

REPORT

Consultation Basic Assessment Report for the Upgrades and Associated Link Road Infrastructure to the R102 in the eThekweni Metropolitan Municipality

BAR

Client: KwaZulu-Natal Department of Transport

Reference: MD1717

Revision: 04/Draft

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PUBLIC REVIEW OF THE CONSULTATION BAR

This Consultation Basic Assessment Report (cBAR) is available for comment for a period of 30 days from 11th January 2017 to 10th February 2017. This report will be amended and updated in response to the comments received during this review period. Once finalised, the BAR will be submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) for decision-making.

Copies of this cBAR are available at strategic public places in the project area (see below) and upon request from Royal HaskoningDHV.

- Stanmore Library – 2 Elf Grove Way, Grove End
- Stonebridge Library – 5 Shortbridge Place, Phoenix
- Royal HaskoningDHV website: www.rhdhv.co.za

OPPORTUNITIES FOR PUBLIC REVIEW

The following methods of public review of the cBAR are available:

- Completing the comment sheet enclosed with the Background Information Document (BID);
- Written submissions by post, e-mail or fax; and
- Telephonic submissions.

**DUE DATE FOR COMMENT ON CONSULTATION BASIC ASSESSMENT REPORT
(cBAR):
10th February 2017**

SUBMIT COMMENTS AND QUERIES TO:

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Acronyms

BA	Basic Assessment
BAR	Basic Assessment Report
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
cBAR	Consultation Basic Assessment Report
CR	Critically Endangered
CMA	Catchment Management Agency
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
D'MOSS	Durban Metropolitan Open Space system
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EKZNW	Ezemvelo Kwa-Zulu Natal Wildlife
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EN	Endangered
ETA	eThekweni Transport Authority
ETM	eThekweni Municipality
fBAR	Final Basic Assessment Report
GA	General Authorisation
GN R.	Government Notice Regulation
HGM	Hydrogeomorphic
I&APs	Interested and Affected Parties
IAP	Invasive Alien Plant
IHI	Index of Habitat Integrity
IDP	Integrated Development Plan
KZN	Kwa-Zulu Natal
KZN DoT	Kwa-Zulu Natal Department of Transport
KZN	Kwa-Zulu Natal Department of Economic Development, Tourism and Environmental Affairs
EDTEA	
LIDPs	Local Integrated Development Plans
MTBE	Methyl Tert-Butyl Ether
NEMA	National Environmental Management Act (Act No. 107 of 1998) (as amended)
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 Forestry Act (Act No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-governmental Organisation
NHRA	National Heritage Resource Act (Act No. 25 of 1999)
NT	Near Threatened
NUDC	Northern Urban Development Corridor
NWA	National Water Act (Act No. 36 of 1998) (as amended)
OHSA	Occupational Health and Safety Act (Act No. 85 of 1993)
PAHs	Polycyclic Aromatic Hydrocarbons
PE	Possible Extinct
PES	Present Ecological State
PPP	Public Participation Process
PU	Planning Unit
SAHRA	South African Heritage Resource Agency
SDP	Spatial Development Plan
SDF	Spatial Development Framework
SIPs	Strategic Infrastructure Projects
VOCs	Volatile Organic Compounds
WUL	Water Use Licence
WULA	Water Use Licence Application

Glossary

Building and Demolition Waste	Building and demolition waste means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.
Contractor	Companies appointed on behalf of the Developer to undertake activities, as well as their sub-contractors and suppliers.
Construction Project Management Team	The team consists of a Project Manager as well as a Safety, Health and Environmental officer.
Degradation	The lowering of the quality of the environment through human activities e.g. river degradation, soil degradation.
Domestic Waste	Domestic waste means waste, excluding hazardous waste, that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes.
Emergency	An undesired event that results in a significant environmental impact and requires the notification of the relevant statutory body such as a local or provincial authority.
Environment	In terms of the National Environmental Management Act (NEMA) (No 107 of 1998)(as amended), “Environment” means the surroundings within which humans exist and that are made up of: <ul style="list-style-type: none"> (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plants and animal life; (iii) any part or combination of (i) of (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Control Officer	An individual nominated through the Developer to be present on-site to act on behalf of the Developer in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation’s activities, products or services.
Environmental Management Programme	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive environmental impacts and limiting or preventing negative environmental impacts are implemented during the life-cycle of the project.
General Waste	General waste means waste that does not pose an immediate hazard or threat to health or to the environment, and includes - <ul style="list-style-type: none"> (i) domestic waste; (ii) building and demolition waste; (iii) business waste; and (iv) inert waste.

General Waste Landfill Site	A waste disposal site that is designed, managed and permitted to allow for the disposal of general waste.
Hazardous Waste Landfill Site	A waste disposal site that is designed, managed and permitted to allow for the disposal of hazardous waste.
Impact	A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.
Incident	An undesired event which may result in a significant environmental impact but can be managed through internal response.
Mitigation	Measures designed to avoid, reduce or remedy adverse impacts.
Principal Agent	The principal agent is appointed by the Developer to oversee the overall project management and the management of the professional project team.
Re-Use	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
Recycle	A process where waste is reclaimed for further use, this involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.
Safety, Health and Environmental Officer	The SHE officer is a Contractor representative, responsible for the safety, health and environmental aspects on the construction-site. The SHE officer will be responsible for the day-to-day monitoring of the EMPr and Health and Safety Plan.
Waste	<p>Waste means any substance, whether or not that substance can be reduced, re-used, recycled and recovered -</p> <ul style="list-style-type: none"> (i) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; (ii) which the generator has no further use of for the purposes of production; (iii) that must be treated or disposed of; or (iv) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but— <ul style="list-style-type: none"> o a by-product is not considered waste; and o any portion of waste, once re-used, recycled and recovered, ceases to be waste.
Waste Disposal Facility	Waste disposal facility means any site or premise used for the accumulation of waste with the purpose of disposing of that waste at that site or on that premises.
Workforce	The entire project team including people employed by the Principal Agent or the Contractor, persons involved in activities related to the project, or person present at or visiting the construction area, including permanent contactors and casual labour.

1 INTRODUCTION

1.1 Project Background

The KwaZulu-Natal Department of Transport (KZN DoT) has appointed Royal HaskoningDHV to conduct the Basic Assessment (BA) study and Water Use Licence Application (WULA) for the proposed R102 Upgrades Project.

Due to increasing traffic volumes along the R102 as a result of increased urbanisation, an improvement to transport infrastructure is required. As the R102 is an existing road serving the communities along its route and it could possibly serve as an alternative route to the N2 Highway to the King Shaka International Airport. The proposed upgrade of the R102 is an extremely important project in terms of overall transport planning in the City.

Royal HaskoningDHV, together with Naidu Consulting, have been appointed by the KZN DoT to construct a partial interchange and upgrade the R102 as illustrated in **Error! Reference source not found.** A Basic Assessment (BA) study was previously conducted for the proposed R102 and partial interchange. The length of road upgrade was approximately 20 km. The route assessed started at the Duffs Road Interchange to Verulam near the entrance to the King Shaka International Airport. The upgrade proposed comprised of the widening of the existing route to a dual carriageway (i.e. two lanes in both directions divided by a centre median which would comprise either a barrier or island).

An Environmental Authorisation (EA) was obtained (Reference number: DM/0133/08), for this work and a portion of the road was constructed. In light of increased demand and traffic volumes, three additional components have been proposed, which did not form part of the previous assessment:

- The P79 Grade Separation (indicated as 'A' in Figure 1-2)
 - A new bridge and road linkage at the Mount Edgecombe partial interchange providing a link from the future south bound carriageway of the R102 from Verulam, over the M41, en route to Mount Edgecombe and Durban;
- The M41 Northbound off-ramp (indicated as 'B' in Figure 1-2); and
- SASA pedestrian bridge (indicated as 'C' in Figure 1-2)
 - A new pedestrian bridge traversing the R102 which will allow for the safe movement of pedestrians across the upgrade R102.

The P79 Grade Separation ('A') and SASA pedestrian bridge ('C') components are the subject of this Basic Assessment (BA) study. The SASA pedestrian bridge does not trigger any listed activities in terms of Government Notice Regulation (GN R.) 983 to 985. It should also be noted that the M41 Northbound off-ramp ('B') is no longer proposed and has thus been excluded from the BA study. Therefore, the P79 Grade Separation is the primary development activity in this BA study.

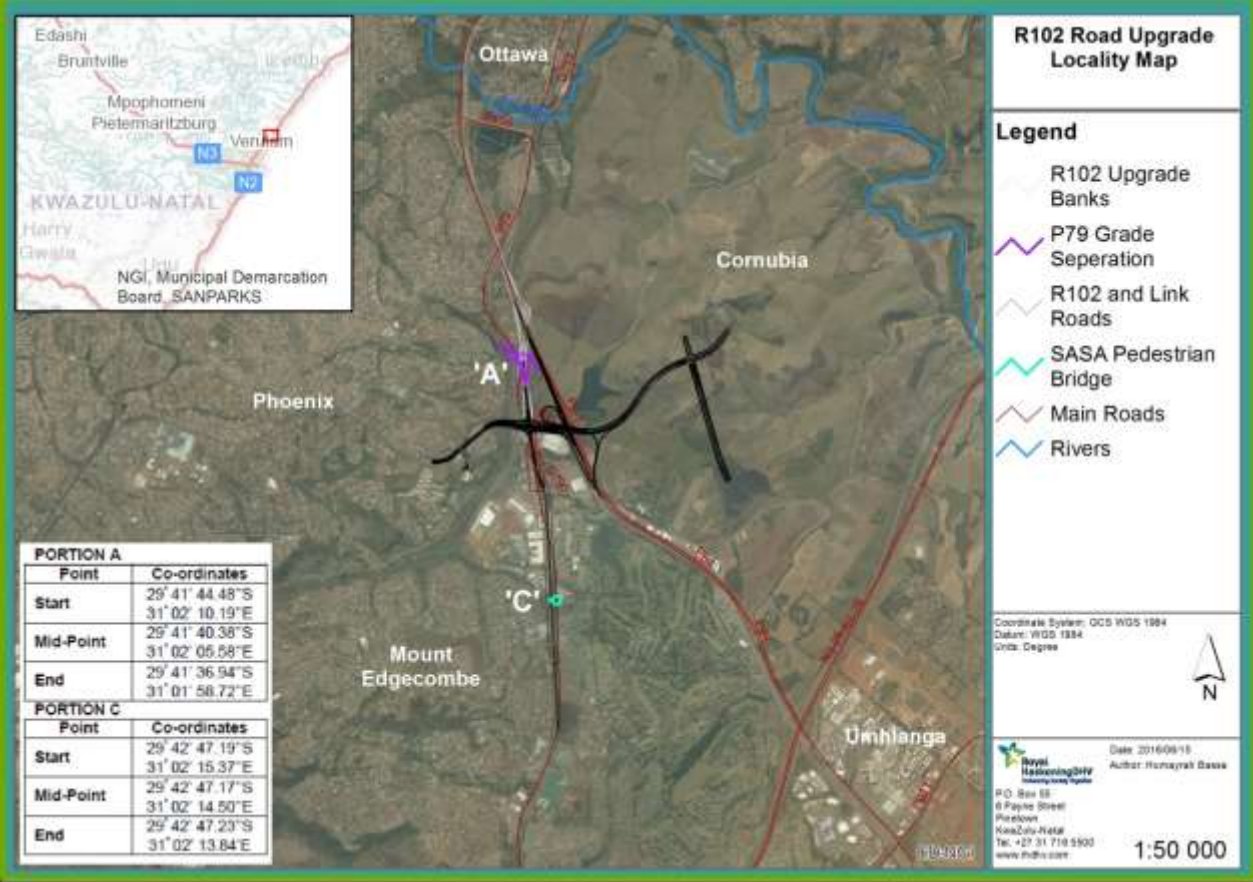


Figure 1-1: Locality Map



Figure 1-2: Additional Components

1.2 Phasing of the R102 Upgrades

An Environmental Authorisation (EA) for the Proposed Upgrade of the R102 between the Duffs Road Interchange and Verulam North at the new Entrance to the Dube Tradeport/King Shaka Airport, located in the eThekweni Municipality, (reference number: DM/0133/08) dated 18th March 2009 was obtained for the KwaZulu-Natal Department of Transport (KZN DoT) in terms of the NEMA EIA Regulations (2006). This EA is still valid and the majority of the R102 upgrades will be undertaken under this EA. However, portions 'A' and 'C' as illustrated in **Figure 1-2** were not assessed or authorised under this EA, resulting in the need for this assessment.

Further to the R102 upgrades proposed by the KZN DoT, an EA for the Proposed Integrated Rapid Public Transport Network (IRPTN) Corridor 9 of Various Portions, located within the eThekweni Municipality (reference number: DM/0042/212) dated 20th November 2014 was obtained by the eThekweni Transport Authority (ETA) in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998)(as amended) Environmental Impact Assessment (EIA) Regulations (2010). This EA is applicable for the Phoenix Interchange which intersects with the R102 (**Figure 1-3**).

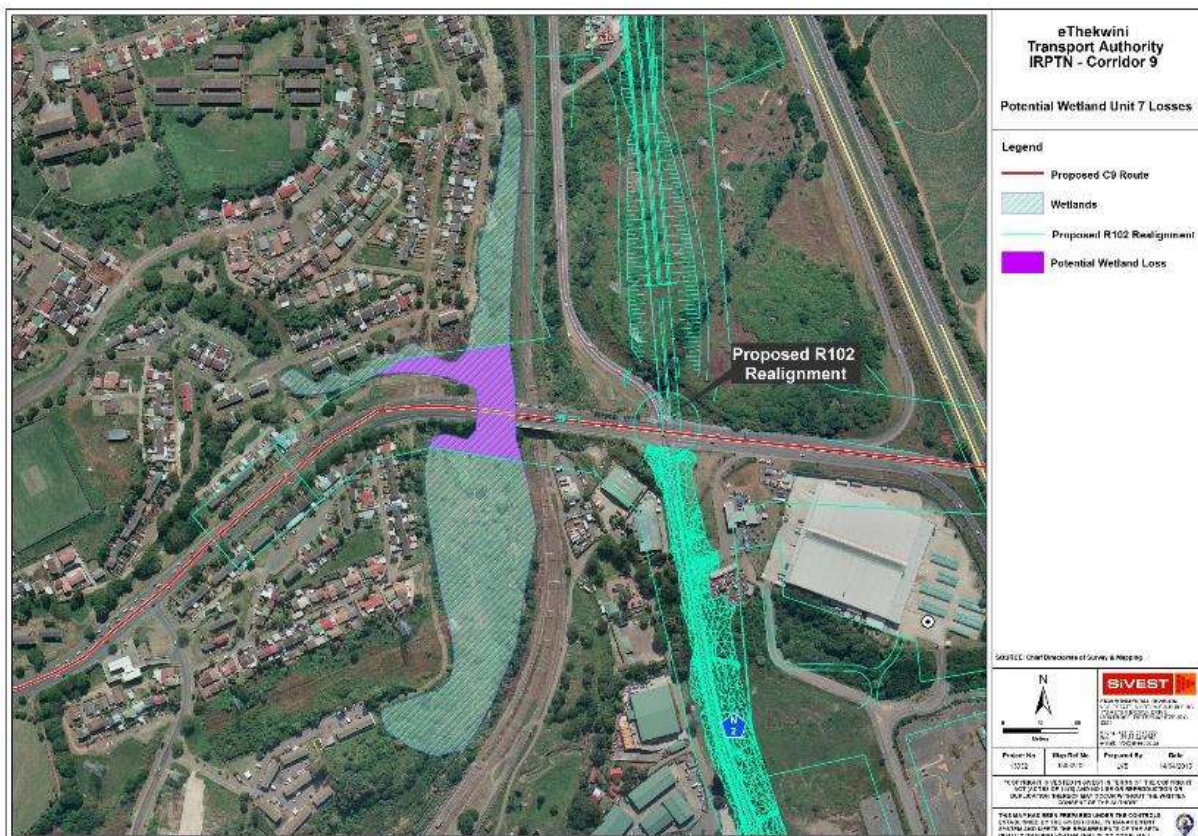


Figure 1-3: IRPTN C9 Alignment and the Phoenix Interchange Intersection with the R102

1.3 Objectives of the Study

The BA aims to achieve the following:

- Conduct a consultative process;

- 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;
- 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 sites and locations within sites 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.

1.4 Approach to the Study

1.4.1 Pre-application Consultation

A pre-application meeting was held with the Competent Authority (CA) - the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA), eThekweni District – on the 24th August 2015. Minutes of this meeting are included as [Appendix A](#).

1.4.2 Application for Environmental Authorisation

An Application for EA will be submitted to the KZN EDTEA on 11th January 2017.

1.4.3 Basic Assessment Report

This Basic Assessment Report (BAR) has been compiled in accordance with the stipulated requirements in GNR. 982 Appendix 1 of the EIA Regulations (2014), 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 specialist studies conducted for the project.

1.4.4 Environmental Management Programme

An EMPr ([Appendix B](#)) has been compiled according to Appendix 4 of GNR. 982 of the EIA Regulations (2014) 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 KZN 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.

The EMPr includes the following:

- Details of the person who prepared the EMPr and the expertise of the person to prepare an EMPr;

- Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in the BAR, including environmental impacts or objectives in respect of operation or undertaking of the activities, rehabilitation of the environment and closure where relevant;
- A detailed description of the aspects of the activity that are covered by the EMPr;
- An identification of the persons who will be responsible for the implementation of the measures;
- Where appropriate, time periods within which the measures contemplated in the EMPr must be implemented;
- Proposed mechanisms for monitoring compliance with the EMPr and reporting thereon;
- An environmental awareness plan; and
- Procedures for managing incidents which have occurred as a result of undertaking the activity and rehabilitation measures.

The following plans have been prepared in support of the EMPr (**Table 1—1**):

Table 1—1: List of Supporting Plans

Specialist Study	Organisation	Appendix
Rehabilitation Plan for Wetlands and Riparian Areas	Eco-Pulse Environmental Consulting Services	Appendix B2
Stormwater Management Plan	Royal HaskoningDHV	Appendix B3
Spill Contingency Plan	Royal HaskoningDHV	Appendix B4

1.4.5 Specialist Studies

To ensure the scientific vigour of the BA Study, as well as a robust assessment of impacts, Royal HaskoningDHV was assisted by various specialists in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the project, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts.

The following specialist studies have been conducted (**Table 1—2**):

Table 1—2: List of Specialist Studies


Specialist Study	Organisation	Appendix
Wetland	Eco-Pulse Environmental Consulting Services	Appendix C1
Vegetation	Eco-Pulse Environmental Consulting Services	Appendix C2
Heritage	Frans Prins (Private)	Appendix C3
Nocturnal	Endangered Wildlife Trust	Appendix C4
Geotechnical Assessment	Moore Spence Jones Geotechnical Consultants	Appendix C5

In addition to the above, the EIA Regulations (2014) 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 a lack of bias and to ensure transparency 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 (Pty) Ltd.

1.5 Details of the Project Proponent

The project applicant is the KZN DoT. The details of the project applicant are as follows:

Table 1—3: Details of the Project Proponent

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

1.6 Details of the Environmental Assessment Practitioner

The environmental team of Royal HaskoningDHV have been appointed as the Environmental Assessment Practitioner (EAP) by the KZN DoT. Royal HaskoningDHV is conducting the appropriate environmental studies for this proposed project. The professional team at Royal HaskoningDHV has considerable experience in the environmental management and Environmental Impact Assessment (EIA) fields.

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

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](#).

Table 1—4: Details of the EAP

Detail	Royal HaskoningDHV		
Contact Persons	Prashika Reddy	Humayrah Bassa (EAP)	Nicole Botham
Postal Address	PO Box 25302, Monument Park, 0105	PO Box 1243 Umhlanga 4320	PO Box 25302, Monument Park, 0105
Telephone	012 367 5973	087 350 6760	012 367 5916
E-mail	Prashika.reddy@rhdhv.com	Humayrah.Bassa@rhdhv.com	Nicole.botham@rhdhv.com
Qualification	BSc Hons Geography BSc Hons Botany SA Council for Natural Scientific Professions, Professional Natural Scientist, 400133/10	MSc Environmental Science SA Council for Natural Scientific Professions, Professional Natural Scientist, 400032/15 IAIAsa	
Experience	15 years	5 years	8 years

1.7 Structure of the Report

This report has been structured to comply with the format required by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) (as amended) and the EIA Regulations (2014). The contents are as follows:

Table 1—5: Report Structure

Chapter	Content
Chapter 1 Introduction	Introduction and background to the project, including the approach to the study and details of the project proponent and EAP.
Chapter 2 Environmental Legislative Framework	Includes an explanation on all applicable legislation and the relevant listed activities applied for.
Chapter 3 Project Context and Motivation	Includes the need and desirability for the project and a description of the proposed activities.
Chapter 4 Project Alternatives	Consideration of alternatives (design/layout and no-go) for the project.
Chapter 5 Description of Study Area	A description of the biophysical and social environment.
Chapter 6 Public Participation Process	Overview of the public participation process conducted to date.
Chapter 7 Summary of the Specialist Findings	The section highlights the key findings of the specialist studies conducted and other environmental considerations.
Chapter 8 Impact Assessment	The impacts identified are rated and a significance score obtained.
Chapter 9 Environmental Impact Statement	Summary of Environmental Impact Assessment. Conclusion and recommendations including Declaration of independence by the EAP.

2 ENVIRONMENTAL LEGISLATIVE FRAMEWORK

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

2.1 The Constitution of South Africa

Section 24 of the Constitution of South Africa (Act No. 108 of 1996) states that:

“...everyone has the right – ... (a) to an environment that is not harmful to their health or well-being; and ... (b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that ... (c) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”

This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in the NEMA and given further expression.

2.2 National Legislation and Regulations

This section outlines the applicable national legislation which needs to be taken cognisance of.

2.2.1 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (Act No. 107 of 1998) (as amended), or otherwise known as NEMA, is South Africa’s overarching environmental legislation and has, as its primary objective 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, and to provide for matters connected therewith.

The principles of the Act are the following:

- *Environmental management must place people and their needs at the forefront of its concern;*
- *Development must be socially, environmentally and economically sustainable;*
- *Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated;*
- *Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person;*
- *Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued;*
- *Responsibility for the environmental health and safety consequences of a policy, programme, project or activity exists throughout its life cycle;*
- *The participation of all interested and affected parties in environmental governance must be promoted;*
- *Decisions must take into account the interests needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge including traditional and ordinary knowledge;*

- *Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness;*
- *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 and assessment;*
- *The right of workers to refuse work that is harmful to human health or the environment;*
- *Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law;*
- *There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment;*
- *The environment is held in public trust for the people, the beneficial use of the environment resources must serve the public interest and the environment must be protected as the people's common heritage;*
- *The cost of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment; and*
- *The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.*

2.2.2 NEMA EIA Regulations (2014)

The nature of the proposed project includes activities listed in the following Listing Notices – GN R. 983 (Listing Notice 1) and GN R. 985 (Listing Notice 3) of the EIA Regulations (2014) – refer to Table 2—1 below.

Table 2—1: Listed activities according to Listing Notices 1 and 3 of the EIA Regulations (2014)

Listed activity as described in GN R 983	Description of project activity that triggers listed activity
<p><u>Activity 19:</u> <i>The infilling or depositing of any material of more than 5 m³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 m³ from—</i> <i>(i) a watercourse;</i> <i>but excluding where such infilling, depositing , dredging, excavation, removal or moving—</i> <i>(a) will occur behind a development setback;</i> <i>(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or</i> <i>(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.</i></p>	<p>The proposed P79 Grade Separation will cross a wetland and will thus require infilling or depositing of material of more than 5 m³ or the dredging, excavation, removal or moving of soil, sand or rock of more than 5 m³ from / into a watercourse.</p>
<p><u>Activity 30:</u> <i>Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).</i></p>	<p>The project will require the clearance of indigenous vegetation.</p>

Listed activity as described in GN R 985	Description of project activity that triggers listed activity
<p><u>Activity 4:</u> The development of a road wider than 4 m with a reserve less than 13.5 m.</p> <p>(d) In KwaZulu-Natal:</p> <p>viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.</p>	<p>The proposed linkage to Main Road 79 will be wider than 4 m with a reserve less than 13.5 m within a CBA in KwaZulu-Natal.</p>
<p><u>Activity 12:</u> The clearance of an area of 300 m² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.</p> <p>(b) In KwaZulu-Natal:</p> <p>v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;</p>	<p>The proposed P79 Grade Separation will require the clearance of indigenous vegetation exceeding 300 m² within a CBA in KwaZulu-Natal.</p>
<p><u>Activity 14:</u> The development of—</p> <p>(iii) bridges exceeding 10 m² in size;</p> <p>(xii) infrastructure or structures with a physical footprint of 10 m² or more;</p> <p>where such development occurs—</p> <p>(a) within a watercourse;</p> <p>excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.</p> <p>(d) In KwaZulu-Natal:</p> <p>vii. Critical biodiversity areas or ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;</p>	<p>The project will entail the development of infrastructure of 10 m² or more; within a watercourse; or within 32 m of a watercourse, measured from the edge of a watercourse within a CBA in KwaZulu-Natal.</p>

2.2.3 National Water Act (Act No. 36 of 1998) (as amended)

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.

Water use in South Africa is managed through a water use authorisation process, which requires that every water use is authorised by the Department of Water and Sanitation (DWS, previously known as the

Department of Water Affairs) or an established Catchment Management Agency (CMA, if applicable for that region), once the water requirements for the Reserve have been determined.

A water use must be licenced unless it (a) is listed in Schedule 1, (b) is an existing lawful use, (c) is permissible under a general authorisation (GA), or (d) if a responsible authority waives the need for a licence. If none of these are relevant a so-called water use licence (WUL) must be applied for and obtained prior to the commencement of such listed activity. In terms of such a WUL the Minister may choose to limit the amount of water which a responsible authority (e.g. CMA, water board, municipality) may allocate. In making regulations and determining items such as GAs, the Minister may differentiate between different water resources, classes of water resources, and geographical areas.

