REPORT

Basic Assessment Report for the proposed Planning & Design for the Maintenance and/or Upgrade of the Patrol Roads and Fencing on the Borders between RSA, Swaziland & Mozambique – Phase 1

Client:	Department of Public Works
Reference:	T&PMD2264/2675R001F01
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Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV (PTY) LTD

21 Woodlands Drive
Building 5
Country Club Estate
Woodmead
Johannesburg
2191
Transport & Planning
Reg No. 1966/001916/07

+27 11 798 6000 **T**
+27 11 798 6005 **F**
durban@rhdhv.com **E**
royalhaskoningdhv.com **W**

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Author(s):	Johan Blignaut & Paul Da Cruz

Drafted by:	Johan Blignaut
Checked by:	Paul da Cruz
Date / initials:	11.12.2017 P.d.C
Approved by:	Malcolm Roods (EAPASA)
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Classification
Project related

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INTRODUCTION

The Department of Public Works (DPW) as the applicant, in conjunction with the KwaZulu-Natal Department of Transport (KZN DoT) as the implementing agent are proposing the upgrade of existing border control infrastructure, and development of new border control infrastructure along a portion of the South Africa (KwaZulu-Natal)-Mozambique Border in the north-eastern part of the Province. This application is termed the 'Phase 1' application and forms a component of a wider project being undertaken by the Department of Public Works for the upgrading of border control infrastructure along the South Africa-Swaziland border and the southern part of the South Africa (KZN)-Mozambique border. The Phase 1 alignment is comprised of the section of the international border with Mozambique from the high water mark of the Indian Ocean (KM0) to the eastern boundary of the Ndumo Game Reserve (KM54).

The project is being undertaken by the DPW in conjunction with the Department of Agriculture Forestry and Fisheries (DAFF) and the South African National Defence Force (SANDF) as end users. The aim of the project is to stop the illegal trafficking of stolen vehicles and contraband across this section of the international border, as well as to prevent the illegal movement of people as well as livestock that could transmit disease. The Phase 1 section of the wider project is being prioritised for development as it is considered a 'high risk' area where significant numbers of stolen vehicles are currently being trafficked into Mozambique from South Africa.

An application for environmental authorisation is being lodged for a fifty (50) meter-wide corridor (as measured from the existing border fence) for a fifty four (54) km long section of the international border with Mozambique (Figure i).

The proposed infrastructure that will be developed within this corridor will include the following components (Figure ii):

- The upgrading / replacing of the existing fence running along the border with a 2.4m high elephant-proof fence along most of the length of the project section (with the exception of the fence in the vicinity of the Farazela (Kosi Bay) Border Post which will be replaced with a clear vu fence)
- The development of an inner fence
- The development of a servitude fence
- The development of a 1.5m high Border Barrier structure along two sub-sections of the Phase 1 section – between the western boundary of the iSimangaliso Wetland Park and the eastern boundary of the Tembe Elephant Park and between the western boundary of the Tembe Elephant Park and the eastern boundary of the Ndumo Game Reserve
- The development of a new 5.5m wide gravel border patrol road within a sub-section of the Phase 1 section that extends westwards from the foot of the primary dune near the Indian Ocean to the eastern boundary of the Ndumo Game Reserve (excluding Lake kuZilonde)
- The development of a wooden 'boardwalk' structure for the use of all-terrain vehicles (ATVs) across Lake kuZilonde within the iSimangaliso Wetland Park
- The development of a 1m-wide footpath across the primary dune at the Indian Ocean, extending from the western foot of the dune to the high water mark of the sea on its eastern side.

In addition a 5ha construction camp is proposed to be developed near the Farazela Border Post.

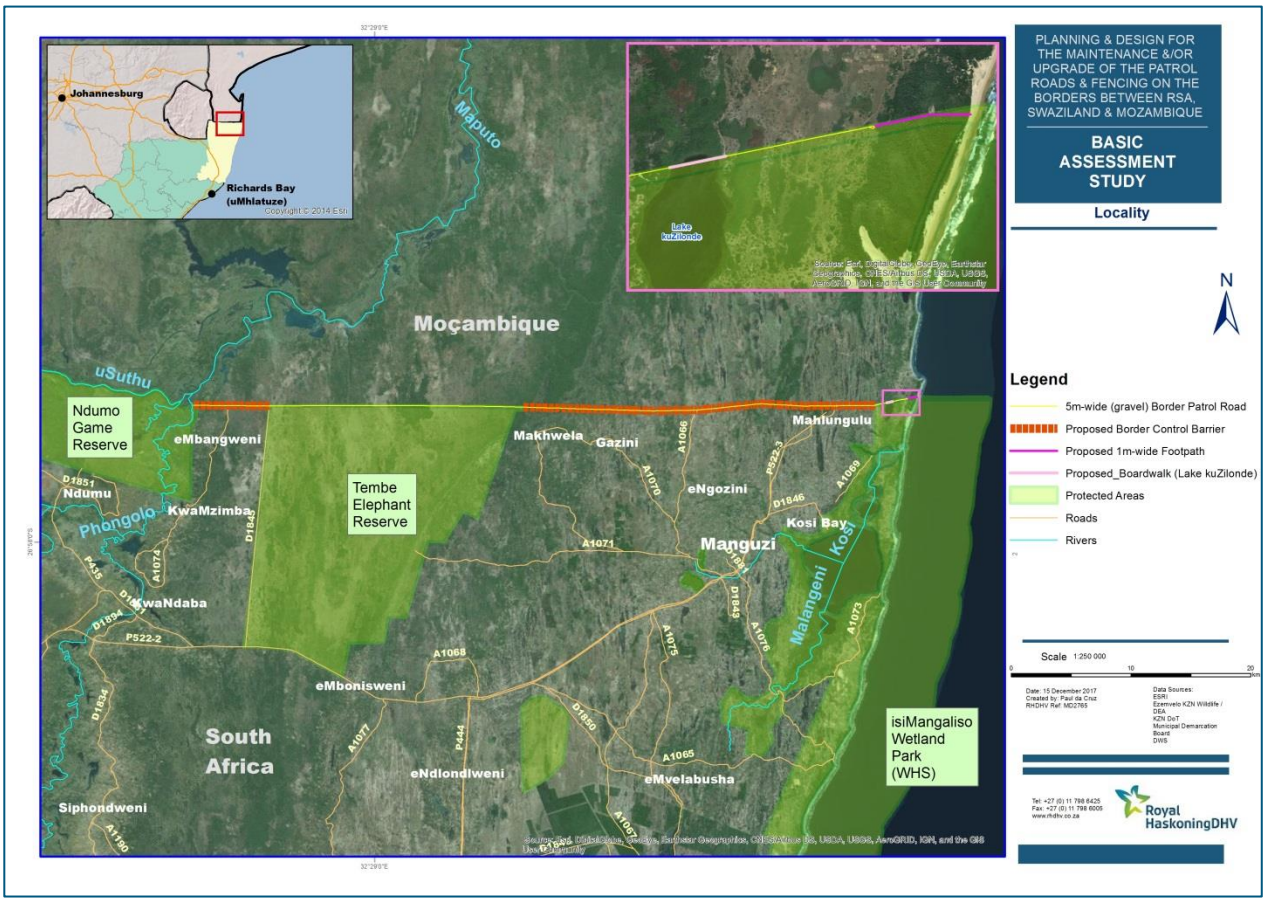

Figure i - Locality Map

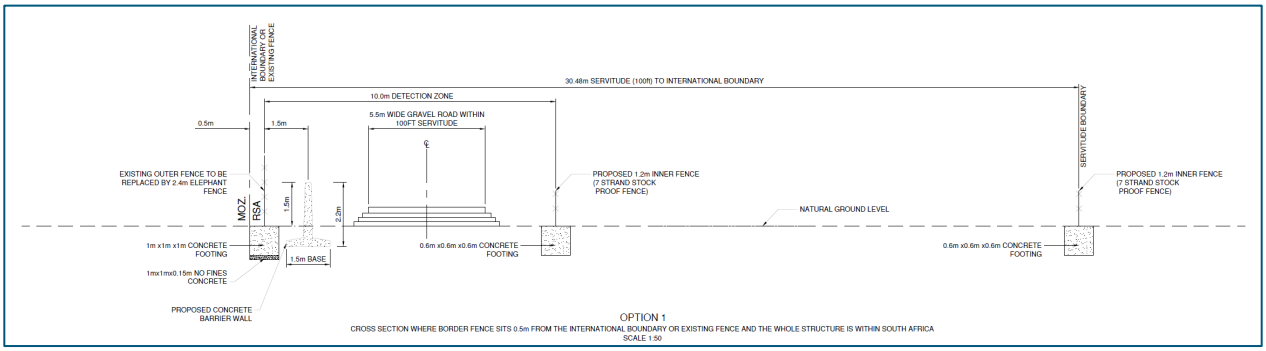

Figure ii – Conceptual Layout of Development Components

LEGISLATIVE CONTEXT

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant portions of environmental legislation that need to be considered during this study. The proposed development will trigger a number of activities in terms of the Environmental Impact Assessment Regulations, 2014 (GNR 982 in GG 382 of 4 December 2014 as amended in 2017) under:

- Listing Notice 1 (GNR 983 in GG 38282 of 4 December 2014 as amended in 2017)

- Listing Notice 3 (GN R984 in GG 38282 of 4 December 2014 as amended in 2017)

The Listing Notice 3 activities are triggered as there are a number of environmentally sensitive areas as defined in Listing Notice 3 for KwaZulu-Natal which are traversed by the proposed development, including world heritage sites, formally protected areas and critical biodiversity areas, *inter alia.*

There are a number of significant pieces of environmental legislation that have been taken into account during this study. These include:

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations 2014 (as amended in 2017)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Environmental Management: Air Quality Act (Act No. 39 of 2004)
National Environmental Management: Integrated Coastal Management Amendment Act, 2014 (Act No. 36 of 2014)
National Water Act (Act No. 36 of 1998) (as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
KZN Nature Conservation Ordinance (Ordinance No.15 of 1974)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)
Construction Regulations (2014)

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

PROJECT ALTERNATIVES

In terms of the EIA Regulations 2014 (as amended in 2017) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the NEMA (Act No. 107 of 1998) (as amended). An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity.

In the context of alignment alternatives, the nature of the project entails the upgrading / development of border control infrastructure along a section of the South Africa- Mozambique International Border. In the context of site alternatives it is very important to note that this infrastructure is required to be placed immediately alongside the international border as the primary aim of the infrastructure is to secure the border line (in the case of fencing) and to allow the patrolling of the border (in the case of the border patrol road and associated infrastructure including the wooden boardwalk structure and footpath that replace the road along certain sections of the Phase 1 alignment. It is thus technically not feasible to locate this infrastructure away from the border line, as the purpose of securing the border and in particular the patrolling of the border which requires visibility of the border line is not able to be achieved. For the majority of the length of the Phase 1 alignment, existing border patrol infrastructure is located along the border, and accordingly for technical and environmental reasons, there is no value in considering a (new) alternative alignment away from the border – environmentally this would result in the transformation of greenfield areas which is much less preferable than widening the existing impacted footprint. For these reasons, ***no alignment alternatives for the border patrol infrastructure*** have been considered in this basic assessment process.

In the context of the proposed construction camp, **site alternatives** were considered. The Construction Camp for the Border Barrier Structure is located just to the south of the Farazela Border Post. During the pre-environmental application phase of the project the environmental (EAP) team on the project engaged with the border barrier design team regarding the optimal environmental location of the construction camp.

The environmental team identified the forestry plantations located to the south-west of the Farazela Border Post as being environmentally optimal for the sighting of the construction camp as these areas have already been completely transformed by the planting of exotic trees (the proposed construction camp site is comprised of natural vegetation). On consideration of this recommendation, the design team ruled these out due to potential landowner issues and the likely requirement of purchasing this land and compensating the individual owners for loss of plantation area which may not be successful and which would likely delay the project. Due to the first component of the barrier structure planned to be constructed being located to the west of the Farazela Border Post, the construction camp needs to be located in the vicinity of the Farazela Border Post. Accordingly no other feasible alternative locations for the construction camp have been able to be identified and comparatively assessed.

Design alternatives were considered in relation to the conceptual design of the infrastructure components within the 50m corridor. Potential design alternatives of different infrastructure components were considered in consultation with the engineering design teams on the Phase 1 project for the following:

- Culverts (box culverts vs pipe culverts)
- Fence and Barrier (retention of these two components as separate components, vs the integration of these two components as one structure)

Neither of these components has been able to be utilised for the consideration of deign-related alternatives. It is important to note that no detailed design has yet been undertaken for the Phase 1 project. In the context of culverts it is not possible for the engineering design teams to determine whether pipe or box culverts will be optimal for use, considering the hydrology of each wetland crossed. The design specification for the project refers to the use of both pipe and box culverts, as well as drift structures for use in the design, depending on local flow conditions in each wetland crossed. It is accordingly not practical to limit the design team to one or other type of culvert design as both types are likely to be utilised in the detailed design of infrastructure.

In the case of the potential assimilation of the elephant fence and the border barrier structure, this will also be only confirmed once detailed design has been undertaken. In certain sections of the alignment the two components may be combined in order to minimise the footprint of the infrastructure in sensitive areas, in particular wetlands where the increase in the footprint of the affected area should be minimised. In other areas the two structures are likely to be retained as separate to one another. It is not practical to specify one design as the preferred**. Accordingly no design alternatives have been able to be considered**.

No-go Alternative - Should the development not proceed, the existing infrastructure will remain. The activities related to border control and border patrol will still be able to be undertaken by the relevant law enforcement agencies within the Phase 1 section, as is currently the case due to the existence of the existing track and fence along the majority of the length of the Phase 1 alignment. However the benefits in terms of improved law enforcement, improved ability to secure the international border and in terms of the ability of government agencies will continue to be compromised by infrastructure that in a state of disrepair in certain parts of the route, or which hinders the ability of the illegal movement to be prevented due to poor access and patrol infrastructure which makes it difficult to patrol and respond to incidents. The non-development of the border barrier will not allow the current high levels of illegal trafficking of stolen / hijacked vehicles across the border to prevented and brought down through the prevention of the physical movement of these vehicles across the border.

