominantly be done by means of half width construction (one lane will be worked upon at a time). If required traffic must be diverted around the construction area (where necessary) using the proposed route highlighted in **Figure 3-3** (yellow stipled line, south of the current road alignment). This should avoid unnecessary disturbance to more intact aquatic habitats in the area.

The layout of construction areas and detours in the use of delineators and warning signs is to be in accordance with the latest Chapter of South African Road Traffic Signs Manual (SARTSM) and comply with the latest editions of the Southern African Development Community (SADC) Road Traffic Signs Manual. The establishment of areas for contractor operations is necessary to minimize the impact on safety of both motorist and worker.

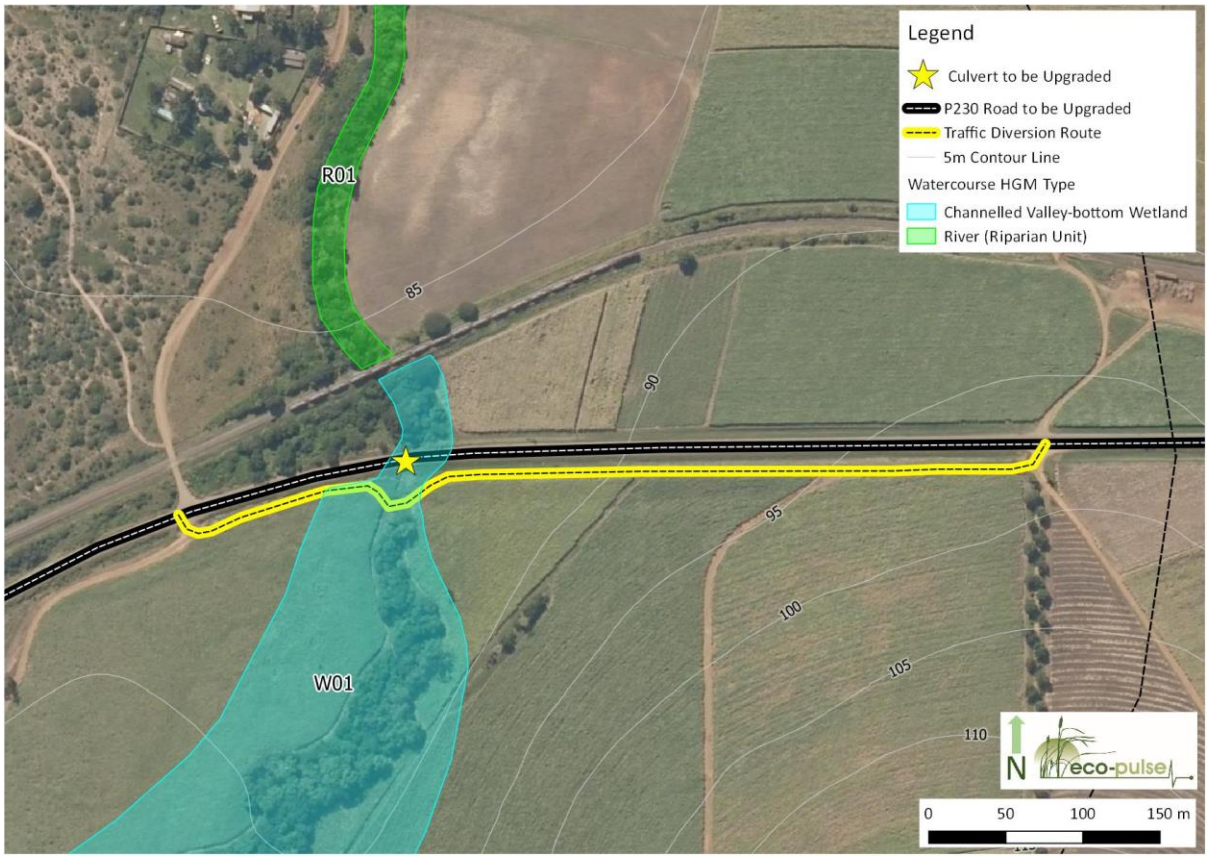

Figure 3-3: Map showing the proposed traffic diversion route

3.4 Project Motivation

3.4.1 Need & Desirability

Table 3-10: 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 P230, 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 and culvert at km41,8 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 P230 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 37,0 to km 47,0 of the P230 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 in need of rehabilitation (i.e. relocation of services, the construction of bulk earthworks required for the horizontal and vertical alignment of the existing road formation and the construction of road layerworks and surfacing, including the associated ancillary works for the construction of the access roads off this main road to neighbouring communities). Furthermore the existing surfaced area varies around a width of 9.4 m and does not conform to a Class 2 cross section standard. A major culvert at km 41,8 was also found to be structurally damaged and will require replacement. The rehabilitation of this road will ensure that the road is safe for users.

3.4.2 Socio-economic Value

What is the expected capital value of the activity on completion?	R 15 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?	70
What is the expected value of the employment opportunities during the development phase?	R 1.2 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 P230, 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 P230 from km 37,0 to km 47,0, the existing layout or alignment will be followed and work will be undertaken within the current 30 m road reserve.

4.3 Design Alternatives

Double-cell in-situ box culverts are preferred over pipe culverts for the proposed project (refer to ***Appendix F*** for the General Arrangement of the proposed culvert). The advantages and disadvantages of pipe versus box culverts are provided in **Table 4-1** below.

Table 4-1: Advantages and disadvantages of pipe vs box culverts

Design Alternatives	Advantages	Disadvantages
Pipes	• Pipe culverts provide low clearance. • Openings suitable for large waterways, and are more aesthetic. • They may also provide a greater hydraulic advantage to fish at low flows • Require less road fill. • Lower cost.	• Prone to high siltation issues causing restricted flow which can cause overtopping of stormwater onto 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 faunal migration. • Piping results in the loss of natural in-stream and bank-side habitats through direct removal and loss of daylight.

Design Alternatives	Advantages	Disadvantages
		• The piping of watercourses leads to fragmentation and loss of wildlife corridors in agricultural environments. • Piped sections may create or exacerbate downstream or upstream 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 and litter, leading to localised flooding during periods of high river flow.
Box culverts	• 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.	• Higher costs.

4.3.1 Design Criteria for 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 the other materials that might be mobilized during storm events, as well as provide passage of aquatic species such as fish.
- Best management practices for road engineering include; 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 ones[2].
- Appropriate measures to dissipate flow velocity below the culvert structure 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 upstream and downstream adjustments in channel

[2] ***Furniss, MJ., 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.*

form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be on-site to guide the settling 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 the 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 fill[3].
- Coarse stone material should be incorporated into culverts to mimic natural riffle / run river biotopes. Furthermore, coarse culvert beds will reduce scouring 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 material[4].
- 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 P230 remain. Should the *status quo* remain, the major culvert at km 41,8 will not be replaced and will continue to experience hydraulic capacity challenges, which will lead to a further degradation of the downstream water resource. Furthermore, the road will not conform to a Class 2 cross-section standard.

[3] ***Furniss, MJ., 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 5-1.