The NWA defines a water resource to be a watercourse, surface water, estuary, or groundwater (aquifer). Included under surface water are manmade water channels, estuaries and watercourses.

As the proposed development involves the crossing of watercourses, a WUL application will be submitted to the DWS for non-consumptive water uses. The NWA, as applicable to the proposed development (see comment in brackets after each item), defines the identified water uses which are potentially applicable under Section 21 as follows:

The following water uses of Section 21 of the NWA are being applied for the WUL:

- (a) *Taking water from a water resource*
- (c) *Impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and*
- (i) *Altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).*

The project team has engaged with the DWS on the requirements of the WUL application submission through a pre-application meeting which was undertaken with the DWS on the 25th November 2015.

2.2.4 National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

The project must comply with the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA) in providing the cooperative governance in biodiversity management and conservation.

NEM:BA provides for the Minister to publish a notice in the Government Gazette that issues norms and standards, and indicators for monitoring progress for the achievement of any of the objectives of the Act.

The NEM:BA also provides for:

- The National Biodiversity Framework;
- Bioregional Plans;
- Biodiversity Management Plans;
- Biodiversity Management Agreements;
- The identification, listing and promotion of threatened or protected ecosystems; and
- Alien invasive species control and enforcement.

The area within which the proposed project is to be undertaken is classified as a CBA 1. These areas are therefore a mandatory area based on the C-Plan Irreplaceability analyses, identified as having an Irreplaceability value of 1. These planning units represent the only localities for which the conservation

targets for one or more of the biodiversity features contained within it, can be achieved i.e. there are no alternative sites available.

The distribution of the biodiversity features is not always applicable to the entire extent of the Planning Unit (PU). However, it is more often than not confined to a specific niche habitat e.g. a forest or wetland reflected as a portion of the PU in question. In such cases, development could be considered within the PU if special mitigation measures are put in place to safeguard this feature(s) and if the nature of the development is commensurate with the conservation objectives. This is dependent on a site by site, case by case, basis.

2.2.4.1 National Spatial Biodiversity Assessments (2004, 2011)

This informs the policies, plans and day to day activities of a wide range of sectors both public and private. A spatial biodiversity assessment can take place at different spatial scales, from global to local.

It involves mapping information about biodiversity features such as species, habitats and ecological processes, protected areas and current and future patterns of land and resource use. It provides a national context for assessments at the sub national scale and points to broad priority areas where further investigation, planning and action are warranted.

It identifies three keys strategies for conserving South Africa's biodiversity existence from the assessment, namely:

- Pursuing opportunities to link biodiversity and socio-economic development in priority geographic areas;
- Focusing on emergency action on threaten ecosystem, to prevent further loss of ecosystem functioning; and
- Expanding of the protected area network.

2.2.4.2 National Biodiversity Strategy and Action Plans (2005)

The National Biodiversity Strategy and Action Plans (NBSAP) aims to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa, now and in the future.

In South Africa, terrestrial, inland water, coastal and marine ecosystems and their associated species are widely used for commercial, semi-commercial and subsistence purposes through both formal and informal markets.

While some of this use is well managed and/or is at levels within the capacity of the resource for renewal, much is thought to be unsustainable. "Use" in this case refers to direct use, such as collecting, harvesting, hunting, fishing, etc. for human consumption and production, as well as more indirect use such as ecotourism.

2.2.4.3 Protected Areas

Protected areas are a fundamental tool for achieving biodiversity objectives and protecting essential natural heritage areas and ecosystems services, since these often provide greater security for conservation-worthy land than the agreements or land use limitations provided for in the National Environmental Management: Biodiversity Act.

The National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA) creates a legal framework and management system for all protected areas in South Africa as well as establishing the South African National Parks (SANParks) as a statutory board. Each conservation area will have its own set of land use restrictions or regulations that stem either from generic restrictions under NEM:PAA, or customized regulations for individual protected areas.

2.2.4.4 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.

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.

Threatened plant species are found on site and two of these species, namely *Scadoxus puniceus* (Snake Lily) and *Aloe Marlothii* will need to be relocated. The Applicant is presently pursuing the necessary permit / licencing requirements from Ezemvelo KZN Wildlife (EKZNW) prior to clearing of vegetation.

2.2.5 National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)

The National Environmental Management Waste Act (Act No. 59 of 2008) (NEM:WA) – the ‘Waste Act’ reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

The objectives of this Act are:

- a) *“to protect health, well-being and the environment by providing reasonable measures for –*
 - i. *minimising the consumption of natural resources;*
 - ii. *avoiding and minimising the generation of waste;*
 - iii. *reducing, re-using, recycling and recovering waste;*
 - iv. *treating and safely disposing of waste as a last resort;*
 - v. *preventing pollution and ecological degradation;*
 - vi. *securing ecologically sustainable development while promoting justifiable economic and social development;*
 - vii. *promoting and ensuring the effective delivery of waste services;*
 - viii. *remediating land where contamination presents, or may present, a significant risk of harm to health or the environment; and*
 - ix. *achieving integrated waste management reporting and planning;*
- b) *to ensure that people are aware of the impact of waste on their health, well-being and the environment;*
- c) *to provide for compliance with the measures set out in paragraph (a); and*
- d) *generally to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being.”*

The NEM:WA has been considered. No activities have been identified as being triggered for the proposed development.

2.2.6 National Heritage Resources Act (Act No. 25 of 1999)

In terms of section 38 of the National Heritage Resources Act (NHRA) (subject to the provisions of subsections (7), (8) and (9) of the Act), any person who intends to undertake a development categorised as:

- *The construction of a road, wall, power line, pipe line, canal or other similar form of linear development or barrier exceeding 300 m in length;*
- *The construction of a bridge or similar structure exceeding 50 m in length;*
- *Any development or other activity which will change the character of a site:*
- *Exceeding 5 000 m² in extent;*
- *Involving three or more existing erven or subdivisions thereof; or*
- *Involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
- *The costs of which will exceed a sum set in terms of regulations by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority;*
- *The re-zoning of a site exceeding 10 000 m² in extent; or*
- *Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.*

2.2.7 National Forests Act (Act No. 84 of 1998)

According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that;

'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

In essence the National Forests Act (NFA) prohibits the destruction of indigenous trees in any natural forest without a licence.

In terms of the NFA and Government Notice 1339 of 6th August 1976 (promulgated under the Forest Act, 1984 (Act No. 122 of 1984) for protected tree species), the removal, relocation or pruning of any protected tree will require a licence.

2.2.8 National Environmental Management: Air Quality Act (Act No. 39 of 2004)

The NEMA Air Quality Management Act (NEM:AQA) states the following as its primary objective:

"To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring,

management and control by all spheres of government, for specific air quality measures, and for matters incidental thereto.

Whereas the quality of ambient air in many areas of the Republic is not conducive to a healthy environment for the people living in those areas let alone promoting their social and economic advancement and whereas the burden of health impacts associated with polluted ambient air falls most heavily on the poor, And whereas air pollution carries a high social, economic and environmental cost that is seldom borne by the polluter, And whereas atmospheric emissions of ozone-depleting substances, greenhouse gases and other substances have deleterious effects on the environment both locally and globally, and whereas everyone has the constitutional right to an environment that is not harmful to their health or well-being, and whereas everyone has the constitutional right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- *Prevent pollution and ecological degradation;*
- *Promote conservation; and*
- *Secure ecologically sustainable development and use of natural resources.*

and whereas minimisation of pollution through vigorous control, cleaner technologies and cleaner production practices is key to ensuring that air quality is improved, and whereas additional legislation is necessary to strengthen the Government's strategies for the protection of the environment and, more specifically, the enhancement of the quality of ambient air, in order to secure an environment that is not harmful to the health or well-being of people."

2.3 Occupational Health and Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (OHSA) provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work, against hazards to health and safety arising out of or in connection with the activities of persons at work.

2.4 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.

2.5 Hazardous Substance Act (Act No. 15 of 1973) and Regulations

The object of the Act is *inter alia* to

'provide for the control of substances which may cause injury or ill health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature or the generation of pressure thereby in certain circumstances; for the control of electronic products; for the division of such substances or products into groups in relation to the degree of danger; for the prohibition and control of such substances'.

In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity, and the Act provides for the control of importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule.

Pollution control in South Africa is effected through numerous national statutes, provincial ordinances and local authority by-laws. Only the more significant legislation pertaining to the regulation of water, air, noise and waste pollution is dealt with in this section.

2.6 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.

3 PROJECT CONTEXT AND MOTIVATION

3.1 Description of the Study Area

The proposed activity is situated on the following properties:

Table 3—1: Property Description

Property Description	Ownership
Portion A: P79 Grade Separation	
Erf 6 Mount Edgecombe 127	National Government
Ptn 4 of Erf 27 Cornubia 217	eThekwini Municipality
Rem of Erf 851 Mount Edgecombe 127	Mount Edgecombe Park Properties
Erf 851 Mount Edgecombe 127	Mount Edgecombe Park Properties
Ptn 1 of Erf 851 Mount Edgecombe 127	Mount Edgecombe Park Properties
Rem of Ptn 13 of the Farm Lot 19 No 1555	Transnet
Ptn 39 of the Farm Lot 19 No 1555	National Government
Erf 434 Grove End	eThekwini Municipality
Portion C: SASA Pedestrian Bridge	
Erf 18 Mount Edgecombe 127	National Government

The 21 digit surveyor-general codes are provided in Table 3—2.

Table 3—2: Surveyor-General Codes for the Proposed Study Area

Portion A																				
N	0	F	U	0	1	2	7	0	0	0	0	0	0	0	6	0	0	0	0	0
N	0	F	U	0	7	1	5	0	0	0	0	0	0	2	7	0	0	0	0	4
N	0	F	U	0	1	2	7	0	0	0	0	0	8	5	1	0	0	0	0	0
N	0	F	U	0	1	2	7	0	0	0	0	0	8	5	1	0	0	0	0	1
N	0	F	U	0	0	0	0	0	0	0	0	1	5	5	5	0	0	0	1	3
N	0	F	U	0	0	0	0	0	0	0	0	1	5	5	5	0	0	0	3	9
N	0	F	U	0	1	2	7	0	0	0	0	0	4	3	4	0	0	0	0	0

Portion C																			
N	0	F	U	0	1	2	7	0	0	0	0	0	0	1	8	0	0	0	0

3.1.1 Land Use Zoning

The site is zoned	Residential / Industrial
Is a change of land use or a consent use application required?	No
Must a building plan be submitted to the local authority?	No

3.1.2 Route Co-ordinates

	Start	Mid-Point	End
Portion A	29° 41' 44.48"S 31° 02' 10.19"E	29° 41' 40.38"S 31° 02' 05.58"E	29° 41' 36.94"S 31° 01' 58.72"E
Portion C	29° 42' 47.19"S 31° 02' 15.37"E	29° 42' 47.17"S 31° 02' 14.50"E	29° 42' 47.23"S 31° 02' 13.84"E

3.1.3 Access/Directions

Portion A: P79 Grade Separation Bridge will be located at the Mount Edgecombe partial interchange on the R102 with a link road to Main Road 79.

Portion C: SASA Pedestrian Bridge traverses the R102 at the Mount Edgecombe Industrial Park located approximately 267 m south of Marshall Drive.

3.2 Project Description

The existing Main Road 2 section 1 (Main Road 2/1) is a single carriageway arterial road which starts at the Duffs Road Interchange at Main Road 25 (P93), viz. KwaMashu Highway, and ends at the Umdloti River Bridge in Verulam.

The proposal by the KZN DoT is to upgrade Main Road 2/1 by constructing a new partial directional interchange by-passing the existing Mount Edgecombe Interchange together with a link road to Main Road 79. This interchange will provide continuity and free-flow on Main Road 2/1 and forms part of the overall upgrading of the R102 corridor to the King Shaka International Airport.

The P79 Grade Separation is a new bridge required to form part of the proposed Mount Edgecombe partial interchange, which will provide a link from the future southbound carriageway of the R102 from Verulam, over the M41, en route to Mount Edgecombe and Durban. This grade separation is located at km 0,800 on the southbound off-ramp of the partial interchange. The underpass will form part of the Main Road 79 link to Main Road 2/1.

It is proposed that this section of Main Road 2/1 be classified as a Class U2 Major Arterial. The route will be designed accordingly for a design speed of 80 km/h. In order to remain within the minimum and maximum grade requirements a considerable volume of earthworks will be required.

The partial interchange off-ramp will have two lanes exiting the M41 and the onramp will be a single lane (refer to **Figure 3-1**).

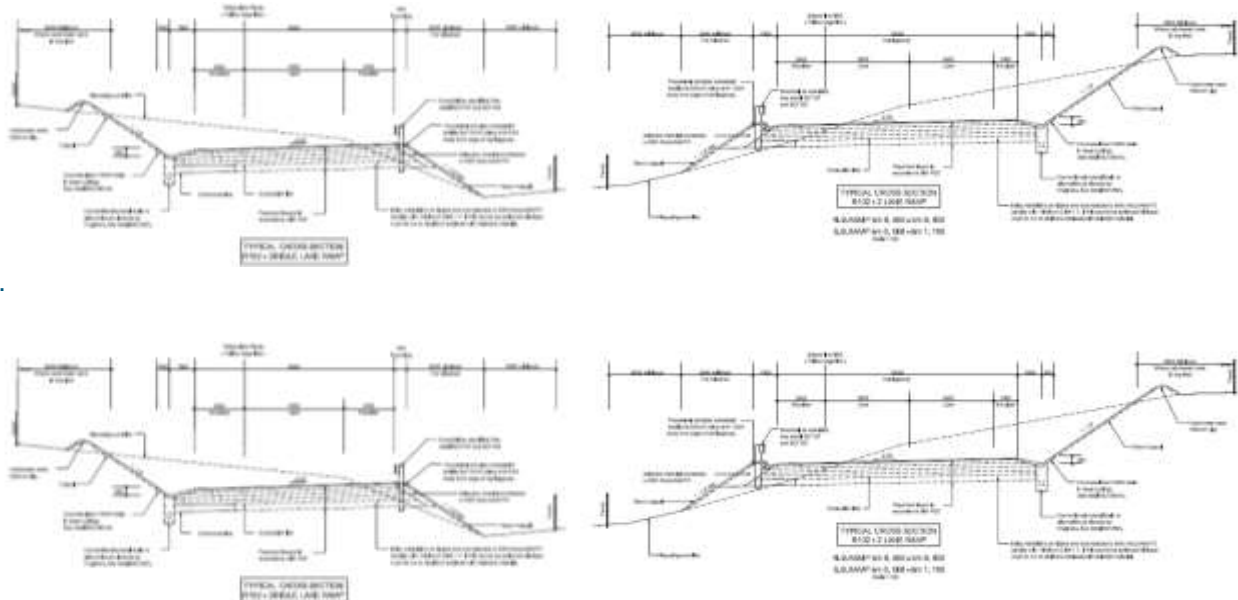


Figure 3-1: Proposed Typical Ramp Cross Section

It is proposed that formal drainage will be constructed in accordance with the typical cross sections, consisting of concrete-lined v-drains through the cuts and concrete pipe culverts (with headwalls and apron slabs) where necessary.

Mobility on the road is adversely impacted by the number and spacing of intersections and associated accesses on it. According to Technical Recommendations for Highways 26 (TRH26), a Class 2 Road should have accesses with at least 800 m spacings ($\pm 15\%$). This spacing is based on an 80 km/h design speed. The P79 link road does not make any allowance for crossing manoeuvres which would impede traffic flow.

The position of pedestrian walkways has been considered and included in the design report (**Appendix C6**). The recommended design speed of 80 km/hr for Main Road 2/1 represents a risk to the significant number of pedestrians travelling along the road edge. This risk necessitates the need for walkways protected by guardrails to be constructed along the length of Main Road 2/1.

It should be noted that an 18 month period has been allocated for the construction of the P79 Grade Separation Bridge and Linkage, and the SASA Pedestrian Bridge, commencing in November 2016.

3.3 Project Need and Desirability

The subsequent section addresses the project's need and desirability according to the DEA's Guideline on Need and Desirability¹. A number of questions are presented in the Guideline, which assists in the identification of the project's need and desirability. These key questions and answers are presented in Table 3—3 and further serve as confirmation that the proposed project is in line with the planning requirement of the Municipality and that reasonable measures have been taken to determine the best practicable environmental option for the proposed site.

¹ Department of Environmental Affairs, (2014). *Guideline on Need and Desirability in terms of the Environmental Impact Assessment Regulations, 2010.*

Table 3—3: Project Need and Desirability

Need and Desirability	
1 Is the activity permitted in terms of the property's existing land use rights? No	
	The site is currently zoned as residential / industrial. However the land use right will not need to be altered as the proposed project is a linear infrastructure project.
2 Will the activity be in line with the planning requirements (i.e. Integrated Development Plan – IDP and Spatial Development Framework - SDF) of the Local Municipality? Yes	
	According to the eThekweni Municipality (ETM) IDP (2015) ² , the upgrading of the R102 is a spatial and transport planning project, comprising of 3 Local Area Plans undertaken in parallel through an intensive transportation planning exercise. Furthermore, the ETM SDF (2014) ³ stipulates that by 2030 there should be adequate provision of services infrastructure to support densification and infill. The proposed activity is therefore in line with the ETM planning requirements.
3 Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)? Yes	
	According to the ETM IDP (2015), the proposed project is located within the Northern Urban Development Corridor (NUDC) earmarked for the upgrading of the R102 to accommodate the King Shaka International Airport and Dube Trade Port and associated development. The proposed land use is therefore best suited to the area selected for the P79 Grade Separation Bridge and Linkage onto Main Road 79.
4 Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations? No	
	There is currently no EMF for the ETM. However an EA was obtained (Reference number: DM/0133/08), for the proposed R102 and that portion of the road was constructed. Therefore the proposed activity does not conflict with any environmental management priority areas. It should also be reiterated that the proposed project is located within the NUDC earmarked for the upgrading of the R102 to accommodate the King Shaka International Airport and Dube Trade Port and associated development (EDM IDP) and therefore the existing environmental priorities for the area will not be compromised.
5 Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.) Yes	
	As stated in the ETM IDP and SDF, one of the priority needs is to provide infrastructure within the NUDC. Therefore, the community does need this activity.
6 Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? No	
	There is sufficient electricity supply currently available at the existing R102 and Main Road 79. However there is insufficient water supply within the study area to undertake construction of the R102 upgrades.

² eThekweni Municipality, (2015). eThekweni Integrated Development Plan, 2015-16.

³ eThekweni Municipality, (2014). eThekweni Spatial Development Framework (SDF) Report 2014/15 Review.

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Therefore raw water sources will be utilised.

7 Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? Yes

The proposed project is specifically provided for in the IDP as the proposed project is located within the NUDC earmarked for the upgrading of the R102 to accommodate the King Shaka International Airport and Dube Trade Port and associated development.

8 Is this project part of a national programme to address an issue of national concern or importance? Yes

The proposed project falls within Strategic Infrastructure Projects (SIPs):

- **SIP 7:** Integrated urban space and public transport programme. Coordinate planning and implementation of public transport, human settlement, economic and social infrastructure and location decisions into sustainable urban settlements connected by densified transport corridors. This will focus on the 12 largest urban centres of the country, including all the metros in South Africa. Significant work is underway on urban transport integration.

9 Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.) Yes

As indicated in Point 2 above, the upgrading of the R102 is a spatial and transport planning project, comprising of 3 Local Area Plans undertaken in parallel through an intensive transportation planning exercise. Furthermore, by 2030 there should be adequate provision of services infrastructure to support densification and infill.

10 Is the development the best practicable environmental option for this land/site? Yes

An Environmental Authorisation (EA) was obtained (reference number: DM/0133/08), for the proposed R102 and partial interchange and a portion of the road was constructed. Since then two additional (P79 Grade Separation Bridge and SASA Pedestrian Bridge) components have been included which did not form part of the initial assessment. Therefore the site selection analysis was conducted in the Initial Phase for the proposed project to determine the site location of the R102. No alternatives have been considered for the P79 Grade Separation Bridge and Linkage as this project is considered an enhancement and upgrading of existing road infrastructure.

Even though the P79 Grade Separation Bridge and Linkage traverses a wetland, it is unlikely that this upgrade will have a significant impact on the wetland as the wetland is in a poor / largely modified condition and with a Low ecological importance and sensitivity.

11 Will the benefits of the proposed land use / development outweigh the negative impacts of it? Yes

As the R102 is an existing road serving the communities along its route and it could possibly serve as an alternative route to the N2 Highway to the King Shaka International Airport, the proposed upgrade of the R102 is an extremely important project in terms of overall transport planning in the City.

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The P79 Grade Separation Bridge and Linkage will provide continuity and free-flow on Main Road 2/1 and forms part of the overall upgrading of the R102 corridor to the King Shaka International Airport.

12 Will the proposed activity / ies contribute to any of the 17 Strategic Integrated Projects (SIPs)? **Yes**

The proposed project falls within Strategic Infrastructure Projects (SIPs):

- **SIP 7:** Integrated urban space and public transport programme. Coordinate planning and implementation of public transport, human settlement, economic and social infrastructure and location decisions into sustainable urban settlements connected by densified transport corridors. This will focus on the 12 largest urban centres of the country, including all the metros in South Africa. Significant work is underway on urban transport integration.

13 How does the project fit into the National Development Plan for 2030?

According to the National Development Plan 2030, a more efficient and competitive infrastructure needs to be developed. This infrastructure will facilitate economic activity and will be conducive to growth and job creation.

This proposed project is therefore in line with the objectives, presented above as it will ensure that the R102 and associated infrastructure is suitable for the movement of goods, services and people.

14 Have the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account. **Yes**

The BA study for the proposed project, had the following key objectives:

- Undertake an assessment of the social and biophysical environments of the affected area by the proposed project;
- Undertake a detailed assessment of the site in terms of environmental criteria including the rating of significant impacts as well as cumulative impacts (Section 8);
- Identify and recommend appropriate mitigation measures (included in **Appendix B** - EMPr) for potentially significant environmental impacts; and
- Undertake a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns were recorded and commented on and addressed in the EIA process (refer to **Appendix E**).

All of these objectives have been met and this has culminated in the formulation of an Environmental Impact Statement by the EAP.

15 Describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.

- **Regulatory and statutory compliance:** the objectives of the proposed project are to ensure compliance with applicable legislation, guidelines, regulations and standards. An EA has already been received for the initial R102 upgrade works. In order to ensure that the additional components are compliant with EIA Regulation (2014), a BA will be conducted and impacts will be determined and assessed.
- **Environmentally:** The results of the impact assessment indicate that the most significant impacts as a

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result of the proposed project would include impacts on ecology, surface water and heritage. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines and the EMPr (refer to Section 8 and **Appendix B**).

- Public Participation (PP) - One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment". A comprehensive PP process has been undertaken for the project (refer to **Appendix E**).

4 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014) 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

An Environmental Authorisation (EA) was obtained (reference number: DM/0133/08), for the proposed R102 and partial interchange and a portion of the road was constructed. Therefore, site and activity alternatives will not be assessed as this project is considered an enhancement and upgrading of existing road infrastructure. Furthermore, the proposal involves linking of key infrastructure which is already authorised and / or constructed (**Figure 4-1**).

4.2 Layout / Route Alignment Alternatives

As part of the Go Durban Integrated Rapid Public Transport Network (IRPTN) Corridor 9, the eThekweni Transport Authority (ETA) has plans to upgrade the Phoenix Interchange. The proximity and configuration of this interchange does not make provision for a northbound on-ramp and a southbound off-ramp for Main Road 2/1 and the M41. It was decided to continue the Main Road 2/1 through the vacant lot between the M41 and the current P79 and create a road intersection before the Terrance overpass. An at-grade intersection was considered for the P79 link from Main Road 2/1. This partial interchange has formed part of the City's planning for some time, and an alternate link cannot be easily accommodated considering the present and future authorised road network in the area.

In terms of the SASA pedestrian bridge, there are a number of existing pedestrian bridges along the R102. The SASA pedestrian bridge provides key a linkage for pedestrians across this busy roadway, improving pedestrian safety. The SASA pedestrian bridge does not traverse any watercourses, and moving the pedestrian bridge further up or down the road is not feasible due to the close proximity to other pedestrian bridges and / or the presence of watercourses.



Figure 4-1: The R102 and Partial Interchange Alignment Approved Previously

4.3 No-go Alternative

Due to increasing traffic volumes along the R102 as a result of increased urbanisation, an improvement to transport infrastructure is required. As the R102 is an existing road servicing the communities along its route and it could possibly serve as an alternative route to the King Shaka International Airport. The proposed upgrade of the R102 is an extremely important project in terms of overall transport planning in the City.

Currently, there are high traffic volumes on the R102 and ancillary roads including the Main Road 2/1 and M41 due to an increase in urbanisation within the area. There is a need to upgrade the R102 and provide the necessary interchanges and linkages to ancillary roads such as the P79.

Should the *status quo* remain then R102 and ancillary roads will not be able to accommodate the increased traffic volumes and the current situation will continue which includes:

- Increased traffic pressure on road surfaces leading to traffic congestion and time delays;
- No provision for a northbound onramp and a southbound off-ramp for Main Road 2/1 and the M41; and
- Limited movement of traffic within the area.

5 BASELINE DESCRIPTION OF THE STUDY AREA

5.1 Biophysical Environment

5.1.1 Climate

The study area is coastal with a summer rainfall and a warm humid climate throughout the year. No frost occurs within the study area and is thus ideal for most crops including sub-tropical crops. Mean annual precipitation is 989 mm and mean annual potential evaporation is 1 659 mm.