If this infrastructure development project is not undertaken, the benefits to the local communities of short term employment opportunities as well as the safeguarding of these communities through the reduction in criminal activities that will be able to be more effectively performed by law enforcement agencies will be unlikely to materialise. The environmental benefits of the project, especially as they relate to the improved ability to prevent illegal activities such as illegal fishing and poaching within protected areas located along the border will not materialise, although it is important to note that the increased transformation of sensitive natural habitats that would result from the increasing of the footprint of the border control infrastructure will not materialise.

NEED AND DESIRABILITY

A number of factors indicate the ***Need*** for the proposed project; firstly it will fulfil a need at a national governance level by assisting in fulfilling the constitutional mandate of a number of national and provincial governmental departments as well as the mandate of the SANDF in:

- securing South Africa's borders,
- protecting its citizens,
- preventing the spread of disease, and
- preventing the illegal movement of goods and people.

The project is thus highly important at a national level. However the outcomes of the development will also exert a positive local-level impact. The level of crime in the northern parts of the Umhlabuyalingana Local Municipality has been partly attributed to the porosity of the international border and illegal activities related to trafficking of stolen goods, including vehicles and livestock into Mozambique. The community representatives have petitioned the relevant authorities to address this issue, hence the prioritisation of the Phase 1 project including the border barrier development, in response to these requests.

The Premier of KZN Mr TW Mchunu received numerous complaints from communities living within the Umkhanyakude District who claimed that they are being continuously victimised by the criminal syndicate(s) that are responsible for the theft and hijacking of vehicles that are subsequently illegally trafficked into Mozambique. These communities and businesses have indicated that this situation is becoming untenable and have made various pleas for government intervention. The Provincial Government of KwaZulu-Natal has subsequently established a steering committee comprising of head of

departments to seek workable solutions to mitigate the illegal movement of vehicles across the border. The Premier of KZN petitioned national government (the Ministry in the Presidency) in late 2016 to assist in this matter. In response the Ministry of the Presidency noted the presence of severe systematic, organisational and infrastructural challenges regarding the implementation of national government's various border security responsibilities that impede government's capacity to ensure the territorial integrity of the country. Accordingly the response from government emphasised the government's intention to prioritise the following directives (inter alia) that directly relate to the project to remedy this situation:

- expediting the construction of border fences and establishment of border patrols
- repairing and strengthening facilities and infrastructure on the borderline

The urgency for decisive action to upgrade border security (fencing) and patrol infrastructure (access and patrol roads) was again emphasised when local community members reportedly demonstrated against the lack of security along the border and forced the temporary closure of the Kosi Bay Border Post on 28 January 2018. The upgrading of the border control infrastructure will make it more difficult for cross-border crimes to be perpetrated, and will address the concerns of the local communities. The development can accordingly be considered to be required at a local level in order to improve the safety and security of affected local communities.

The ***Desirability*** of the project is also indicated in a number of different contexts. The project will not require municipal resources and services except for the provision of municipal water for construction purposes. It will not conflict with any landuse rights and is in line with the relevant municipal planning initiatives, including the IDP and the SDF. The project will create numerous job opportunities in the construction phase and labour-intensive construction methods are planned that will intensify this positive socio-economic impact.

From an environmental perspective existing border control infrastructure in the form of a fence and border patrol track is located along the majority of the length of the Phase 1 alignment. Although the footprint of the infrastructure will be increased, resulting in the loss of natural habitat, this will constitute a cumulative impact in the context of an existing impact, rather than a new linear impact in an un-impacted context.

The alignment will traverse a number of terrestrial and freshwater areas of very high sensitivity. Within certain sensitive sections of the route the design will be adapted (e.g. across Lake KuZilonde where a wooden boardwalk structure rather than a road will be constructed), or the development footprint will be narrowed (e.g. in the Tembe Game Reserve where upgraded infrastructure will be limited to the existing narrow strip of land between the Tembe outer fence and the international border fence) in order to minimise environmental impacts. The proposed development will also assist in the prevention of cross-border impacts on the protected areas situated along the Phase 1 alignment that are currently adversely impacting these areas (e.g. gill-netting in iSimangaliso that originates in Mozambique and poaching – in particular rhino poaching).

A series of detailed mitigation measures have been specified to minimise the impacts on biodiversity and freshwater resources in the highly sensitive parts of the alignment, including the coastal forest on the primary dune at the Indian Ocean, Lake kuZilonde and its associated wetland habitat, and two highly sensitive and intact Swamp Forest wetlands.

Although it does not form part of the study area, the wider Phase 2 project will result in significant infrastructural benefits to the Ndumo Game Reserve that is located immediately adjacent to the western end of the Phase 2 alignment. The project will re-erect the eastern boundary fence of the reserve that was removed in 2008 as part of a land invasion of the eastern part of the reserve by certain neighbouring communities. This act has resulted in the significant degradation of this part of the reserve through the establishment of subsistence ('slash and burn') cultivation that has adversely affected the highly sensitive

riparian zone of the Phongolo River floodplain and which, if not stopped, threatens to spread into the rest of the reserve west of the Phongolo River, thus threatening its Ramsar Site status. eZemvelo KZN Wildlife which manages the reserve has no current budget for replacing the fence and patrol road, and thus the project will provide a significant biodiversity benefit to this highly significant protected area and Ramsar site, allowing the affected parts of the reserve to be secured and rehabilitated in time.

Negative environmental (biophysical and conservation planning) impacts are offset by the positive socio-economic impacts that will materialise of employment generation (albeit short term) and improved safety and security in the local area, as well as through the minimised prospects for livestock disease transmission that would adversely impact on subsistence cattle ranging which is key to the socio-cultural wellbeing of the area.

In this context the benefits of the proposed development will outweigh the negative aspects of it, and must be considered a key national infrastructural development requirement that is desirable in the context of the biophysical and socio-economic environment of the project location.

ENVIRONMENTAL IMPACT ASSESSMENT

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

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

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

KEY FINDINGS OF ASSESSMENT

The proposed Phase 1 development of a number of different infrastructure components is located within an area characterised by a number of biophysical environmental sensitivities due to a number of factors:

- low levels of human habitation,
- large number of large wetland systems, of which certain wetland types are rare in a South African context (freshwater coastal lakes) or contain unique and threatened swamp forest habitat
- large areas of undisturbed natural habitat outside of protected areas,
- the presence of two large protected areas which are traversed by the proposed development,
- the project's location within a biological centre of endemism at the southern extent of the east African coastal plain which entails that many plant and animals reach their southern-most extent of distribution and occur nowhere else in South Africa.

A synthesis of these factors engenders the receiving natural environment with a high degree of environmental sensitivity. The proposed development will thus stand to impact a number of sensitive terrestrial and aquatic habitats.

Based on the impact identification and assessment, biodiversity and freshwater impacts are arguably the most significant environmental impacts associated with the proposed development. A number of key negative biophysical impacts were identified, namely the physical destruction and / or modification of terrestrial and aquatic habitat, as well as flow modifications and erosion / sedimentation impacts and water quality impacts within the wetlands crossed by the alignment. A particularly sensitive freshwater habitat that exists along the route is Lake kuZilonde, a freshwater coastal lake within the iSimangaliso Wetland Park that is not currently affected by any existing border control or other infrastructure. The development of the full complement of border control infrastructure would constitute an impact of high intensity and significance on this freshwater resource and this surface water feature has been flagged as highly sensitive.

A number of other wetlands along the Phase 1 alignment have been identified to be highly ecologically and hydrologically sensitive, in particular some of the large wetland systems which are comprised of extensive wetland habitat in a largely unmodified state, including a number of wetland units forming part of the Muzi Swamp wetland system, and two swamp forest wetlands in the eastern part of the alignment which are relatively unmodified and which perform a high degree of wetland related functionality.

Highly sensitive terrestrial habitats, including a number of which have been designated as being threatened (Vulnerable) on a national and provincial (Endangered) scale occur in the study area. The forest ecosystem types as well as the Maputaland Coastal Belt and Wooded Grassland Vegetation types are threatened. These vegetation types have been assigned a high or moderately high degree of ecological importance and sensitivity (EIS). These factors twinned with the occurrence of protected areas and critical biodiversity areas (CBAs) have resulted in large parts of the alignment being designated as being highly or very highly sensitive in a terrestrial ecological context. The coastal forest vegetation occurring on the primary dune at the Indian Ocean has been identified to be pristine and highly sensitive in the context of the proposed development. Significant impacts on natural habitat could thus result due to the proposed increase in the footprint of the border infrastructure if not mitigated.

A comprehensive series of mitigation measures have been identified in the biodiversity and freshwater reports in order to reduce the impacts of the project to acceptable levels. These mitigation measures are directed at preventing the different types of biophysical impacts from materialising, including direct impacts such as physical transformation of habitat and indirect / secondary impacts, including downstream (hydrological) and adverse impacts on ecological processes such as loss of ecological connectivity and fragmentation. Site-specific impacts have been specified certain freshwater and terrestrial habitats that are highly sensitive, including the coastal forest on the primary dune, Lake kuZilonde and two swamp forest wetlands along the Phase 1 alignment.

The application of sound environmental management and the application of all of the mitigation measures specified for biophysical impacts will allow the development to proceed without resulting in significant impacts on natural habitat, that will allow ecological processes to continue, and that will permit recommended management objectives for areas of natural habitat to be maintained.

It is important to note that the involvement of the biophysical specialist teams and EAP team in the planning and design of the project has allowed design measures to be implemented that comprise mitigation measures in their own right. The inclusion of design-related mitigation measures, in particular the replacement of a road across Lake kuZilonde with a wooden boardwalk structure, the non-development of a road across the primary dune at the Indian Ocean and the narrowing of the servitude as it traverses the Tembe Elephant Park will assist in the mitigation / minimisation of impacts in highly sensitive natural habitats along the Phase 1 alignment.

It should also be noted that one of the mitigation measures specified in both the freshwater and biodiversity specialist studies is the recommendation that the loss / transformation of terrestrial and freshwater habitat be offset, thus the recommendation that has been made that ecological offsets be implemented. It is important to note that the need and desirability for such an offsetting process will need to be assessed and specified as necessary or unnecessary by the relevant determining authority (DEA), in consultation with the relevant provincial authorities (EKZNW in KZN). Should offsets be deemed to be required as part of an environmental authorisation for the project, the nature and implementation of such offsets would need to be determined through consultation between the applicant, DEA and the commenting authorities, taking into account the economic and ecological benefits to biodiversity that will be provided by the project, as detailed above. Any offset recommendations specified as such by DEA must be adhered to in the development of the project

Very limited negative impacts that would result from the project development have been identified on the heritage and palaeontological environments in the area. Mitigation measures have been specified to ensure that archaeological or palaeontological resources be documented or protected should these be uncovered in the process of constructing the project infrastructure.

The overall negative biophysical impacts associated with the loss of natural habitat are counter balanced by the presence of existing border control infrastructure along the international border, and accordingly the presence of an existing impact on the natural and freshwater habitat that is associated with this infrastructure. In addition positive impacts are likely to accrue due to the project in the form of the securing of the two large protected areas along the Phase 1 alignment and the concomitant reduction of illegal cross-border impacts on biodiversity that are likely to materialise as a result.

The socio-cultural and socio-economic impacts of the project are largely positive in nature. The project is a large-scale infrastructure development project and will thus generate employment opportunities during the construction phase which will assist inhabitants of the project area to maintain their livelihoods should local inhabitants be employed by the project. In addition the infrastructure upgrades will secure the section of the border which is currently subject to a high degree of illegal movement of people and stolen goods, in particular stolen and hijacked vehicles. The infrastructure upgrades will enable a number of government departments and agencies, in particular the SANDF to more effectively perform their mandate which will assist in the securing of the border area which is subject to high levels of crime, much of which is related to the illegal cross-border activities. This will bring positive socio-economic benefits to this part of the uMhlabuyalingana Local Municipality. In addition the securing of the border is likely to result in positive impacts on the two large protected areas traversed by the Phase 1 infrastructure by preventing poaching and illegal gill-netting which are currently significant cross-border impacts on the biota within these reserves. The positive conservation impacts are counter-balanced by the further limiting of free movement of fauna (especially large fauna – i.e. elephants) between South African and Mozambique which is one of the key objectives of the Lubombo Transfrontier Conservation Area which has been established based on a number of formal protocols signed by South Africa and Mozambique, and which is traversed by large sections of the Phase 1 alignment.

A summary of the impacts is provided below.

Table i - Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
Planning Phase		
Impact related to protected plant species and habitat if pre-construction planning not undertaken	High (-11)	Low (-4)
Construction Phase		
Physical degradation of soils due to removal and compaction	Medium (-8)	Low (-4)
Soil erosion as a result of exposed soils	Medium (-8)	Low (-5)
Groundwater contamination (spillage of fuels, chemicals and lubricants; lack of ablution facilities; wash bay areas)	High (-10)	Low (-5)
Biodiversity – Direct Impacts - Physical Habitat Destruction (degradation of sensitive terrestrial habitat) and killing of fauna	Medium (-10)	Low (-4)
Biodiversity - Indirect Erosion, Sedimentation and Pollution Impacts	Medium (-9)	Low (-5)
Biodiversity - Impacts on Biodiversity Processes (Connectivity)	Medium (-9)	Low (-5)
Biodiversity – Ecological Disturbance and Nuisance Impacts	Medium (-9)	Medium (-7)
Freshwater - Physical destruction and / or modification of aquatic habitat	High (-11)	Medium (-9)
Freshwater - Flow modification (Hydrological) and erosion/sedimentation impacts	High (-10)	Medium (-7)
Freshwater (Surface Water) - Impacts on water quality due to potential contaminants	Medium (-9)	Low (-5)
Heritage – Impacts on heritage resources through vegetation clearing, excavation and possible destruction of structures with heritage value	Medium (-9)	Low (-5)
Palaeontological – Impacts on undiscovered palaeontological resources through vegetation clearing and excavation	Medium (-8)	Low (-6)
Waste – physical waste generation during construction	Medium (-9)	Low (-4)
Air quality impacts - Dust emissions, emissions from equipment and vehicles and odour from chemical toilets	Medium (-8)	Low (-6)
Noise Pollution - Increase in noise pollution from construction vehicles and construction staff.	Medium (-9)	Low (-6)
Socio-economic Impacts – job creation	Medium (+7)	Medium (+9)
Socio-economic impacts - Proliferation of social ills and issues such as crime, prostitution, the spread of HIV/AIDS, informal settlements	High (-10)	Low (-6)

Impacts	Without Mitigation	With Mitigation
Public and construction staff safety during construction	High (-10)	Low (-5)
Operational Phase Impacts		
Biodiversity: Residual Habitat Modification	Medium (-9)	Low (-5)
Biodiversity - Indirect Impacts – Erosion, Sedimentation and Pollution	Medium (-8)	Low (-5)
Biodiversity - Positive Impacts on biodiversity features, esp. in protected areas	Medium (+7)	High (+10)
Freshwater - Residual physical alteration of wetland habitat	Medium (-9)	Low (-6)
Freshwater - Flow Modification & Erosion/ Sedimentation Impacts	High (-10)	Medium (-7)
Socio-economic – positive Impacts on the local economy due to prevention of illegal cross border activities and the prevention of spread of livestock disease	High (+10)	High (+12)

CONCLUSIONS AND RECOMMENDATIONS

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

In order to protect the environment and ensure that the development or upgrading of infrastructure as part of the Planning & Design for the Maintenance and/or Upgrade of the Patrol Roads and Fencing on the Borders between RSA, Swaziland & Mozambique – Phase 1 Project is constructed and operated in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that have been taken into account during this study. This legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.