Table 5-1: Key biophysical details of the study area

Biophysical Aspects	Desktop Biophysical Details	Source
Elevation a.m.s.l.	Approx. 115 – 130 m a.m.s.l.	Google Earth™
Rainfall distribution	Mid-Summer, Early Summer, Late Summer	DWAF, 2007
Mean annual precipitation (MAP)	1041.3 mm	Schulze, 1998
Mean annual temperature	15 – 22 °C	DWAF, 2007
Potential Evaporation (mm) Mean Annual A-pan Equivalent	1784.5 mm	Schulze, 1998
Median annual simulated runoff (mm)	208.3 mm	Schulze, 1998
Geology and soils	Shale, Mudstone, Ecca Group arenite (sandstone) and Greenstone	KZN Geology dataset
Water management area	Mvoti to Umzimkulu	DWA, 1996
Quaternary catchment/s	W12H	DWA, 1996
Main collecting river in the catchment	Nseleni River	CSIR, 2011
DWA Ecoregion (Level 2)	North-Eastern Uplands (14.05)	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 Zululand Coastal Thornveld (SVI 24 & 54) which is considered **Endangered** nationally **and Critically Endangered** provincially.

The vegetation of the area is characterised by highly modified grassland areas, with limited pockets of forest, and areas that have shifted to bushlands mixed with grass. Remnant forest areas, when present, are associated with watercourses and small koppies. Aside from one section along the east-west portion of the road, the vegetation is largely modified from its original reference state.

Zululand Coastal Thornveld (SVI 24 & 54) vegetation is associated with gently rolling landscapes supporting wooded grasslands dominated by Red grass (*Themeda triandra*) and with strong bush clump areas. As noted in Low & Rebelo (1996) the vegetation type is highly transformed, mostly by cultivation, sugarcane or communal lands. This is coupled with urban sprawl moving into these areas as at the eastern end of the road (Empangeni).

When considering the current vegetation extents, it is apparent that the level of **modification of the vegetation is high** (present and past). It is evident from **Figure 5-1** that no threatened ecosystems occur near the road rehabilitation project. This is supported by the fact that the nearest area that is deemed of conservation importance is in the form of a landscape corridor between two key areas of importance i.e. Ngoye and Fundimvelo Forest Reserves, which is more than 10 km to the west of the proposed road rehabilitation project (**Figure 5-2)**.

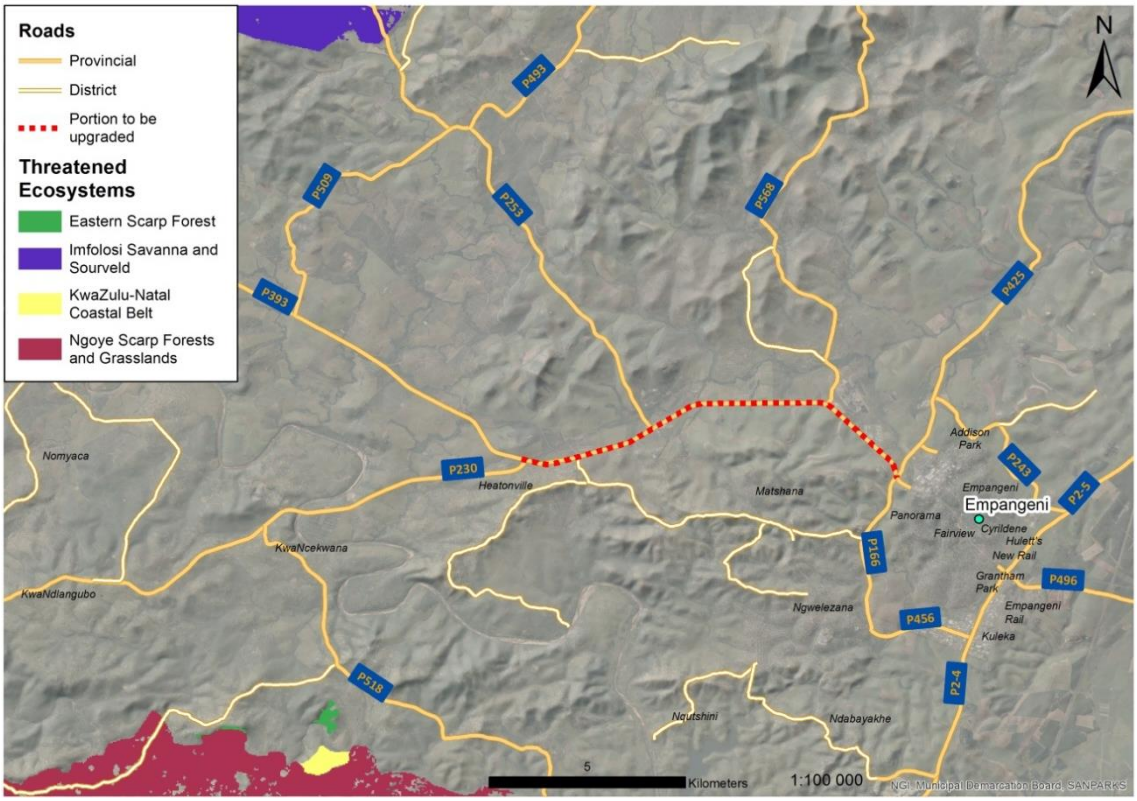

Figure 5-1: Threatened ecosystem status (*eZemvelo* BGIS 2016)