Table 5—1: Climate data from SASA Experiment Station, Mount Edgecombe

	TMX	TMN	DBA	WBA	RHA	DBP	WBP	RHP	SUN	RAIN	EVP	WND
	°C	°C	°C	°C	%	°C	°C	%	h	mm	mm/d	km/d
Jan	27.3	19.7	23.8	21.0	77.3	26.2	22.2	69.9	6.0	126.7	5.6	163.9
Feb	27.5	19.9	23.7	21.2	79.5	26.6	22.6	69.9	6.4	122.0	5.4	152
Mar	27.0	19.3	22.7	20.5	80.9	26.0	22.0	69.4	6.6	105.1	4.6	136.9
Apr	25.6	16.7	20.3	18.2	80.8	24.6	20.3	66.2	7.0	67.1	3.7	114.7
May	24.2	13.7	17.3	14.9	75.9	23.2	18.2	60.6	7.3	50.7	2.9	94.9
Jun	22.7	11.4	14.4	11.6	69.8	21.7	16.0	53.6	7.4	30.9	2.5	90.7
Jul	22.8	11.1	14.2	11.4	70.6	21.4	15.7	53.8	7.5	31.5	2.7	101.4
Aug	22.8	12.3	16.0	13.4	74.1	21.7	16.6	58.6	7.0	40.2	3.2	128.9
Sept	23.3	14.4	18.4	15.7	74.8	22.0	17.7	64.4	6.0	65.8	3.8	156.7
Oct	24.1	16.2	20.2	17.3	74.1	22.6	18.6	67.7	5.6	93.5	4.4	178.0
Nov	25.2	17.7	21.9	18.8	74.0	23.7	19.9	69.8	5.6	107.6	4.9	177.6
Dec	26.6	19.1	23.3	20.3	75.1	25.2	21.3	70.0	5.9	115.0	5.5	170.3
Mean	24.9	16.0	19.7	17.0	75.6	23.7	19.3	64.5	6.5	79.7	4.1	138.8

TMX – Maximum temp

TMN – Minimum temp

DBA – Dry bulb 8:00

WBA – Wet bulk 8:00

RHA – Relative humidity 8:00

DBP – Dry bulk 14:00

WBP – Wet bulk 14:00

RHP – Relative humidity 14:00

SUN – Sunshine hours

RAIN – Rainfall

EVAP – A-pan evaporation

WND – Wind run

5.1.2 Geology, Soils and Topography

The following description is from the Moore Spence Jones Geotechnical Report (**December 2008**) conducted for the initial R102 upgrade. The R102 is underlain by fill, alluvial and residual soils overlying a succession of shales of the Pietermaritzburg Formation (Ecca Group), Karoo Supergroup. In the northern part of the R102 is composed of the Vryheid Formation (Ecca Group) shales and sandstone. These successions have been intruded by dolerite sill of the Jurassic Age.

The average inclination of the shale bedding planes is expected to range between 6° and 15° generally dipping towards the east. It is also likely that large variations in the dip and direction of dip will be encountered closer to intrusion contact zones with dolerite intrusions. Potentially unstable slopes can arise where new road cuttings expose unfavourably dipping shale beds, resulting in a requirement for lateral support.

The topography along the route comprises gentle to moderate rolling hills. There are no steep or very steep portions along the R102. Adjacent to the road there are localised areas of steep to very steep slopes which resulted from the cut and fill slopes created during the construction of the existing road as well as where the road traverses drainage channels and rivers.

5.1.3 Vegetation

The study area falls within both the Savanna Biome (one of the four main biomes in KwaZulu-Natal) and regionally within the Indian Ocean Coastal Belt Bioregion⁴. At a local scale, the study area falls within the KwaZulu-Natal Coastal Belt (CB 3) Vegetation Type (*ibid*). The extent of the vegetation type is shown in **Figure 5-1**. This classification is consistent with the KZN Vegetation Types⁵. EKZNW (2012) also identified several other vegetation types which occur within the general vicinity of the study areas. Of particular relevance is the Freshwater Wetlands: Subtropical Freshwater Wetland (AZf6) which occurs next to the proposed pedestrian bridge crossing (**Figure 5-2**). It should be noted that the site is transformed as the benchmark vegetation types reflect historical vegetation coverages. The KwaZulu-Natal Coastal Belt (CB 3) Vegetation Type is the reference or benchmark vegetation type by which the findings of the vegetation survey were compared in order to establish the level of habitat degradation and transformation.

Details of the KwaZulu-Natal Coastal Belt Vegetation Type are provided below:

KwaZulu-Natal Coastal Belt (CB3)

National Threat Status: Endangered (EN)

Provincial Threat Status: Critically Endangered (CR)

Conservation Status: Conserved only in Ngoye, Mbambuzi and Vernon Crookes Nature Reserves.

⁴ Mucina, L. and Rutherford, M. C. (eds), 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

⁵ Ezemvelo KwaZulu-Natal Wildlife, 2012. *Provincial Vegetation Map*.

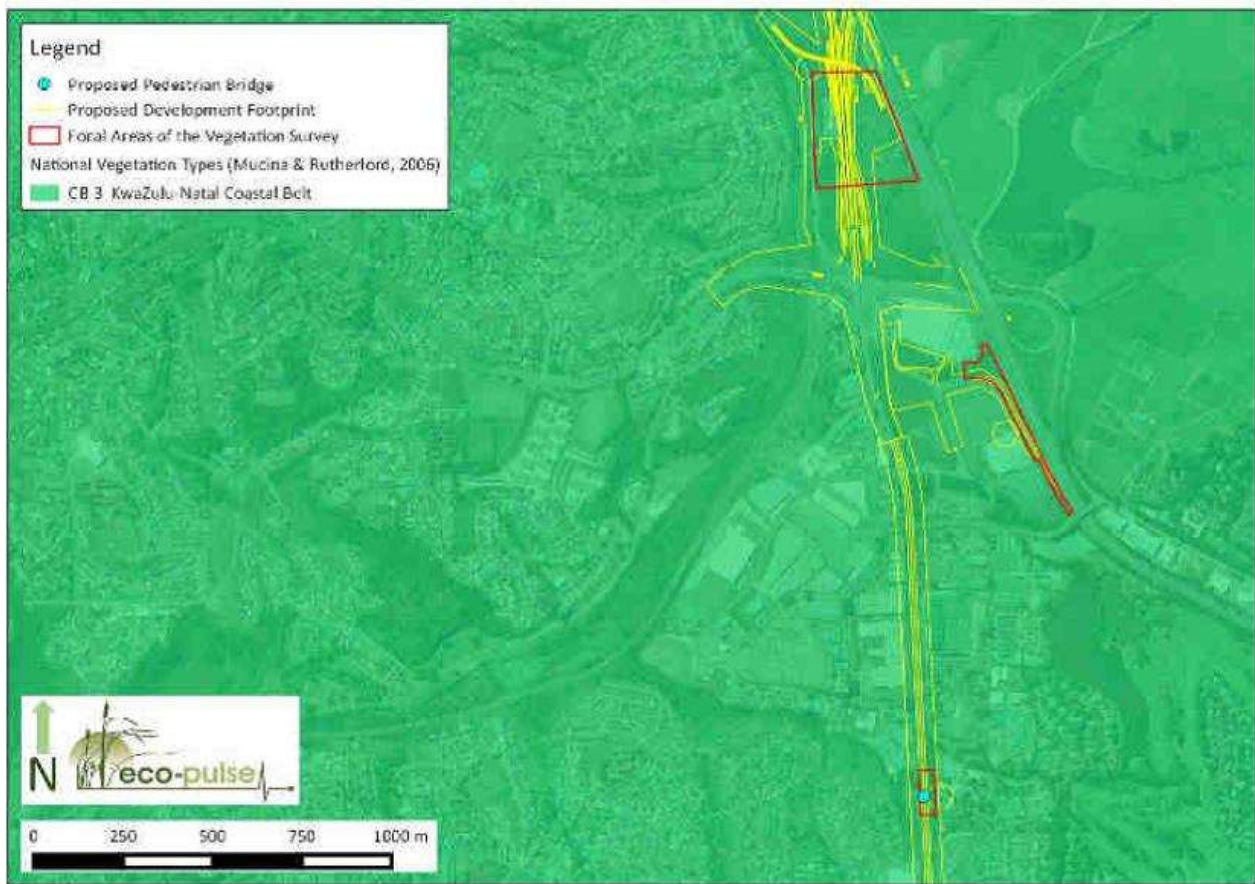


Figure 5-1: Map showing the outputs of the National Vegetation Type Map according to Mucina and Rutherford (2006).

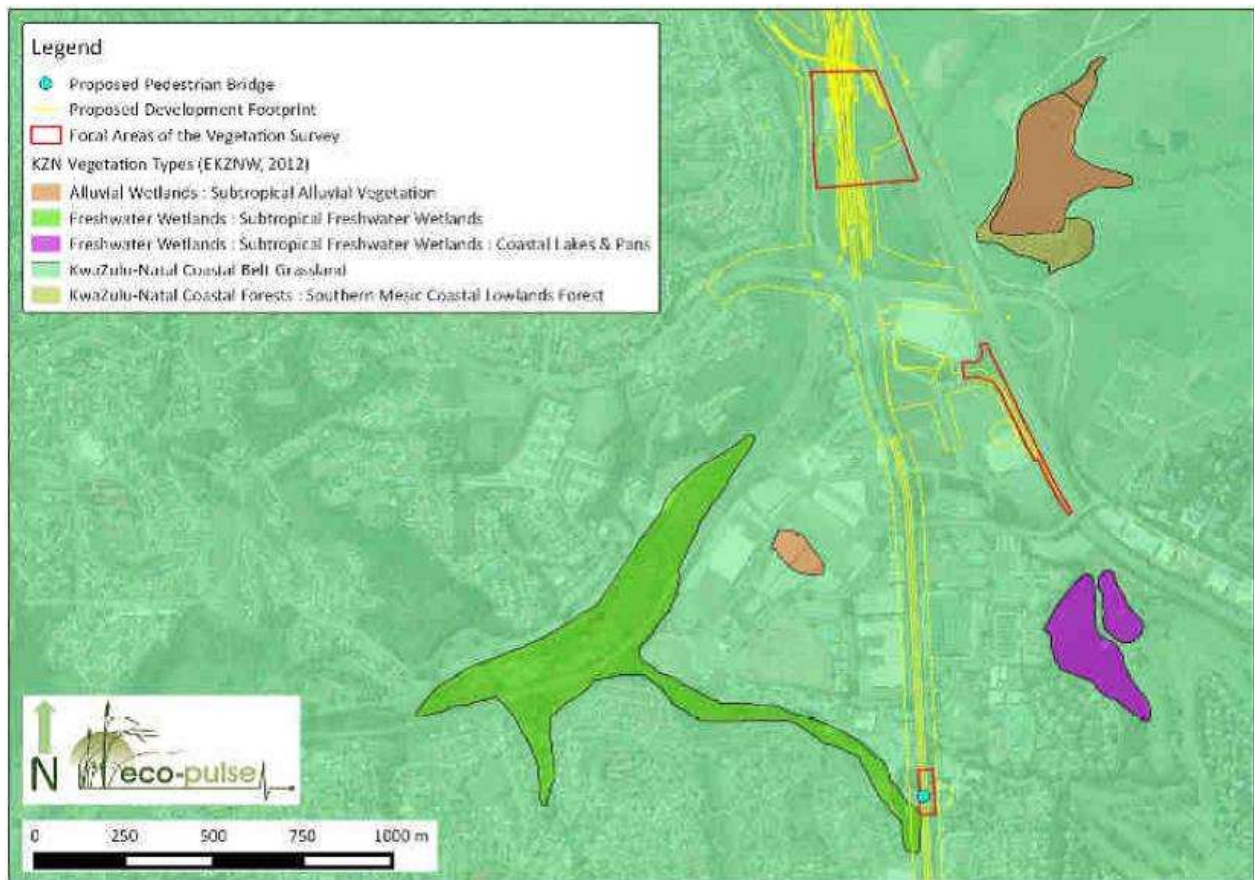


Figure 5-2: Map showing outputs of the Provincial Vegetation Type Map for the Study Area according to EKZNW (2012).

5.1.3.1 KZN Vegetation Map

Five (5) provincial vegetation types have been mapped for the study area, many of which are no longer well-represented at the site due to the level of transformation of land cover that has occurred in this highly urbanised and developed area (**Figure 5-2**). Terrestrial vegetation (i.e. Southern Mesic Coastal Lowlands Forest and KZN Coastal Belt Grassland, both Critically Endangered in terms of their threat status) are no longer represented at the site due to transformation and alien plant invasion, with two riparian / wetland vegetation types (i.e. Subtropical Freshwater Wetlands and Subtropical Alluvial Vegetation associated with river floodplains) which are present at the site. The habitat and vegetation have been largely altered from the natural / reference state as a result of habitat destruction, general disturbance and alien plant infestation levels being high (generally replacing native plant species).

5.1.3.2 Terrestrial Systemic Conservation Plan (CPlan)

The entire construction footprint is classified as a “Critical Biodiversity Area 1 (Mandatory)” in terms of the KZN Terrestrial Systemic Conservation Plan (**Figure 5-3**). This classification means that these planning units represent the only localities for which the conservation targets for one or more of the biodiversity features contained within it can be achieved (i.e. there are no alternative sites available⁶). The following flora and vegetation types are known or modelled to exist within Critical Biodiversity Area 1 for the study area:

⁶ Ezemvelo KwaZulu-Natal Wildlife, 2011. *Biodiversity Impact Assessment Handbook for KwaZulu-Natal. Version 1.0, Final Draft, June 2011. EKZNW IEM Section.*

- North Coast grassland (Vegetation Type);
- KwaZulu-Natal Coastal Forest (Vegetation Type);
- *Vernonia africana* / *Vernonella africana* (Extinct flora, South African Endemic); and
- *Barleria natalensis* (Extinct flora, South African Endemic).

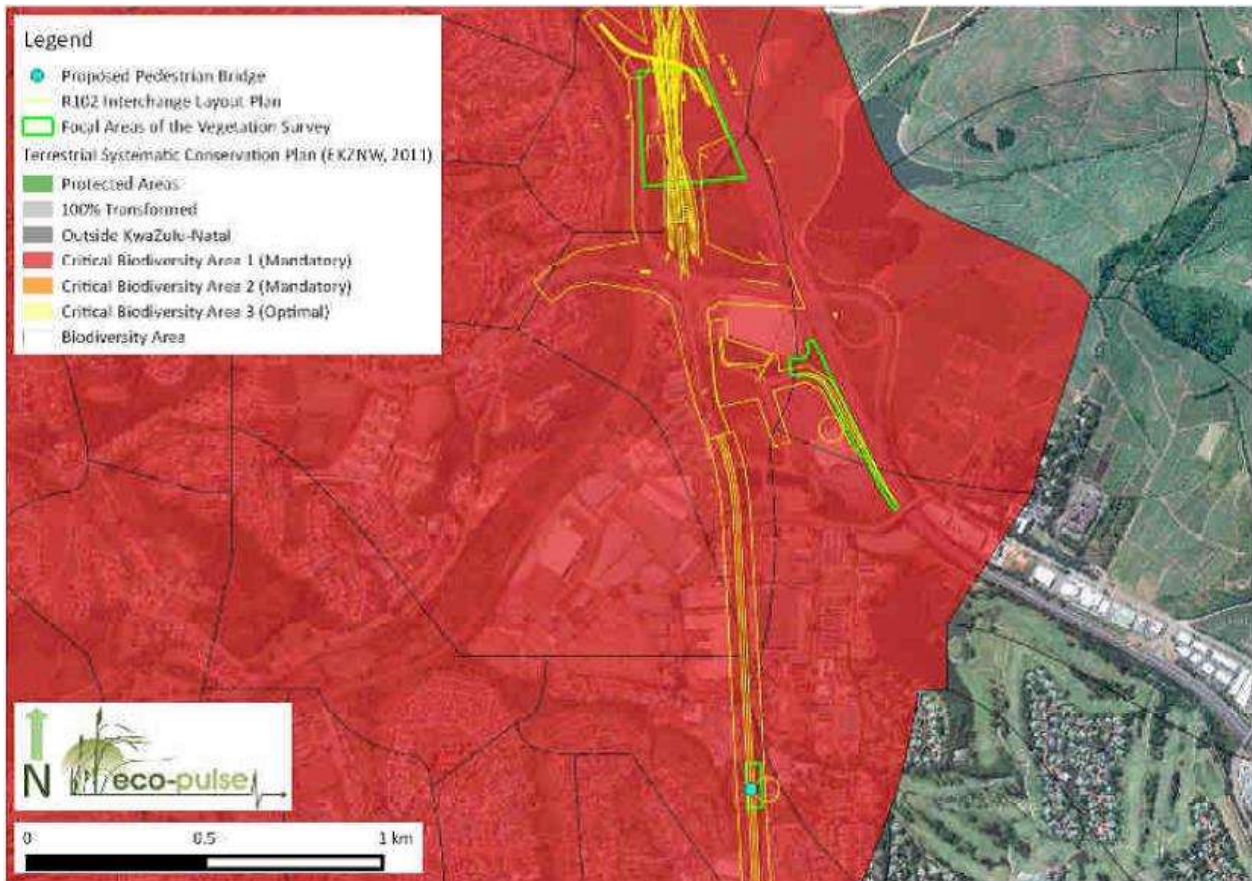


Figure 5-3: Terrestrial Systematic Conservation Plan for KZN (Ezemvelo KZN Wildlife, 2010⁷)

5.1.3.3 Durban Metropolitan Open Space System (D'MOSS)

The Durban Metropolitan Open Space system or D'MOSS is made up of a series of interconnected open spaces that incorporate areas of high biodiversity value and other supporting elements, delivering a range of ecosystem goods and services (EG&S) including water supply, food, raw materials, soil formation processes, nutrient cycling, erosion control, flood attenuation and climate change mitigation (i.e. carbon storage capacity).

The ecosystem goods and services provided free of charge by D'MOSS were conservatively valued in 2003 to be in the order of R 3.1 billion per annum, excluding the value that open space contributes to tourism. Without these free services, the municipality would require an unaffordable increase to its budget to provide these services, especially in rural areas where communities rely heavily on the natural environment for daily needs⁸. D'MOSS is incorporated into the city's Integrated Development Plan (IDP),

⁷ Ezemvelo KwaZulu-Natal Wildlife, 2010. *Terrestrial Systematic Conservation Plan: Minimum Selection Surface (MINSET)*. Unpublished GIS Coverage [tscp_minset_dist_2010_wll.zip], Biodiversity Conservation Planning Division, Ezemvelo KZN Wildlife, P. O. Box 13053, Cascades, Pietermaritzburg, 3202.

⁸ online reference: <http://www.durban.gov.za>

associated Strategic Development Framework (SDF) and the regional Spatial Development Plans (SDP). D'MOSS areas identified around the study area are unlikely to be directly impacted by the proposed development (**Figure 5-4**).

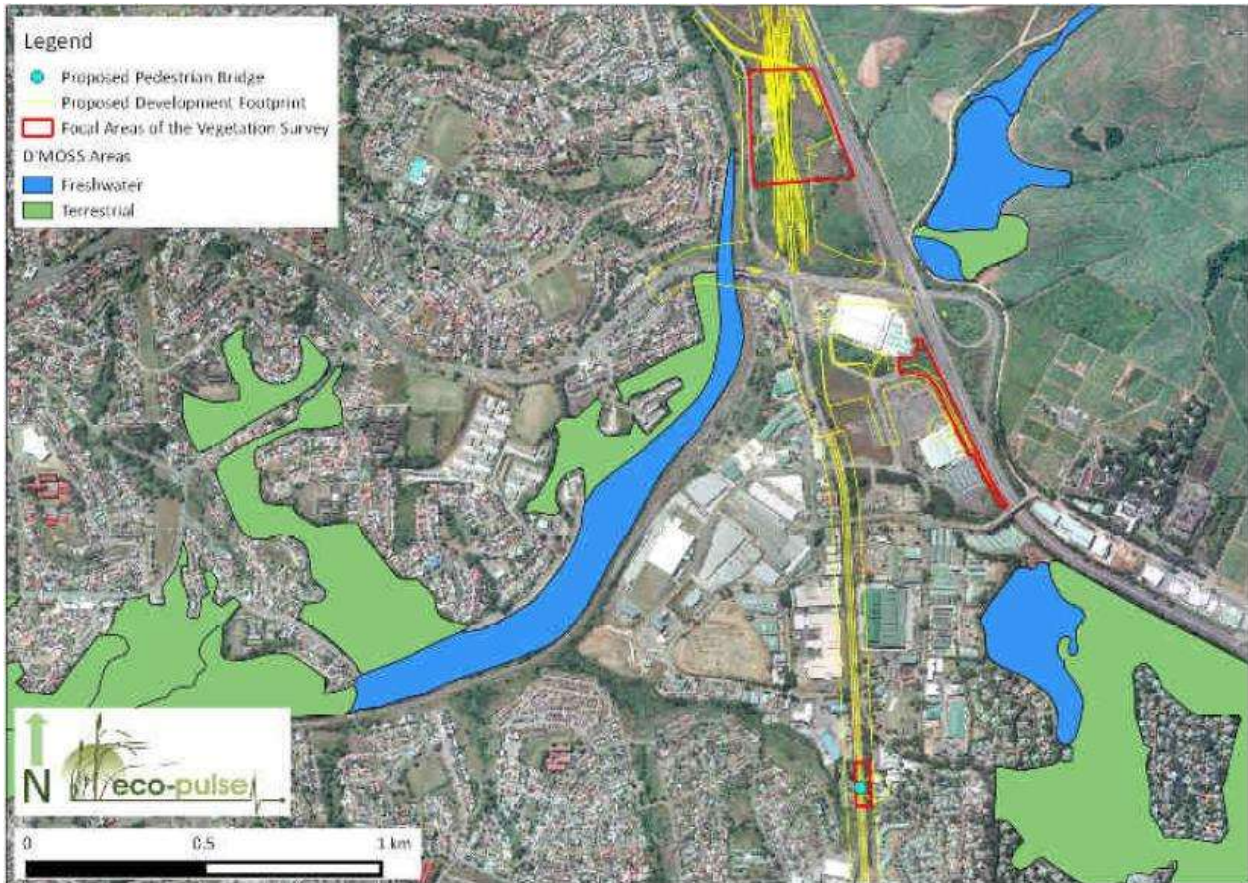


Figure 5-4: Map showing the Durban Metropolitan Open Space System coverage (eThekweni Municipality, 2011)

5.1.3.4 Regional Connectivity

Maintaining connectivity between natural areas is considered critical for the long term persistence of both ecosystems and species, in the face of human development and changes in global climatic conditions. Natural ecological corridors/linkages are therefore considered crucial for allowing species to migrate naturally and to accommodate shifts in species ranges in response to climate change. Due to high levels of infrastructural development within the local area, natural connectivity has already been severely compromised, with only small, fragmented pockets of semi-natural grassland and bushland / thicket habitat remaining in many instances. Alien vegetation has also replaced large areas of natural habitat. Natural ecological linkage is severed by a number of large, multi-lane tarred roads and industrial/commercial development.

5.1.3.5 Potential Plant Species of Conservation Concern

Species of conservation concern are plant species that have a high conservation importance in terms of preserving South Africa's high biological diversity and include threatened species that have been classified as 'at high risk of extinction in the wild'. Interrogation of SANBI's website and threatened species database and the outputs of the Provincial Terrestrial Systematic Conservation Plan (or CPlan) indicated flora of conservation concern that could potentially occur in the project area (**Table 5—2**).

Based on the habitat requirements / preferences and distributional / altitudinal ranges for these key species, a number of Declining, Near Threatened (NT) and Critically Endangered (CR), Possibly Extinct (PE) plants could potentially occur within the more intact vegetation on site. Field investigations did not confirm the presence of any of these species at the site; however, the potential occurrence of some of the species cannot be overlooked entirely.

Table 5—2: Potential Species of Conservation Concern for the Study Area Terrestrial Habitats

Family	Botanical Name	Threat Status	SA Endemism	Description	Potential Occurrence on Site
FABACEAE	<i>Lotononis dichiloides</i>	CR (EW)	Endemic	Perennial herb	Unlikely
ASPHODELACEAE	<i>Kniphofia littoralis</i>	NT	Endemic	Perennial herb	Unlikely
CELASTRACEAE	<i>Elaeodendron croceum</i>	Declining	No	Perennial tree	Possible
ASTERACEAE	<i>Vernonia africana</i> (<i>Vernonella africana</i>)	Extinct	Endemic	Herb	Unlikely
ACANTHACEAE	<i>Barleria natalensis</i>	Extinct	Endemic	Herb	Unlikely
AMARYLLIDACEAE	<i>Crinum macowanii</i>	Declining	No	Perennial Geophyte	Possible
HYPOXIDACEAE	<i>Hypoxis hemerocallidea</i>	Declining	No	Perennial Geophyte	Possible
ORCHIDACEAE	<i>Disperis woodii</i>	Declining	No	Perennial Geophyte, herb	Possible
PASSIFLORACEAE	<i>Adenia gummifera</i>	Declining	No	Perennial, climber, succulent	Possible
RHIZOPHORACEAE	<i>Cassipourea malosana</i>	Declining	No	Perennial, Shrub	Possible

5.1.4 Surface Hydrology

5.1.4.1 Local Drainage Setting

The local drainage setting falls within uMvoti-Mzimkhulu Water Management Area (WMA). The proposed road and interchange development footprint are located primarily within DWA Quaternary catchment U20M. This catchment is drained by a tributary of the perennial uMhlangane River which drains the western half of the study area in a south-easterly direction and eventually discharges into the large perennial uMgeni River in the south, prior to entering the South Indian Ocean. A small portion of the site in the north falls within the adjacent catchment U30B which is drained by the perennial Ohlanga River. The proposed development is shown in **Figure 5-5** with quaternary catchments and local/regional drainage indicated on the map.