The conclusions of this BAR will be updated to include comments and concerns from I&APs to ensure that all issues captured and to ensure that a comprehensive BA study is conducted. The public consultation process will make every effort to be inclusive, and every effort will be made to include representatives of all stakeholders within the process.

The project is envisaged to have an overall ***"Medium Negative"*** significance rating prior to the application of mitigation measures proposed, and a ***"Low Negative"*** significance rating post application of mitigation measures proposed.

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. The project is a critical strategic importance on a national level and forms part of the National Government's obligations to secure the borders of South Africa and to protect its citizens from illegal activities. Therefore, the EAP recommends that the development / upgrading of the proposed infrastructure be authorised.

Construction is expected to commence in March 2018 and will last 36 months (for the border barrier). An EA with a validity of 10 years is recommended.

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

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this BA study are included within an EMPr. The EMPr must be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for the construction phase of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

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

a) The Developer is not excused from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:

   i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);

   ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);

   iii. Provisions of the National Forests Act (Act No. 84 of 1998); and

   iv. Provisions KwaZulu-Natal Nature Conservation Ordinance (Ordinance No. 15 of 1974).

b) The Developer must appoint a suitably experienced Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) A botanist must be appointed to oversee the search and rescue of plants in parts of the alignment as directed by the terrestrial ecology study.

d) An Ordinary Permit from the *eZemvelo* KZN Wildlife (*E*KZNW) is required to handle and remove any protected plant species as detailed in Schedule 12 (Specially Protected Plants) of the KZN Nature Conservation Ordinance (No. 15 of 1974) from the construction servitude.

e) A permit is required from the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of all protected tree species as listed by the Notice of the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998).

f) All other necessary permits, licences and approvals must be obtained prior to the commencement of construction.

g) The site specific mitigation measures for the sensitive areas along the alignment as detailed in this report (i.e. at the primary dune at the Indian Ocean, Lake kuZilonde and at the two Swamp Forest Wetlands) must be strictly adhered to. A wetland specialist must be appointed to oversee the design and implementation of construction through these wetlands.

Acronyms

AMSL	Above Mean Sea Level
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CLO	Community Liaison Officer
CV	Curriculum Vitae
DAFF	Department of Agriculture, Fisheries and Forestry
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EKZNW	eZemvelo KZN Wildlife
EMPr	Environmental Management Programme
ESI	Environmental Screening Investigation
FEPA	Freshwater Ecosystem Priority Area
GA	General Authorisation
GIS	Geographic Information System
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
IAP	Invasive Alien Plant
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
ITB	Ingonyama Trust Board
IWP	iSimangaliso Wetland Park
KZN	KwaZulu-Natal
KZN BSP	Kwazulu-Natal Biodiversity Sector Plan
KZN DoT	KwaZulu-Natal Department of Transport
MCE	Maputaland Centre of Endemism
NBA	National Biodiversity Assessment, 2006
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management – Waste Act (Act No. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No. 25 of 1999)

NWA	National Water Act (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No 85 of 1993)
PES	Present Ecological State
PPE	Personnel Protective Equipment
PPP	Public Participation Process
PSEDS	KwaZulu-Natal Spatial Economic Development Strategy
REC	Recommended Ecological Category
RMO	Resource Management Objective
SACNASP	South African Council of Natural Science Professionals
SANDF	South African National Defence Force
SAHRA	South African Heritage Resource Agency
SAPS	South African Police Service
SARS	South African Revenue Service
SDF	Spatial Development Framework
SWMP	Stormwater Management Plan
TEP	Tembe Elephant Park
TFCA	Transfrontier Conservation Area
WUA	Water Use Application

Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Biome	The largest land community unit recognised at a continental or sub continental scale and therefore does not recognise any subsets of a biome as a biome of lower rank.
Buffer	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer is usually an artificially imposed zone included in a management plan.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
Environment	In terms of the National Environmental Management Act (NEMA) (Act No 107 of 1998) (as amended), "Environment" means the surroundings within which humans exist and that are made up of: i. the land, water and atmosphere of the earth; ii. micro-organisms, plants and animal life; iii. any part or combination of (i) and (ii), and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental Authorisation	An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.
Environmental Assessment	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments,

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

	Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Pollution	The National Environmental Management Act, No. 107 of 1998 defines pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
Re-use	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Significance	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
Stakeholder Engagement	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.
Sustainable Development	Development which meets the needs of current generations without hindering future generations from meeting their own needs.
Watercourse	Defined as: i. a river or spring; ii. a natural channel or depression in which water flows regularly or intermittently; iii. a wetland, lake or dam into which, or from which, water flows; and iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
Water Pollution	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property".
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1 INTRODUCTION

The Department of Public Works (DPW) as the applicant, in conjunction with the KwaZulu-Natal Department of Transport (KZN DoT) as the implementing agent are proposing the upgrade of existing border control infrastructure, and development of new border control infrastructure along a portion of the South Africa (KwaZulu-Natal)-Mozambique Border in the north-eastern part of the Province. This application is termed the 'Phase 1' application and forms a component of a wider project being undertaken by the Department of Public Works for the upgrading of border control infrastructure along the South Africa-Swaziland border and the southern part of the South Africa (KZN)-Mozambique border. The Phase 1 alignment is comprised of the section of the international border with Mozambique from the high water mark of the Indian Ocean (KM0) to the eastern boundary of the Ndumo Game Reserve (KM54).

The current Phase 1 project is the culmination of two initially separate infrastructure projects; the proposed upgrading of the border control infrastructure (border patrol road and fence) along the entirety of the South Africa-Swaziland International Border and the South Africa (KZN)-Mozambique International Border as being undertaken by the National DPW as part of the wider departmental initiative to secure all of South Africa's borders, and the proposed development of a border control barrier along sections of the South Africa (KZN) international border with Mozambique as being undertaken by the KZN DoT as implementing agent on behalf of the DPW. Following high level consultation between these two organs of state a resolution was made to combine the environmental authorisation processes for the two projects for a section of the KZN-Mozambique International Border for a number of reasons including the proximity of the two projects and the resultant similarity in affected environment and environmental impacts, and in order to minimise stakeholder confusion related to public participation for the environmental authorisation processes.

The project is being undertaken by the DPW in conjunction with the Department of Agriculture Forestry and Fisheries (DAFF) and the South African National Defence Force (SANDF) as end users. The aim of the project is to stop the illegal trafficking of stolen vehicles and contraband across this section of the international border, as well as to prevent the illegal movement of people as well as livestock that could transmit disease. South Africa has approximately 4 800 km of land border and 2 800 km of coastline border which is required to be secured. South Africa is greatly affected and financial impacted by illegal imports, smuggling and other similar illegal activities which transpire over borders. In order to effectively respond to the range of security and control challenges that are being experienced by responsible organs of the State, it is important to assess the situation and to be able to incorporate a viable solution.

The Phase 1 section of the wider project is being prioritised for development as it is considered a 'high risk' area where significant numbers of stolen vehicles are currently being trafficked into Mozambique from South Africa.

An application for environmental authorisation is being lodged for a fifty (50) meter-wide corridor (as measured from the existing border fence) for a fifty four (54) km long section of the international border with Mozambique. The extent of the study area is indicated in Figures1-1 and 1-2 (in addition detailed locality maps are included in Appendix F).

The proposed infrastructure that will be developed within this corridor will include the following components:

- The upgrading / replacing of the existing fence running along the border with a 2.4m high elephant-proof fence along most of the length of the project section (with the exception of the fence in the vicinity of the Farazela (Kosi Bay) Border Post which will be replaced with a ClearVu or similar fence)
- The development of an inner fence
- The development of a servitude fence
- The development of a 1.5m high Border Barrier structure along two sub-sections of the Phase 1 section – between the western boundary of the iSimangaliso Wetland Park and the eastern boundary of the Tembe Elephant Park and between the western boundary of the Tembe Elephant Park and the eastern boundary of the Ndumo Game Reserve
- The development of a new 5.5m wide gravel border patrol road within a sub-section of the Phase 1 section that extends westwards from the foot of the primary dune near the Indian Ocean to the eastern boundary of the Ndumo Game Reserve (excluding Lake kuZilonde)
- The development of a wooden 'boardwalk' structure for the use of all-terrain vehicles (ATVs) across Lake kuZilonde within the iSimangaliso Wetland Park
- The development of a 1m-wide footpath across the primary dune at the Indian Ocean, extending from the western foot of the dune to the high water mark of the sea on its eastern side.

In addition a 5ha construction camp is proposed to be developed near the Farazela Border Post.

A number of listed activities were identified to be applicable to the proposed project including activities from Listing Notice 1 of the EIA Regulations 2014 (as amended in 2017). Large parts of the study area are designated as environmentally sensitive in terms of Listing Notice 3 and accordingly a number of listed activities from Listing Notice 3 of the EIA Regulations 2014 (as amended in 2017) are applicable to the proposed project as well. The triggering of these activities (and others) requires a BA study to be undertake