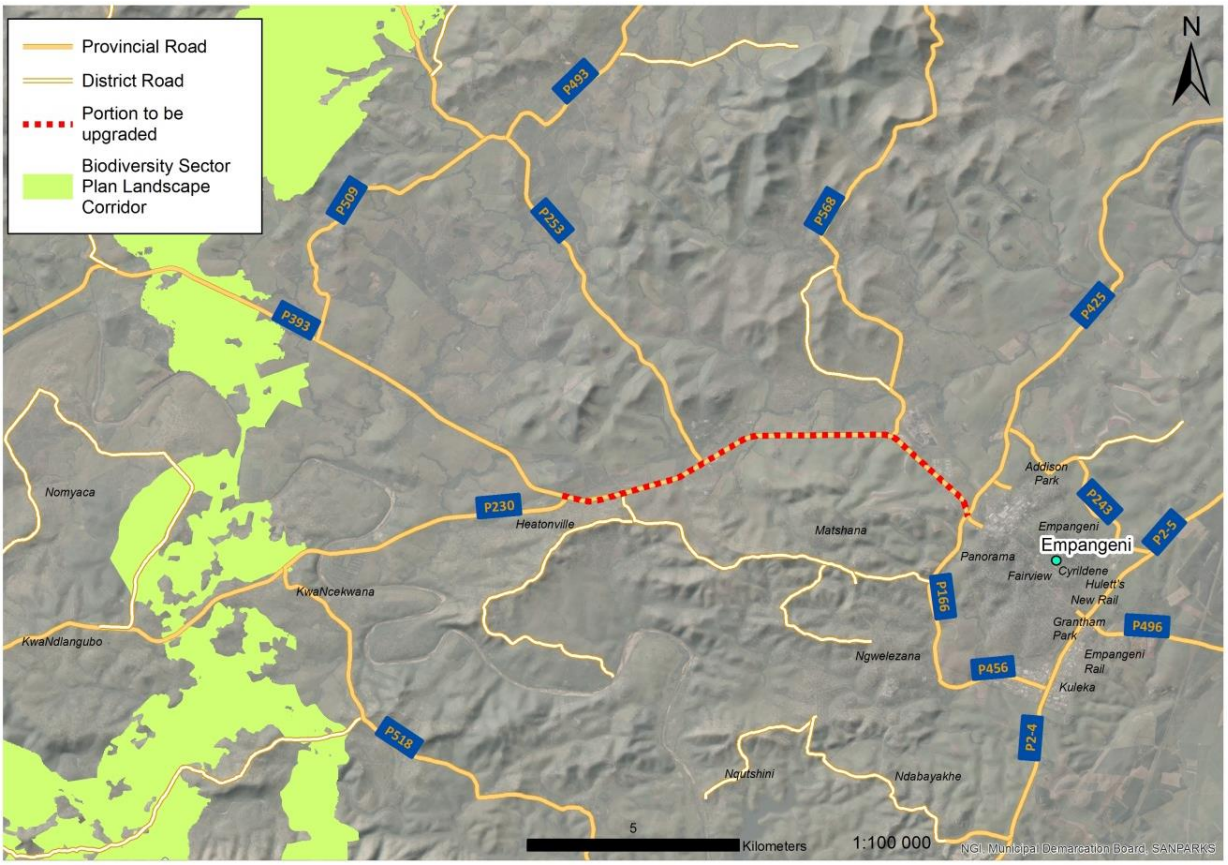

Figure 5-2: Biodiversity sector plan areas of significance (*eZemvelo* BGIS 2016)

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

- The Nseleni River and its associated sub-quaternary catchment (No. 3401).
- No wetland FEPA has been identified within the impact zone of the proposed development or immediately downstream.
- The study area falls within the Lowveld Group 11 reference NFEPA wetland vegetation group, which is considered **Vulnerable**.

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

- The proposed section of the P230 Road to be rehabilitated traverses two sub-catchments (No. 1980 and 1986) classified as 'Available' according to the freshwater C-PLAN, with no specific conservation priorities set for aquatic ecosystems in these catchment areas.

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 5-3**).

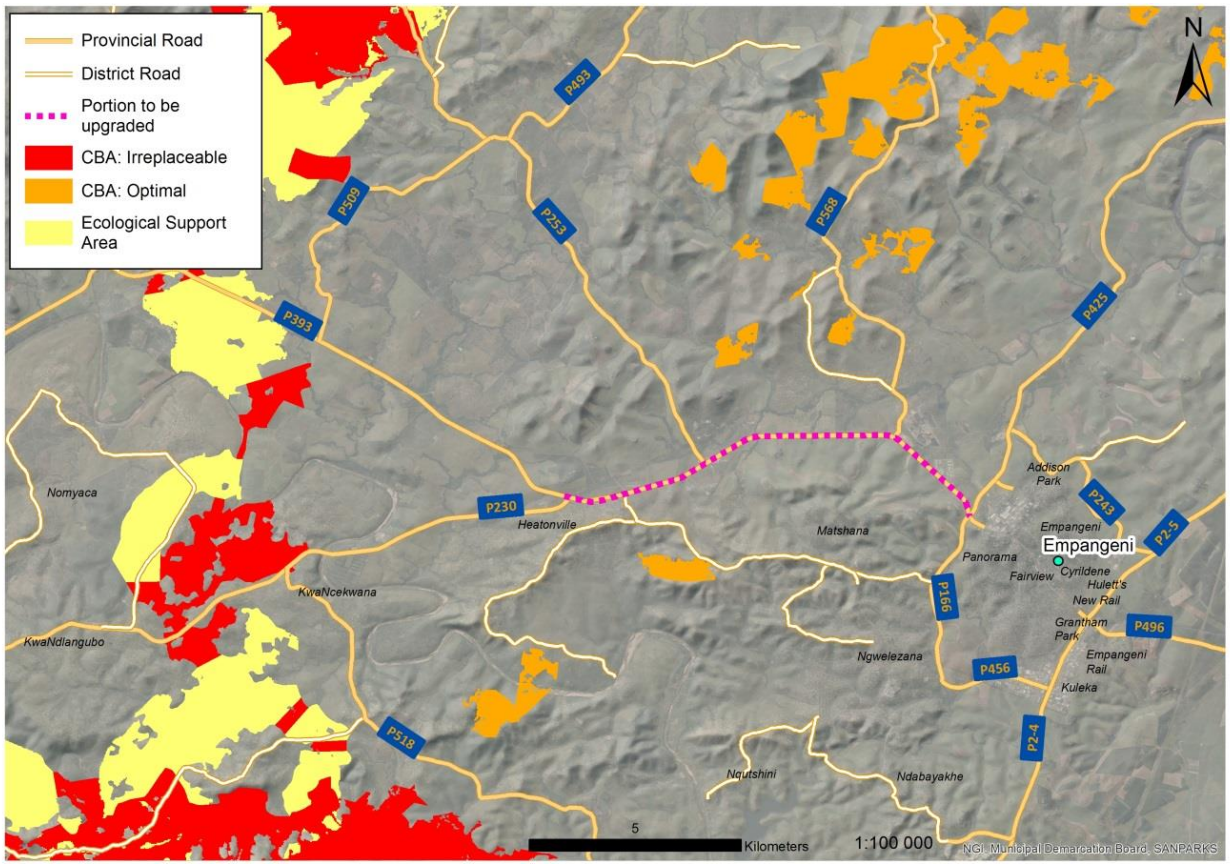

Figure 5-3: Sensitive geographical areas in relation to the P230 rehabilitation project

5.3 Desktop Watercourse Delineation

Four (4) watercourse including three (3) wetlands **HGM Units** and a single weakly seasonal river occurring within a 500 m radius of the culvert upgrade site were mapped at a desktop level, shown in **Figure 5-4** and as follows:

i. Wetland Unit W01: channelled valley-bottom wetland (8.2ha in extent)
ii. Wetland Unit W02: wetland seep (0.8ha in extent)
iii. Wetland Unit W03: channelled valley-bottom wetland (4.7ha in extent)
iv. River Unit R01: Weakly Seasonal River