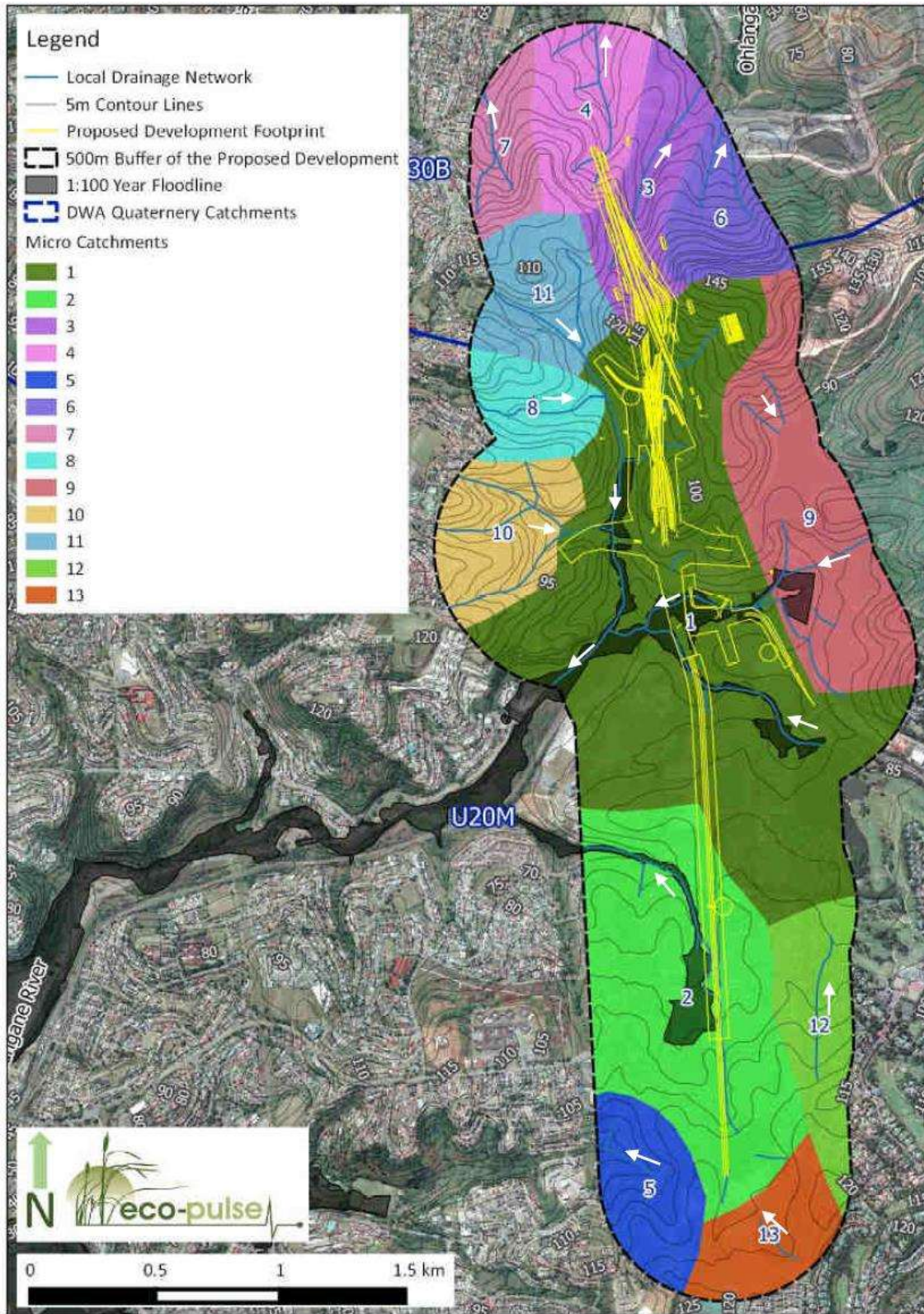


Figure 5-6: Local Drainage Setting and Wetland/River Micro-catchments identified and mapped within a 500 m radius of the proposed R102 interchange and road upgrade development (General directions of flow are indicated by the “white” arrow markers)

5.1.5 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Area (NFEPA) project⁹, is the first formally adopted national freshwater conservation plan that provides strategic spatial priorities for conserving the country's freshwater ecosystems and supporting the sustainable use of water resource units that includes rivers, wetlands and estuaries. Wetlands identified within the 500 m radius of the proposed development and downstream areas have not been classified as wetland FEPAs. The large perennial river systems located further downstream are regarded as FEPAs and need to be managed such that current ecological integrity and functioning is protected. This includes managing the upstream catchment and network of tributary feeder rivers and streams that ultimately flow into these systems.

The mapping of wetlands for the NFEPA project was undertaken at a broad desktop-level relying on existing wetland datasets for the Province and must therefore be interpreted with caution.

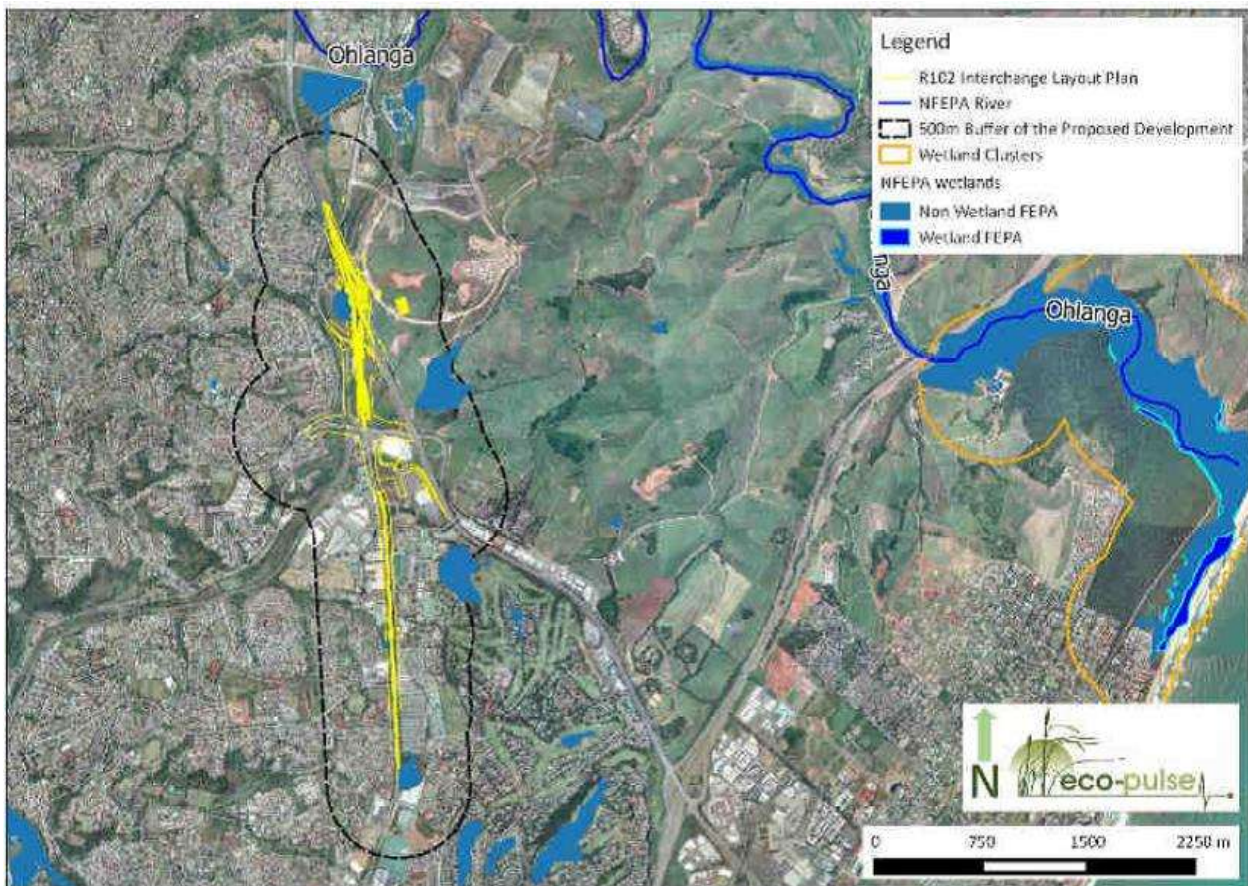


Figure 5-7: Map indicating the Location of Wetland FEPAs and Non-wetland FEPAs, FEPA rivers and Wetland Clusters

⁹ Nel, J. L., Murray, K. M., AM Maherry, A. M., Petersen, C. P., DJ Roux, D. J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E. R., Smith-Adao, L. B., Mbona, N., Downsborough, L. and Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. Report to the Water Research Commission. WRC Report No. 1801/2/11.

5.2 Socio-economic Environment

5.2.1 Heritage

The region contains a wide spectrum of archaeological sites covering different time-periods and cultural traditions. These range from Early Stone Age, Middle Stone Age, and Later Stone Age to Early Iron Age, Middle Iron Age, and Later Iron Age sites. Two notable Middle Stone Age sites, i.e. Umhlatuzana near Mariannhill and Segubudu near Stanger have been excavated in the last two decades and yielded impressive archaeological stratigraphies relating to the period associated with the origins of anatomically modern people.

The Umhlatuzana shelter is situated approximately 15 km to the south of the study area. Apart from an impressive stone tool assemblage covering both Later and Middle Stone Age periods it has also yielded faunal remains of large mammals that became extinct during the early Holocene such as the giant buffalo (*Pelarovis* sp).

Also notable is the Shongweni Later Stone Age shelter which was excavated in the 1970's by Dr Oliver Davies. Shongweni is situated approximately 25 km to the south of the study area in the Umlazi River Valley. This shelter yielded some of the earliest remains of domesticated cereals in South Africa. The same site also yielded some of the only San rock art in the greater Durban area¹⁰.

5.2.2 Land-use

The land use within the region is dominated by urban / industrial areas and sugarcane cultivation.

Land use along the R102 from the P79 Grade Separation Bridge to SASA Pedestrian Bridge comprises a mixture of high density residential, commercial, light industrial and agricultural use.

Table 5—3: Surrounding Land Uses

Description	Y/N	Description	Y/N
Natural area	N	Light industrial	Y
Low density residential	Y	Medium industrial	Y
Medium density residential	Y	Heavy industrial	N
High density residential	Y	Power station	N
Informal residential	N	Military or police base/station/compound	N
Retail commercial & warehousing	Y	Spoil heap or slimes dam	N
Office/consulting room	Y	Dam or reservoir	Y
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

¹⁰ Mazel, A, 1989. *The Stone Age peoples of Natal*. In Duminy, A & Guest, B.(eds). *Natal and Zululand: From Earliest Times to 1910 – A New History: 1 - 27*. University of KwaZulu-Natal Press.

Description	Y/N	Description	Y/N
Railway line	N	Major road (4 lanes or more)	Y
Harbour	N	Plantation	Y
Sport facilities	N	Agriculture	Y
Golf course	N	River, stream or wetland	Y
Polo fields	N	Nature conservation area	N
Filling station	Y	Mountain, koppie or ridge	N
Landfill or waste treatment site	N	Museum	N
Historical building	N	Protected Area	N
Graveyard	Y	Archaeological site	N
Airport	N	Other:	N

Key: Y = Yes P = Possibly N = N

6 PUBLIC PARTICIPATION PROCESS

Public participation is a process 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. 733) under the NEMA (as amended).

The public participation process for proposed R102 Upgrades Project will be undertaken according to the stages outlined below.

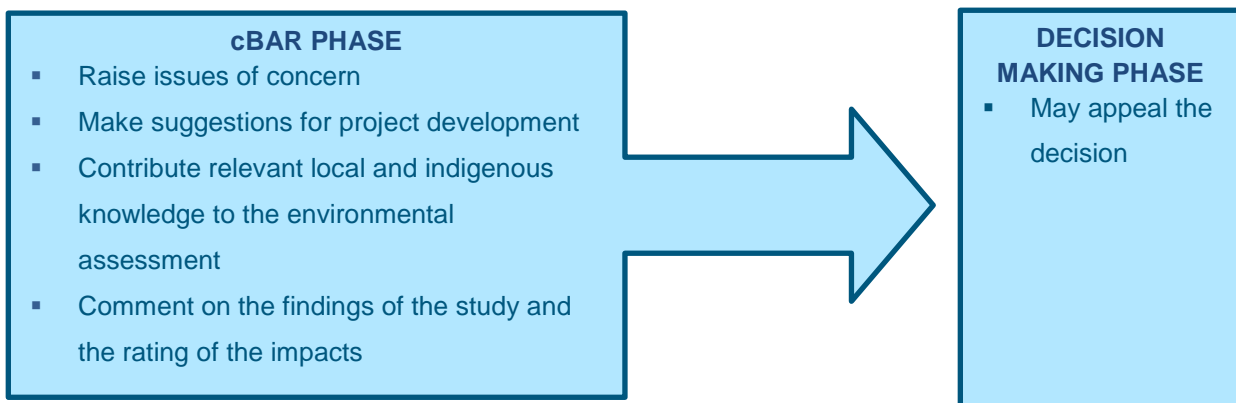


Figure 6-1: Responsibilities of I&APs in the different PPP stages

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

- The identification of stakeholders
 - 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 proposed development;
- The development of a living and dynamic database that captures details of stakeholders from all sectors;
- The continued engagement of public leaders to whom the public generally turn for information, keeping such individuals well informed about process and progress;
- 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.

Specifically the proposed R102 Upgrades Project BA PPP will entail the following activities.

6.1 Authority Consultation

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

Authority consultation to date includes the following activities:

- Pre-application consultation in the form of an upfront meeting with Ms Natasha Brijlal of the KZN EDTEA on the 24th August 2015.

6.2 Consultation with Other Relevant Stakeholders

Consultation with other relevant key stakeholders will be undertaken through telephone calls and written correspondence in order to actively engage these stakeholders throughout the BA process.

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

The identified stakeholders of this project include:

Table 6—1: Key Stakeholders contacted as part of the Public Participation Process

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE	
Ms. Diane van Rensburg	eThekweni Municipality

Mr Viwe Tlaleane	Transnet
Mr Mohammed Hussen	Mount Edgecombe Park Properties
Mr Jon Dodd	Mount Edgecombe Park Properties
Mr Rory Wilkinson	Tongaat Hulett Developments
Numerous individual property owners, businesses and/or home occupants along the R102.	
LOCAL AUTHORITY	
Ms. Diane van Rensburg	eThekweni Municipality
Mr Solly Singh	Phoenix Councillor
Mr Ramsamy Moodley	Phoenix Councillor
Mr Musa Dudla	Mount Edgecombe Councillor
PROVINCIAL AUTHORITY	
Ms. Weziwe Tshabalala	Amafa KwaZulu-Natal
Ms. Natasha Brijjal	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
Ms. Seokwang Modise	KwaZulu-Natal Department of Agriculture, Forestry and Fisheries
Mr. Andy Blackmore	Ezemvelo KZN Wildlife
Mr Casper Landman	SANRAL
STATE DEPARTMENTS	
Ms. Shameela Rambullan	National Department of Water and Sanitation

6.3 Site Notification

The NEMA EIA Regulations (2014) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates and at points of access or high through traffic. The purpose of this is to notify the public of the project and to invite the public to register as stakeholders and inform them of the PP Process.

Royal HaskoningDHV has erected 30 notices at various noticeable locations along the alignment. Details of location and photographs are presented in the PPP Summary Report (refer to [Appendix E](#)).

6.4 Identification of Interested and Affected Parties

I&APs have been identified primarily from responses received from the notices mentioned above. E-mails will be sent to key stakeholders and other known I&APs, informing them of the application for the project, the availability of the cBAR for review and indicating how they can become involved in the project.

Additionally hard copies of the cBAR will be made available the Stanmore and Stonebridge Libraries.

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 briefing paper or Background Information Document (BID) for the proposed project was compiled in English (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.

Approximately 800 BIDs were distributed to I&APs along the alignment and within the general vicinity, together with a registration / comment sheets inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

6.6 Advertising

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

- The Mercury on the 9th January 2017 (Refer to **Appendix E**).

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

6.7 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 Report.

The Issues Trail will be included in the fBAR, in which all comments received and responses provided will be captured.

6.8 Key Issues Raised by the Public (Summarised)

Key issues raised will be summarised in the table below once the consultation BAR has been reviewed by the public.

Table 6—2: Summary of issues raised throughout the BAR process

Issued Raised	Response
To be updated in fBAR	

6.9 Public Review of Reports

All registered I&APs will be notified of the availability of the report via email and through the placement of an advert in the Mercury newspaper.

The cBAR will be made available for authority and public review for 30 days from 11th January 2017 to 10th February 2017.

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

- Stanmore Library – 2 Elf Grove Way, Grove End; and
- Stonebridge Library – 5 Shortbridge Place, Phoenix.

In addition, the reports will be made available at the following places for viewing;

- Electronically on the Royal HaskoningDHV Website: www.rhdhv.co.za.

6.10 Final 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.

This final BAR (i.e. fBAR) is the product of all comments and specialist studies, compiled prior to being submitted to KZN EDTEA for review and decision-making.

6.11 PPP Summary

Table 6—3: Summary of Public Participation Process

Activity	Description	Reference
Identifying stakeholders	Stakeholders have been and will continue to be identified and a database of all I&APs will be compiled.	<i>Appendix E</i>
Publishing newspaper adverts	The Mercury	<i>Appendix E</i>
Distribution of a BID	BIDs will be distributed electronically and by hand to I&APs	<i>Appendix E</i>
Erection of site notices	A number of A2 site notices will be erected on the perimeter of the site.	<i>Appendix E</i>
Preparation of an on-going Issues Trail	Comments, issues of concern and suggestions received from stakeholders will be captured in a Comment and Response Report.	<i>Appendix E</i>
Release of Draft Reports	The Consultation Basic Assessment Report (cBAR) will be advertised and made available for a period of 30 days for public review and comment. This cBAR will be made available for review until 10 February 2017.	<i>Appendix E</i>
Release of final Reports	This final Basic Assessment Report is the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.	<i>Appendix E</i>

7 SUMMARY OF THE SPECIALIST ASSESSMENTS

7.1 Geotechnical Assessment

7.1.1 General Slope Stability

Saturation of the loose, cohesionless sands of the Berea Formation can result in liquefaction of these materials, resulting in down slope earth flows. The dip of the shale beds may impact on the widening of road cuttings and where considered by a suitably qualified geotechnical engineer/engineering geologist to present stability problems, may require active stabilisation measures. Potential for planar block slides exists along the sub-horizontally inclined shale bedding planes, particularly if the shale beds are smooth and flat, lubricated by wet clay gouge between bedding planes and dip unfavourably or daylight out of cut slopes.

The relationship between the topography and the orientation of the shale beds, and proposed cuttings into the slope, will need to be explored in greater detail by digging inspection pits by excavator to expose the rock structure. This will need to be done as part of a more detailed geotechnical investigation along the sections of road to be widened. Where widening of the road requires significant widening of cuttings, more extensive geotechnical investigations, including borehole drilling, will be required during the construction phase.

7.1.2 Materials Usage and Subgrade Treatment for Roads

7.1.2.1 Areas Underlain by Shale

The transported soils overlying the residual soils and shale bedrock are expected to comprise clayey to gravelly silty sands through to sandy clays. Experience indicates that these soils have been found to range in quality from <G10 to G9 (TRH14:1985), with variability in quality to be expected. They are generally not likely to be suitable for use in the construction of roads and are best stripped to stockpile for top-soiling use.

The underlying residual soils are generally anticipated to be very thinly developed and seldom more than about 0.5 m thick. Their quality could be expected to range from <G10 to G8 in quality depending on the gravel and relative amounts of clay present. It has generally been found however, that the transported soils and residual shale soils are very poor to unsuitable subgrade materials, and will require subgrade treatment where encountered at or near the top of subgrade. Such subgrade treatment will require spoiling or undercutting and replacement with suitable quality subgrade materials.

The underlying weathered shale will generally consist of a dark grey streaked and mottled yellow, tightly bedded, intensely laminated, material of very soft to soft rock strength, improving in strength to soft rock and medium hard rock. The weathered shale is likely to be at least G7 quality depending on the degree of weathering. This material is generally suitable for use as a wearing course material for gravel roads although it tends to create a slippery surface on steeper gradients when wet. Weathered shale will undergo rapid deterioration on exposure to the atmosphere (slaking / exfoliating) and is not recommended for use as a general fill unless extremely well compacted and pulverised into soil sized particles. Under no circumstances should the weathered shale be used as dump rock material. The weathered shale material is likely to stabilise fairly well with lime.

7.1.2.2 Areas Underlain by Weathered Dolerite

The near surface transported soils overlying the weathered dolerite are expected to be very similar to those encountered in the shale areas. Given their generally very clayey composition in this area, they will not be suitable for road construction and are best stockpiled for topsoil use.

The quality of the underlying residual dolerite soils can generally be expected to be rather poor, in the range <G10 to G9, being very clayey in composition. These soils will classify as very poor to unsuitable subgrade materials. Where these soils occur at or near the top of subgrade they will generally require spoiling or undercutting and replacement with suitable quality subgrade materials.

Weathered dolerite bedrock, represented by boulders in deeply weathered profiles becoming more common with depth until sound dolerite occurs is generally hard to very hard in strength. It is unlikely to be suitable for any road construction materials usage unless encountered as a solid deposit, such as a local cliff, of sufficient quality and quantity for the quarrying of crushed stone products. One such deposit comprises the road cutting for the R102 through solid dolerite in the vicinity of Mount Edgecombe, and was utilised for construction of the road.

Dolerite in high rainfall areas such as KwaZulu-Natal frequently fall into the “rapid weathered dolerite” category and appropriate rock soundness tests must be carried out should the rock be considered for use as a source for crushed stone products.

7.1.2.3 Areas Underlain by Berea Formation

The quality of the sands of the Berea Formation can generally be expected to be fair to good, in the range 10 to G7, depending on the clay content. These soils will classify as fair to good subgrade materials, and are suitable for use in bulk fills.

7.1.2.4 Areas Underlain by Alluvium

Due to the potential for shallow groundwater and the nature of these sediments, all areas underlain by alluvial sediments should be suitably bridged. Culverts should be used to bridge the affected watercourses. Detailed geotechnical investigations will be required to determine suitable founding for the culverts and bridges.

Abutment fills resting on thick, compressible alluvium.

7.2 Heritage Assessment

The ground survey located no heritage sites or features on the actual footprint. The existing structures on or adjacent to the footprint are all younger than 60 years. As such they have no heritage value. The area is also not part of any known cultural landscape.

However, a large informal cemetery is located approximately 800 m to the north of the footprint directly adjacent to the M41 (**Figure 7-1**) which have been rated as locally significant (Local Grade 111B). It covers an area of approximately 850 m x 450 m. The GPS coordinates for the cemetery are: S 29° 41' 31.31" E 31° 03' 54.35" (**Figure 7-2**). Although this heritage site is not threatened by the proposed development it is nevertheless recommended that the developers maintain a buffer zone of at least 30 m around the site. Should future developments expand towards this cemetery then a Phase 2 Heritage Impact Assessment must be implemented. This Phase 2 Heritage Impact Assessment should also investigate the feasibility of potential grave exhumation and relocation.

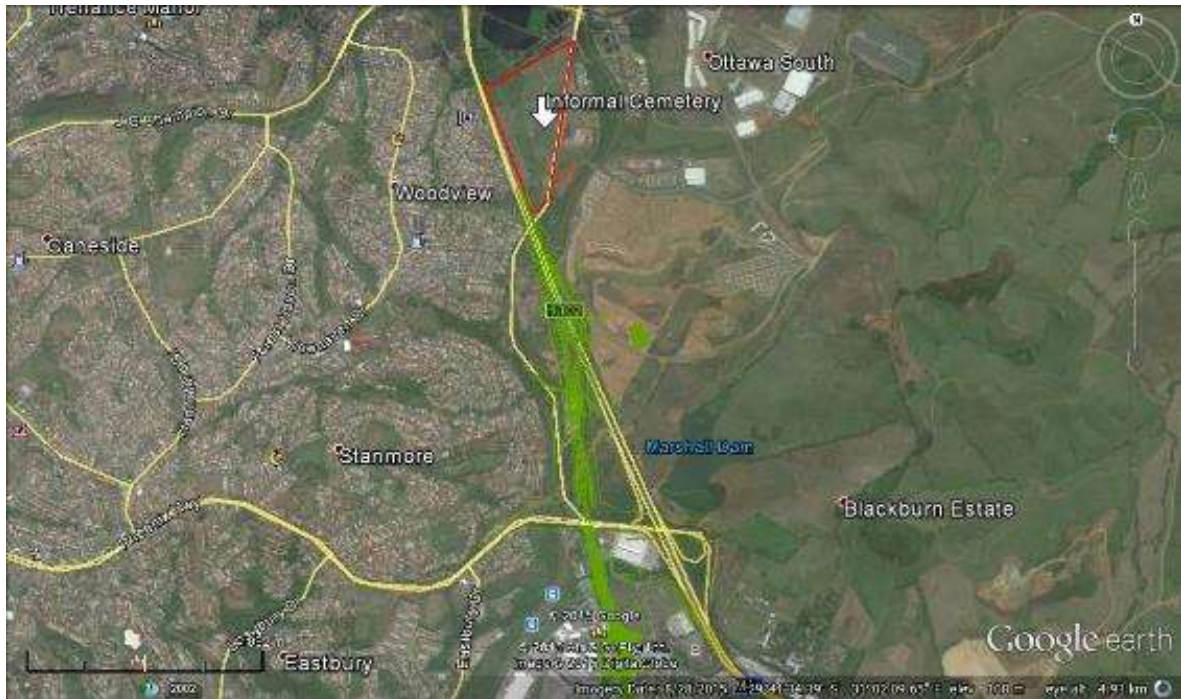


Figure 7-1: Google aerial photograph showing the location of the large informal cemetery (red polygon)



Figure 7-2: Photograph of the cemetery situated directly adjacent to the M41 in the northern section of the study area

7.3 Terrestrial Ecology Assessment

7.3.1 Vegetation Communities at the Proposed P79 Grade Separation

The terrestrial environment and habitats at the proposed P79 Grade Separation Bridge and Linkage was characterised by three (3) distinct terrestrial vegetation communities, namely:

- i. Wooded alien thicket along the existing R102 highway to the west;

- ii. Wooded grassland in the southern portion of the site; and
- iii. *Hyparrhenia filipendula* grassland along the north-eastern edge of the study area, as shown in Figure 7-3.