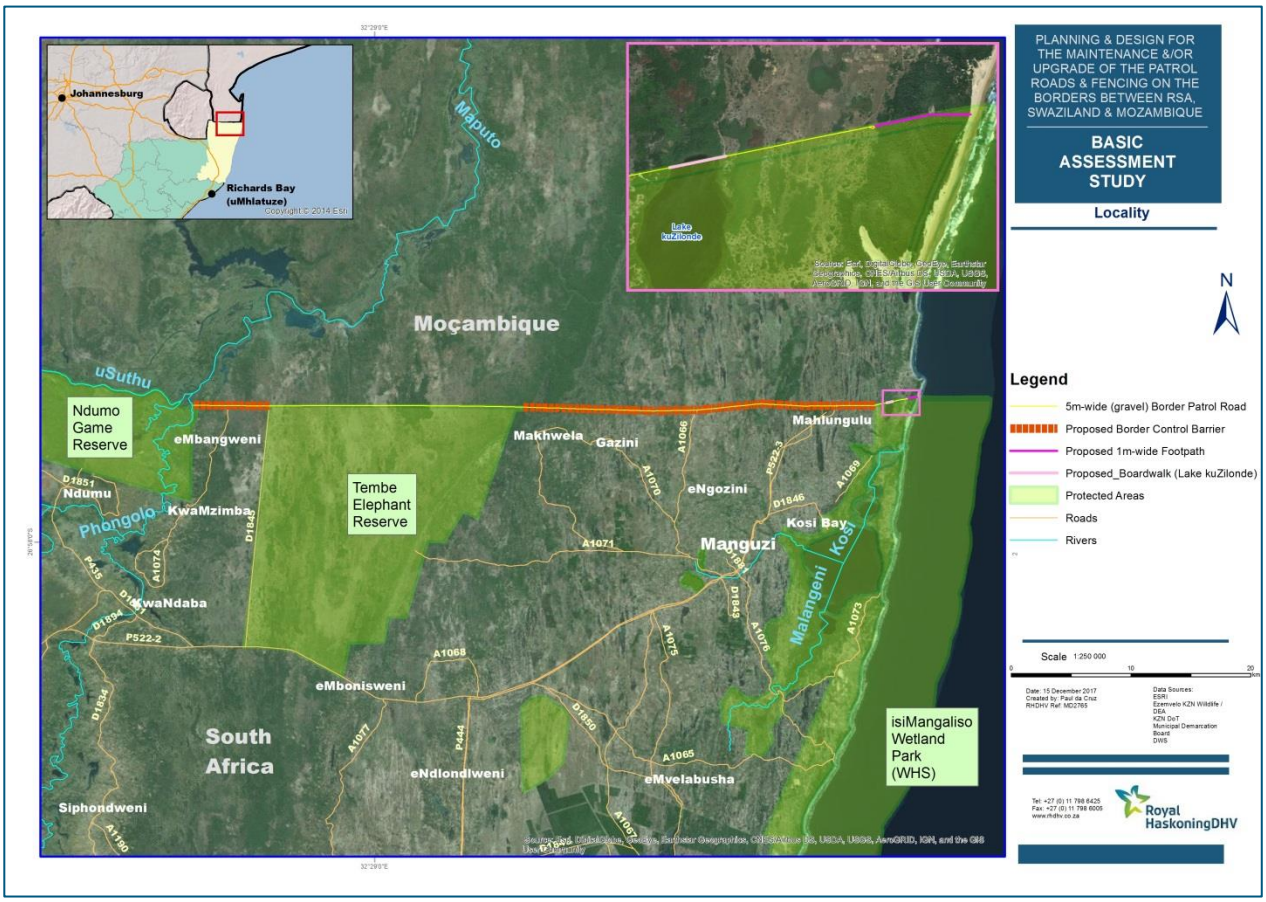

Figure 1-1: Locality map

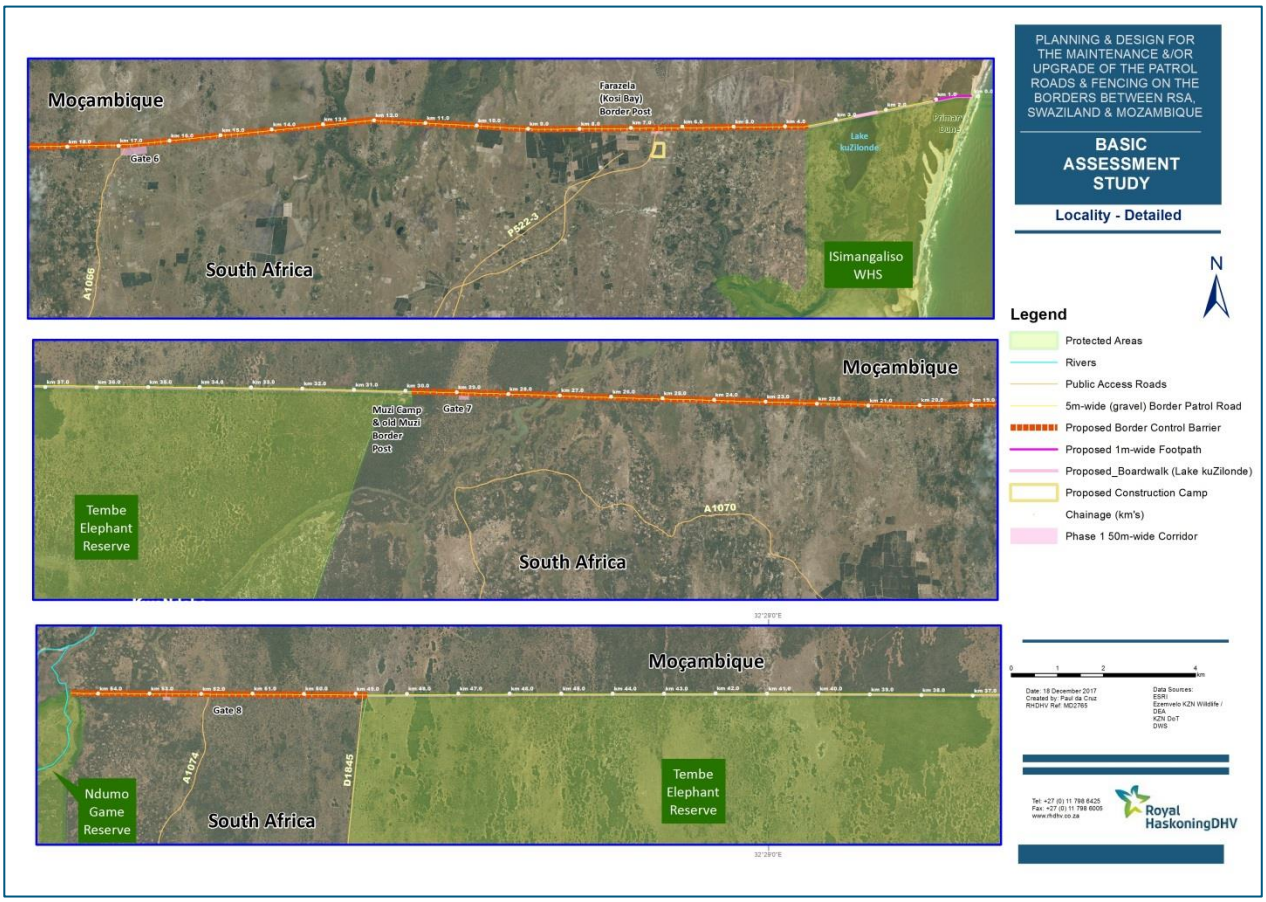

Figure 1-2: Locality map – Detailed

1.1 Approach to the Study

1.1.1 Desktop Screening Assessment

A desktop Environmental Screening Investigation (ESI) was previously undertaken in January 2017 to determine key environmental sensitivities and potential environmental impacts related to the proposed development of a border control barrier along sections of the KZN-Mozambique border, as well as to determine listed activities applicable to the project[1]. The key findings of the ESI were:

- The high-level desktop study aided by GIS spatial analysis identified a number of highly sensitive environments that are traversed by the proposed border control barrier. Therefore, care must be taken to avoid these sensitive and protected areas as far as possible during the detailed design phase.
- The proposed border control barrier will create fragmentation to various ecological habitats by creating a barrier for wildlife which will be a sensitive subject to be considered and addressed during the Basic Assessment study.
- Consideration must be afforded to international treaties and obligations. South Africa is a signatory to two international treaties / conventions (i.e. the World Heritage Convention and Ramsar Treaty) which protect areas designated under these treaties. Such areas (World Heritage Sites and Ramsar Sites) are located in close proximity to the proposed barrier.

[1] *Note – the ESI did not encompass the wider project, excluding the border patrol road and fencing components*

- International Protocols have been signed by South Africa to establish the Lubombo Transfrontier Conservation Area TFCA, of which two key focus areas fall within the study area. The TFCA protocols promote the free movement of wildlife across international boundaries, in particular the re-establishment of natural movement patterns of the coastal elephant population between protected areas and natural elephant habitat in coastal Mozambique and Maputaland. The construction of a physical barrier in the form of the wall could be considered to be contrary to South Africa's obligations in this context, especially if the natural movement of elephants was prevented or restricted.
- A key focus of a Basic Assessment study to be undertaken for the border wall development must be the impact on land parcels within the study area designated under these two Protocols. Mitigation measures to ensure that the barrier structure development does not adversely impact on the state of these designated areas and does not adversely impact the natural features for which these areas were designated. Consultation with the responsible management authorities of the TFCA and respective international ministries of participating neighbouring states would be important. Plans for the barrier structure would need to be incorporated into the management plans and protocols governing the international co-operative management of the TFCA, and measures to ensure that the objectives of the TFCA are not compromised by the barrier structure development must be identified through consultation and implemented.
- The border wall traverses clusters of highly sensitive wetland areas. The potential to re-align of the border wall away from highly sensitive (FEPA) wetland systems is recommended.
- This proposed project should also be considered in terms of the bigger project that has been initiated by the South African National Defence Force (SANDF) which is a client of the National Department of Public Works (DPW) i.e. the Swaziland– KwaZulu-Natal – Mpumalanga Border Road: Reconstruction, Alignment and Construction – Site Clearance. This project will entail the road alignment selection and provisional (conceptual) design work for the construction, upgrading and possible re-alignment of the road and border fence. It includes obtaining Environmental Approval for the road alignment from the DEA in order to identify and obtain formal road servitudes and includes the verification and marking of the existing border fence line in terms of the actual international border line coordinates. If possible, the border patrol road, fence and the border wall needs to be on the same alignment in order to complement one another and provide an optimised solution to the end-user/s.

The findings and recommendations of the ESI for the border barrier are considered and addressed in this report. The ESI is contained within Appendix G

1.1.2 Pre-application Consultation

The Project Team on the Border Barrier Project[2] requested a meeting with the National Department of Environmental Affairs (DEA) in February 2017 in order to determine the national department or the provincial department (EDTEA) would be the determining authority for the project, due to its location in close proximity to the border. The meeting was also utilised to seek the interpretation of the Department relating to a proposed Intervention Staging approach being considered by the project team for the Barrier Structure at that time. Related to this subject an Interpretation Query was lodged with the DEA to obtain clarity on these matters. A response was received from the Department on 07 March 2017.

A pre-application meeting for the consolidated Border Patrol Road and Barrier Structure Project will be convened with the DEA – the Determining Authority for both the Phase 1 Project and the wider Swaziland-Mozambique Border Control Infrastructure Project in January 2018.

[2] *This meeting with DEA only addressed the Border Barrier Project as the two projects had not yet been aligned at that stage*

1.1.3 Basic Assessment Study

A BA is the level of environmental assessment applied to activities listed in Listing Notices 1 and 3. A BA is applied to activities that are considered less likely to have significant environmental impacts and the potential impacts and outcomes are known. Therefore, it would be unlikely to require a detailed EIA. The BA Report (BAR) is a more concise analysis of the environmental impacts of the proposed activity/development than a Scoping and EIA Report (the reporting approach required for Listing Notice 2 Activities).

The BA aims to achieve the following:

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

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

An EMPr (***Appendix B***) has been compiled according to Appendix 4 of GNR 982 of the EIA Regulations 2014 (as amended in 2017) for the construction and rehabilitation phases of the project. The EMPr has been compiled as a stand-alone document from the BAR and will be submitted to the Department of Environmental Affairs (DEA) along with the BAR. The EMPr provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and/or eliminate any anticipated negative environmental impacts and to enhance positive impacts. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

1.2 Structure of the Basic Assessment Report (BAR)

The BAR is structured as follows:

Table 1-1: Structure of the report

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

1.3 Specialist Assessments

To ensure the scientific rigour of the BA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned a number of specialist studies to be undertaken in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the proposed barrier, fences, road and culverts where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts.

These Specialist Studies comprised of:

1.3.1 Specialists

Table 1-2: Appointed Specialists

Specialist Study	Organisation
Terrestrial Ecological Assessment	EcoPulse (Adam Teixeira-Leite & Brian Mafela)
Dune Vegetation Assessment	Indiflora cc (Johan Bodenstein)
Freshwater Habitat Assessment (including Aquatic Assessment and Wetland Assessment)	EcoPulse (Ross van Deventer) Royal HaskoningDHV (Paul da Cruz)*
Heritage Assessment	Active Heritage cc (Frans Prins)
Palaeontological Assessment	Banzai Environmental (Elize Butler)

* - Note that all specialist work compiled by Paul da Cruz of Royal HaskoningDHV was independently reviewed by Doug McFarlane of EcoPulse.

1.3.2 Peer Review

In addition to the above, the EIA Regulations 2014 (as amended in 2017) requires the Environmental Assessment Practitioner (EAP) to be independent, objective and have expertise in conducting EIAs. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity. To ensure that there is no bias and that the process has been transparent an external technical peer review will be undertaken prior to the public review during the formal BA process. This peer review has been conducted by Catherine Smith of Gaia AE and is appended as Appendix H.

1.4 Details of the Project Developer

The Developer is the DPW and the details of the responsible person are listed in Table 1-3 below.

Table 1-3: Applicant details

Applicant	KwaZulu-Natal Department of Public Works	
Representative	Mr. Malusi Ganiso (Director)	
Physical Address	Cnr West & Aliwal Street, Durban, 4001	public works Department: Public Works REPUBLIC OF SOUTH AFRICA
Postal Address	Private Bag X 54315, Durban	
Telephone	031 314 7149	
E-mail	thuthuka.mbhele@dpw.gov.za	

1.5 Details of the Environmental Assessment Practitioner

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

The professional team of Royal HaskoningDHV has considerable experience in the environmental management field. Royal HaskoningDHV have been involved in and / or managed several of the largest EIAs undertaken in South Africa to date.

A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), mixed-use developments, bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, urban, rural and township developments, environmental aspects of Local Integrated Development Plans, as well as general environmental planning, development and management.

Table 1-4: EAP details

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
Contact Persons	Malcolm Roods	Paul da Cruz	Johan Blignaut
Postal Address	PO Box 867 Gallo Manor 2191		
Telephone	011 798 6000		
E-mail	Malcolm.roods@rhdhv.com	Paul.dacruz@rhdhv.com	Johan.blignaut@rhdhv.com
Qualification	BA (Hons) Geography and Environmental Management	BA (Hons) Geography and Environmental Management	BSc (Hons) Geography
Expertise	Malcolm Roods is a Principal with RHDHV specializing in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. This builds on a broad government background, which has made him particularly flexible. His past experience includes 6 years public service which included policy development,	Paul da Cruz offers a varied set of skills and a wide set of experience in different disciplines. He performs the role of an environmental specialist and EIA project management. He has worked on SEAs, EIAs, EMPs and environmental auditing. He also performed the role the project manager for a number of large EIAs. Paul has acquired a multi-disciplinary package of specialist skills which includes wetland assessment, visual impact	Johan is an Environmental Consultant who is responsible for a number of duties, including monitoring the implementation of the Environmental Authorisation (EA) and the Environmental Management Programme (EMPr) during the construction phase of projects, serving as a liaison between property owners and contractors, undertaking of Environmental Control Officer (ECO) audits, writing of ECO reports, and assisting with public participation processes.

Consultant	Royal HaskoningDHV	Royal HaskoningDHV	Royal HaskoningDHV
	environmental law reform and EIA reviews. His experience also includes more than 9 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and business management. Since joining the company he has been involved with major EIA projects such as the Transnet New Multi Product Pipeline (NMPP), various Rand Water Pipeline projects, numerous Eskom Research, Generation, Transmission and Distribution projects, SANRAL road developments as well as undertook Independent Reviews of the EIA process for the National Department of Environmental Affairs, etc. to name but a few.	assessment, tourism assessment, and avifaunal assessment. His extensive wetland assessment experience was gained during work undertaken for the Mondi Wetlands Project. He worked in the UK for three years in regulatory and water resources assessment roles for both the Environment Agency in England and the Scottish Environmental Protection Agency (SEPA). During this period he gained excellent experience and skills relating to catchment management planning, hydro-ecological risk assessment, water resource regulations and water resources strategies	

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

2 ENVIRONMENTAL LEGISLATIVE CONTEXT

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

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

Table 2-1: Key legislation considered

Acts	Objectives, important aspects, associated notices and regulations

Acts	Objectives, important aspects, associated notices and regulations
National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended	***Objectives:*** To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state. ***Relevant Notices and Regulations:*** • Environmental Impact Assessment Regulations, 2014 (GNR 982 in GG 382 of 4 December 2014 as amended in 2017) • Listing Notice 1 (GNR 983 in GG 38282 of 4 December 2014 as amended in 2017) • Listing Notice 2 (GNR 984 in GG 38282 of 4 December 2014 as amended in 2017) • Listing Notice 3 (GN R984 in GG 38282 of 4 December 2014 as amended in 2017) ***Relevance to the proposed project:*** • Development must be socially, environmentally and economically sustainable. • Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated; the social, economic and environmental impacts of activities including disadvantages and benefits, must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration. • 'Polluter Pays' principle. • Any activity that is proposed and which is listed in the NEMA EIA Regulations requires environmental authorisation. ***Listed Activity/ies & Applicability:*** **Listing Notice 1** **Activity 12 -** The development of - (iii) bridges exceeding 100 m^2 in size; (vi) bulk storm water outlet structures exceeding 100 m^2 in size; (xii) infrastructure or structures with a physical footprint of 100 m^2 or more; where such development occurs— a) within a watercourse **This activity will be triggered as the proposed infrastructure will be constructed within (across) numerous watercourses (wetlands) and will**