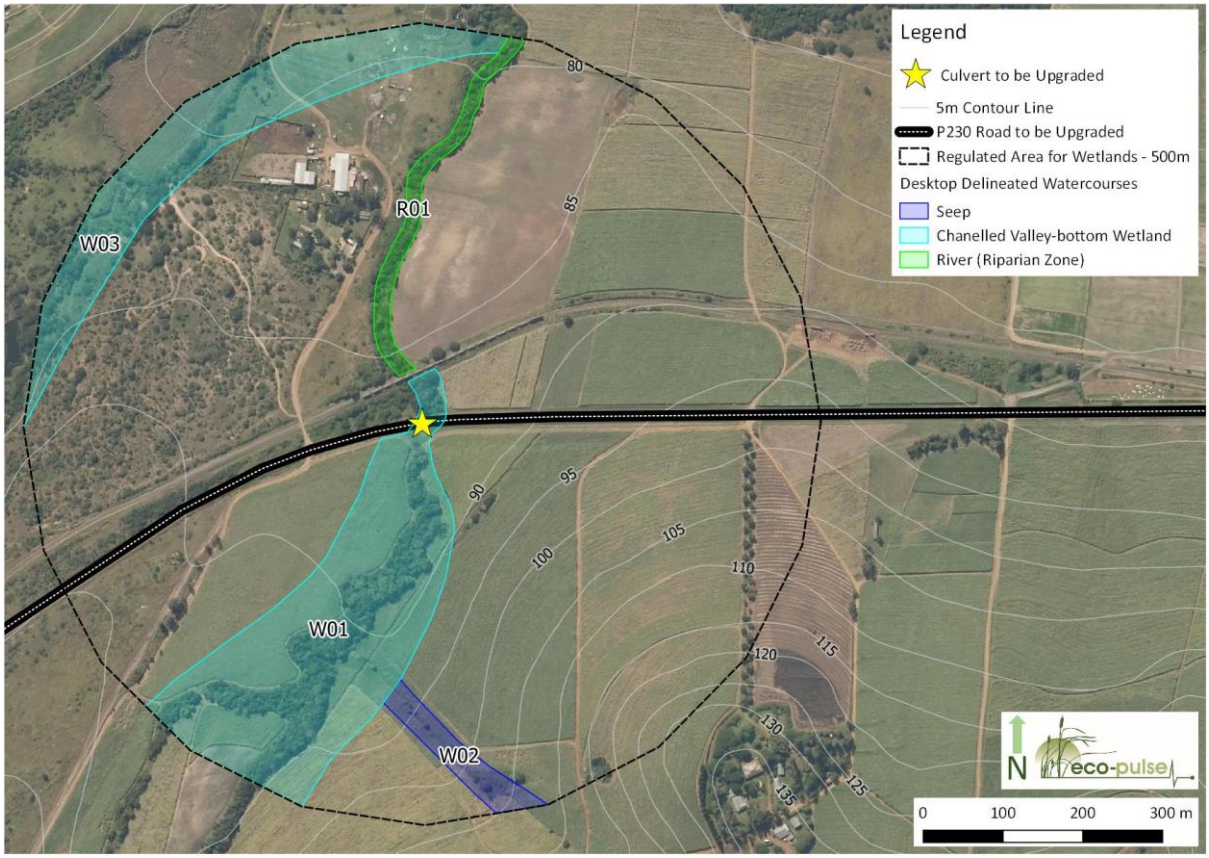

Figure 5-4: Desktop delineation of watercourses within the 500 m regulated area for wetlands

5.4 Land Use

Land use in the study area varies from the urban edge of Empangeni, to open and less intensive agricultural land-usage moving along the road westwards from Empangeni.

Starting from the eastern-most end, the road runs along the eastern edge of the Hillview residential area. On the far side of the road, the land is characterised as highly modified grasslands, possibly old fields, with a few dwellings.

At the northern edge of Hillside at the intersection with Gwala Gwala Street is a shopping centre, a housing estate and a correctional services installation. The land to the west of the P230 is intensively farmed land with croplands evident.

At the point where the road curves to the west, is the Maguzulu Industrial Park with a large industrial area to the east thereof and Tronox KZN Sands. Across the P230 within the curve of the road is sugar cane (planted and currently fallow), with pockets of bushland and indigenous vegetation along the watercourses.

From just east of the turn to the SPCA, shows a steep reduction in the level of cultivation with indigenous vegetation becoming more prevalent, this aside from the large mixed-use node found to the south of the Ngqwatayi railway station.

After the watercourse crossing to the west of this development node, agriculture again becomes more common, but predominantly grazing lands with scattered homesteads to the north of the P230. South of

the road is the relatively low density Mevamhlophe community area, which is found on the southern side of the remainder of the road portion.

5.5 Heritage and Palaeontological Resources

A formal heritage assessment has not been undertaken as this is a road rehabilitation project to be undertaken within the existing road reserve and there will be minimal impacts outside this reserve.

Figure 5-5 shows the level of sensitivity (as noted by the South African Heritage Resources Agency-SAHRA), with approximately two-thirds of the road crossing very high / high sensitivity areas. It is similarly noted that as the site is a maintenance intervention that the road is unlikely to impact on additional new sites of significance and the EMPr will include best practice management measures to protect these areas.

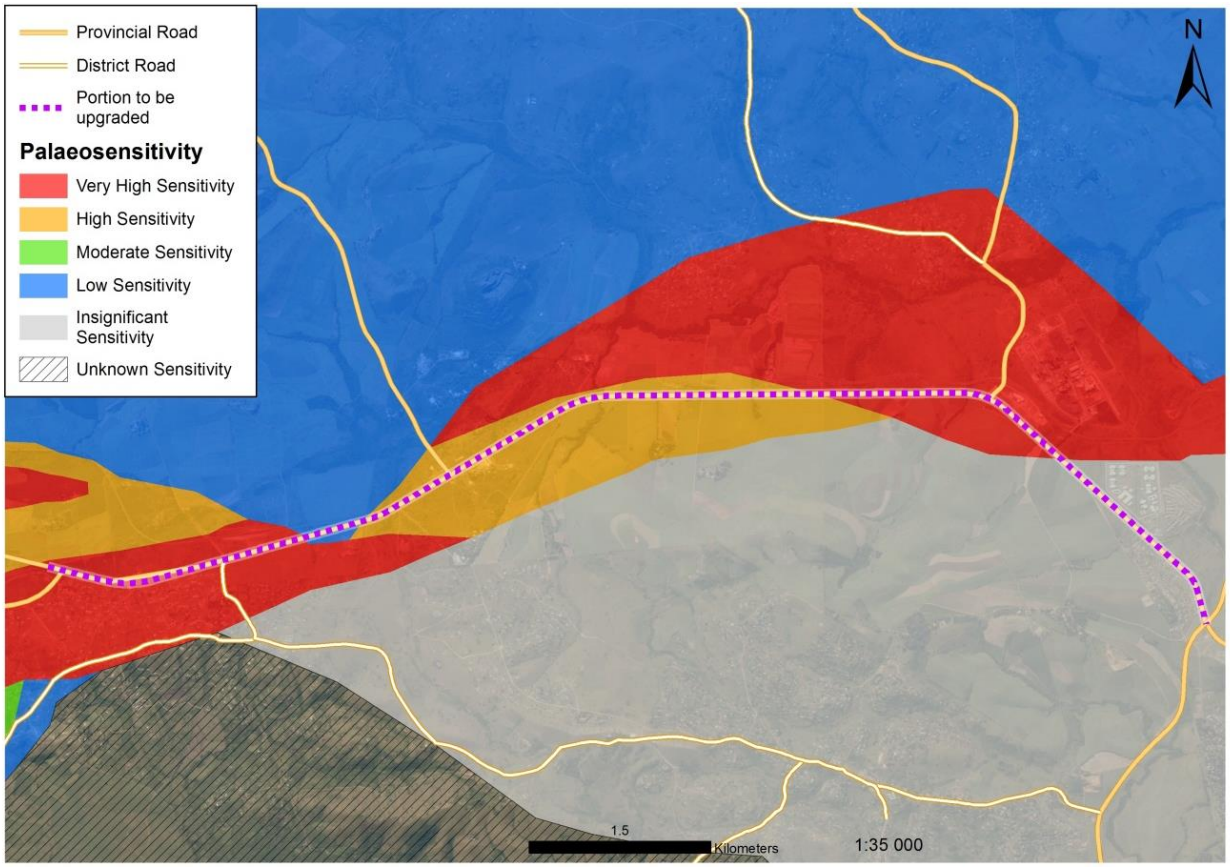

Figure 5-5: Paleontological sensitivity (*eZemvelo* BGIS 2016)

The key to the sensitivities is provided below.

Table 5-2: Paleontological sensitivity key

Sensitivity	Required Action
Very High	Field assessment and protocol for finds is required
High	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
Moderate	Desktop study is required

Sensitivity	Required Action
Low	No palaeontological studies are required however a protocol for finds is required
Insignificant / Zero	No palaeontological studies are required
Unknown	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map

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 P230 rehabilitation project will be undertaken according to the stages outlined below.