A substantial portion of the study area in the north-west has been transformed (existing construction site camp) and another stripped of vegetation and left bare during recent construction of a bulk pipe-line and associated infrastructure in the south-eastern section of the focal study area. The central portions of the focal study area comprised wetland / riparian habitat (refer to Section 7.4.3).

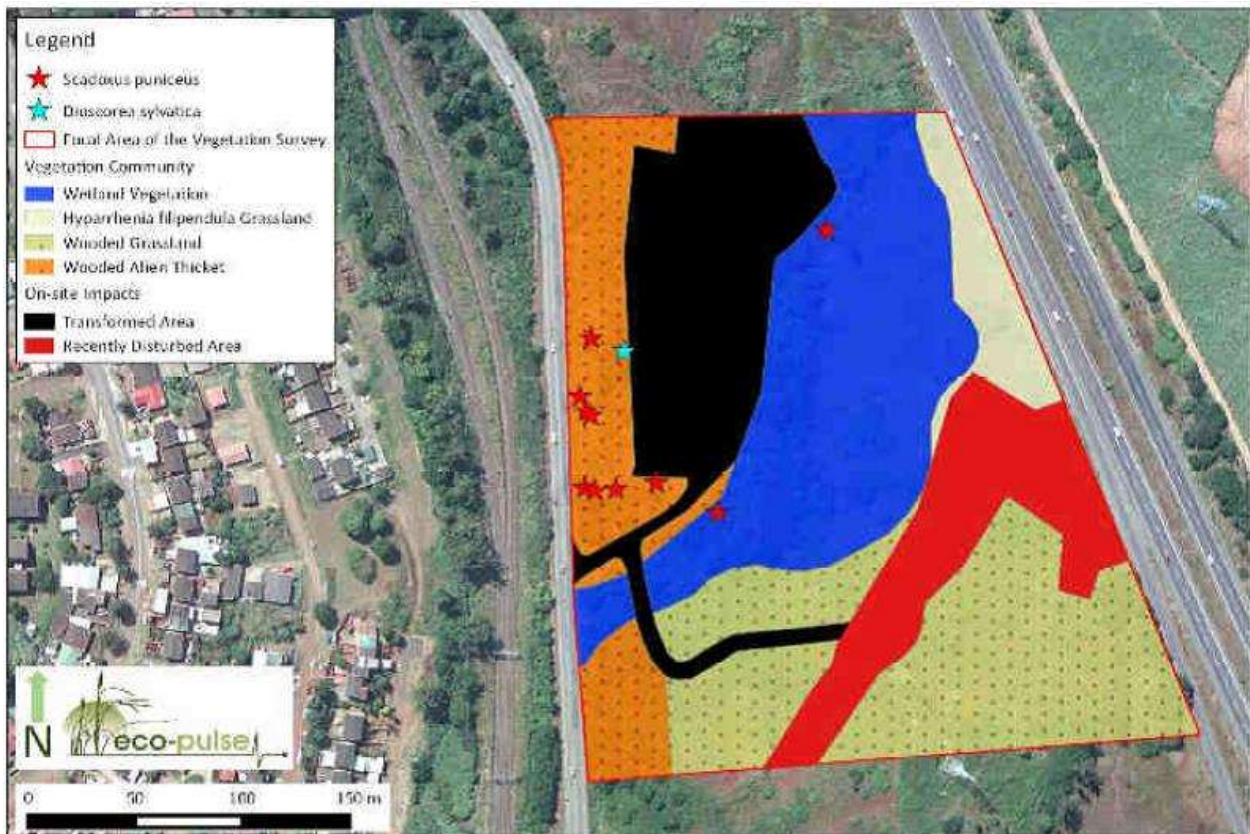


Figure 7-3: Map showing terrestrial and aquatic vegetation communities within the focal assessment area at the proposed P79 grade separation

Descriptions of each of the three (3) terrestrial vegetation communities are provided below. Refer to the Terrestrial Vegetation Report (**Appendix E**) for the complete list of species.

7.3.1.1 Wooded Alien Thicket

The wooded alien thicket occurred on a slope to the west historically disturbed during construction of the existing R102 road infrastructure. It was found to comprise a mix of short woody and arborescent species in the interior and ruderal grass and herbaceous species along the edge. Characteristic and dominant woody species included invasive alien plants. Beneath and interspersed between the woody alien species were dense impenetrable stands of arborescent alien species including *Chromolaena odorata*, *Lantana camara*, *Tithonia diversifolia* and to a lesser extent, *Ricinus communis* within the more recently disturbed areas.

In open areas along the edge of this community was a mix of ruderal grasses and herbaceous plant species particularly creepers and climbers. Indigenous trees were low in abundance. Due to historical disturbances and high alien infestation levels in this community, the wooded alien thicket community can be considered secondary in nature and of low sensitivity.

Notwithstanding the aforementioned, this community contains two plants species protected under Schedule 12 of the Natal Nature Conservation Ordinance of 1974 namely *Scadoxus puniceus* (Snake lily) and *Dioscorea sylvatica* (Elephant's foot/Wild yam) - **Figure 7-4**. Any disturbance / destruction to these plants will require an Ordinary Permit from the EKZNW permits office.



Figure 7-4: *Dioscorea sylvatica* (Elephant's foot/Wild yam) growing along the edge of the wooded alien thicket (left) and *Scadoxus puniceus* (Snake lily)

7.3.1.2 Wooded Grassland

The wooded grassland occurring in the southern site focal area was likely naturally open coastal grassland that has become subject to woody alien encroachment with the absence of fire. The woody component comprised of shrubs and a few scattered trees, dominated by alien species and the groundcover was vegetated with indigenous grasses and a moderate abundance of pioneer and ruderal herbaceous species. Small areas within the community have been historically disturbed as evidenced by an excavation and a soil stockpile.

Dominant woody species included invasive alien trees and dominant shrubs included *Chromolaena odorata*, *Lantana camara* and *Senna didymobotrya*. The groundcover layer included the following indigenous grasses: *Hyparrhenia filipendula*, *Imperata cylindrica*, *Melinis repens* as well as a number of herbs typical of degraded areas such as *Tagetes minuta* and *Bidens pilosa*.

Along the edges of the recently cleared pipe line servitude were numerous pioneer and alien plants. When considering the level of alien infestation and current disturbances, this community is considered to be of a relatively low sensitivity.

7.3.1.3 *Hyparrhenia filipendula* Open Grassland

The *Hyparrhenia filipendula* open grassland is dominated exclusively by the indigenous, locally common grass species, *Hyparrhenia filipendula* (**Figure 7-5**). In terms of sensitivity this unit is considered to be of moderate sensitivity because it is characterised largely by indigenous vegetation with limited alien infestation.



Figure 7-5: View of the *Hyparrhenia filipendula* Open Grassland Community with a few scattered Woody Clumps of Alien Species

7.3.2 Vegetation Community at the Proposed Pedestrian Bridge Crossing

Two vegetation communities were identified within the study area linked with the proposed SASA Pedestrian Bridge crossing (i) Ruderal herbaceous community within in the R102 road reserve on the western side, and (ii) Wooded alien thicket within the road reserve on the eastern side of the R102, as shown in Figure 7-6.

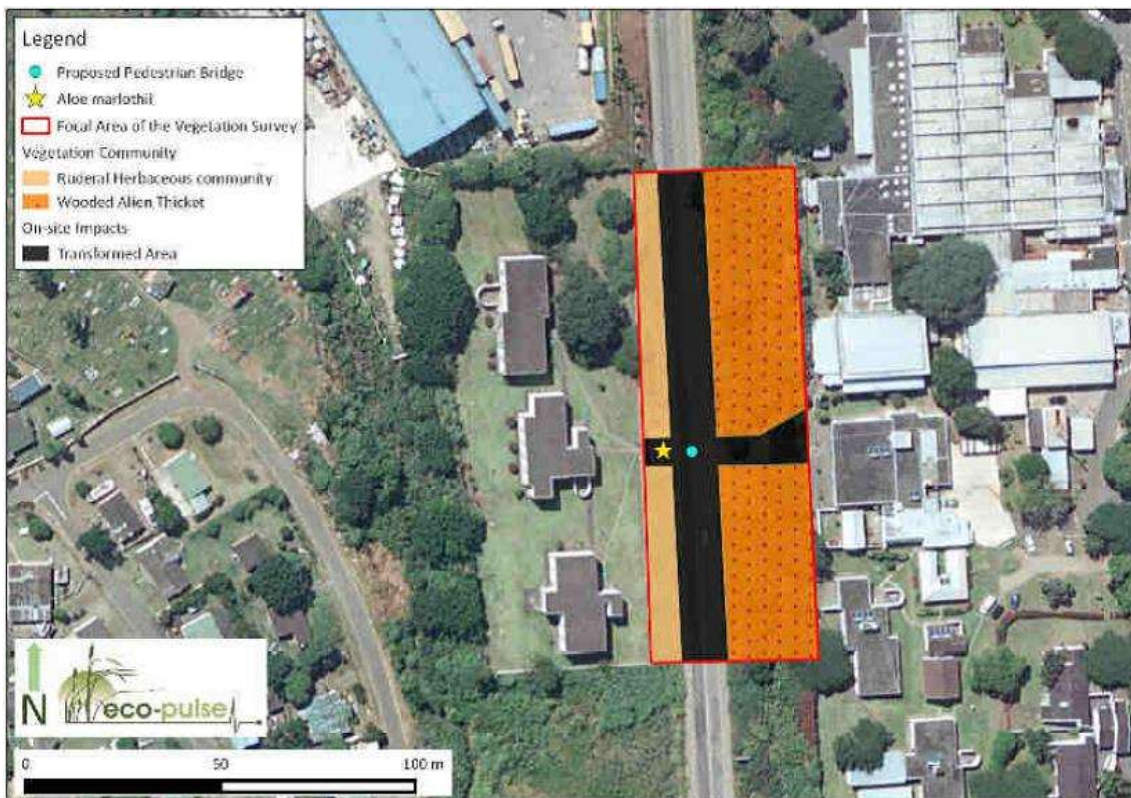


Figure 7-6: Map showing the Two Terrestrial Vegetation Communities within the study area at the Proposed Pedestrian Bridge Crossing

7.3.2.1 Ruderal Herbaceous Community

The ruderal herbaceous community within the R102 road reserve on the western side is dominated by grasses and short herbaceous plants that are generally common along road verges. Clumps of *Pennisetum purpureum*, an invasive alien grass, were recorded in the southern portion of the study focal area. Indigenous trees were limited to only a few specimens of locally common and species of least concern: *Ziziphus mucronata*, *Trichilia emetica* and saplings of *Strelitzia nicolai*.

The community, being dominated by pioneers, weeds and alien plants with few locally common trees and grasses, was regarded as being secondary and of low ecological sensitivity. Notably, a few planted *Aloe marlothii* were observed along the road verge (locations shown in Figure 7-6). This species is protected under the Schedule 12 of the Natal Nature Conservation Ordinance. Any disturbance/destruction to these plants will require an Ordinary Permit from the EKZNW permits office.

7.3.2.2 Wooded Alien Thicket

The wooded alien thicket within the R102 road reserve on the eastern side is secondary in nature and characterised by a mix of woody alien species. Growing in between the woody tree species were a few invasive alien creepers. The understorey of the woody alien thicket was poorly developed due to limited sunlight penetration and was found to be covered in leaf litter.

On the edges of the thicket, however, the following species were recorded *Pennisetum purpureum*, *Bougainvillea* sp., and limited ruderal grasses. This second community, also being dominated by pioneers, weeds and alien plants with few locally common trees and grasses, was regarded as being secondary and of low ecological sensitivity.

7.3.3 Comparison with the Benchmark Vegetation Type

When comparing the vegetation communities defined for the study area with the benchmark vegetation, KwaZulu-Natal Coastal Belt (CB3), the various vegetation communities were assessed as being largely dissimilar from the reference/benchmark vegetation state.

In terms of species composition, vegetation communities identified on site were generally characterised and dominated by alien plant species with the exception of the *Hyparrhenia filipendula* dominated open grassland community associated with the study area at the proposed P79 Grade separation. Although the *Hyparrhenia* grassland community was dominated by indigenous species, it still cannot be considered a true reference / representation of the KwaZulu-Natal Coastal Belt vegetation type which is typically dominated by the grasses *Aristida junciformis* subsp. *galpinii*, *Digitaria eriantha*, *Panicum maximum* and *Themeda triandra*.

7.3.4 Ecological Sensitivity of Terrestrial Vegetation Communities

The ecological sensitivity of the various vegetation communities was assessed in terms of the following criteria:

- Species composition and similarity with the benchmark vegetation type;
- Level of alien plants, pioneer encroachment and weeds;
- Woody encroachment of grassland habitats and ecosystems;

- Presence/absence and relative abundance of conservation important species (endemic plants and protected/threatened species); and
- The level of onsite impacts/degradation caused by humans/animals.

Based on this, the results of the assessment (**Table 7—1**) indicate that the *Hyparrhenia filipendula* dominated open grassland habitat associated with the proposed P79 Grade Separation Bridge and Linkage is of moderate sensitivity due to its limited level of degradation / disturbance, high level of naturalness (% natural composition) and limited extent of alien infestation. All other communities considered in the study were assessed as being of low sensitivity due to the secondary nature of the plant communities, moderate to high levels of alien plant/weed infestation, poor natural plant proportion and diversity and high level of degradation caused by humans. Terrestrial vegetation/habitat sensitivity maps are included as **Figure 7-7** and **Figure 7-8**.

Table 7—1: Summary of the various terrestrial vegetation communities assessed in terms of their ecological sensitivity

Assessment Focal Area	Vegetation Community	Ecological Sensitivity	Level of Naturalness	Level of Disturbance/ Transformation
A: P79 Grade Separation	<i>Hyparrhenia filipendula</i> open grassland	Moderate	High	Low
	Wooded grassland	Low	Moderately Low	Moderately High
	Wooded alien thicket	Low	Low	High
C: SASA Pedestrian Bridge	Ruderal herbaceous community	Low	Low	High
	Wooded alien thicket	Low	Low	High

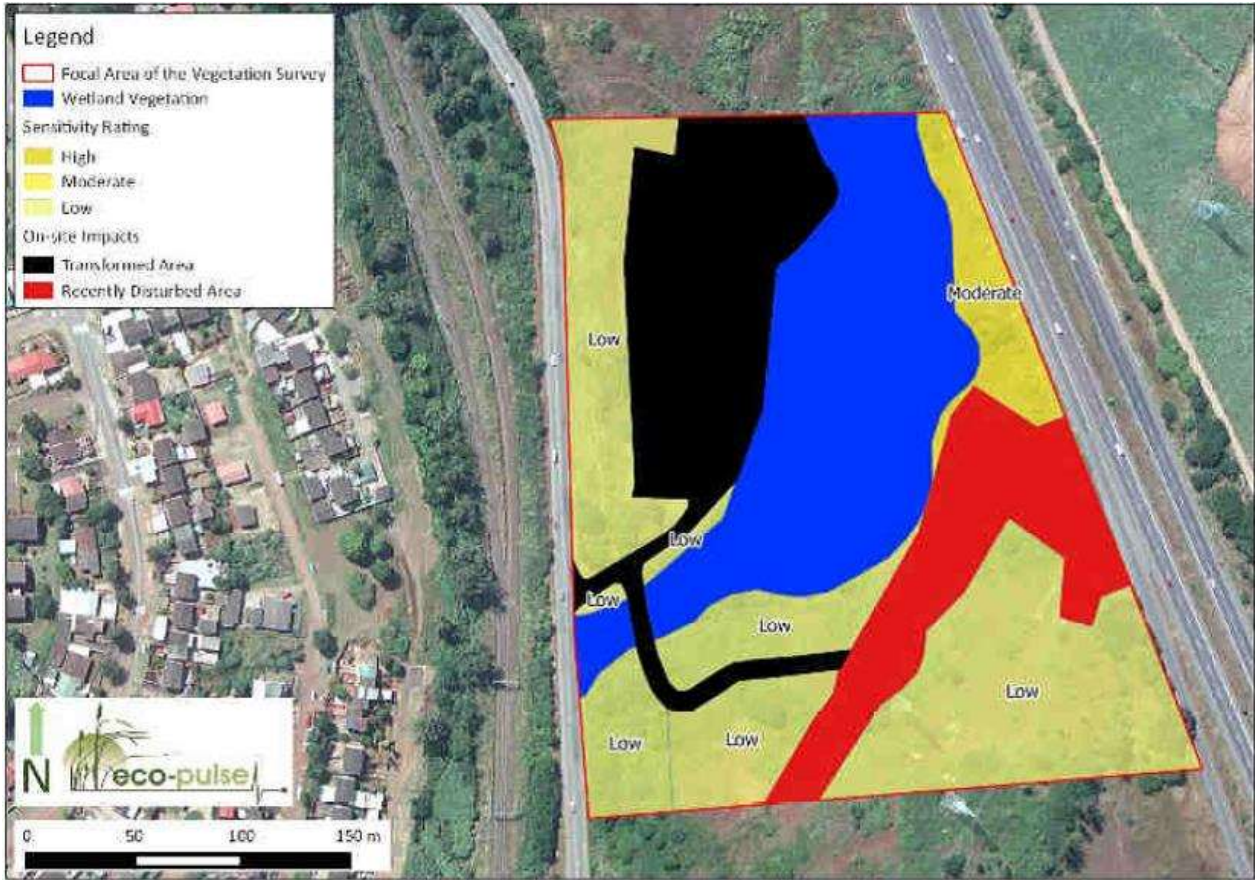


Figure 7-7: Terrestrial Vegetation/Habitat Sensitivity Map for the Focal Study Area at the proposed P79 Grade Separation

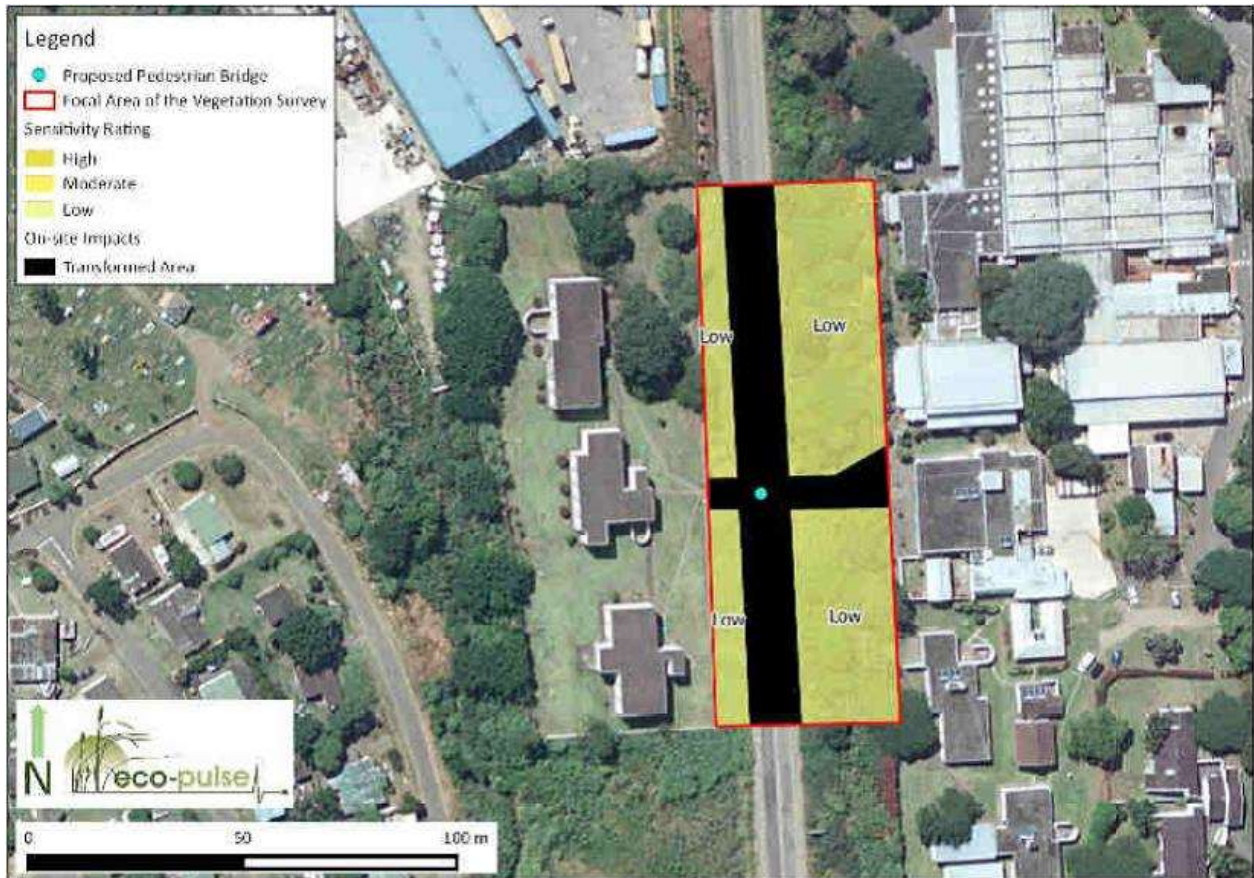


Figure 7-8: Terrestrial Vegetation/Habitat Sensitivity Map for the Focal Study Area at the Proposed Pedestrian Bridge Crossing

7.3.5 Potential Ecological Impacts

Typical ecological impacts to terrestrial vegetation and habitat likely to be associated with the development project are discussed in detail below.

Impact 1: Destruction / loss of terrestrial vegetation & habitat

This refers to the direct physical destruction, complete removal or partial destruction / disturbance of vegetation by machinery and workers during road construction, impacting directly on the ecological condition and availability of habitats. Possible ecological consequences associated with this impact may include:

- Reduction in the representation and conservation of vegetation types / communities;
- Reduction / loss of habitat for fauna; and
- Reduction in and / or loss of species of conservation concern (i.e. rare, threatened/endangered plants).

Impact Description

The direct destruction and disturbance of vegetation / flora will take place for terrestrial habitats within and in the vicinity of the construction / development footprint of the P79 Grade Separation Bridge and Linkage and the SASA pedestrian bridge. Whilst this impact is typically associated with activities within

the construction zone, it may extend beyond this footprint if construction activities are not carefully managed. The impacts on vegetation will be most significant in areas that are still largely natural and which contain or support important fauna and flora. Construction activities occurring within close proximity to natural habitat and plant communities containing fauna and flora that may have medicinal-use, use in crafts or can be used for construction / building purposes can lead to an increase in the pressure on these natural resources through hunting / poaching / trapping of plants, animals, reptiles or insects from these locations. Site clearing may also result in the removal of important plant species, exacerbate habitat fragmentation and reduce the availability of habitat for local wildlife. Although most plant species were identified as being IAPs, they can still play a role in the provision of habitat and control of soil erosion. The planned P79 Grade Separation Bridge and Linkage is also likely to also impact on species of conservation concern, particularly *Scadoxus puniceus* (Blood Lily). This species is specially protected by the Natal Nature Conservation Ordinance of 1974. This impact can be potentially and quite effectively be mitigated by identifying species locations and avoiding disturbance of these species or through the relocation of protected species to adjacent undisturbed areas. In addition, locally common species of 'Least Concern' (SANBI) will also be affected through direct loss of these plant species. Whilst this may seem acceptable given the low indigenous plant diversity and high levels of invasive alien plants characterising the majority of habitats, cumulative loss of biodiversity is often a cause of species becoming threatened or endangered. Terrestrial vegetation and habitat transformation for agriculture and infrastructural development is already regarded as high within the eThekweni Municipal Area. The R102 development (road infrastructure footprint) will contribute to increased levels of habitat transformation, albeit that the extent of untransformed terrestrial vegetation impacted by the project will be relatively low.

Impact 2: Modification of vegetation community and habitat through disturbance

This refers to the secondary effects of vegetation disturbance, including but not limited to: erosion risk and encroachment / colonisation of terrestrial habitats by IAPs. Possible ecological consequences associated with this impact may include:

- Reduction in representation and conservation of vegetation types / communities;
- Reduction / loss of habitat for fauna; and
- Reduction in and / or loss of species of conservation concern (i.e. rare, threatened/endangered species)

Impact Description

Similar to the direct loss of vegetation, secondary modification of vegetation composition and structure through disturbance associated with construction activities can have a detrimental impact on the composition, structure and floral diversity of terrestrial vegetation communities. The colonisation of areas by weeds and IAPs poses a risk to indigenous plant species and would be facilitated by disturbance of natural vegetation and surface soil layers during construction. Disturbance of soil and clearing of vegetation during construction encourages the establishment of pioneer vegetation, in many cases weeds and IAPs. IAPs can have far reaching detrimental effects on native biota and has been widely accepted as being a leading cause of biodiversity loss. They typically have rapid reproductive turnover and are able to outcompete native species for environmental resources, alter soil stability, promote erosion, change litter accumulation and soil properties and promote or suppress fire. Failure to manage stripping of vegetation, topsoil and rehabilitation can lead to serious IAP infestation which compromises the quality of habitat provided by the vegetation community. Clearing and disturbance is also likely to result in an increase in edge habitat immediately adjacent to disturbed areas, which can be particularly devastating for adjacent areas that are largely free of alien plants. Edge habitat is characterized by a predominance of generalist and alien species that are usually highly competitive species which can

invade areas of established vegetation, resulting in a loss of sedentary species of mature habitats which are normally considered sensitive. In addition, certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flows. Edge effects will be lower for grasslands and generally higher for wooded communities. Although the impact is initiated during the construction phase, it is really an operational issue as recovery of vegetation community types is a long term process. Uncontrolled fires caused either accidentally or intentionally, can also exacerbate impacts to natural vegetation, particularly if these take place under unfavourable weather conditions.

Impact 3: Pollution of soils, water and vegetation

This refers to the alteration or deterioration in the physical, chemical and biological characteristics of water, soil and air resources which inevitable impacts on vegetation.