Acts	Objectives, important aspects, associated notices and regulations
	have physical footprints of >100m^2. **Activity 14** – The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres ***This activity will not be triggered*** **as the volume of fuel stored on the site (including at the Farazela Construction Camp and at the site camps along the alignment) *will not exceed 80 cubic meters*.** **Activity 15** – The development of structures in the coastal public property where the development footprint is bigger than 50 square metres **This activity will be triggered as the proposed border fence is proposed to be extended to the high water mark of the Indian Ocean and thus into the coastal public property.** **Activity 17 –** Development— i) in the sea; ii) within the littoral active zone; v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater; in respect of— (f) infrastructure or structures with a development footprint of 50 square metres or more **This activity will be triggered as the proposed border fence is proposed to be extended to the high water mark of the Indian Ocean. The proposed fence and footpath will be developed within 100m inland of the high-water mark and is likely to have a combined footprint of 50 square metres or more.** **Activity 19 –** The infilling or depositing of any material of more than 10 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m^3 from a watercourse. **This activity will apply as the proposed infrastructure will be constructed within a number of watercourses (wetlands) and will thus constitute infilling or depositing of material of more than 10m^3 as well as the excavation, removal or moving of soil, sand or rock of more than 10m^3 from / into these wetlands.** **Activity 19A –** The infilling or depositing of any material of more than 5m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 m^3 from the seashore. **This activity will apply as the proposed infrastructure (fence) will be constructed within the seashore (to the high water mark) and will thus require infilling or depositing of material of more than 5m^3 or the dredging, excavation, removal or moving of soil, sand or rock of more than 5m^3 from / into the seashore.** **Activity 27** - The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—

Acts	Objectives, important aspects, associated notices and regulations
	(i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan. **This activity will apply as a construction camp of approximately 5ha in size is planned to be developed as part of the proposed development that will result in the clearing of an area of >1ha of indigenous vegetation.** **Activity 48 -** The expansion of— i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion [or expansion and related operation] occurs— (a) within a watercourse; (c) if no development setback exists, within 32m of a watercourse, measured from the edge of a watercourse. **This listed activity will apply as existing culvert structures and the existing border patrol road structure may be expanded within wetlands which are crossed.** **Listing Notice 3** **Activity 4** - The development of a road wider than 4 metres with a reserve less than 13,5 metres within: ii. Trans- frontier protected areas managed under international conventions; v. World Heritage Sites; vi. A protected area identified in terms of NEMPAA; vii. Sites or areas identified in terms of an international convention; viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; x. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas: (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; or **This listed activity will apply as it is likely that a new 5.5.m wide border patrol road will be developed along most of the length of the section of the border under consideration. All of the above sensitive areas are traversed and this listed activity would thus apply.** **Activity 10** - The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but

Acts	Objectives, important aspects, associated notices and regulations
	not exceeding 80 cubic metres within: ii. Trans-frontier protected areas managed under international conventions; v. World Heritage Sites; vii. A protected area identified in terms of NEMPAA, excluding conservancies; ix. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; xiii. Outside urban areas: (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; (bb) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or (cc) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland; ***This activity will not be triggered*** **as the volume of fuel stored on the site (including at the Farazela Construction Camp and at the site camps along the alignment)** ***will not exceed 30 cubic meters*****.** **Activity 12** - The clearance of an area of 300 square metres 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 within the following sensitive areas d) in KwaZulu-Natal: i. Trans-frontier protected areas managed under international conventions; iv. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; vi. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; vii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; viii. A protected area identified in terms of NEMPAA, excluding conservancies; ix. World Heritage Sites;

Acts	Objectives, important aspects, associated notices and regulations
	x. Sites or areas identified in terms of an international convention; xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; **This listed activity will apply as it is highly likely that this threshold will be exceeded due to the removal of indigenous vegetation associated with the development of the proposed infrastructure within all of the above sensitive areas.** **Activity 14** – The development of infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse within the following sensitive areas in KwaZulu-Natal: iv. A protected area identified in terms of NEMPAA, excluding conservancies; v. World Heritage Sites; vii. Critical biodiversity areas or ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; x. Outside urban areas: (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEM:PAA or from the core area of a biosphere reserve **This listed activity will apply as the proposed infrastructure will be constructed within and across numerous watercourses (wetlands) and structures exceeding the threshold will be constructed within watercourses that occur within sensitive areas identified.** **Activity 18** - The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre within the following sensitive areas in KwaZulu-Natal: i. Trans-frontier protected areas managed under international conventions; World Heritage Sites; vi. A protected area identified in terms of NEMPAA; viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; x. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; xii. Outside urban areas: (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve **This listed activity will apply due to the existing border patrol road**

Acts	Objectives, important aspects, associated notices and regulations
	potentially being widened by more than 4m in the sensitive areas identified as part of the development of infrastructure. **Activity 23** - The expansion of— (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs— (a) within a watercourse in the following sensitive areas within KZN: iv. A protected area identified in terms of NEMPAA, excluding conservancies; v. World Heritage Sites; vii. Critical biodiversity areas or ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; Outside urban areas: (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve **This listed activity will apply due to existing culvert structures potentially being expanded within wetlands which are crossed within the sensitive areas identified, as part of the development of infrastructure.**
National Water Act (Act No. 36 of 1998) (as amended)	***Objectives:*** The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations. ***Relevance to the proposed project:*** • Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems. • Defines 11 water uses and provides licencing procedures. ***Notices and Regulations:*** • General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (c) and (i) (GN in GG 40229 of 26 August 2016).

Acts	Objectives, important aspects, associated notices and regulations
	Water uses triggered: As the proposed development involves the crossing of numerous wetlands , a Water Use Authorisation is required in terms of Section 21 (c) and (i) of the NWA: • Section 21(c) - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and • Section 21 (i) - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).

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

Table 2-2: Other legislation considered

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Rights Section 24 – Environmental Rights
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. 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.
National Forests Act (Act No. 84 of 1998)	Certain tree species were observed within the study area that are protected under the NFA of 1998, which will require a permit from DAFF should the trees need to be removed for the construction of any infrastructure.
National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations: • Threatened or protected species (GN 388) • Lists of species that are threatened or protected (GN 389) • Alien and invasive species regulations (GNR 506) • Publication of exempted alien species (GNR 509) • Publication of National list of invasive species (GNR 507) • Publication of prohibited alien species (GNR 508)	Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources. Three terrestrial ecosystems located within the study area have been listed as threatened under the National Biodiversity Assessment (2011).
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) - NEMPAA	Creates a legal framework and management system for all protected areas in South Africa as well as establishing the South African National Parks (SANParks) as a statutory board. Each conservation area will have its own set of land use restrictions or regulations that stem either from generic restrictions under NEM:PAA, or customized regulations for individual protected areas.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
National Environmental Management: Waste Act (Act No. 59 of 2008)(as amended)	Section 17 - Every attempt must be made to reduce, recycle or re-use all waste before it is disposed. Section 25 - All waste (general and hazardous) generated during construction may only be disposed of at appropriately licenced waste disposal sites.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Section 32 - Control of dust. Section 34 - Control of noise. Section 35 - Control of offensive odours.
National Environmental Management: Integrated Coastal Management Amendment Act, 2008 (Act No. 24 of 2008)(as amended)	The Act establishes a system of integrated coastal and estuarine to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes. The Act defines the coastal public property and sets out the use and management of the coastal protection zone.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)(as amended)	Section 22 - Application for a mining permit / right. Section 39 - Environmental management programme and environmental management plan. ***Material for construction will be obtained from commercial sources.***
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 - No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. Section 35 - No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site. Section 36 - No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. “Grave” is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 8 - General duties of employers to their employees. Section 9 - General duties of employers and self-employed persons to persons other than their employees.
Construction Regulations (2014)	Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.
National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)	Chapter 4 – Veld Fire Prevention through firebreaks - places a duty on owners to prepare and maintain firebreaks. An owner whose land is subject to a risk of veld fire whose land or any part of it coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to that border.
Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)	The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by • the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or • destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. Section 5 details measures for the prohibition of the spreading of weeds.
World Heritage Convention Act, 1999 (No, 49 of 1999)	The Act provides for the incorporation of the World Heritage Convention into South African law; the enforcement and implementation of the World Heritage Convention in South Africa; the recognition and establishment of World Heritage Sites.
Spatial Planning and Land Use Management Act, 2013; Act of 2013	The primary object of the Act is to provide for a uniform, effective and comprehensive system of spatial planning and land use management in South Africa that promotes social and economic inclusion. The Act sets out the spatial planning system in South Africa, including spatial development frameworks at varying levels of government in South Africa. SDFs interpret and represent the spatial development vision of the responsible sphere of government / authority, guiding infrastructure development in a spatial context.

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
Lubombo Transfrontier Conservation Resource Area Protocol, 22 June, 2000	
By-laws	
Umkhanyakude District Municipality IDP (2016 – 2017) Umhlabuyalingana Local Municipality IDP review 2017/2018 Umhlabuyalingana Local Municipality Spatial Development Framework (2017)	

2.2 Sustainable Development

The principle of Sustainable Development has been established in the Constitution of the Republic of South Africa (Act No. 108 of 1996) and given effect by NEMA. Section 1(29) of NEMA states that sustainable development means the integration of social, economic and environmental factors into the planning, implementation and decision-making process so as to ensure that development serves present and future generations.

Therefore, Sustainable Development requires that:

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

3 PROJECT CONTEXT & MOTIVATION

3.1 Site Description and Ownership

The study area is almost exclusively rural in nature, with no large towns or urban centres occurring close to the section of the South Africa-Mozambique border under consideration. The Phase 1 section spans two protected areas – the iSimangaliso Wetland Park in the east along the Indian Ocean Coastline, and the Tembe Elephant Park, which are highly natural in character with no human habitation. The remainder of the study area is predominantly tribal (communal) land and is managed by the Ingonyama Trust Board (ITB). Areas of human habitation take the form of scattered individual homesteads, but are all located away from the border line and no such homesteads occur within the corridor.

For most of its length, the corridor currently consists of an existing fence (approximately 1.5m high) and a sandy track running parallel to the fence, with the remainder of the corridor comprising of the natural vegetation. The only change in the natural vegetation occurs in limited areas located to the west of the Farazela Border Post where forestry plantations (Eucalyptus) have been established. The natural vegetation varies in composition and structure along the Phase 1 alignment. Dense coastal forest with a closed canopy is located on the primary dune situated immediately to the west of the Indian Ocean. The section of the alignment closer to the coast (around the Farazela Border Post) is largely comprised of grassland interspersed with bush / forest patches, with certain wetlands being covered in Swamp Forest (characterised by large mature trees with a closed canopy). Closer to the Tembe Elephant Park, and in large parts of Tembe itself, the natural vegetation is characterised by dense bush and thicket (sand forest). The sand forest is interspersed with more open grassy woodland in places. The sand forest extends west of Tembe till the western extent of the Phase 1 alignment to the Phongolo River floodplain.

In certain sections of the corridor located between the Farazela (Kosi Bay) Border Post and Tembe, an approximately 2.5m high single strand electric strand (fence) has been erected on the southern side of the border patrol track by eZemvelo KZN Wildlife (EKZNW) to prevent elephants from Mozambique from crossing into South Africa. Within the Tembe Elephant Park the reserve fence and track are located immediately to the south of the existing border fence and patrol track. The only section of the Phase 1 alignment where no fence along the border currently exists is at Lake kuZilonde (a freshwater coastal lake) where no fence or track exists through the open water and adjacent wetland (swamp).

3.2 Co-ordinates

3.2.1 Corridor

Table 3-1: Co-ordinates of the corridor

	Latitude	Longitude
Eastern extent of Corridor (high water mark of the Indian Ocean)	26°51'30.61"S	32°53'27.65"E
	26°51'30.70"S	32°53'16.42"E
	26°51'37.92"S	32°52'40.22"E
	26° 51' 51.70"S	32° 51' 31.47"E
	26° 51' 52.06"S	32° 51' 7.62"E
	26° 51' 52.55"S	32° 50' 16.23"E
	26° 51' 53.04"S	32° 47' 57.48"E
	26° 51' 54.69"S	32° 49' 49.94"E
	26° 51' 54.68"S	32° 49' 44.85"E
	26° 51' 51.93"S	32° 45' 44.17"E
	26°51'56.83"S	32°35'42.05"E
	26°52'4.55"S	32°35'41.70"E
	26°52'3.91"S	32°35'20.53"E
	26°51'56.33"S	32°35'23.06"E
	26° 51' 59.12"S	32° 44' 31.41"E
	26° 52' 6.44"S	32° 42' 1.98"E
	26° 52' 8.36"S	32° 43' 46.98"E
	26° 52' 9.74"S	32° 43' 29.99"E
	26° 52' 5.24"S	32° 43' 31.79"E
	26° 52' 6.44"S	32° 42' 1.98"E
	26° 52' 2.61"S	32°38' 57.36"E
	26° 52' 0.47"S	32° 36' 21.36"E
	26° 52' 0.33"S	32° 36' 15.30"E
	26° 51' 56.92"S	32° 35' 41.73"E

	Latitude	Longitude
	26° 51' 54.92"S	32° 21' 58.30"E
	26° 51' 54.88"S	32° 21' 54.43"E
	26° 51' 53.51"S	32° 24' 17.07"E
	26° 51' 52.53"S	32° 22' 33.60"E
Western extent of corridor (Phongolo River floodplain and eastern boundary of Ndumo Game Reserve)	26° 51' 51.90"S	32° 20' 50.06"E

3.2.2 Construction Camp

Table 3-2: Co-ordinates of the construction camp

	Latitude	Longitude
North-western corner of the Site	26°52'2.03"S	32°49'45.10"E
North-eastern corner of the Site	26°52'2.30"S	32°49'51.40"E
South-eastern corner of the Site	26°52'11.72"S	32°49'51.37"E
South-western corner of the Site	26°52'10.93"S	32°49'42.27"E
Point on western site boundary	26°52'8.88"S	32°49'43.50"E
Point on western site boundary	26°52'5.41"S	32°49'44.67"E

3.2.3 Access Road to Muzi Camp

Table 3-3: Co-ordinates of the access road to Muzi Camp

	Latitude	Longitude
Southern end of road	26°52'37.04"S	32°36'8.61"E
	26°52'30.50"S	32°36'3.56"E
	26°52'27.08"S	32°36'0.52"E
	26°52'21.82"S	32°35'52.95"E
	26°52'11.45"S	32°35'35.73"E
Northern end of Road	26°52'4.89"S	32°35'32.39"E

3.2.4 Surrounding Land Uses

Table 3-4: Surrounding land uses

Description	Y/N	Description	Y/N
Natural area	Y	Light industrial	N
Low density residential	N	Medium industrial	N
Medium density residential	N	Heavy industrial	N
High density residential	N	Power station	N
Informal residential	Y	Military or police base/station/compound	Y
Retail commercial & warehousing	N	Spoil heap or slimes dam	N
Office/consulting room	N	Dam or reservoir	N
Quarry, sand or borrow pit	N	Hospital/medical centre	N
School	N	Tertiary education facility	N
Church	N	Old age home	N
Sewage treatment plant	N	Train station or shunting yard	N
Railway line	N	Major road (4 lanes or more)	N
Harbour	N	Plantation	Y
Sport facilities	N	Agriculture	Y
Golf course	N	River, stream or wetland	Y
Polo fields	N	Nature conservation area	Y
Filling station	N	Mountain, koppie or ridge	N
Landfill or waste treatment site	N	Museum	N
Historical building	N	Protected Area	Y
Graveyard	N	Archaeological site	N
Airport	N	Other:	N

Key: Y = Yes P = Possibly N = N

3.2.5 Material for Construction

Material for the Phase 1 Section will be sourced from licenced commercial sources.