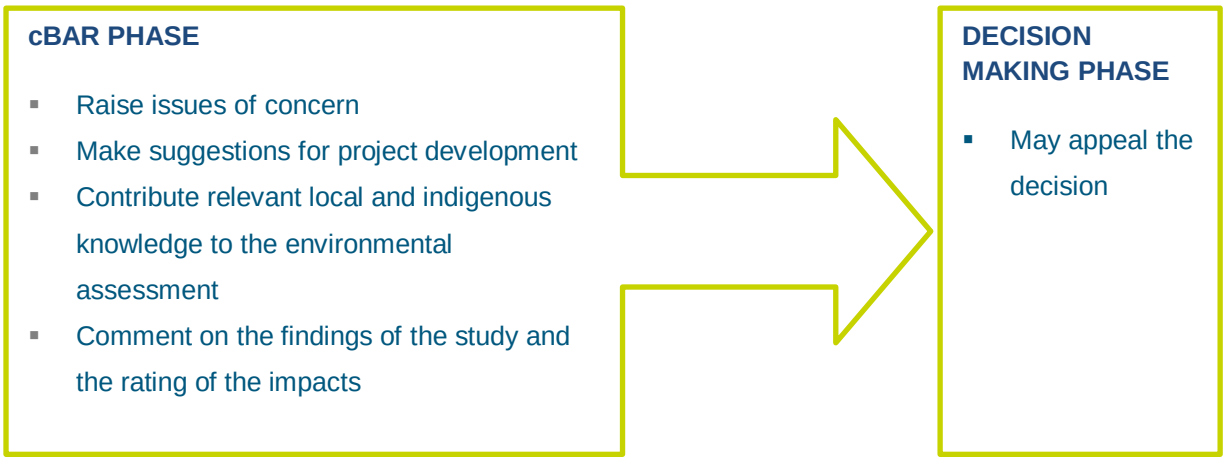

Figure 6-1: Responsibilities of I&APs

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 P230 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:

- Lodging on an Interpretation Query on 29th November 2016.
- Pre-application consultation and site visit with Mr M Mdamba KZN EDTEA on 23rd January 2017.
- Submission of an application for environmental authorisation in terms of **section 26** of the EIA Regulations 2014 (as amended in 2017) on 17th July 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 BID's 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 6-1**.

Table 6-1: Key stakeholders

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE	
Thornhill Estate	
LOCAL AUTHORITY	
Ms Gugu Khwela	uMhlathuze Local Municipality
Mr Mandla Nkosi	King Cetshwayo District Municipality
Mr Dlamini Siphosenkosi Gift / Mr Ntombela Sipho Francis	Councillor

STATE DEPARTMENTS	
Ms. Weziwe Tshabalala	AMAFA KwaZulu-Natal
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.

I&APs were identified primarily from responses received from the notices notify the public of the project and to invite 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 rehabilitation route alignment (refer to ***Appendix E***).

6.4 Identification of Interested and Affected Parties

E-mails 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 EMPr. A Focus Group Meeting will be held should significant interest / issues arise during the project process.

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 13th July 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

No comments have been received to date.

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 17th July 2017 to 16th July 2017.

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

- Empangeni public library: Corner of Union and Commercial Street, 3880 Empangeni
- Available from the Local Councillor
- 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 BAR (i.e. fBAR) 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 6-2** below, with the documents provided in ***Appendix E***.

Table 6-2: 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.

Activity	Description
Erection of site notices	A number of A2 site notices were erected on the perimeter of the site.
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 16th August 2017.
Focus Group Meeting	Not expected.
Release of final Report	The fBAR will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

7 SPECIALIST ASSESSMENT

7.1 Freshwater Habitat Assessment

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

7.1.1 Screening

A qualitative screening assessment of the potential impacts of the development on each watercourse identified and mapped at a desktop level (**Figure 7-1**) was undertaken to identify watercourses that are likely to be measurably negatively affected by the proposed culvert 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 watercourses: Wetland Unit W01 and River Unit R01 (**Figure 7-2**) were assigned impact ratings of 'definite' and 'probable' (respectively) in terms of the probable risk of being measurably impacted by the proposed development and/or triggering water use. These watercourses were thus subject to further impact assessment and were investigated further.

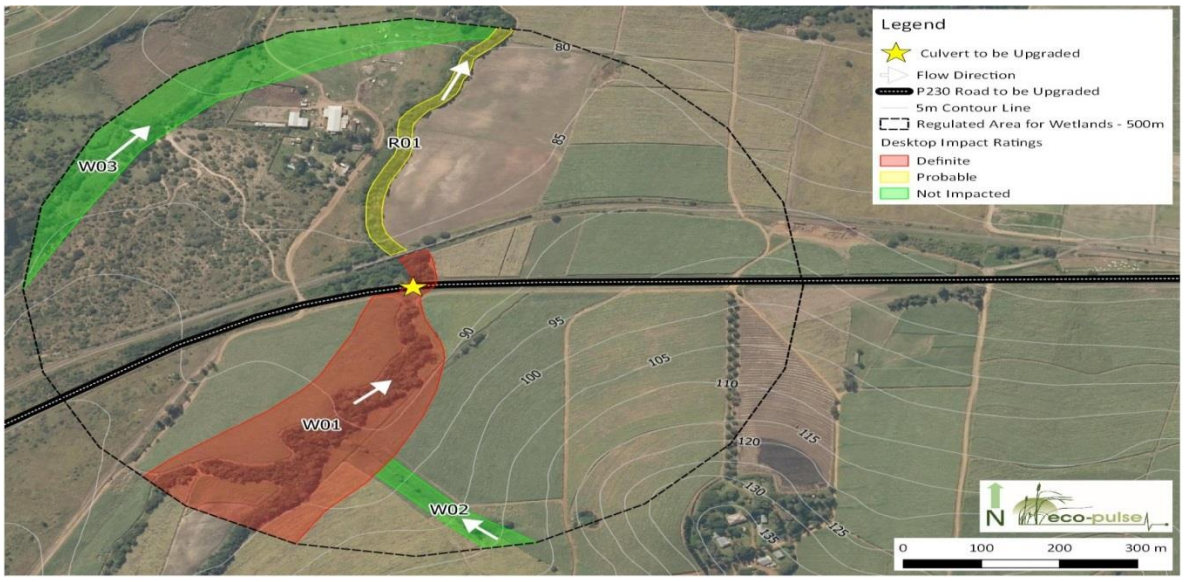

Figure 7-1: Impact screening and rating of desktop mapped watercourses within the 500 m regulated area for wetlands in terms of Section 21 c and/or i water use (National Water Act) for the culvert