Impact Description

Terrestrial vegetation and habitats are susceptible to pollution, like all other natural resources and ecological infrastructure. Pollution impacts on vegetation can either be direct or secondary in nature. Direct impacts relate to the physiological changes of vegetation upon direct contact with pollutants whilst secondary impacts relate to the physiological changes of vegetation as a response to its polluted environment e.g. contaminated soil / water.

Potential contaminants and their relevant source 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;

Contaminants such as hydrocarbons, solids and pathogens may be generated during the construction phase from a number of potential sources (examples include petrol / diesel, oil / grease, paint, cement / concrete and other hazardous substances). These contaminants have the capacity to negatively affect soil ecosystems including sensitive or intolerant species of flora and fauna. Where significant changes in soil / water quality occur, this will ultimately result in a shift in flora and soil microbes species composition, favouring more tolerant species, and potentially resulting in the localised exclusion of any sensitive species. When these pollutants come into contact with plants they often result in the destruction of plant parts e.g. leaves ultimately resulting in the death of the plant. Because these pollutants are retained in the soil for extensive periods of time, they may inhibit the establishment of vegetation during rehabilitation of disturbed areas. Relatively inert pollutants such as cement and bitumen products do not have an acute impact on vegetation but can suppress plant growth. The risk of solid waste pollution (litter) is likely to be limited and is likely to arise from workers unless appropriate controls are in place. The impacts on vegetation will be most significant in areas that are still largely natural and which contain or support important flora and fauna and lowest in cases where vegetation has been largely transformed or invaded by alien plants.

Impact 4: Reduction / loss of ecosystem goods and services

This refers to the reduction in the level of supply of ecosystem goods and services (such as biodiversity support, carbon sequestration, erosion control, flood control, etc.) provided by natural terrestrial

ecosystems and habitats including grasslands, woodlands, bushland and forests.

Impact Description

Terrestrial ecosystems such as grasslands, woodlands and natural forests can provide a range of important ecosystem goods and services to society. They typically support a rich diversity of locally common and endemic grasses, trees, wild flowers, invertebrates, reptiles, birds and other animals. Other services provided by these ecosystems include their role in reducing runoff and attenuating downstream flooding, assisting with binding topsoil and controlling erosion as well as their role in storing atmospheric carbon, especially in the topsoil. Benefits to local communities may include medicinal plants, firewood, building materials and thatching grass. The loss of grassland and woodland vegetation and habitat will likely contribute somewhat to the concomitant reduction in the level of ecosystem goods and benefits provided by these ecosystems. Habitat fragmentation is also a major problem in the eThekweni municipal Area and the R102 development will likely result in further fragmentation of habitat in an areas that has seen severe levels of destruction and fragmentation of natural habitats due to human infrastructure development and agriculture (sugarcane farming).

7.3.6 Nocturnal Survey

Pickersgill's Reed Frog, *Hyperolius pickersgilli*, is a small frog known only from limited and highly fragmented coastal wetland habitat in the KwaZulu-Natal Province of South Africa. The species has been prioritised for conservation action due to its Red List status, endemism and ongoing deterioration in and loss of habitat. The species is currently globally listed as Critically Endangered (2011), and is the KwaZulu-Natal's only amphibian species with this status. It is also the first frog species in the country for which a Biodiversity Management Plan under the auspices of Section 9 of the National Environmental Management: Biodiversity Act (NEM:BA) has been compiled. Species assigned this status are defined as facing an extremely high risk of extinction in the wild.

Pickersgill's Reed Frog is endemic to a narrow and extremely fragmented range within about 16 km of the KwaZulu-Natal coastline, where as of October 2015, it is known from 24 localities. Although it is a species of importance in KwaZulu-Natal¹¹, only two populations are known from formally protected areas (Umlalazi Nature Reserve and St Lucia at the iSimangaliso Wetland Park), and the need to identify and protect remaining breeding populations is crucial. The species has been prioritised for conservation research¹² and is also the first threatened frog species in South Africa to be used in a captive breeding program¹³.

Given the proximity and nature of the wetland concerned (Wetland C1-W01) and its proximity to the locality of the original discovery in 1977 of Pickersgill's Reed Frog¹⁴ (Figure 7-9) a nocturnal survey of Wetland C1 (hereafter referred to as 'the site') was conducted to assess the presence of this, and other possible Red List amphibian and reptile species on site.

¹¹ Goodman, P. 2000. (Ed.). *Determining the conservation value of land in KwaZulu-Natal. Final Report. Biodiversity Division, KwaZulu-Natal Nature Conservation Service, Pietermaritzburg.*

¹² Measey, G.J. (Ed.), 2011. *Ensuring a future for South Africa's frogs: a strategy for conservation research. SANBI Biodiversity Series 19. South African National Biodiversity Institute, Pretoria.*

¹³ Visser, I. 2011. *An ex-situ conservation and research project for Pickersgill's Reed Frog. AARK Newsletter, 16, 14.*

¹⁴ Raw, L.R.G., 1982. *A new species of reed frog (Amphibia: Hyperoliidae) from the coastal lowlands of Natal, South Africa. Durban Museum Novitates, 13, 117–126.*



Figure 7-9: Google Earth image showing the Study Site Wetland C1 (pink polygon) relative to the locality of the original discovery of the Critically Endangered Pickersgill's Reed Frog (white polygon)

At the time of the survey the wetland area in question was very dry and no standing water was present. Whilst there was evidence of suitable habitat for a variety of frog species (dominated by Bulrush, *Typha capensis*, as well as *Persicaria* and some patches of sedge, *Cyperus*), no frogs were observed (heard or seen). Even though no frogs were observed during the survey, there is a likelihood that common frog species may occur on site. Overall the wetland itself, but in particular the periphery, appeared to be heavily disturbed as a result of heavy earthworks.

Two individuals of the Flap-necked Chameleon, *Chamaeleo dilepis*, were detected on high vegetation on the periphery of the wetland.

The terrestrial orchid, *Eulophia speciosa*, was also detected surrounding the periphery of the wetland. This species is a terrestrial herb which grows in grassland and wooded grassland with shrubs, miombo and mixed deciduous woodland, usually on sandy soils, also in brackish swampy coastal grassland.

The proposed activities will directly impact on the wetland area in question through direct habitat destruction caused by construction and earth moving activities for the road works. This was already in evidence during the site visit. Indirect impacts during and following construction include run-off of sediment and / or contaminants from the road works and once the road is operational.

7.4 Freshwater Habitat Assessment

All water resources (namely wetlands and riparian areas associated with channelled watercourses such as rivers and streams) within the 500 m regulated area specified by DWS (i.e. within a 500 m radius of the development extent) were identified and delineated. Based on the position of the identified water resources in the landscape and in relation to the proposed development and related activities, this enabled the "risk of impact" for each watercourse to be determined.

Wetlands and riverine ecosystems / habitat within the 500 m regulated area are shown mapped in **Figure 7-10** (with rationale for risk rating in **Table 7—2**) and have been screened and risk-rated according to the risk categories included in **Table 6** of the Aquatic Ecological Assessment (**Appendix C1**).

Table 7—2: Summary of risk ratings of delineated water resource units and their rationale

Water Resource Unit	HGM Type	Risk Rating	Rationale	Triggers need for a WULA or further impact assessment?
C1-R01	Small river	Moderate	Only indirect impacts such as sedimentation and altered flows are likely to impact the uMhlangane tributary river. The proposed upgrade will end just short of the existing road bridge over the uMhlangane River. As such the uMhlangane River is only regarded as being at a moderate risk and may trigger a Section 21 c and i water use. This system was flagged as requiring further specialist assessment.	Yes
C1-R02	Stream	Low	This stream is located upstream of the development impact zone and is unlikely to incur either direct or indirect impacts (low risk). No further assessment required.	No
C1-R03	Small river	High	This river is situated under the R102 Highway and is likely to be disturbed during widening of the road. The risk of ecological modification is therefore regarded as high. This triggers a Section 21 c and i water use and environmental authorisation requirements and the river was flagged as requiring further assessment.	Yes
C1-R04	Small river	High	As per C1-R03, above.	Yes
C1-W01	Wetland seep	High	The new road infrastructure will bisect the wetland and result in the direct partial loss of wetland habitat and reduction in functioning. This triggers a Section 21 c and i water use and environmental authorisation requirements and the wetland was flagged as requiring further assessment.	Yes
C2-W01	Wetland seep	Low	This wetland is located upstream of the development impact zone and is unlikely to incur either direct or indirect impacts (low risk). No further assessment required.	No
C2-D01	Artificial (dam)	Low	As per C2-W01, above.	No
C2-R01	Stream	Moderate	Likely to be affected by secondary impacts.	Yes
C2-R02 C3-W01 C11-R01	Roadside storm water drains (artificial)	High	Although stormwater drains are at a high risk of being affected by the development as they are located within the development footprint, these areas act merely as water conduits and are considered artificial in nature. As such these areas were flagged for further qualitative assessment only. The need for a WUL for artificial storm water drains will need to be discussed with the DWS.	Possibly (TBC)
C4-W01 C5-W01 C7-R01 C8-R01	Various	Low	These water resource units are located in adjacent micro-catchments and are at a very low risk of being impacted. No further assessment required for these areas.	No

Water Resource Unit	HGM Type	Risk Rating	Rationale	Triggers need for a WULA or further impact assessment?
C9-R01 C9-W01 C9-W03 C9-D01 C10-W01 C12-W01 C12-D01 C12-D02 C12-D03 C13-W01				

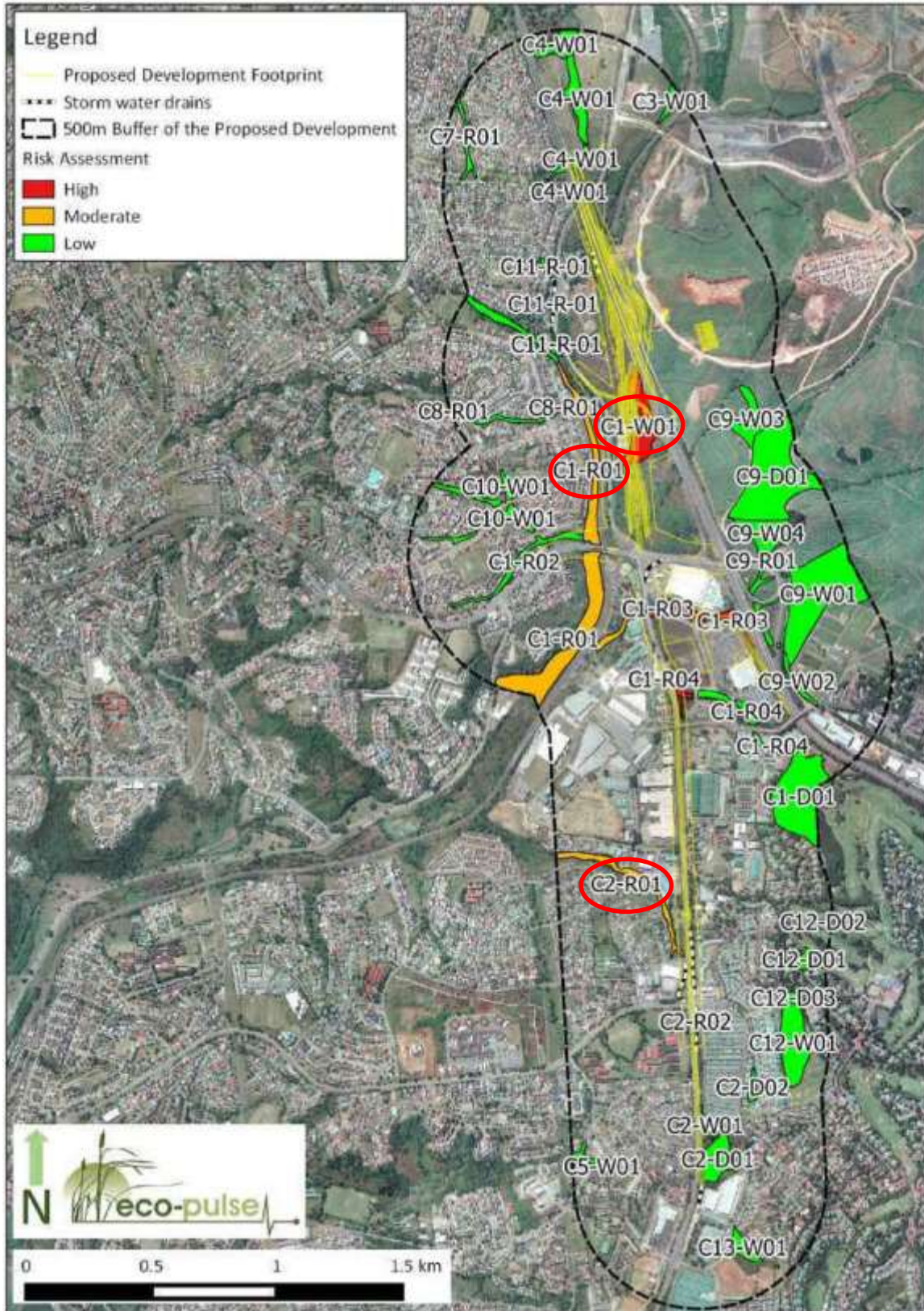


Figure 7-10: Risk Rating of Delineated Water Resource units within a 500 m radius from the Development (Risk ratings range from High shaded in “Red” to Low shaded in “Green”)

The results of the aquatic screening and risk assessment exercise suggests that six watercourses are likely to be at risk of being negatively impacted by the proposed development, either directly or indirectly, and will trigger the need for environmental authorisation and a WULA in terms of Section 21 (c) and (i) water use since the characteristics of these watercourses is highly likely to be modified in some way.

The following watercourses were subject to further assessment as part of the assessment and included one (1) wetland and two (2) rivers/streams (circled in red in **Figure 7-10**):

- **C1-R01**: uMhlangane River 1
- **C1-W01**: Hillslope seep (wetland)
- **C2-R01**: Tributary of the uMhlangane River

These watercourses (wetlands, rivers / streams and associated riparian habitats) are shown mapped in **Figure 7-11** and were the subject of further detailed field delineation and baseline ecological assessment to inform the assessment of potential impacts and recommendation of impact mitigation / management measures, ecological monitoring requirements and water use licensing requirements.

The remaining wetlands and rivers / streams identified within the 500 m radius of the development are regarded as low risk systems that are unlikely to incur either direct or indirect impacts due to their position in the landscape (i.e. within adjacent catchment areas to the impact zone or a significant distance downstream such that these resources are very unlikely to be impacted in any way, shape or form). The requirements for a WUL in terms of a Section 21 (c) and (i) water use will therefore not be triggered for those resources located within adjacent catchment areas or a significant distance upstream of the development.



Figure 7-11: Delineated Watercourses (wetlands and rivers/riparian areas) within a 500 m radius of the Development Project (the location of watercourse crossings/direct impacts are indicated by the "red" stars on the map)

7.4.1 C1-R01: uMhlangane River 1

The uMhlangane River reach assessed occurs on the western side of the proposed interchange and road upgrade. The uMhlangane River is a perennial river, characterised by a relatively narrow, incised active channel within a broad, alien infested woody-herbaceous riparian zone. The active channel is a single, sinuous, mixed alluvial bedrock channel measuring up to 3 m in width and 2 m in depth. The river's catchment is characterised by high levels of transformation, including; formal housing, road and railway infrastructure and high levels of alien plant infestation. On-site impacts include infilling, active channel excavation and re-alignment, river bank modification, solid waste dumping and high levels of Invasive Alien Plant (IAP) infestation, particularly associated with the riparian habitat.

Two distinct alien vegetation communities are described for the river reach: (i) *Pennisetum purpureum-Eucalyptus* sp. Community and (ii) Wooded *Pennisetum purpureum* Community. The *Pennisetum purpureum-Eucalyptus* sp. community occurs upstream of the existing road bridge crossing the river. The vegetation community is dominated by short *Pennisetum purpureum* (Napier grass) which extends from the edge of the active channel to the boundary of the macro-channel **Figure 7-12**. The subdominant *Eucalyptus* sp. occurs along the edge of the active channel. Pioneer and opportunistic herbaceous species were also recorded particularly in recently disturbed areas.



Figure 7-12: Upstream view of the active channel of the uMhlangane River. The dominant vegetation in the photo is *Pennisetum purpureum* which occurs as dense stands along the river course

Immediately below the existing bridge, the vegetation community grades into a Wooded *Pennisetum purpureum* community that also includes scattered indigenous trees and palms, namely *Syzygium cordatum*, *Trichilia emetic* and *Phoenix reclinata* which are remnant species of the natural riparian vegetation, with the remaining species being replaced by Napier grass as well as other IAPs. The vegetation community is largely secondary in terms of composition and structure.

7.4.2 C2-R01: Tributary of the uMhlangane River

This tributary of uMhlangane River (C2-R01) is located on the western side of the R102 just north of the intersection of the R102 with Hillhead Drive. The river is perennial in terms of flow period and is fed primarily by stormwater flows emanating from buildings and roads in the catchment. The channel is

significantly incised with near vertical and undercut banks in places and controlled along its length by stepped sandstone bedrock outcrops. The macro-channel measures up to 4 m in width and 2 m in terms of bank height (clearly incised channel). Evidence of channel straightening and re-alignment is apparent in the upper sections of the river course. The stream's catchment is characterised by a high density of hardened surfaces (building and road infrastructure) and with open spaces dominated by maintained parks and infested areas with IAPs.

The vegetation community present within the reach assessed is best described as an alien *Pennisetum purpureum* dominated riparian community. This community is secondary in nature and not indicative of the native vegetation community which has been replaced almost entirely with only a few remaining scattered indigenous trees remaining in places (*Combretum kraussii*, *Albizia adianthifolia* and *Millettia grandis*). It should be noted that these indigenous trees will not be impacted upon.

7.4.3 C1-W01: Hillslope Seepage Wetland

Wetland C1-W01 can be classified as a relatively small (approximately 2.6 ha in extent) hillslope seepage wetland occurring primarily on a west-facing slope in the central to northern study area. The P79 Grade Separation Bridge and Linkages traverses the C1-W01 Wetland. The seepage wetland has formed on a relatively steep slope mainly as a result of the discharge of sub-surface water which moves diffusely through the soils and is linked via a drainage channel which drains in a westerly direction towards the uMhlangane River. The wetland is characterised by temporal to seasonal saturated soils whilst the lower lying areas towards the mid reaches and toe end of the system are characterised by seasonal to permanently saturated soils. The wetland's catchment area is largely transformed by sugarcane farming and road infrastructural development, with a new housing development currently underway in the upper catchment on the eastern side of the M41 highway. On-site impacts include infilling linked with development of the western edge of the wetland, channel incision and artificial drainage, vegetation clearing, IAP infestation, woody plant encroachment and sediment deposition at the lower reach of the wetland.

A number of vegetation community types were identified for the wetland, including:

- i. *Hyparrhenia filipendula-Imperata cylindrica* temporary to seasonal short-medium hygrophilous grassland community: occurring on the seasonally to temporarily saturated slopes in the upper wetland adjacent to the M41 highway.
- ii. *Phragmites australis-Typha capensis* permanently wet herbaceous community: within permanent ponds and artificial drains where water stands and emergent water-loving species such as *P. australis* and *T. capensis* flourish, fringed by wet ferns and with creeping/mat-forming *Persicaria* sp. interspersed.
- iii. Invaded herbaceous *Pennisetum purpureum* seasonal fringe community: fringe habitat in the north-east at the top of the wetland dominated by dense stands of Napier grass.
- iv. Invaded Wooded/Riparian channelled community occurs on the valley along the western boundary of the wetland unit. The community is comprised of a mixture of indigenous woody riparian forest species. IAPs infestation is significant, however, indigenous species are still identifiable and characterise considerable areas of the community. Of particular importance is the provincially specially protected plant, *Scadoxus puniceus* (Snake lily) recorded within this community.
- v. Wooded grassland community: a mosaic of small clumps of herbaceous and woody species such as *Chromolaena odorata*, *Lantana camara* and *Schinus terebinthifolius* on the slopes adjacent to the wooded habitat in the lower wetland to the south.

7.4.4 Baseline Ecological Assessment of Rivers and Streams

7.4.7.1 Present Ecological State (PES) of Rivers and Streams

The Present Ecological State (PES) refers to the health or integrity of a river system, and includes both in-stream habitat as well as riparian habitat adjacent to the main channel.

A summary of the results of the Index of Habitat Integrity (IHI) assessment for the two (2) rivers assessed suggest that all river systems assessed can be regarded as being in a 'poor ecological condition'. Habitat quality, natural diversity, size and variability have been largely modified. The impact of IAPs, channel bed and bank modification, channel straightening / re-alignment, catchment impacts such as hardened surfaces and increased storm flows as well as water quality modifications are regarded as being generally high. The poor ecological condition of the rivers, with reduced species diversity and simplified species communities which are less resilient are evidence thereof.

A summary of the IHI results for the rivers and streams in the study area is provided in **Table 10** of the Aquatic Ecological Assessment (**Appendix C1**).

7.4.7.2 Ecological Importance and Sensitivity (EIS) of Rivers and Streams

The Ecological Importance and Sensitivity (EIS) of riparian areas is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on local and wider scales; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred¹⁵.

Both river systems assessed were determined to be of 'relatively low EIS'. This is attributed to the following:

- Poor ecological integrity associated with both in-stream and riparian habitats, linked to poor water quality, the influence of IAPs and significant flow modifications in the river catchments. This has essentially led to reduced species diversity, an increase in species able to tolerate such conditions, and simplified species communities which are less resilient and largely insensitive to flow / water quality impacts.
- Whilst no species / taxon richness assessment was undertaken it is assumed based on the high level of degradation and transformation that species richness is very low. Furthermore the rivers have limited habitat types and poor water quality to support a high diversity of biota and are unlikely to harbour any rare or endangered species.
- During times of environmental stress the in-stream habitat is unlikely to offer any refugia for biota because of limited habitat diversity and poor water quality. Stormwater discharge may contribute some flows which may offer refugia to biota.
- Rivers assessed are not regarded as being of particular conservation importance in terms of Provincial and Regional Aquatic Conservation planning information available at the time of the assessment. Despite not being identified as being of particular national / provincial conservation importance in terms of the NFEPA and EKZNW Aquatic C-PLAN, the rivers are supporting tributary systems of the uMgeni River, which is a regionally and provincially important river system and catchment. Their conservation importance is likely to be downplayed by the high levels of degradation and loss of ecosystem integrity and functionality that has taken place.

¹⁵ Kleynhans, C.J., Graham, M. and Louw, M.D., 2009. *Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of habitat Integrity (Section 2, Model photo guide)*. WRC Report No. TT 378-09.

- Despite the poor water quality and the high levels of flow and habitat degradation, the in-stream and riparian habitat retains some landscape connectivity. This, despite the vegetation being largely comprised of large alien invasive and alien plant species.

7.4.5 Baseline Ecological Assessment of Wetlands

7.4.8.1 Present Ecological State (PES) of Wetland C1-W01

The overall health or PES of the seepage wetland C1-W01 is regarded as being Moderately to Largely Modified (“C/D” PES Category), which suggests that a moderately large change in ecological processes and loss of natural habitat and biota has occurred. A summary of the results of the WET-Health condition / PES assessment (i.e. impacts to and current state of each component of wetland health: hydrology, geomorphology and vegetation) is provided in **Table 13** of the Aquatic Ecological Assessment (**Appendix C1**).

7.4.8.2 Wetland Functionality (Ecosystem Services) Assessment for Wetland C1-W01

The level of supply provided for regulating and supporting services (such as water quality enhancement, sediment trapping and flow/flood regulation) is generally regarded as moderate for this small wetland. Provisioning and cultural services are not considered particularly important for this wetland (linked to low supply / demand).

The importance of the wetland in terms of biodiversity maintenance was rated as moderately-low, with habitat being relatively limited for this system as a result of alien plant infestation levels. However, a number of locally common frog species (Painted reed frog, Bush squeakers, Forest tree frog) were recorded at the site which is considered important in supporting locally common species. Note that the presence of threatened species was not verified through formal faunal surveys.

A Summary of the importance of wetlands in providing ecosystem goods and services is provided in **Table 14** of the Aquatic Ecological Assessment (**Appendix C1**).

7.4.8.3 Ecological Importance and Sensitivity (EIS) of Wetland C1-W01

The small, moderately to largely modified seepage wetland is regarded as being of relatively low biodiversity importance, which can be attributed to the lack of Red Data / threatened species of flora / fauna (note that the presence of threatened species was not verified through formal faunal surveys and recommendations) and moderately low diversity of functional habitats/features as well as the poor long-term viability of the site (small size, not well connected, limited buffer zone to protect intact habitat).

In terms of the wetlands functional / hydrological importance, this is regarded as moderately low, whilst the importance in terms of the estimated provision of direct benefits to society is regarded as very low. Based on wetland HGM type (seepage wetland), small wetland size and the individual characteristics of the wetland system (e.g. habitat and vegetation), this small seepage system is regarded as being moderately sensitive, particularly with respect to potential water quantity / flow related modifications as well as changes to water quality. Based on this assessment, the wetland system is considered to be Moderately Low EIS and is considered to be ecologically important and sensitive only at a local scale (typically plays a small / limited functional role in the landscape).

7.4.6 Potential Aquatic Ecological Impacts

Aquatic ecological impacts associated specifically with the proposed road and bridge construction project are discussed below. Potential impacts have been split into (i) Construction Phase Impacts which will

occur during the construction phase and (ii) Operational Phase Impacts which will occur during the operational phase.

Impact 1: Destruction, loss and physical modification of aquatic vegetation & habitat for biota

This refers to the direct physical destruction or disturbance of aquatic habitat caused by vegetation clearing, disturbance of wetland / riparian habitat, encroachment / colonisation of habitat by invasive alien plants and alteration of river and wetland geomorphological profiles (including stream beds and banks). Possible ecological consequences associated with this impact may include:

- Reduction in representation and conservation of freshwater ecosystem / habitat types;
- Reduction in the supply of ecosystem goods & services;
- Reduction / loss of habitat for aquatic dependent flora & fauna; and
- Reduction in and / or loss of species of conservation concern (i.e. rare, threatened / endangered species).