3.3 Project Description

3.3.1 Spatial alignment of Proposed / Upgraded Infrastructure within the Border Patrol Zone

The Phase 1 project assimilates 2 previously separate projects for construction of a Border Control Barrier Structure and the upgrading of the existing and installation additional fences and patrol road that traverses most of the length of the Phase 1 Section. All of the proposed infrastructure will be constructed within, and will form part of a 'border patrol zone' that will be located in immediate proximity to the existing international border (fence) line.

The typical cross-section of the border patrol zone will consist of the following infrastructure components (refer to Figure 3-1 below) –

- three (3) fences,
- a 5.5m wide gravel patrol road,
- a 10m wide detection zone, and
- a 1.5m high border control barrier

These components will be constructed within a servitude of 100ft (30.48m) width that will be declared as part of the project. This servitude will be located within the confinements of the 50m-wide corridor.

It is important to note that the border patrol zone will comprise a 10m wide detection zone (cleared of vegetation) between the international border fence and the inner fence. This is a requirement of the SANDF to provide protection for their staff patrolling the international boundary to provide them with a clear, uninterrupted view of the fence and immediately adjacent area. The border barrier (in the sections where it is proposed to be developed) and the road will be placed within this 10m wide detection zone.

An existing border fence is located along the majority of the length of the Phase 1 section, with the exception of Lake kuZilonde. It is planned that this existing fence will be upgraded to a 2.4m high elephant-proof fence along the entire Phase 1 section, including across Lake kuZilonde where a new elephant fence will be constructed. The additional (inner) fences will be new and do not currently exist. These fences are proposed to be constructed along the entire length of the Phase 1 alignment, except across Lake kuZilonde.

Similarly to the fence, an existing border patrol track is located along the length of the border along the Phase 1 alignment, with the exception of Lake kuZilonde and across the primary dune west of the Indian Ocean. It is proposed that this existing track be upgraded for its entire length along the Phase 1 alignment to a 5.5 meter wide gravel road. The only sections of the Phase 1 alignment where a border patrol road will not be constructed / upgraded are the primary dune located at the Indian Ocean where a 1m-wide footpath will be developed, and at Lake kuZilonde where a wooden boardwalk structure is proposed to be constructed due to the sensitivity of this freshwater environment (Figure 1-1).

A new 1.5m high border control barrier structure is proposed to be developed along two sections of the international border (Figure1-1) –

- between the western boundary of the iSimangaliso Wetland Park and the eastern boundary of the Tembe Elephant Park(26.31km in length),

- and between the western boundary of the Tembe Elephant Park and the eastern boundary of the Ndumo Game Reserve (5.74km in length).

Two design options for the proposed conceptual layout of all components within the Border Patrol Zone of the Phase 1 Section have been provided by the design team. The two designs differ slightly in terms of whether the border barrier would be retained as a separate structure, or whether it would be incorporated into the international border (elephant) fence to form one structure. The two layouts are provided in Figure 3-1 below.

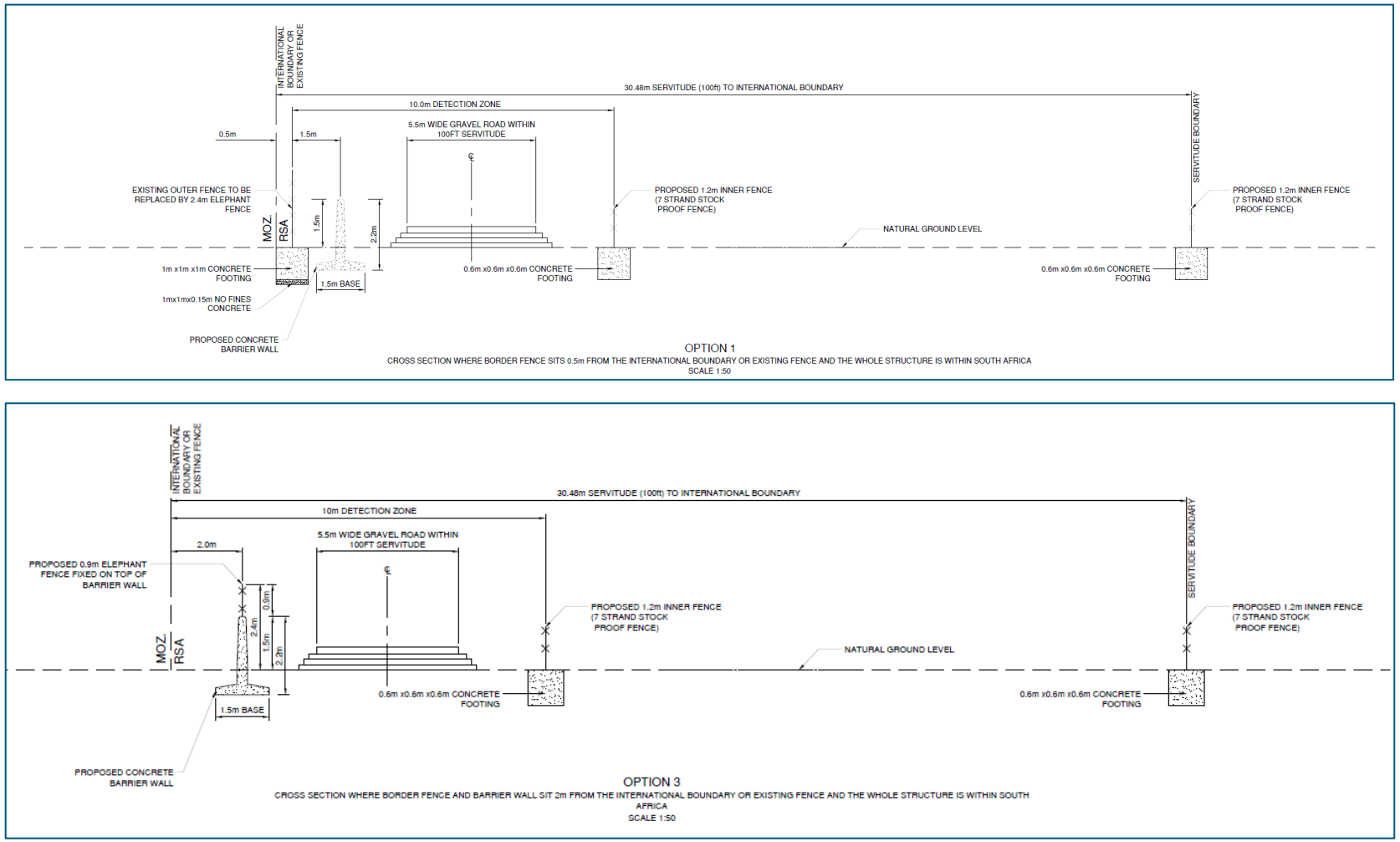

Figure 3-1: Alternative Conceptual layouts of all Phase 1 development components within the application corridor

3.3.2 State of Existing Structures and Infrastructure

Engineering Site inspections have revealed and confirmed that an existing fence and road (border patrol track) are located along the border between Mozambique and South Africa for most of the Phase 1 section, except at Lake kuZilonde where no fence or road exist, and at the primary dune at the Indian Ocean as well as certain sections of the border line east of the Farazela Border Post where no border track exists. Even though the fence is still in good condition along the majority of the border, in places the wooden fence posts have been damaged by elephants, falling vegetation, or illegal activity (movement of people across the border).

For most of the border Phase 1 alignment, the border patrol track in its existing state is a narrow (no wider than 4m) very sandy track that requires the use of vehicles with 4x4 capabilities. The border track is raised above ground level within the larger wetlands that are traversed by the border road to allow vehicle access across these systems when they are inundated. In addition a number of culverts have historically been constructed to allow flow within these wetlands to underpass the patrol track.

No existing infrastructure (fence or road) currently exists across Lake kuZilonde and its associated wetlands. The existing border track extends to the western foot of the primary dune within the iSimangaliso Wetland Park, at which point it stops. Although the fence extends up the dune, no existing footpath is located along the fence as it traverses the dune forest.

It should be noted that the existing border patrol track and existing fence extend across the section of the border along the Tembe Elephant Park's northern boundary. These are located in a narrow strip bounded to the south by the Park's boundary fence, inner electric fence and patrol track.

It should also be noted that eZemvelo KZN Wildlife recently completed the erection of an electrified dual strand 2m high structure to prevent the movement of elephants from Mozambique into South Africa along a section of the border to the east of the Tembe Elephant Park. This structure is located on the southern side of the existing border patrol road. The applicant is engaging EKZN regarding the future of this structure. The intention of the upgrading of the border fence to an elephant-proof fence is to control and prevent the movement of elephants into the parts of South African within the Phase 1 section of the project from Mozambique, thus performing the same function as the EKZN structure. Should the decision be made in consultation with EKZN to remove the structure, it is important to ensure that the material be returned to EKZN.

Figure 3-2: Example of the existing fence along the Mozambique-South African border in the Tembe Elephant Park

Figure 3-3: Existing fence and track in the area east of the Ndumo Game Reserve. Note the proximity of the fringing vegetation

Figure 3-4: Existing fence and road in the area east of Tembe, showing the border fence (right), track, and EKZNW elephant fence

Figure 3-5: Existing fence in states of disrepair – damaged by a fallen tree in the Tembe area (left) and the damaged by people crossing into Mozambique east of Tembe (right)

Figure 3-6: Existing fence damaged by elephants east of the Tembe Elephant Park

Figure 3-7: Existing fence with no existing road / footpath access at the western foot of the primary dune at the Indian Ocean

Figure 3-8: Existing international border fence (far left) and patrol track (centre), with the Tembe Elephant Park boundary fence, inner electric fence and patrol tracks (right) in the Tembe Elephant Park

Figure 3-9: View west along the international border at the eastern end of the Lake kuZilonde wetland system; note that the border fence (right) does not extend into the wetland

Figure 3-10: View east along the international border showing the existing fence, track and size of the primary dune

3.3.3 Construction Methodology

Various structural configurations have been used in the preliminary design of the Phase 1 Project. All alternatives will be constructed from cast-in-situ or precast concrete, with exception to the wooden boardwalk over Lake kuZilonde which will be constructed from treated timber. The concrete structures are the most durable, require minimal maintenance and provide a design life > 75 years.

Clear and Grub

'Clear and grub' will be undertaken as the first task for the various components:

- Clear and grub a 10m wide strip of vegetation for the detection zone;
- Clear and grub of a 3m wide strip along each fence (3 in total) for construction and maintaining the clearance to improve the lifespan of the fence. This strip will also be used as a pedestrian walkway to inspect the fences; and
- Clear and grub of 7m wide strip for the road layerworks (typically overlapping the 10m detection zone).

Clear and grub will similarly be undertaken for the border barrier where required but as the barrier will typically be constructed on the existing border patrol track, and as it will be located within the 10m detection zone, this may not be required.

Road Upgrade

Note: The existing track will either be upgraded (widened) in its present position, or a new road will be constructed within the 50m corridor to the south of the existing track (in order to accommodate the border barrier structure that will be placed close to the fence). Whether the existing track will be upgraded in its current position or a new road constructed will be determined during detailed engineering design.

New Border Patrol Road

The roadworks will consist of:

- Clear and grub vegetation to a width of 7m.
- Remove unsuitable loose material, in general to a depth of 100mm. This material will be stored next to the road and used as last cover to the completed road's side slopes. Very little material will be spoiled but if needed, it will be spoiled in utilised borrow pits.
- Compact in-situ material to a depth of 150mm.
- Build gravel layers of 150mm thickness with 150mm-wide steps in each layer to a final with of 5.5m.
- Gravel will originate from existing commercial sources.
- Storage of fuel, materials and equipment for road building at the construction camp at Farazela or at locations within the 50m application corridor;
- Extraction of water from local municipal sources for the compaction of the layer works.
- Excavation and installation of culverts and headwalls, drifts and other water drainage structures and berms to facilitate cross-drainage.
- Stockpiling of road materials within the servitude
- Cut of material to stockpile,
- Cut of material to waste site.

Upgrading of Existing Patrol Road

The roadworks will consist of:

- Clear and grub vegetation to a width of 7m,
- Remove and stockpile existing road materials within the road reserve;
- Rip and re-compact in-situ material to a depth of 150mm
- Build gravel layers in 150mm thickness with 150mm-wide steps in each layer to a final with of 5.5m
- Gravel will originate from existing commercial sources.
- Storage of fuel, materials and equipment for road building at the construction camp at Farazela or at locations within the 50m application corridor;
- Extraction of water from local municipal sources for the compaction of the layer works.
- Excavation and installation of culverts and headwalls, drifts and other water drainage structures and berms to facilitate cross-drainage.

Wooden Boardwalk over Lake kuZilonde

For the purpose of an ATV (Quad Bike) access by the SANDF, a boardwalk / bridge structure is required to pass over Lake kuZilonde. The boardwalk will be designed to take vehicles smaller than cars and pedestrians only. The boardwalk will be constructed from treated timber, with timber piles used for foundations. This bridge type is felt to have the least environmentally effects compared to concrete / steel

alternatives while being the most economical. The design life of the structure is however lower than a concrete/steel alternative.

It is proposed to construct a boardwalk over Lake KuZilonde. The structural works will consist of:

- Establish onsite, clearing and grubbing;
- Drive treated timber piles into lake;
- Construct treated timber deck;
- Construct treated timber railings; and
- Construct gabion boxes at abutments/approaches for erosion protection.