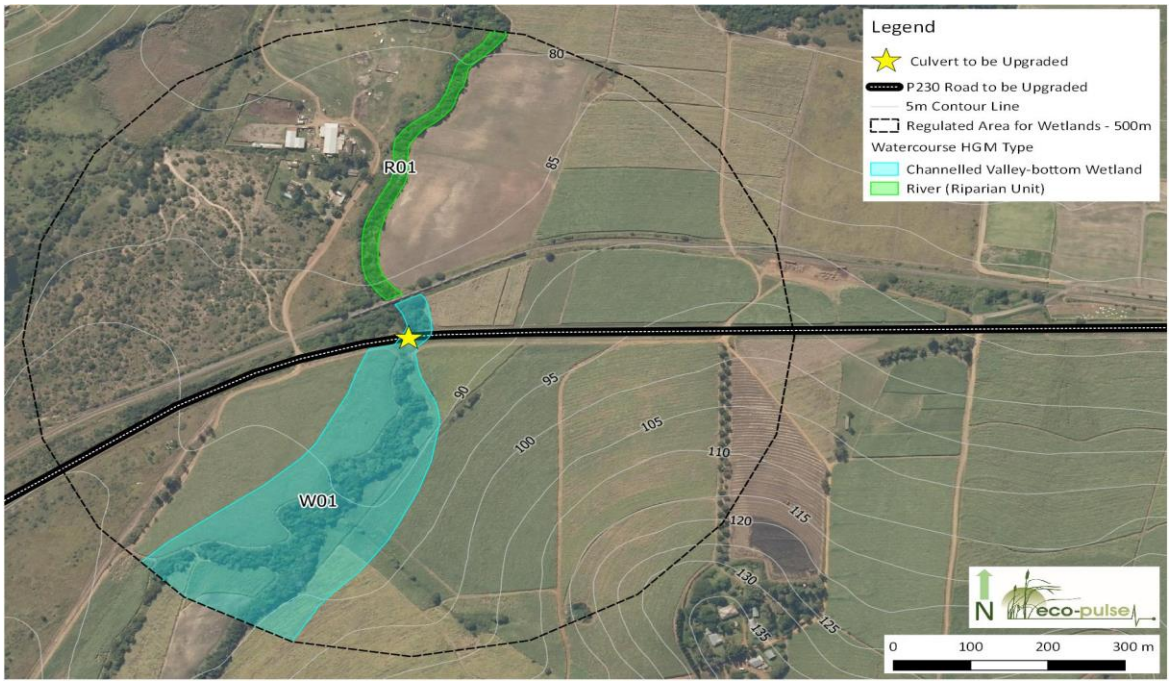

Figure 7-2: Map showing the location of watercourses identified as requiring further detailed delineation and field assessment (includes Wetland Unit W01 south of the P230 road and River Unit R01 to the north

A summary of the key biophysical characteristics of the two (2) watercourse units assessed (W01 and R01), including dominant existing anthropogenic impacts, is provided below in **Table 7-1**.

Table 7-1: Summary of the biophysical characteristics of wetland and river habitats sampled

Unit	Watercourse Classification	Habitat Description
W01	**Channelled valley-bottom wetland**	**Hydrology:** Water inputs are mainly in the form of overland flow with some subsurface interflow from the upstream catchment supporting the wetland, and adjacent valley sides. Water generally moves through the wetland system as concentrated / channelled flow via a central channel. **Vegetation / habitat:** The wetland comprises three different vegetation communities including (i) a secondary herbaceous marsh immediately upstream of the culvert, (ii) a wooded riparian community along the river channel and (iii) a cultivated sugar cane (*Saccharum officinarum*) plantation which covers a large portion of the wetland. The secondary herbaceous marsh comprises a mix of hygrophilous grasses, reeds, *Cyperus* species and a few ruderal forbs whilst the forested/wooded riparian community along the river channel comprises typical coastal indigenous trees such as *Syzygium cordatum, S. cumini, Phoenix reclinata, Rauvolfia caffra, Trema orientalis, Trichilia emetica* and *Bridelia micrantha*.
R01	**Weakly seasonal river**	**Hydrology and channel morphology:** The river was characterised by near vertical banks and ephemeral to weakly seasonal flows driven principally by upstream water inputs.

Unit	Watercourse Classification	Habitat Description
		Vegetation/habitat: The instream habitat comprised a few forbs mainly *Plectranthus* species established along the edges of the active channel. Channel banks were characterised by a wooded riparian community (lowland riverine forest) comprising the following indigenous trees: *Phoenix reclinata, Rauvolfia caffra, Trema orientalis, Trichilia emetica, Syzigium cordatum, S. cumini* and *Bridelia micrantha.*

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

Photo 1: Weakly seasonal soil sample extracted from the wetland area under sugar cane cultivation. Note the dark grey soil matrix and orange mottles indicating weakly seasonally saturated soils.

Photo 2: General view of the wetland unit W01 located upstream (south) of the culvert to be upgraded. Note the wooded/tree community along the river channel

Photo 3: Area of wetland W01 under sugar cane cultivation (cane recently harvested).

Photo 4: Secondary herbaceous marsh with Cyperaceae within W01 immediately upstream of the culvert to be upgraded.

Photo 5: Instream habitat and river bed of the River Unit R01.

Photo 6: Dense, wooded riparian habitat of the River Unit R01.

7.1.2 Present Ecological State (PES)

PES for the Wetland Units

The results of the PES assessment of the Wetland Unit W01 indicates that the wetland is in a **Largely Modified** state (ecological category = "D"). This suggests that a large change in ecosystem processes and loss of natural habitats has taken place.

PES for the River Unit R01

The assessment of habitat integrity of the instream and riparian zone of River Unit R01 indicated that the instream habitat was found to be in a Largely Natural state and the riparian habitat was **Moderately Modified**. Overall, the river unit can be considered to be in a Largely Natural to Moderately Modified state (ecological category = "B/C") with a small to moderate change in natural habitat having taken place, however, the ecosystem functions are essentially unchanged.

7.1.3 Ecosystem Services Assessment

Most ecosystem goods and services are of **low to moderately low importance**, with only one (1) ecosystem service, cultivated foods, identified as being of noteworthy importance (i.e. of Moderate importance or higher). The moderately-high importance of the wetland for cultivated foods is attributed to extensive cultivation of sugar cane within the wetland, along with high regional demand for cultivation of sugar cane. High levels of transformation linked with sugar cane cultivation and general habitat degradation have impacted on the wetland's ability to supply other key services at significant levels.

7.1.4 Ecological Importance and Sensitivity (EIS) Assessment

The EIS assessment results indicate that Wetland Unit W01 and River Unit R01 are essentially of Low EIS, dominated by features regarded as somewhat ecologically important and sensitive at a local scale. The functioning and / or biodiversity features have a low-medium sensitivity to anthropogenic disturbances and generally play a very small role in providing ecological services at the local scale.

7.1.5 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.

Wetland Unit W01 and River Unit R01 should be to maintain the current state and functioning, with the REC set at Category "D": Largely Modified state for Wetland W01 and Category "B/C" Largely to Moderately Modified for River R01 (as per). The nature and extent of the proposed project does not warrant a directive to improve the current state of this ecosystem.

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 7-2**, below. The nature and extent of the proposed project does not warrant a directive to improve the current state of these ecosystems.

Table 7-2: Summary of REC and RMO for all watercourses assessed based on their PES and EIS ratings

Unit	Type	PES	EIS	REC	RMO
W01	Channelled Valley-bottom Wetland	D: Largely Modified	Low	D: Largely Modified	*Maintain PES/EIS*
R01	Weakly Seasonal River	B/C: Largely Natural	Low	B: Largely Natural	*Maintain PES/EIS*

7.2 Potential Impacts

7.2.1 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.

7.2.2 Flow Modification and Erosion/Sedimentation Impacts

Construction Phase Impacts

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

- Coffer dams 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.
- 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 are 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 in-stream 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 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.