Construction Phase

Freshwater riverine vegetation and habitat can be impacted directly through the complete removal or partial disturbance of existing indigenous vegetation during road construction (stripping of vegetation and in-filling), leading to the deterioration in the ecological condition of aquatic vegetation and availability of habitat supporting aquatic biota. This is associated with the construction footprint being located within or across a watercourse and by machinery and workers accessing the site. In many cases, clearing and disturbance is not only limited to the construction zone and may include areas used by machinery and workers to access the site and to construct temporary drainage, storm water and erosion control measures. The result is either the complete loss or the disturbance and partial loss of indigenous vegetation communities and habitat in the broader area. Likely secondary consequences of such direct physical disturbance impacts include a reduction in channel bank stability, exposed bank erosion and in-stream and riparian habitat sedimentation down slope and downstream. Noise and dust caused by human activities can also affect the use of adjoining habitat by various species. This impact is likely to be most significant for intact, species diverse riverine ecosystems, particularly those that may potentially harbour sensitive or rare / threatened species of flora & fauna.

The road widening and resurfacing activities will only result in the loss of poor and low functionality habitat along artificial road-side drains and invaded riparian habitat. New road infrastructure (interchange development) will be established through an alien wooded-habitat and will impact directly on a wetland seep (C1-W01). Whilst this wetland is considered moderately to largely modified, it is likely to provide a moderately low level of hydrological services. It may provide some refugia to wetland dependent fauna such as common reed and tree frog species within a highly transformed catchment area with little remaining natural wetland habitat. It is estimated that up to 0.7 ha (27%) of this roughly 2.6 ha of the wetland area / habitat will be irreversibly lost. A further 0.3 ha is likely to be disturbed and require rehabilitation within a 10 m buffer of the development footprint. One needs to bear in mind that any loss of wetland habitat / functioning should be considered undesirable and therefore every effort must be made to limit the impact.

Likely secondary consequences of such direct physical disturbance impacts include sedimentation of downstream aquatic environments, disturbance of adjoining habitats during construction and decreased habitat connectivity as a result of habitat fragmentation. Noise and dust caused by construction activities can also affect the use of adjoining habitat by various species. In terms of the potential loss of habitat for threatened / Red data frog species such as the Critically Endangered Pickersgill's reed frog (*Hyperolius pickersgilli*).

Impact 1: Destruction, loss and physical modification of aquatic vegetation & habitat for biota

Operational Phase

Road development across rivers and in the vicinity of watercourses is likely to introduce unnatural disturbance to the aquatic ecosystems and habitat and generally promotes the establishment of disturbance-tolerant species, including colonisation by IAPs, weeds and pioneer plant species, particular where there is an existing seed source for these plants nearby. Although this impact is initiated during the construction phase of the project, it is likely to persist well into the operational phase. IAPs can have far-reaching detrimental effects on native biota and has been widely accepted as being a leading cause of biodiversity loss in South Africa. They typically have rapid reproductive turnover and are able to outcompete native species for environmental resources, alter soil stability, promote erosion, change litter accumulation and soil properties and promote of suppress fire. In addition, certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flows thereby potentially increasing sediment inputs and altering natural hydrology of receiving watercourses.

The significance of this impact is likely to be highest for areas that are largely natural and lowest for sites that are already degraded / infested with alien plants and weeds (i.e. further degradation is likely to be quite insignificant in this context). Furthermore, poorly managed stormwater has a potential to flood, scour / erode habitat and / or result in a shift in soil saturation levels (wetland hydro-period) which will ultimately affect the baseline aquatic habitat type and condition.

Impact 2: Flow modification / Hydrological impacts

This refers to any alterations in the quantity, timing and distribution of water inputs and flows within a watercourse, such as a wetland or river/stream. Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity;
- Reduction / loss of habitat for aquatic dependent flora & fauna; and
- Reduction in the supply of ecosystem goods & services.

Construction Phase

Construction activities associated with bulk earthworks (such as excavations, reshaping, back-filling and compaction) can also alter natural patterns of surface runoff reaching water resources down slope / downstream. Infilling, compaction and rutting of soils caused by construction may also alter the patterns of diffuse surface and sub-surface flows by altering micro-topography and the permeability of soil profiles. Changes in flow patterns reaching aquatic ecosystems does not only affect hydrological functionality and thus ecosystem integrity, but can also lead to erosion and sedimentation though increased runoff velocities (linked to artificial concentrated flow paths created during construction). Furthermore, should temporary damming and abstraction of water take place at river / stream crossings, a short-term reduction in flows to downstream aquatic habitat / ecosystems may also result.

Temporary obstructions / impoundments may also alter the sediment balance by retaining sediment and resulting in increased erosive power of the sediment-starved water affecting areas downstream of impoundments.

Temporary flow modification during construction is anticipated due to the potential need for flow diversions to create a “dry” working area when working within perennial river systems / wetlands. Whilst this impact may be temporary, impact significance can be potentially high depending on the method of diversion / impoundment of flows. Flow diversion can also lead to concentrated flows which have the

Impact 2: Flow modification / Hydrological impacts

potential to alter the base of the river section where the diversion will occur and eroded adjacent river banks. If this is not adequately addressed post-construction through stream rehabilitation, the natural flow and distribution patterns of flows may be artificially altered. Furthermore, temporary bypass / access roads across the river can also affect flow patterns and velocities to some extent. During construction there will be a cut to fill exercise and alteration of the natural ground level. As a result, surface and subsurface flows are likely to be altered. Where excavations are planned, water may pool in low lying / excavated areas during construction or the groundwater may be intercepted and abstracted in order to ensure a dry working environment. Infilled areas will result in impounding of flows and the concomitant temporary desiccation of downstream aquatic environments due to lack of flow. The significance of this impact is likely to be moderate, depending on the progress of construction and time of year.

Operational Phase

Hardened / artificial infrastructure such as roads will generally alter the natural processes of rain water infiltration and surface runoff, promoting increased volumes and velocities of stormwater runoff which can be detrimental to water resources receiving concentrated flows off these areas. While the upgrade of the existing road infrastructure is not expected to alter any surface or subsurface flows beyond the current flow regime, new road infrastructure planned has the potential to contribute to altered hydrology in the long-term. Infrastructure will impede water movement unless sufficient allowance is made to sustain natural flows through wetlands and rivers / streams. Downstream areas below planned road infrastructure are likely to receive concentrated flows via concrete / piped culverts and directed storm water runoff that can alter natural water distribution and retention patterns within wetlands. Furthermore, increased volumes and velocities of storm water draining from the road and discharging into downstream rivers / streams / wetlands can alter the natural ecology of a wetland / river system, also increasing the risk of erosion and channel incision / scouring.

Impact 3: Erosion & sedimentation

This refers to the alteration in the physical characteristics of wetlands and rivers as a result of increased turbidity and sediment deposition, caused by soil erosion and earthworks that are associated with construction activities, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity; and
- Reduction/loss of habitat for aquatic dependent flora & fauna.

Construction Phase

Vegetation clearing and disturbed soils within and upslope of wetland / stream / river habitats during construction will increase the risk of erosion and sedimentation of downstream habitats. If runoff and erosion control measures are not effectively implemented by the contractors, erosion rills and gullies may form along the cleared and exposed slopes upslope within the construction footprint and lead to increased rates of erosion and sedimentation within the riparian and in-stream habitat in the vicinity of the construction zone. These impacts will be more pronounced during rainfall events and / windy conditions, and especially where steep slopes are encountered. Such impacts during low flows will likely result in increased sediment loads, increased bed sedimentation and increased water turbidity that will likely contribute to decreased local water quality and degradation in local aquatic habitat integrity. If construction is undertaken in a poor manner with little consideration of minimising erosion and sedimentation impacts, there could be significant impacts in and around the construction zone that will contribute to deterioration in local in-stream, riparian and wetland habitat, both onsite and downstream.

Impact 3: Erosion & sedimentation

Some of the key biological effects related to the elevated levels of deposition and suspended sediment within the water column of rivers / wetlands may include:

- Habitat alteration downstream of crossing points due to increased sediment deposition;
- The creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic biota;
- Increased downstream drift by benthic invertebrates causing localised reductions in population densities; and
- Reduced density and diversity in benthic invertebrate and fish communities as a result of reduced water quality (suspended solids impacting intolerance taxa), habitat degradation caused by smothering of aquatic habitat, changes in streambed and biotope composition (i.e. reduced habitat suitability through the destruction of habitat).

Erosion and sedimentation is likely to be a key construction-related impact experienced during vegetation clearing, bulk earthworks, excavations and backfilling required to construct the new road infrastructure. This is likely to be most significant for smaller streams and wetlands which have limited buffering capacity for sediment-related impacts and areas where steep slopes are encountered. Although sediment barriers and erosion control measures will be implemented, erosion and sedimentation risk is considered significant. Soil stockpiles are also vulnerable to erosion and likely to contribute significantly towards sediment generation due to the presence of loose materials. Hardened / compacted soils tend to promote increased / concentrated flows which translate to increased erosive power and result in erosion of downstream environments. Sedimentation has the potential to blanket and temporarily destroy habitats and deteriorate the quality of in-stream river habitat.

Operational Phase

Where soil erosion problems and bank stability concerns initiated during the construction phase are not timeously and adequately addressed through on-site rehabilitation post-construction, these can persist into the operational phase of the project and continue to have a negative impact on adjacent / downstream water resources for an extended period of time. The consequences of erosion & sedimentation are highlighted above under the Construction Phase impact description.

Flow related impacts (dealt with under **Impact 2**, above) have the potential to increase the erosive capacity of the river system and can lead to bank instability, collapse and channel bed scouring. Water draining off the new road surfaces and drains at potentially high velocities will have the capacity to erode soils and deliver sediment to the downstream aquatic environment. If unmitigated within a short timeframe the impacts can be escalated to gullies, dongas and completely silted water resource units. Sedimentation can also compromise the functioning of stormwater infrastructure. The significance of erosion and sedimentation is likely to be high given the steep slopes in the project area and the presence of erodible soils.

Impact 4: Pollution of water resources

This refers to the alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water / soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use. In the context of this impact assessment, water quality refers to its fitness for maintaining the health aquatic ecosystems. Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity; and
- Reduction in and/or loss of species of conservation concern (i.e. rare, threatened / endangered species).

Construction Phase

Potential construction phase contaminants and their relevant source 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; and
- Sediment – suspension of fine soil particles as a result of soil disturbance and altered flow patterns (covered above).

These contaminants which may enter water resource units during construction activities have the capacity to negatively affect the in-stream aquatic habitat and species. Where significant changes in water quality occur, this will ultimately result in a shift in aquatic species composition, favouring more tolerant species and potentially resulting in the localised reduction of sensitive species. Sudden drastic changes in water quality can also have chronic effects on aquatic biota in general, leading to localised extinctions. Water pollution impacts during construction are likely to be of moderately low ecological significance given that the proposed development handles limited pollutants and due to the reduced sensitivity of the aquatic environments as a result of existing land use transformation and modifications to aquatic habitat integrity.

Operational Phase

Pollution sources from road development projects in their operational-phase can vary greatly. In general, tarred road run-off have been identified as a significant source of diffuse pollution contaminating water resources as they may contain significant loads of nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether (MTBE). In general, 'water pollution impacts' during road operation are unlikely to increase in significance in the context of the existing impact that the R102 road infrastructure is having on the environment. Despite the high traffic volumes expected during the operational phase, the significance of this impact is expected to be low under normal circumstances in light of the low levels of pollutants expected which can be easily assimilated by the environment and due to the reduced sensitivity of the river network in the study area (as a consequence to the existing level of catchment transformation and loss of sensitive / intolerant biota that has already taken place).

7.4.7 Wetland Rehabilitation

A Rehabilitation Plan for Wetlands & Riparian Areas has been compiled by Eco-Pulse.

The aims of this Wetland Rehabilitation plan are to prevent the occurrence of large-scale damaging events as well as repeated, chronic, persistent, subtle events which can in the long-term be far more damaging (e.g. as a result of sedimentation and pollution).

The Wetland Rehabilitation Plan has the following key rehabilitation objectives:

- 1 To stabilise erodible soils / material within disturbed wetland/riparian areas;
- 2 To reinstate the natural wetland / river topography, soils and vegetation (similar to that which would have occurred at the site prior to disturbance / impact) using only suitable indigenous trees, shrubs and grasses;
- 3 To ensure continued wetland and river hydrological functioning, mimicking the natural situation as far as practically possible;
- 4 To replicate / restore the natural diversity and complexity of the wetland, instream and riparian habitat and aquatic ecosystems prior to disturbance / impact;
- 5 To provide for the control of invasive alien plants and weeds that may have colonised the wetlands / rivers post-disturbance; and
- 6 To provide for post-rehabilitation monitoring and aftercare/maintenance.

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).

It is also imperative that 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.

The environmental impact assessment is focused on the following phases of the project namely: Construction and Operational Phases only.

As the project entails upgrades and development of new infrastructure which will be permanent, decommissioning is not applicable to this project.

8.2 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.

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.

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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

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 the EMPr (*Appendix B*).

8.3 Rating of Potential Impacts

The potential impacts identified are explained per phase (construction and operational phases) of the project and mitigation measures are provided below.

8.3.1 Construction

8.3.1.1 Geotechnical

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>The following geotechnical constraints which are likely to have an effect on the proposed P79 Grade Separation Bridge and Linkage are the following:</p> <ul style="list-style-type: none"> ▪ Areas of anticipated shallow groundwater less than 1.5 m deep; ▪ Poor road construction or subgrade materials; ▪ Areas of shallow bedrock / boulders; ▪ Areas of steep slopes; ▪ Areas of potentially unstable slopes; ▪ Areas affected by the river/streams and possible stream diversions; and ▪ Areas of thick or compressible alluvium over which road fills are to be built. 	<p>Extent: Site (-1) Duration: Long-term (-3) Intensity: High (-3) Probability: Highly Probable (-3) Significance: Medium (-10)</p>	<ul style="list-style-type: none"> ▪ The detailed geotechnical investigation will define more accurately the nature (consistency) of the underlying soils, the depth to bedrock, the occurrence of groundwater seepage and allow for the taking of samples for laboratory testing. This detailed investigation is particularly important to obtain an indication of site specific geotechnical conditions which may have adverse effects on the proposed development. 	<p>Extent: Site (-1) Duration: Medium-term (-2) Intensity: Low (-1) Probability: Possible (-2) Significance: Low (-6)</p>

8.3.1.2 Soils

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Disruption of surface soils: erosion and sediment from construction activities (vegetation clearing).	Extent: Site (-1) Duration: Short-term (-1) Intensity: Moderate (-2) Probability: Highly Probable (-3) Significance: Medium (-7)	<ul style="list-style-type: none"> Disturbed areas of terrestrial and riparian vegetation must be rehabilitated immediately to prevent soil erosion. No vehicles should be allowed to cross rivers or streams in any area other than an approved crossing, taking care to prevent any impact (particularly erosion) in surrounding habitat. As far as possible, all construction activities should occur in the low flow season, during the drier winter months. Remove and store topsoil separately in areas where excavation / degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate re-growth of species that occur naturally in the area. 	Extent: Site (-1) Duration: Short-term (-1) Intensity: Low (-1) Probability: Improbable (-1) Significance: Low (-4)

8.3.1.3 Destruction/Loss of Terrestrial Vegetation and Habitat - Moderate Sensitivity Vegetation Communities

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Possible ecological consequences associated with this impact may include: <ul style="list-style-type: none"> Reduction in the representation 	Extent: Site (-1) Duration: Permanent (-4) Intensity: Moderate (-2)	<ul style="list-style-type: none"> Keep the clearing of vegetation through sensitive grassland areas to a minimum and attempt to ensure that clearing occurs in 	Extent: Site (-1) Duration: Permanent (-4) Intensity: Moderate (-2)

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>and conservation of vegetation types/communities;</p> <ul style="list-style-type: none"> ▪ Reduction/loss of habitat for fauna; and ▪ Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered plants). 	<p>Probability: Definite (-4) Significance: High (-11)</p>	<p>parallel with the construction progress where practically possible.</p> <ul style="list-style-type: none"> ▪ No open fires to be permitted in the vicinity of grassland / woodland vegetation, whether indigenous or not. ▪ Protected species of plants / trees are not to be removed or damaged where possible; otherwise a licence is required by law. ▪ Where protected or rare/threatened species (namely <i>Scadoxus puniceus</i>) are known to occur on the basis of habitat characteristics and where these are likely to be disturbed during construction, a plant 'rescue' operation must be undertaken by an appropriate specialist prior to construction. ▪ The ECO will need to acquire the necessary permits for plant removal / relocation of any threatened/protected plant species. 	<p>Probability: Possible (-2) Significance: Medium (-9)</p>

8.3.1.4 Modification of Vegetation Community and Habitat through Disturbance - Moderate Sensitivity Vegetation Communities

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>Possible ecological consequences associated with this impact may include:</p> <ul style="list-style-type: none"> Reduction in representation and conservation of vegetation types/communities; Reduction/loss of habitat for fauna; and Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species). 	<p>Extent: Local (-2) Duration: Permanent (-4) Intensity: Moderate (-2) Probability: Highly Probable (-3) Significance: High (-11)</p>	<ul style="list-style-type: none"> Keep the clearing of vegetation through sensitive grassland areas to a minimum and attempt to ensure that clearing occurs in parallel with the construction progress where practically possible. Construction activities, site camps and equipment lay-down areas must be limited to the road servitude wherever possible and not to be located within sensitive/undisturbed vegetation or habitat. Access routes should be designed to limit potential impact on the environment, bearing in mind steep slopes and areas that are already showing reduced groundcover and soil erosion. The ECO will need to acquire the necessary permits for plant removal/relocation of any threatened/protected plant species. 	<p>Extent: Site (-1) Duration: Medium-term (-2) Intensity: Moderate (-2) Probability: Possible (-2) Significance: Medium (-7)</p>

8.3.1.5 Pollution of Soils, Water and Vegetation - Moderate Sensitivity Vegetation Communities

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>This refers to the alteration or deterioration in the physical, chemical and biological characteristics of water, soil and air resources which inevitably impacts on vegetation.</p> <p>Potential contaminants and their relevant source may include:</p> <ul style="list-style-type: none"> ▪ 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; and ▪ Bitumen - spillages from poor application, handling and disposal practices. 	<p>Extent: Local (-2) Duration: Long-term (-3) Intensity: Moderate (-2) Probability: Possible (-2) Significance: Medium (-9)</p>	<ul style="list-style-type: none"> ▪ The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) needs to be administered. Construction materials liable to spillage are to be stored in appropriate containment structures (e.g. drip-trays). ▪ Storage containers must be regularly inspected so as to prevent leaks. ▪ All employees handling fuels and other hazardous materials are to be properly trained in their safe use, environmental restrictions and methods for proper disposal. ▪ Hazardous storage and re-fuelling areas must be bunded prior to their use on site during the construction period. The bund wall should be high enough to contain at least 110% of any stored volume. ▪ Mixing and / or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface and must be protected from the ingress and egress of stormwater. ▪ Spillages of fuels, oils and other potentially harmful chemicals should be cleaned up immediately and contaminants properly drained 	<p>Extent: Site (-1) Duration: Short-term (-1) Intensity: Moderate (-2) Probability: Improbable (-1) Significance: Low (-5)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
		and disposed of using proper solid/hazardous waste facilities (not to be disposed of within the natural environment).	

8.3.1.6 Reduction/Loss of Ecosystem Goods and Services - Moderate Sensitivity Vegetation Communities

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
This refers to the reduction in the level of supply of ecosystem goods and services (such as biodiversity support, carbon sequestration, erosion control, flood control, etc.) provided by natural terrestrial ecosystems and habitats including grasslands, woodlands, bushland and forests.	Extent: Local (-2) Duration: Long-term (-3) Intensity: Moderate (-2) Probability: Possible (-2) Significance: Medium (-9)	<ul style="list-style-type: none"> The mitigation measures provided under sections 8.3.1.3 – 8.3.1.5 are also applicable to this potential impact. It should be reiterated that as far as possible unnecessary disturbance of vegetation and habitat adjacent to the development must be avoided. 	Extent: Site (-1) Duration: Medium-term (-2) Intensity: Low (-1) Probability: Possible (-2) Significance: Low (-6)

8.3.1.7 Impact on Low Sensitivity Vegetation Communities

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Destruction/loss of terrestrial vegetation and habitat – refer to the nature of the impact under section 8.3.1.3.	Extent: Site (-1) Duration: Permanent (-4) Intensity: Low (-1) Probability: Definite (-4) Significance: High (-10)	<ul style="list-style-type: none"> Refer to mitigation measures provided under section 8.3.1.3. 	Extent: Site (-1) Duration: Permanent (-4) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-8)

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Modification of vegetation community and habitat through disturbance - refer to the nature of the impact under section 8.3.1.4 .	Extent: Local (-2) Duration: Permanent (-4) Intensity: Low (-1) Probability: Highly Probable (-3) Significance: High (-10)	<ul style="list-style-type: none"> Refer to mitigation measures provided under section 8.3.1.4. 	Extent: Site (-1) Duration: Medium-term (-2) Intensity: Low (-1) Probability: Possible (-2) Significance: Low (-6)
Pollution of soils, water and vegetation - refer to the nature of the impact under section 8.3.1.5 .	Extent: Local (-2) Duration: Long-term (-3) Intensity: Moderate (-2) Probability: Possible (-2) Significance: Medium (-9)	<ul style="list-style-type: none"> Refer to mitigation measures provided under section 8.3.1.5. 	Extent: Site (-1) Duration: Short-term (-1) Intensity: Low (-1) Probability: Improbable (-1) Significance: Low (-4)
Reduction/loss of ecosystem goods and services - refer to the nature of the impact under section 8.3.1.6 .	Extent: Local (-2) Duration: Long-term (-3) Intensity: Low (-1) Probability: Highly Probable (-3) Significance: Medium (-9)	<ul style="list-style-type: none"> Refer to mitigation measures provided under section 8.3.1.6. 	Extent: Site (-1) Duration: Medium-term (-2) Intensity: Low (-1) Probability: Possible (-2) Significance: Low (-6)

8.3.1.8 Destruction, Loss and Physical Modification of Aquatic Vegetation and Habitat for Biota

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
This refers to the direct physical destruction or disturbance of aquatic habitat caused by vegetation clearing, disturbance of wetland/riparian habitat, encroachment/colonisation of habitat by invasive alien plants and alteration of river and wetland geomorphological profiles (including stream beds and banks). Possible ecological consequences associated with this	Extent: Local (-2) Duration: Permanent (-4) Intensity: Moderate (-2) Probability: Definite (-4) Significance: High (-12)	<ul style="list-style-type: none"> A method statement for working within the riverine / stream habitats must be compiled by the ECO in line with the mitigation measures proposed in the Aquatic Ecological Assessment (Appendix C) and in conjunction with the appointed contractor in order to confirm all methods of watercourse encroachment and the most 	Extent: Site (-1) Duration: Permanent (-4) Intensity: Moderate (-2) Probability: Possible (-2) Significance: High (-9)

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>impact may include:</p> <ul style="list-style-type: none"> Reduction in representation and conservation of freshwater ecosystem/habitat types; Reduction in the supply of ecosystem goods and services; Reduction/loss of habitat for aquatic dependent flora and fauna; and Reduction in and / or loss of species of conservation concern (i.e. rare, threatened / endangered species). 		<p>practical and effective steps to minimise the impacts to wetland, instream and riparian habitat.</p> <ul style="list-style-type: none"> Construction activities within wetland unit C1-W01 must be limited to a 30 m working servitude measured from the toe of the road infrastructure. Delineated water resource units outside of the construction footprint are considered sensitive areas ('No-Go' areas). Access through and construction activities within the No-Go areas are strictly prohibited in these areas. Site camp and equipment lay-down areas are not to be located within delineated water resource units and should rather be located within transformed or disturbed terrestrial areas. These areas will need to be preapproved by the ECO before commencing with construction. 	

8.3.1.9 Flow Modification/Hydrological Impacts

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>This refers to any alterations in the quantity, timing and distribution of water inputs and flows within a watercourse, such as a wetland or</p>	<p>Extent: Local (-2) Duration: Short-term (-1) Intensity: Moderate (-2)</p>	<ul style="list-style-type: none"> Stormwater and erosion control measures must be implemented during the construction phase to ensure that erosion and 	<p>Extent: Site (-1) Duration: Short-term (-1) Intensity: Moderate (-2)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>river /stream. Possible ecological consequences associated with this impact may include:</p> <ul style="list-style-type: none"> ▪ Deterioration in freshwater ecosystem integrity; ▪ Reduction/loss of habitat for aquatic dependent flora and fauna; and ▪ Reduction in the supply of ecosystem goods and services. 	<p>Probability: Highly Probable (-4) Significance: Medium (-9)</p>	<p>sedimentation impacts to water resource units are avoided or minimised.</p> <ul style="list-style-type: none"> ▪ Vegetation / soil clearing activities must only be undertaken during agreed working times and permitted weather conditions. ▪ Run-off generated from cleared and disturbed areas such as access roads and slopes that drain into stream or wetlands must be controlled using erosion control (e.g. sand bags, earthen berm etc.) and sediment trap measures (e.g. silt fence). ▪ Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms or retaining walls) must be established to protect downstream water resource units from erosion and sedimentation impacts from upslope. ▪ Berms, sandbags and / or silt fences employed must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. ▪ Any dewatering is to be done in such a manner that water does not result in concentrated flow down slope that could cause soil erosion. ▪ Ensure that any trenches or excavations are closed and compacted immediately after 	<p>Probability: Possible (-2) Significance: Low (-6)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
		<ul style="list-style-type: none"> construction is completed. All river / stream channel embankments at crossings must be rehabilitated to ensure both longitudinal and cross sectional stability against summer floods. Depending on the circumstances, this may necessitate stabilizing structures such as gabions or reno-mattresses as well as careful attention to vegetation rehabilitation. 	