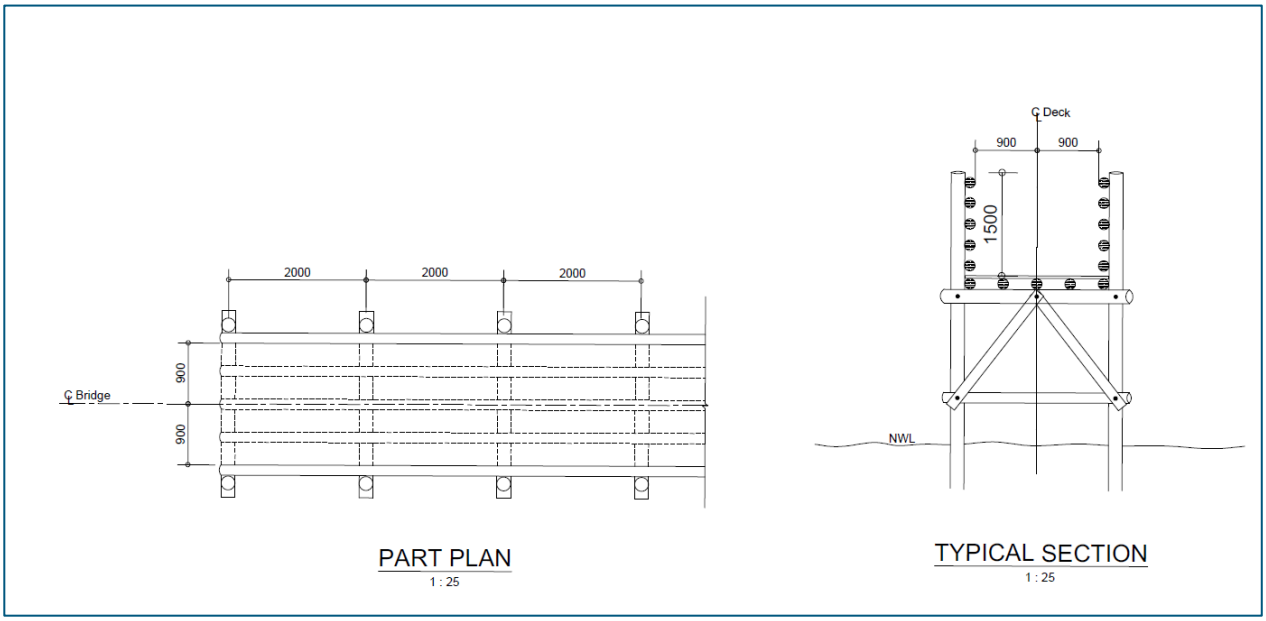

Figure 3-11: Proposed Design of the Wooden Boardwalk Structure over Lake kuZilonde

Fencing

The fences will consist of the following:

International Border Fence:

- An international border fence will be constructed along the length of the border from the high water mark of the Indian Ocean, westwards. This fence will be a 2.4m high elephant fence for most of the length of the Phase 1 alignment, except for a 2km stretch of the alignment (1km either side of the Farazela (Kosi Bay) Border Post where a 2.4m high mesh fence (ClearVu or similar approved) will be constructed.
- The Border (Elephant Fence) Fence will be electrified
- The 2.4m high elephant fence is a requirement from DAFF to prevent elephants and other large game from crossing into South Africa and spreading foot-and-mouth disease;
- The 2.4m high mesh fence (ClearVu or similar approved) will be used to prevent pedestrian crossings in the vicinity of the Farazela Border Post, as required by the SANDF.

Inner Fence

- An inner fence will be constructed along most of the Phase 1 alignment, except for Lake kuZilonde, across the primary dune at the Indian Ocean, and within the section along the northern Tembe boundary. This inner fence will be a 7 strand 1.2m high stock-proof fence, typically located 10m away (to the south of) the international fence within RSA.
- The detection zone will be located between this fence and the international border fence.
- This purpose of this inner fence is to prevent game / livestock from within South Africa grazing within the 10m detection zone. The primary purpose of the livestock / game exclusion zone adjacent to the international border is to stop air-borne mucus from game / livestock on the Mozambique side of the fence that could contaminate vegetation immediately adjacent to the fenceline from transmitting livestock diseases, in particular foot and mouth disease, to game / livestock on the South African side.

Servitude Fence

- A servitude fence (typically a 7 strand 1.2m high stock-proof fence) will be erected on the on the servitude boundary, 100ft (30.48m) away from the international boundary.
- The servitude fence will be constructed along the entire length of the Phase 1 alignment, except for Lake kuZilonde, across the primary dune, and within the section that runs to the north of the Tembe Elephant Park.

Gates will be erected at various points along the fence where required, to allow access into the servitude and border patrol zone from the south.

It should be noted that cleared areas (3m wide – 1.5m each side of the fence centreline) for the construction of the fences will be retained as areas cleared of vegetation and will be used as footpaths to inspect the fences by DAFF staff.

Replacing & Construction of new 2.4m high elephant fence

The proposed fence height will be 2.4m which will include I-beam Straining posts (305 x 102 x 25 kg/m) spaced a minimum of 150m in line with the fence. It is highly likely, however, that in the sandy, and saturated soils of the Phase 1 section that the I-beams will need to be more closely spaced (the spacing will only be determined in detailed design). The fence will also include line posts (305 x 102 x 25 kg/m) which will be placed every 15m apart, with 16 x 2.5mm double twisted fully galvanized barb wire strands and five 12 mm hot dipped galvanized stay wire ropes. Intermediates will consist of 3.05m Y-standards every 6m and 2.45m CCA or Creosote treated wooden droppers every 1.5m. There will be extra line posts, slip posts and corner posts which will be positioned between straining posts.

The construction method to replace (the existing) and construct (the new) fence with 2.4m high elephant fence:

- Remove existing fence, posts and foundations;
- Clear vegetation 3m wide (1.5m on each side of the fence);
- Excavate footings for the line posts at 15m intervals (1m wide x 1m long x 1.3m deep tapering out at 45 degrees to 2m wide x 2m long at the surface)
- Rip and re-compact 0.15m deep in bottom of excavation;
- Construct 0.15m deep cemented soil foundation in bottom of hole;
- Construct a 1m x 1m x 1m concrete cube footing with I-beams for the elephant fence; and
- Span 5 cables along the I-beams with barbed wire in-between.

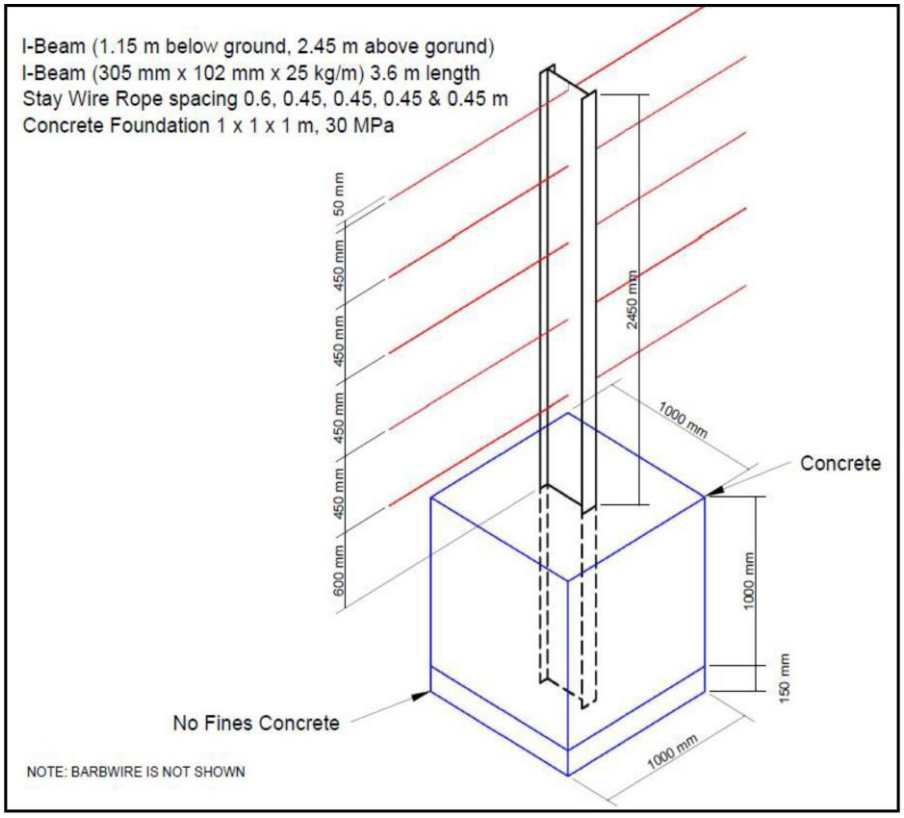

Figure 3-12: Typical footing for elephant fence line posts (DAFF, 2.4m elephant fence, 2017)

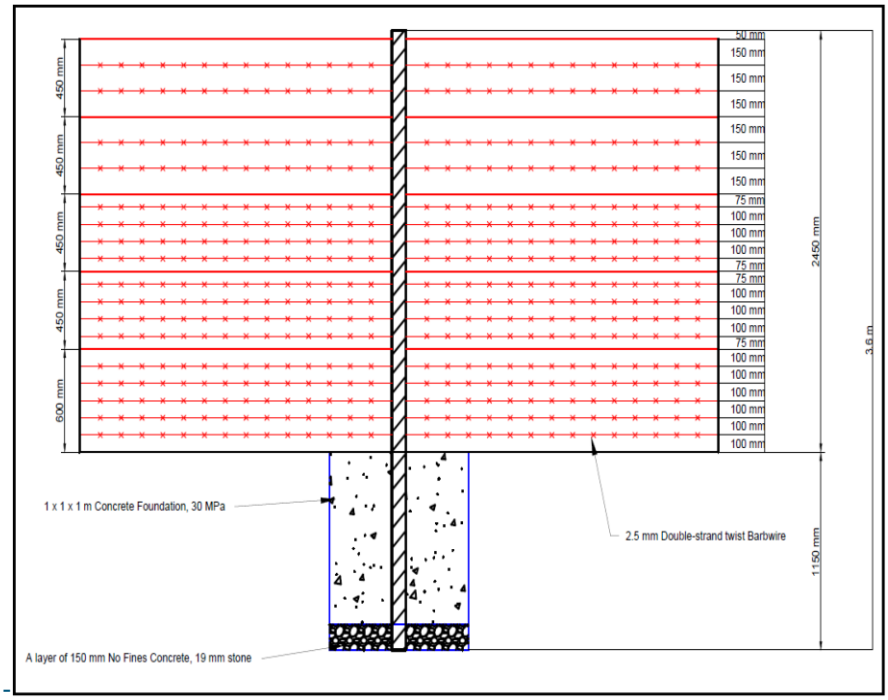

Figure 3-13: Typical detail of cable and barb wire strands for elephant fence (DAFF, 2.4m elephant fence, 2017)

Construction of new 1.2m high inner and servitude fences

It is proposed that the height of the fences will be 1.2m with 4 strands of 2.5mm fully galvanized double twisted barb wire and 3 strands of 12mm hot dipped stay wire supported by 200 X 100 X 22.4kg/m I-Beams, 1.8m Y-Standards and 1.2m hardwood droppers.

The construction method will entail:

- Clear vegetation 3m wide (1.5m on each side of the fence);
- Excavate footings for the line posts at 15m intervals (1m wide x 1m long x 1.3m deep tapering out at 45 degrees to 2m wide x 2m long at the surface);
- Rip and re-compact 0.15m deep in bottom of excavation;
- Construct 0.15m deep cemented soil foundation in bottom of hole.
- Span 5 cables along the I-beams with barbed wire in-between

Footpath over the Primary Dune

The footpath over the primary dune will be located adjacent to the international fence. The area cleared for the construction of the fence will be used as a footpath to inspect the integrity of the fence. In order to prevent erosion of the dune sands along the footpath in steeply sloping parts of the dune, wooden poles or branches of trees felled to as part of the construction will be keyed into the slope to create a stepped footpath.

Border Barrier Structure

The border barrier will not be a continuous wall-type structure, but will rather be comprised of individual units 6m in length, spaced 1.5m apart. The main purpose of the barrier structure is to prevent the movement of vehicles across the border and have been designed accordingly.

It is proposed that the barrier units will be manufactured in pre-casting yards away from the site. Following manufacture, the concrete barrier units will be transported to the border area and placed on a prepared stabilised foundation. Each reinforced concrete barrier segment is a precast concrete panel on 1.5m spread footing. Each panel would comprise of 6 x 0.9m long precast segments which would be placed and then connected with concrete in-fill (using SoilChem). The design of the structures is accordingly an inverted “T” with the base of the structure being 1.5m in length, placed 0.7m below ground level.

The barrier structure will be built within the South African boundary and no construction activity is expected within Mozambique. It is anticipated that the wall would be aligned 1.5m to the south of the international border fence, with an design option alternative to incorporate the barrier and international (elephant) border fence by placing the fence on top of the barrier structures. The proposed wall will require a construction footprint of 7.5 m and will incorporate a 1.5 m gap between barrier units every 6 m along the alignment to enable the movement of fauna and to allow the flow of stormwater. The wall is expected to be 1.5 m high from ground level.