7.2.3 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 impacts 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 impacts 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 of a 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 exhibit 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 8-1.

Table 8-1: 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 8-2: 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 (7 -9 points)	Mitigation is possible with additional design and construction inputs.
	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 EMPr.

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 8-1** and **8-2**.

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 8-3: 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 the culvert at km 41,8. **Impact:** Impact on a single protected *Crinum* sp.	**Without**	2	2	3	3	-10	**High**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ 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 *E*KZNW is required to handle the *Crinum* sp. plant identified within Wetland Unit W01 (GPS Coordinates 28° 43' 29.46" S, 31° 50' 14.89" E).						
	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: ▪ 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 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.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Culverts should be installed during the dry season to reduce the risk of erosion and sedimentation during construction. ▪ Appropriate measures to dissipate flow velocity below 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 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 onsite to guide the settling 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 the natural through flows without impeding and focusing flows. ▪ Coarse stone material should be incorporated into culverts to mimic natural riffle/ run river biotopes. ▪ 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 new culvert discharges onto an unstable stream channel, an energy dissipater should be installed to prevent scour at the outlet. This can be constructed of appropriately sized rock armour and should have a concave cross-section to prevent the scouring of adjacent stream banks. ▪ Where flows are encountered, water should be diverted away from excavation areas to reduce turbidity and eliminate saturation of the crossing fill as it is excavated. A small diversion dam should be built upstream and stream flow piped around the worksite and discharged into the stream below the worksite or to a site where sediment can be captured.				

8.3.2 Soils

Table 8-4: Impact on soils

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). **Impact:** Physical degradation due to the removal and compaction of soil during construction activities.	**Without**	1	2	2	2	-7	Medium
		With	1	1	1	1	-4	Low
		Key mitigation measures: ▪ 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. A recommended set-back distance of at least 30 m from the active river channel edge is recommended. ▪ The contractor must, 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.						
	Aspect: Construction activities (site clearing). **Impact:**	**Without**	1	2	2	3	-8	Medium
		With	1	1	1	2	-5	Low
		Key mitigation measures: ▪ Construction activities must 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						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Physical degradation due to soil: erosion as a result of exposed soil and topsoil.	steep slopes. ▪ 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 gulley 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). **Impact:** Impact on land use and land capability – disturbance of soils to the location of the construction camp and associated infrastructure.	**Without**	1	2	2	2	-7	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ The contractor laydown area must not be placed in or in close proximity to any watercourse. ▪ No materials must be stored or equipment repaired beyond the boundaries of the contractor laydown area.						

8.3.3 *Geohydrology*

Table 8-5: Geohydrology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction		Without	2	2	3	2	-9	Medium
		With	1	1	1	2	-5	Low
	Aspect: ▪ Improper storage of fuels, chemical etc. ▪ Construction equipment, vehicles, workshop and wash bay areas. ▪ Inadequate ablutions. **Impact:** Groundwater contamination as a result of: ▪ 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.	**Key mitigation measures:** ▪ 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 implemented on-site. ▪ Potential construction practices that might lead to groundwater contamination should be conducted on areas with impervious surfaces to avoid infiltration of contaminated						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		substances into the groundwater aquifer. ▪ All contaminated stormwater should be treated before being discharged into the surrounding natural environment.					

8.3.4 Vegetation

Table 8-6: 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. **Impact:** Loss / degradation of wetland habitat.	**Without**	1	1	3	3	-8	Medium
		With	1	1	1	1	-4	Low
		Key mitigation measures: ▪ 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.						

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	2	2	3	-8	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ 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.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ 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.					

8.3.5 Watercourses

Table 8-7: 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:** Physical destruction and / or modification of aquatic habitat including: ▪ Destruction or modification of habitat. ▪ Destruction or modification of wetland/riparian vegetation and river banks (bank modification). ▪ Unintentional physical destruction or modification	**Without**	2	2	2	4	-10	**High**
		With	1	1	1	4	-7	**Medium**
		Key mitigation measures: ▪ It is recommended that construction within the river take place in the winter / dry months (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. ▪ 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 or danger tape with steel droppers.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	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.	▪ Maintain site demarcations in position until the cessation of construction works. ▪ 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. ▪ Traffic must be diverted around the construction area (where necessary) using the proposed route highlighted in Figure 3-3. This should avoid unnecessary disturbance to more intact aquatic habitats in the area.						
	Aspect: Construction activities within watercourses. **Impact:** Flow modification and erosion/sedimentation impacts: ▪ Coffer dams 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.	**Without**	2	2	2	3	-9	**Medium**
		With	1	1	1	2	-5	**Low**
		Key mitigation measures: ▪ One of two flow diversion methods is recommended for implementation during the construction phase: ○ 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) are 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 works area. ○ Method 2: Full isolation over pumping / siphon: A whole section of the channel is isolated using barriers that span the full width of						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	▪ Inundation or back-flooding upstream of coffer dams 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.	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 and no permanent walls, berms or dams may be installed. ▪ Under no circumstance shall a new channel or drainage canals 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: Construction activities within watercourses. **Impact:** Impacts on water quality due to potential contaminants (hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste) released into watercourses.	**Without**	2	2	2	3	-9	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ 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 50m 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							

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		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.					
Operations	**Impact:** Alien invasive plant (IAP) encroachment.	**Without**	1	3	2	3	-9	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ 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.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ 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	3	1	1	-5	**Low**
		Key mitigation measures: ▪ 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 recommendations for culverts.						
	Impact: Impacts on water quality due to potential contaminants (hydrocarbons; heavy metals; suspended solids and solid waste) released into watercourses.	**Without**	2	3	1	3	-9	**Medium**
		With	1	3	1	1	-6	**Low**
		Key mitigation measures: ▪ 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:**	**Without**	2	3	2	2	-9	**Medium**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Downstream watercourse impacts due to: ▪ 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. ▪ Instream 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.	**With**	2	2	1	1	-6	**Low**
		Key mitigation measures: ▪ With the implementation of good mitigation measures such as limited vegetation clearing only to 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 (WUA) 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 WUA. ▪ 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. ▪ Refer to the key mitigation measures presented in **section 8.3.1** for the design recommendations for culverts.						

8.3.6 *Waste*

Table 8-8: Waste 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 including the removal of the existing culvert. **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.).	**Without**	1	1	2	3	-7	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ 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 being demolished. ▪ Once loaded onto a truck, the rubble must be taken to a 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.						

8.3.7 *Air Quality*

Figure 8-1: 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: ▪ Dust must be suppressed on the construction site during dry periods by the regular application of water. ▪ Water used for this purpose must be used in quantities that will not result in the generation of runoff. ▪ 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 piles should be maintained for as short a time as possible and should be enclosed by wind-breaking enclosures of similar height to the pile. ▪ Stockpiles should be situated away from the site boundary, watercourses and nearby receptors and should take into account the predominant wind direction. ▪ 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.).	**Without**	1	1	2	2	-6	Low
		With	1	1	1	2	-5	Low
		Key mitigation measures: ▪ All mobile plant and equipment must be in good working order.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Impact: Generation of fumes from vehicle emissions may pollute the air.	▪ 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: ▪ 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.						

8.3.8 Noise

Table 8-9: Noise impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Constructions staff, vehicles and equipment. **Impact:** Increase in noise pollution from construction vehicles and construction staff.	**Without**	1	1	3	3	-8	**Medium**
		With	1	1	1	2	-5	**Low**
		Key mitigation measures: ▪ 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). ▪ All operations should meet the noise standard requirements of the Occupational Health and						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		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.					