8.3.1.10 Erosion and Sedimentation

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>This refers to the alteration in the physical characteristics of wetlands and rivers as a result of increased turbidity and sediment deposition, caused by soil erosion and earthworks that are associated with construction activities, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include:</p> <ul style="list-style-type: none"> Deterioration in freshwater ecosystem integrity; and Reduction / loss of habitat for aquatic dependent flora and fauna. 	<p>Extent: Local (-2) Duration: Medium-term (-2) Intensity: High (-3) Probability: Highly Probable (-3) Significance: High (-10)</p>	<ul style="list-style-type: none"> Refer to mitigation measures provided under section 8.3.1.9. 	<p>Extent: Site (-1) Duration: Short-term (-1) Intensity: Moderate (-2) Probability: Possible (-2) Significance: Low (-6)</p>

8.3.1.11 Pollution of Water Resources

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>Possible ecological consequences associated with this impact may include:</p> <ul style="list-style-type: none"> ▪ Deterioration in freshwater ecosystem integrity; and ▪ Reduction in and / or loss of species of conservation concern (i.e. rare, threatened/endangered species). <p>Potential construction phase contaminants and their relevant source may include: hydrocarbons; oils and grease; cement; bitumen; sewage and sediment.</p>	<p>Extent: Local (-2) Duration: Long-term (-3) Intensity: High (-3) Probability: Possible (-2) Significance: High (-10)</p>	<ul style="list-style-type: none"> ▪ The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) needs to be administered. Construction materials liable to spillage are to be stored in appropriate containment structures (e.g. drip-trays). ▪ Storage containers must be regularly inspected so as to prevent leaks. ▪ All employees handling fuels and other hazardous materials are to be properly trained in their safe use, environmental restrictions and methods for proper disposal. ▪ Hazardous storage and re-fuelling areas must be bunded prior to their use on site during the construction period. The bund wall should be high enough to contain at least 110% of any stored volume. ▪ Mixing and / or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface and must be protected from the ingress and egress of stormwater. ▪ Spillages of fuels, oils and other potentially harmful chemicals should be cleaned up immediately and contaminants properly drained 	<p>Extent: Site (-1) Duration: Short-term (-1) Intensity: Moderate (-2) Probability: Improbable (-1) Significance: Low (-5)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
		and disposed of using proper solid / hazardous waste facilities (not to be disposed of within the natural environment).	

8.3.1.12 Impact on Amphibian and Reptile Species of Concern

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<ul style="list-style-type: none"> The proposed activities will directly impact on the wetland area through direct habitat destruction caused by construction and earth moving activities for the road works. This might have a direct impact on amphibian and reptile species of concern (e.g. Pickergill's Reed Frog). 	<p>Extent: Site (-1) Duration: Permanent (-4) Intensity: High (-3) Probability: Possible (-2) Significance: High (-10)</p>	<ul style="list-style-type: none"> It is recommended that no further impacts to the wetland (C1-W01) are permitted and that a 20 - 30 m buffer around the wetland is maintained during and following the proposed upgrades to the road system in as far as possible given existing infrastructure. Additional nocturnal surveys are advisable should the wetland condition be restored to that of a functional system. 	<p>Extent: Site (-1) Duration: Long-term (-3) Intensity: Moderate (-2) Probability: Improbable (-1) Significance: Medium (-7)</p>

8.3.1.13 Heritage

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Impact on sites of cultural significance, e.g. graves / cemetery.	<p>Extent: Local (-2) Duration: Permanent (-4) Intensity: High (-3) Probability: Improbable (-1)</p>	<ul style="list-style-type: none"> A buffer zone of at least 30 m around the large cemetery that is located almost 800 m to the north of the footprint. 	<p>Extent: Local (-2) Duration: Short-term (-1) Intensity: Low (-1) Probability: Improbable (-1)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
	Significance: High (-10)	<ul style="list-style-type: none"> Attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) which, requires that operations that expose all graves, as well as archaeological and historical remains should cease immediately, pending evaluation by the provincial heritage resources authority. 	Significance: Low (-5)

8.3.1.13 Traffic Accommodation

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
Impact on neighbouring landowners during the construction phase due to temporary land acquisition for traffic accommodation and/or traffic nuisance.	Extent: Local (-2) Duration: Long-term (-3) Intensity: High (-3) Probability: Highly probable (-3) Significance: High (-11)	<ul style="list-style-type: none"> A Traffic Management Plan must be compiled and implemented prior to construction commencing. All affected stakeholders must be included and liaised with during the compilation of the Traffic Management Plan. 	Extent: Local (-2) Duration: Long-term (-3) Intensity: High (-3) Significance: High (-11)

8.3.2 Operations

8.3.2.1 Destruction, Loss and Physical Modification (Alien Plants)

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<ul style="list-style-type: none"> Road development across rivers / wetlands and in the vicinity of watercourses is likely to introduce unnatural disturbance to the aquatic ecosystems and habitat and generally promotes the establishment of disturbance-tolerant species, including colonization by Invasive Alien Plants (IAPs), weeds and pioneer plant species. Certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flows thereby potentially increasing sediment inputs and altering natural hydrology of receiving watercourses. Poorly managed stormwater has a potential to flood, scour / erode habitat and / or result in a shift in soil saturation levels (wetland hydro-period) which will ultimately affect the baseline aquatic habitat type and condition. 	<p>Extent: Local (-2) Duration: Long-term (-3) Intensity: Moderate (-2) Probability: Highly Probable (-3) Significance: High (-10)</p>	<ul style="list-style-type: none"> It is the responsibility of the developer / applicant to eradicate and control alien invasive plants that invade the road servitude and all areas disturbed during construction and operation of the proposed road infrastructure. 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 new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner. It is recommended that bi-annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually. 	<p>Extent: Site (-1) Duration: Long-term (-3) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-7)</p>

8.3.2.2 Flow Modification/Hydrological Impacts

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<ul style="list-style-type: none"> Hardened / artificial infrastructure such as roads will generally alter the natural processes of rain water infiltration and surface run-off, promoting increased volumes and velocities of stormwater run-off which can be detrimental to water resources receiving concentrated flows off of these areas. 	<p>Extent: Local (-2) Duration: Permanent (-4) Intensity: Moderate (-2) Probability: Highly Probable (-3) Significance: High (-11)</p>	<ul style="list-style-type: none"> Review of the current road layout (Plan Number: C29324) indicates that water is likely to pool at the north-eastern corner of the at-grade intersection (chainage 440-500). Appropriate stormwater management as per the stormwater management plan is required. Additionally, stormwater in roadside drains can be released into the adjacent veld at regular intervals and distributed in a more diffuse or natural manner and not allowed to pool. Refer to the mitigation measures provided in section 8.3.1.9. 	<p>Extent: Local (-2) Duration: Long-term (-3) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-8)</p>

8.3.2.3 Erosion and Sedimentation

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<ul style="list-style-type: none"> Where soil erosion problems and bank stability concerns initiated during the construction phase are not timeously and adequately addressed through on-site rehabilitation post-construction, these can persist into the 	<p>Extent: Local (-2) Duration: Long-term (-3) Intensity: High (-3) Probability: Possible (-2) Significance: High (-10)</p>	<ul style="list-style-type: none"> Refer to the mitigation measures provided in section 8.3.1.10. 	<p>Extent: Site (-1) Duration: Long-term (-3) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-7)</p>

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<p>operational phase of the project and continue to have a negative impact on adjacent / downstream water resources for an extended period of time.</p> <ul style="list-style-type: none"> Water draining off the new road surfaces and drains at potentially high velocities will have the capacity to erode soils and deliver sediment to the downstream aquatic environment. 			

8.3.2.4 Pollution of Water Resources

Potential impacts	Significance rating of impacts before mitigation	Proposed mitigation (Further mitigation provided in the EMPr – Appendix B)	Significance rating of impacts after mitigation
<ul style="list-style-type: none"> Road run-off have been identified as a significant source of diffuse pollution contaminating receiving water resource units as they may contain significant loads of nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether (MTBE). 	<p>Extent: Local (-2) Duration: Permanent (-4) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-9)</p>	<ul style="list-style-type: none"> Refer to the mitigation measures provided in sections 8.3.1.9 – 8.3.1.11. 	<p>Extent: Local (-2) Duration: Permanent (-4) Intensity: Low (-1) Probability: Possible (-2) Significance: Medium (-9)</p>

9 ENVIRONMENTAL IMPACT STATEMENT

9.1 Key Findings of the Study

The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on terrestrial and aquatic ecology environments. These impacts can be successfully mitigated through the measures and recommendations presented in this study (**Sections 8.3.1** and **8.3.2**) and the Environmental Management Programme – EMPr (**Appendix B**). The site sensitivity map is presented in **Figure 9-1**.

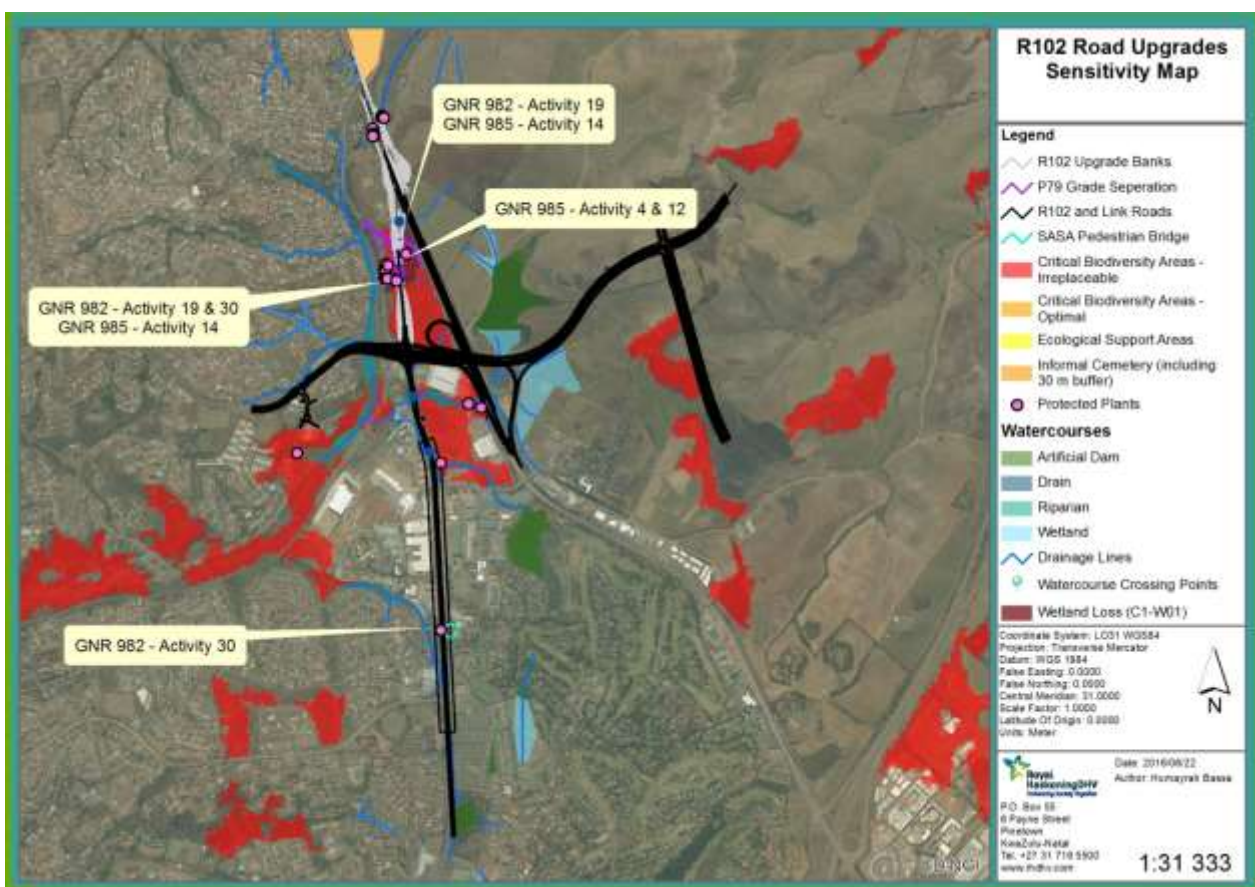


Figure 9-1: Sensitivity map for the P79 Grade Separation Bridge and Linkage, and SASA Pedestrian Bridge

Currently, there are high traffic volumes on the R102 and ancillary roads including the Main Road 2/1 and M41 due to an increase in urbanisation within the area. There is a need to upgrade the R102 and provide the necessary interchanges and linkages to ancillary roads. The upgrades include the P79 Grade Separation Bridge and Linkage. Should the *status quo* remain then R102 and ancillary roads will not be able to accommodate the increased traffic volumes and the current situation will continue which includes:

- Increase traffic pressure on road surfaces;

- No provision for a northbound onramp and a southbound off-ramp for Main Road 2/1 and the M41; and
- Limited movement of traffic within the area.
- Time delays
- Traffic congestion / personal stress

The EAP therefore, based on the findings of this BA study, recommends that the P79 Grade Separation Bridge and Linkage, and the SASA Pedestrian Bridge be authorised.

9.1.1 Summary of Impacts

A summary of positive and negative impacts are provided in Table 9—1.

Table 9—1: Summary of positive and negative impacts identified and assessed

Environmental Attributes	Impacts Per Phase	
	Construction	Operation
Geotechnical	<p>Negative impacts</p> <p>Geotechnical constraints:</p> <ul style="list-style-type: none"> ■ Areas of anticipated shallow groundwater less than 1.5 m deep; ■ Poor road construction or subgrade materials; ■ Areas of shallow bedrock/boulders; ■ Areas of steep slopes; ■ Areas of potentially unstable slopes; ■ Areas affected by the river/streams and possible stream diversions; and ■ Areas of thick or compressible alluvium over which road fills are to be built. 	<p>No impacts envisaged</p>
Soils	<p>Negative impacts</p> <p>Erosion and sediment from construction activities (vegetation clearing).</p>	<p>Negative impacts</p> <p>Where soil erosion problems and bank stability concerns initiated during the construction phase are not timeously and adequately addressed through on-site rehabilitation post-construction, these can persist into the operational phase of the project.</p> <p>Certain alien plants exacerbate soil erosion thereby potentially increasing sediment inputs and altering natural hydrology of receiving watercourses.</p>
Terrestrial Vegetation	<p>Negative impacts</p> <p>Reduction in the representation and</p>	<p>Negative impacts</p> <p>Road development across rivers /</p>

Environmental Attributes	Impacts Per Phase	
	Construction	Operation
	<p>conservation of vegetation types / communities. Reduction/loss of habitat for fauna. Reduction in and/or loss of species of conservation concern (i.e. rare, threatened / endangered plants). Alteration or deterioration in the physical, chemical and biological characteristics of water, soil and air resources which inevitably impacts on vegetation. Reduction in the level of supply of ecosystem goods and services (such as biodiversity support, carbon sequestration, erosion control, flood control, etc.) provided by natural terrestrial ecosystems and habitats including grasslands, woodlands, bushland and forests.</p>	<p>wetlands and in the vicinity of watercourses is likely to introduce unnatural disturbance to the aquatic ecosystems and habitat and generally promotes the establishment of disturbance-tolerant species, including colonization by Invasive Alien Plants (IAPs), weeds and pioneer plant species. Certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flows thereby potentially increasing sediment inputs and altering natural hydrology of receiving watercourses. Poorly managed stormwater has a potential to flood, scour / erode habitat and/or result in a shift in soil saturation levels (wetland hydro-period) which will ultimately affect the baseline aquatic habitat type and condition.</p>
Aquatic Vegetation	<p>Negative impacts Reduction in representation and conservation of freshwater ecosystem / habitat types. Reduction in the supply of ecosystem goods and services. Reduction / loss of habitat for aquatic dependent flora and fauna. Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).</p>	<p>Negative impacts Road development across rivers / wetlands and in the vicinity of watercourses is likely to introduce unnatural disturbance to the aquatic ecosystems and habitat and generally promotes the establishment of disturbance-tolerant species, including colonization by Invasive Alien Plants (IAPs), weeds and pioneer plant species. Poorly managed stormwater has a potential to flood, scour / erode habitat and/or result in a shift in soil saturation levels (wetland hydro-period) which will ultimately affect the baseline aquatic habitat type and condition.</p>
Hydrology	<p>Negative impacts Alterations in the quantity, timing and distribution of water inputs and flows within a watercourse, such as a wetland or river /</p>	<p>Negative impacts Certain alien plants can contribute to a reduction in stream flows thereby potentially increasing sediment inputs</p>

Environmental Attributes	Impacts Per Phase	
	Construction	Operation
	<p>stream.</p> <p>Pollution of water resources due to hydrocarbons; oils and grease; cement; bitumen; sewage and sediment.</p>	<p>and altering natural hydrology of receiving watercourses.</p> <p>Hardened / artificial infrastructure such as roads will generally alter the natural processes of rain water infiltration and surface run-off, promoting increased volumes and velocities of stormwater run-off which can be detrimental to water resources receiving concentrated flows off of these areas.</p> <p>Water draining off the new road surfaces and drains at potentially high velocities will have the capacity to erode soils and deliver sediment to the downstream aquatic environment.</p> <p>Road run-off have been identified as a significant source of diffuse pollution contaminating receiving water resource units as they may contain significant loads of nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether (MTBE).</p>
Amphibians and Reptiles	<p>Negative impact</p> <p>The proposed activities will directly impact on the wetland area through direct habitat destruction caused by construction and earth moving activities for the road works. This might have a direct impact on amphibian and reptile species of concern (e.g. Pickergill's Reed Frog).</p>	<p>No impacts envisaged</p>
Heritage	<p>Negative impact</p> <p>Impact on sites of cultural significance, e.g. graves / cemetery.</p>	<p>Negative impact</p> <p>Impact on sites of cultural significance, e.g. graves / cemetery.</p>
Traffic Accommodation	<p>Negative impact</p> <p>Impact on neighbouring landowners (e.g. traffic nuisance and land acquisition).</p>	<p>Negative impact</p> <p>Impact on neighbouring landowners (e.g. traffic nuisance and land acquisition).</p>

9.2 Conditions

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

The implementation of this EMPr for the entire life-cycle (i.e. pre-construction, construction, operation and rehabilitation) of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, it is recommended that the following key conditions should be included as part of the authorisation:

- a) The proponent 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:
 - Provisions of the National Water Act, 1998 (Act No. 36 of 1998).
 - Provision of the National Heritage Resources Act, 1999 (Act No. 25 of 1999).
- b) The proponent 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) Adhere to mitigation measures which will be implemented during the construction phase of the P79 Grade Separation Bridge and Linkage includes the following:
 - Keep the clearing of vegetation through sensitive grassland areas to a minimum and attempt to ensure that clearing occurs in parallel with the construction progress where practically possible.
 - Two threatened plant species, namely *Scadoxus puniceus* (Snake Lily) and *Aloe marlothii*, will be affected by the P79 Grade Separation Bridge and Linkage, and the SASA Pedestrian Bridge.. The Applicant will need to pursue the necessary permit / licencing requirements from Ezemvelo KZN Wildlife (EKZNW) prior to clearing of vegetation. An ecologist will need to be appointed to oversee the removal of the threatened plant species.
 - No vehicles should be allowed to cross rivers or streams in any area other than an approved crossing, taking care to prevent any impact (particularly erosion) in surrounding habitat.
 - Remove and store topsoil separately in areas where excavation/degradation takes place.
 - Construction activities within wetland unit C1-W01 must be limited to a 30 m working servitude measured from the toe of the road infrastructure.
 - Delineated water resource units outside of the construction footprint are considered sensitive areas ('No-Go' areas). Access through and construction activities within the No-Go areas are strictly prohibited in these areas.
 - Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms or retaining walls) must be established to protect downstream water resource units from erosion and sedimentation impacts from upslope.
 - Eradicate and control alien invasive plants that invade the road servitude.

- A Traffic Management Plan must be compiled and implemented.

9.3 Assumptions, Gaps and Limitations of the Study

- All information provided by KZN DoT to the EAP was correct and valid at the time it was provided.
- All data from unpublished research is valid and accurate.
- This study is based on preliminary bridge and linkage designs as provided in the Design Report prepared by Royal HaskoningDHV, Transport and Planning.
- Not all wetlands within the 500 m DWS regulated area were assessed / delineated in the field. Focal areas at risk of being impacted or triggering Section 21 c and i water use were flagged during the desktop risk / screening exercise to be assessed in detail in the field. Thus, finer habitat type details of the systems not formally assessed were not acquired.
- Infield soil and vegetation sampling was only undertaken within a specific focal area in the vicinity of the proposed development, while the remaining water resource / HGM units were delineated at a desktop level with limited accuracy.

9.3.1 Freshwater Habitat Assessment

The following limitations and assumptions apply to this assessment:

- This report deals exclusively with a defined area and the extent and nature of wetlands / aquatic ecosystems in that area.
- Not all wetlands within the 500 m DWS regulated area were assessed/delineated in the field. Focal areas at risk of being impacted or triggering Section 21 c and i water use were flagged during the desktop risk / screening exercise to be assessed in detail in the field. Thus, finer habitat type details of the systems not formally assessed were not acquired.
- The wetland boundary was identified and classified along a transitional gradient from saturated through to terrestrial soils which makes it difficult to identify the exact boundary of the wetland. The boundaries mapped in this specialist report therefore represent the approximate boundary of wetlands as evaluated by an assessor familiar and well-practiced in the delineation technique.
- It is important to note that the delineation of some wetland and riparian areas was made difficult by land transformation, particular infilling and hardened infrastructure.
- Mapped boundaries are based largely on the GPS locations of soil sampling points. GPS accuracy will therefore affect the accuracy rating of mapped sampling points and therefore wetland/riparian boundaries. Soil sampling points were recorded using a Garmin Oregon™ Global Positioning System (GPS) with an accuracy of 3-5 m.
- Infield soil and vegetation sampling was only undertaken within a specific focal area in the vicinity of the proposed development, while the remaining water resource / HGM units were delineated at a desktop level with limited accuracy.
- The field assessment was undertaken over a number of days in late winter / early spring (August / September 2015) and therefore does not cover the seasonal variation in conditions likely to occur at the site.
- All field assessments were limited to day-time assessments.
- Sampling by its nature, means that generally not all aspects of ecosystems can be assessed and identified.

- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked.
- The vegetation information provided is based on observation not formal vegetation plots. As such species documented in this report should be considered as a list of dominant and / or indicator wetland / riparian species and only provide a very general indication of the composition of the wetland/riverine vegetation communities.
- 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.
- It should be noted that while WET-Health (**Macfarlane et al., 2008**) is the most appropriate technique currently available to undertake assessments of wetland condition/integrity, it is nonetheless a rapid assessment tool that relies on qualitative information and expert judgment. While the tool has been subjected to an initial peer review process, the methodology is still being tested and will be refined in subsequent versions. For the purposes of this assessment, the assessment was undertaken at a rapid level with limited field verification. It therefore provides an indication of the PES of the system rather than providing a definitive measure.
- The Ecological Importance and Sensitivity assessment did not specifically address the finer-scale biological aspects of the rivers such as fauna (amphibians and invertebrates) occurring. No detailed assessment of aquatic fauna / biota was undertaken. Fauna documented in this report are based on site observations during site visits and are therefore not intended to reflect the overall faunal composition of the habitats assessed.
- 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.
- 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).
- Post-development PES and EIS assessments were not undertaken. The predicted change in the state and level of ecosystem services provided by the delineated freshwater habitats was qualitatively described based on professional opinion.

9.3.2 Vegetation Assessment

The following limitations and assumptions apply to this assessment:

- This report deals exclusively with a defined area and the extent and nature of the vegetation and habitat/ecosystems in that area.
- The study focused on 'terrestrial' or dryland vegetation and wetland/aquatic vegetation and habitats were not included as these have already been dealt with separately in the Specialist Wetland and Aquatic Assessment Report compiled by Eco-Pulse in August/September 2015.
- The location of species of conservation concern was recorded using a Garmin Montana™ Global Positioning System (GPS) and captured on a map of the area using a Geographical Information System (GIS). GPS accuracy was limited to 3-5 m and recording points beneath tree cover is likely to have further reduced GPS accuracy in heavily vegetated areas.
- The field assessment was undertaken in spring / onset of summer (late September 2014). The assessment therefore does not cover the seasonal variation in conditions at the site.
- 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. Due to the moderately small extent of the site, the area was quite intensively sampled, reducing the risk of overlooking species.
- Information on the threat status of plants species was informed largely by the SANBI Threatened Species Online database, which was assumed to be up to date and accurate at the time of compiling this report. Any changes made after the compilation of the report are therefore not covered.
- While an assessment of the potential occurrence of species of conservation concern has been undertaken, and is informed by readily available information, this provides only a surrogate indicator of the likelihood of such species occurring. This is however regarded as appropriate given the level of habitat degradation/transformation across much of the project area.
- The assessment of impacts and recommendation of mitigation measures was informed by the site specific ecological concerns arising from the vegetation field surveys and based on the assessor's working knowledge and experience with similar development projects.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the Province / Local Municipality at the time of the assessment.
- The focus of this assessment was on surveying the vegetation of the target property. Whilst no fauna was actively observed during the field visit, it is to be noted that faunal surveys were not undertaken or included as part of the assessment.

9.3.3 Nocturnal Assessment

The following limitations and assumptions apply to this assessment:

- Timing and external factors - Despite the timing of the survey being conducted at an appropriate time of year in terms of amphibian breeding activity, very little rain had been received in the region and the wetland area in questions was very dry, thereby severely limiting the possibility of any amphibian activity.
- Data to be provided – Royal HaskoningDHV provided all the necessary spatial and other relevant data about the study site.

9.4 Construction Programme

An 18 month construction programme, commencing in November 2016 is envisaged.

9.5 Declarations by the EAP

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

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



Signed: Humayrah Bassa (EAP)
Royal HaskoningDHV



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