8.3.9 Socio-economic & Health

Table 8-10: Socio-economic 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. **Impact:** Expected to provide in excess of 70 jobs during the construction phase.	**Without**	2	2	2	2	+8	**Medium**
		With	2	2	2	2	+8	**Medium**
		Key mitigation measures: ▪ All labour (skilled and unskilled) and Contractors should be sourced locally where possible. ▪ A labour and recruitment policy must be developed, displayed and implemented by the contractor. ▪ Recruitment at the construction site must not be allowed. ▪ A CLO must be appointed to deal with the employment of local labour and to interface between the contractor and the local community. ▪ 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. **Impact:**	**Without**	2	2	3	2	-9	**Medium**
		With	2	2	1	1	-6	**Low**
		Key mitigation measures:						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	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.	▪ 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 allowed. ▪ Contractors must be educated about the risk of prostitution and spread of HIV and AIDS. ▪ Strict penalties will be built 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. **Impact:** Public and construction staff safety during construction.	**Without**	2	2	2	1	-7	**Medium**
		With	1	2	1	1	-5	**Low**
		Mitigation measures: ▪ Members of the public adjacent to the construction site must be notified of construction activities in order to limit unnecessary disturbance or interference. ▪ Construction activities will be undertaken during daylight hours. ▪ Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction. ▪ 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

The proposed culvert upgrade associated with the rehabilitation of the P230 from km 37,0 to km 47,0, stands to measurably impact only a channelled valley bottom wetland (W01) and a weakly seasonal river system (R01), triggering a water use and the need for impact assessment. Given the current moderately modified to largely modified habitat condition and low ecological importance and sensitivity (EIS) rating for the wetland 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 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. 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 wetland 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 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 wildlife. 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 probably 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 / negligible** 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.

A single protected plant species (*Crinum* sp.) was identified within Wetland Unit W01. In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974 an Ordinary Permit is required to handle the Crinum plant. An ordinary permit can be obtained from *Ezemvelo* KZN Wildlife (*E*KZNW).

The sensitivity map presented in **Figure 9-1** has been considered when determining if the proposed project should be positively authorised.

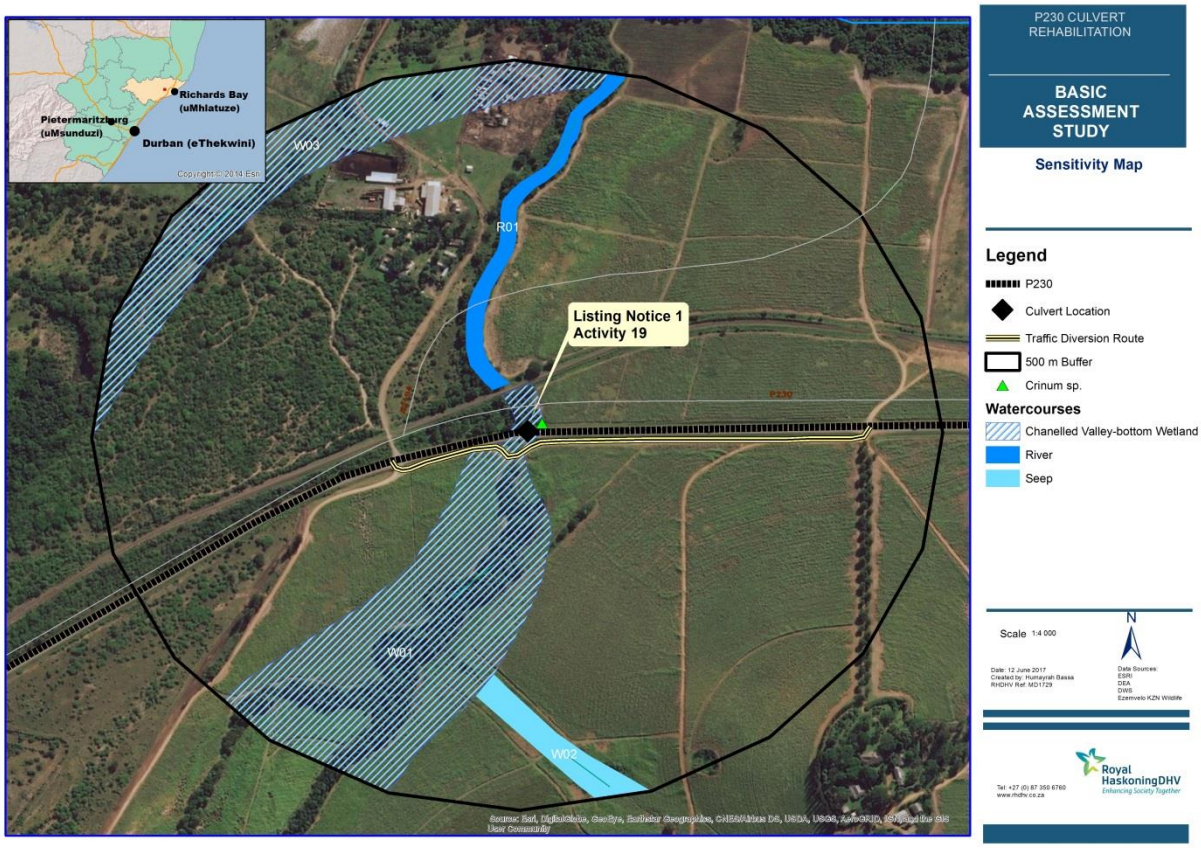

Figure 9-1: Sensitivity map[5]

A summary of the impacts is provided in Table 9-1.

Table 9-1: Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
Planning Phase		
Impact on a single *Crinum* sp.	High (-10)	Low (-4)
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)
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)

[5] *An enlarged map is included in Appendix F.*

Impacts	Without Mitigation	With Mitigation
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)	High (-10)	Medium (-7)
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 (-9)	Low (-5)
Impact on water quality (potential contaminants i.e. hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste released into watercourses)	Medium (-9)	Low (-4)
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 (-9)	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 (-5)
Water quality	Medium (-9)	Low (-6)
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 P230 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)

The 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 P230 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 report deals exclusively with a defined study area and the extent and nature of aquatic ecosystems in that area.
- The watercourse boundaries delineated are based on sampling points obtained at regular intervals. 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.
- Watercourse 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. All soil / vegetation / terrain sampling points were recorded using a Garmin Monterra™ Global Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing.
- Infield soil and vegetation sampling was only undertaken a 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 riparian 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.
- Sampling by its nature, means that generally not all aspects of ecosystems can be assessed and identified.
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. Every effort has been made 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.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the field survey and based on the assessor's working knowledge and experience with similar development projects.
- The impact descriptions and assessment are based on the author's understanding of the proposed development based on the information provided.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures included in the Environmental Management Programme (EMPr).

- 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 it inhabitants and can be mitigated significantly. Therefore, the EAP recommends the replacement of the culvert.

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) The Stormwater Management Plan must be complied with.

d) An Ordinary Permit from the *eZemvelo* KZN Wildlife (*E*KZNW) is required to handle the *Crinum* sp.

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. A financial provision for all of the proposed and recommended mitigation measures must be allowed for in all contractual documentation and the EMPr must be submitted to all tenderers in order for them to accurately cost the proposed project.

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.

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