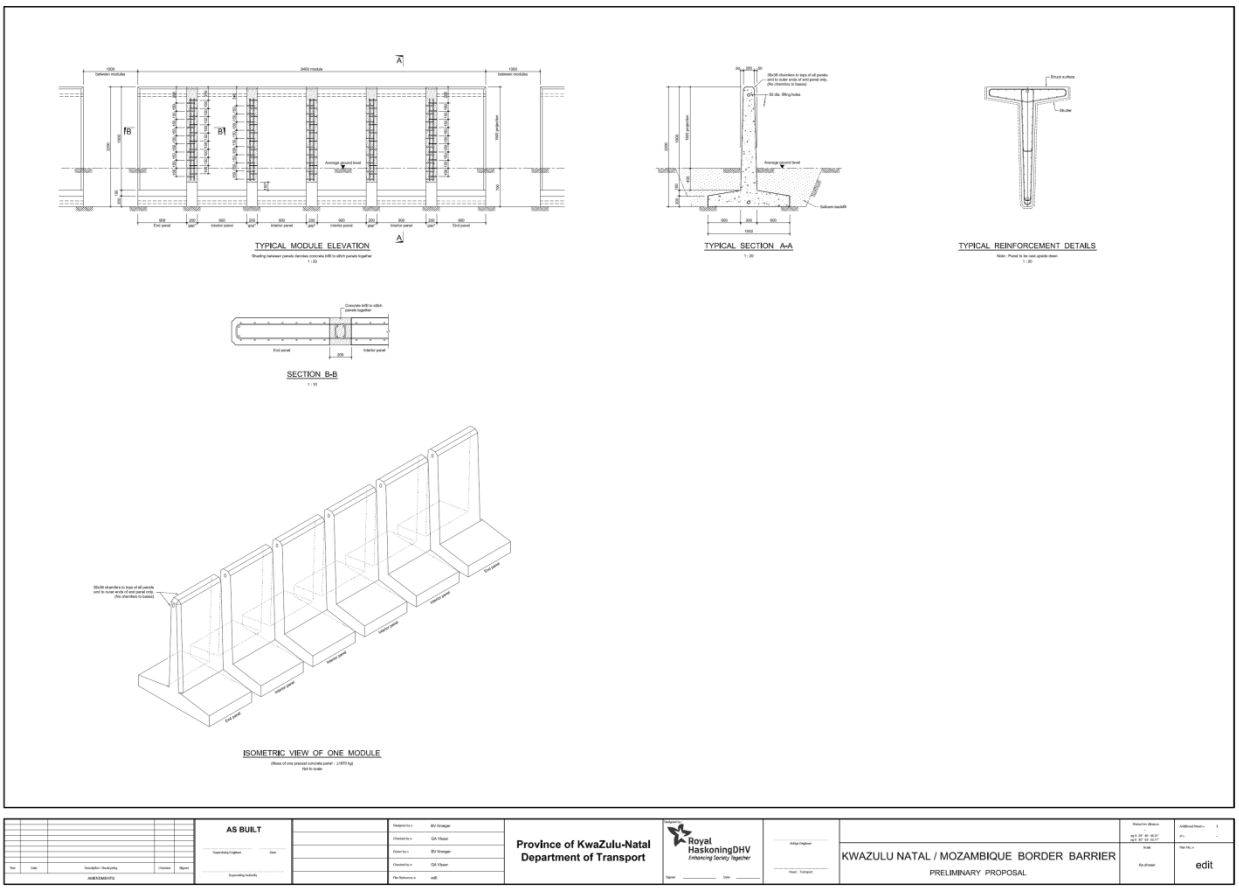

Figure 3-14: Proposed Design of the border barrier structure

The construction method to construct a new 1.5m high concrete border barrier structure:

- Establish onsite, clearing and grubbing;
- Provide traffic accommodation facilities;
- Excavate 850mm below ground level;
- Prepare foundation base for wall;
- Construct 0.9m precast concrete barrier segments;
- Transport and place precast concrete barrier segments;
- Construct 6.4m barrier modules with 6 precast segments and 5 x 0.2m cast-in situ joints; and
- Backfill with soil cement.

3.3.4 Culvert / Wetland Crossing Structure Design

Culverts and other wetland crossing structures have been designed and will have to be constructed in areas where wetlands are crossed along the Phase 1 alignment. Culverts will be constructed along all infrastructure components (road and fencing) where wetlands are crossed. In certain instances, especially relating to the border barrier structure, existing culverts along the border track will be utilised and upgraded / repaired where necessary. These existing culverts may be extended for the accommodation of new infrastructure, but this will be determined during the detailed design phase.

A number of culvert / crossing structure designs are being considered as part of the Phase 1 project scope. Two types of culverts - box culverts and pipe culverts – are being considered.

Box Culverts / Series of Box Culverts

Culverts will consist of cast-in situ concrete boxes. Concrete box cell width/heights will vary from 1.2m to 3.6m depending on the vertical profile of the road levels above natural ground level. Culverts will be used where a drift type structure is not warranted. Apron slabs with cut-off walls along with gabion mattresses will be used to prevent erosion and undermining of the culverts which will protect the roadway. Series of culverts will likely be used in low lying flood plain areas.

Pipe Culverts / Series of Pipe Culverts

Pipe Culverts will consist of precast concrete pipes 900-1200mm in diameter. Pipe Culverts will be used in low flow catchments compared to box culverts and where a drift type structure is not warranted. It is recommended that a minimum diameter be 900mm. This reduces the potential for siltation blocking of the culverts and reduces potential for debris blocking. End treatments to the pipe ends will be used to prevent erosion and undermining of the culverts which will protect the roadway. Series of pipe culverts will likely be used in low lying flood plain areas.

The structural works will consist of:

- Establish onsite, clearing and grubbing;
- Provide traffic accommodation facilities;
- Provide dewatering / accommodation of stream drainage, where necessary;
- Excavate approximately 2m below ground level;
- Place and compact rock fill;
- Construct concrete box culvert including slabs and walls;
- Construct earwings and retaining walls;
- Construct approach slabs (if necessary);
- Construct apron slabs and gabion mattresses; and
- Place compacted backfill at culvert to road level.

Vented Drifts

Vented Drifts (causeway-type structures) could also be used as a wetland crossing structure.

For new vented drifts:

- Establish onsite, clearing and grubbing;
- Provide traffic accommodation facilities;
- Provide dewatering / accommodation of stream drainage;
- Excavate approximately 2m below ground level;
- Place and compact rock fill;
- Construct concrete culverts and headwalls;
- Place compacted backfill between and above culverts and construct concrete deck slab; and
- Place compacted backfill at approach embankments.

Note: The exact location of culverts and other crossing structures within the servitude has not yet been determined; exact culvert locations will only be determined once detailed engineering design has been completed. It is highly important that the recommendations of the freshwater study relating to culvert design and installation be considered once the detailed design of culvert structures takes place.

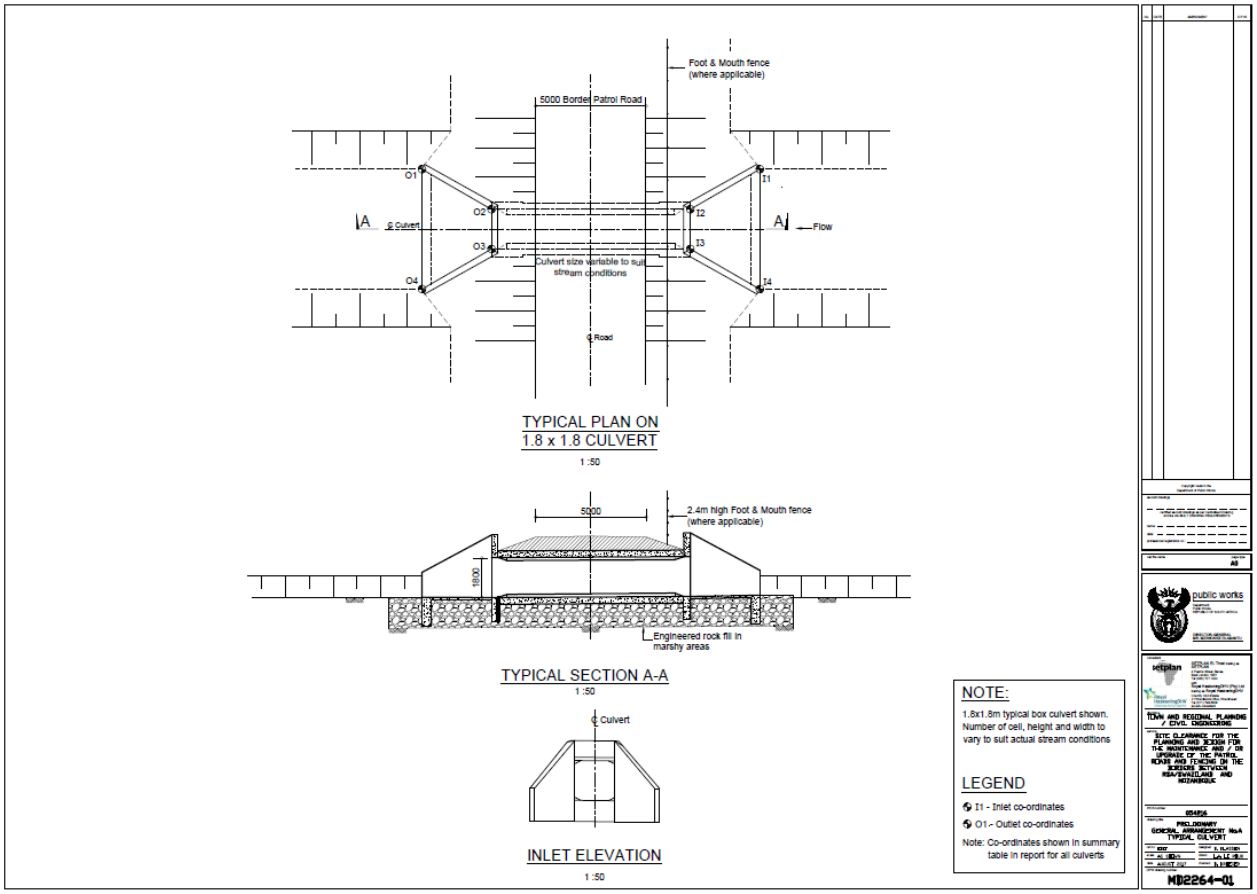

Figure 3-15: Typical Culvert Design

Access Roads

It is important to note that currently **no new access roads** to the Phase 1 alignment are proposed to be constructed / developed and the development of access roads to the Phase 1 alignment has not been included in the scope of the project or as one of the activities that requires environmental authorisation. Other than the proposed declaring of an access road servitude to the south of Muzi Camp, all access for construction will either be within the 50m wide environmental authorisation corridor and existing roads / tracks will be used with no upgrading and no declaration of any new access servitudes.

The design team for the border patrol road and fencing component of the Phase 1 project has indicated that operational access (of SANDF vehicles) to the Muzi Camp area (located at the eastern boundary of the Tembe Elephant Park) of the Phase 1 alignment will be along the A1070 local access road to a point close to the crossing of the Muzi Swamp wetland, from which an existing local access track that crosses the Muzi Swamp wetland and which then runs north-westwards to the boundary of the TEP at Muzi Camp will be utilised. Should access through the Muzi Camp to the existing border line not be possible, a new

5.5m road approximately 510m in length will need to be developed around the TEP boundary fence and this road will form part of the border patrol road that will be developed along the Phase 1 alignment.

It is important to note that the existing track running from the A1070 to the Muzi Camp will be declared as a border access road servitude of 13m width and will thus not trigger any Listing Notice 1 Activity in the context of the EIA Regulations, as amended. This existing track will not be widened by more than 4m and will thus not trigger any Listing Notice 3 Activities in the context of the EIA Regulations.

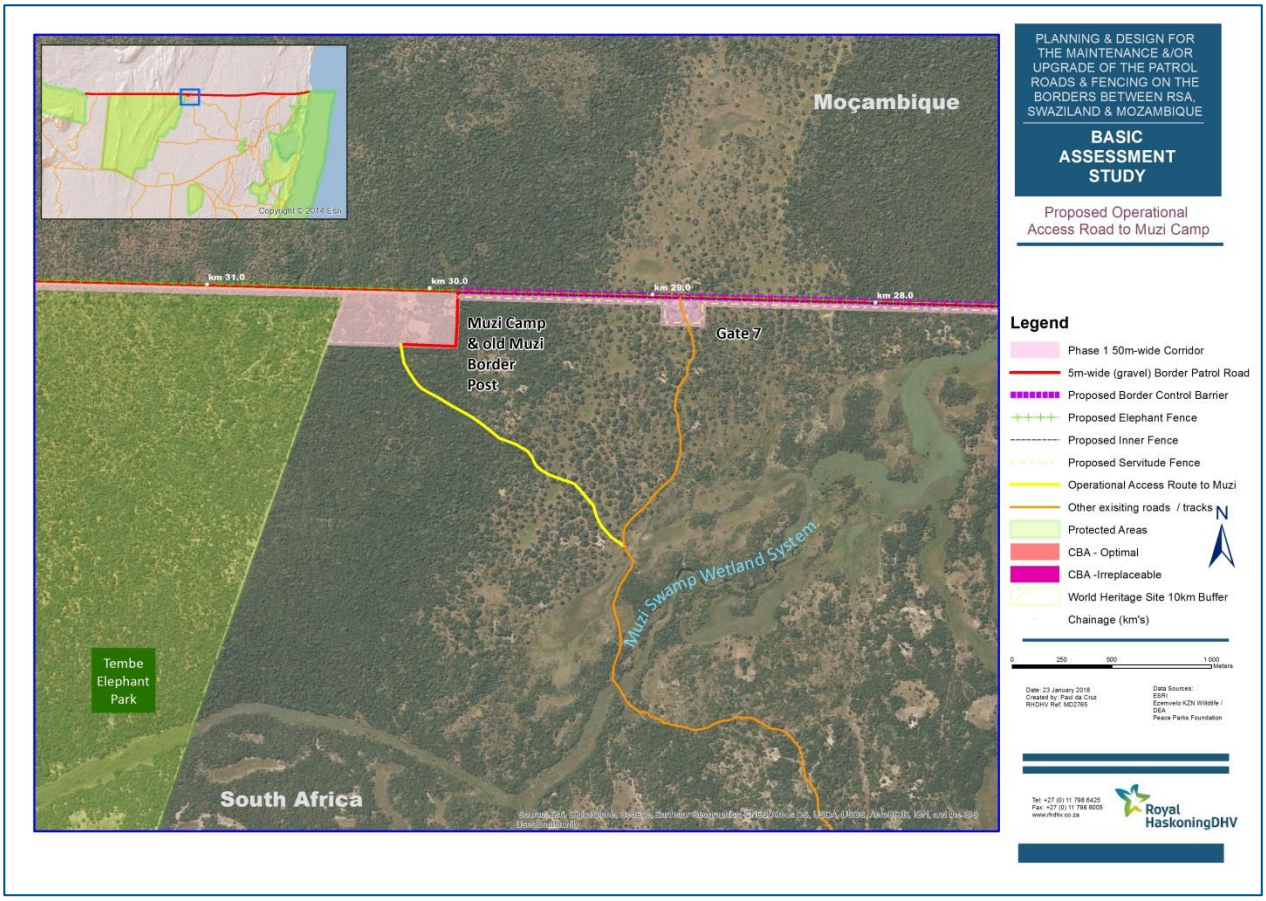

Figure 3-16: Location of Operational Access Road to Muzi Camp

Construction Camps

A construction camp for planned first phase of construction of the proposed infrastructure – the border barrier – is proposed at a site very close to the Farazela (Kosi Bay) Border Post. The construction camp is approximately 5ha in size (Figure3-17).

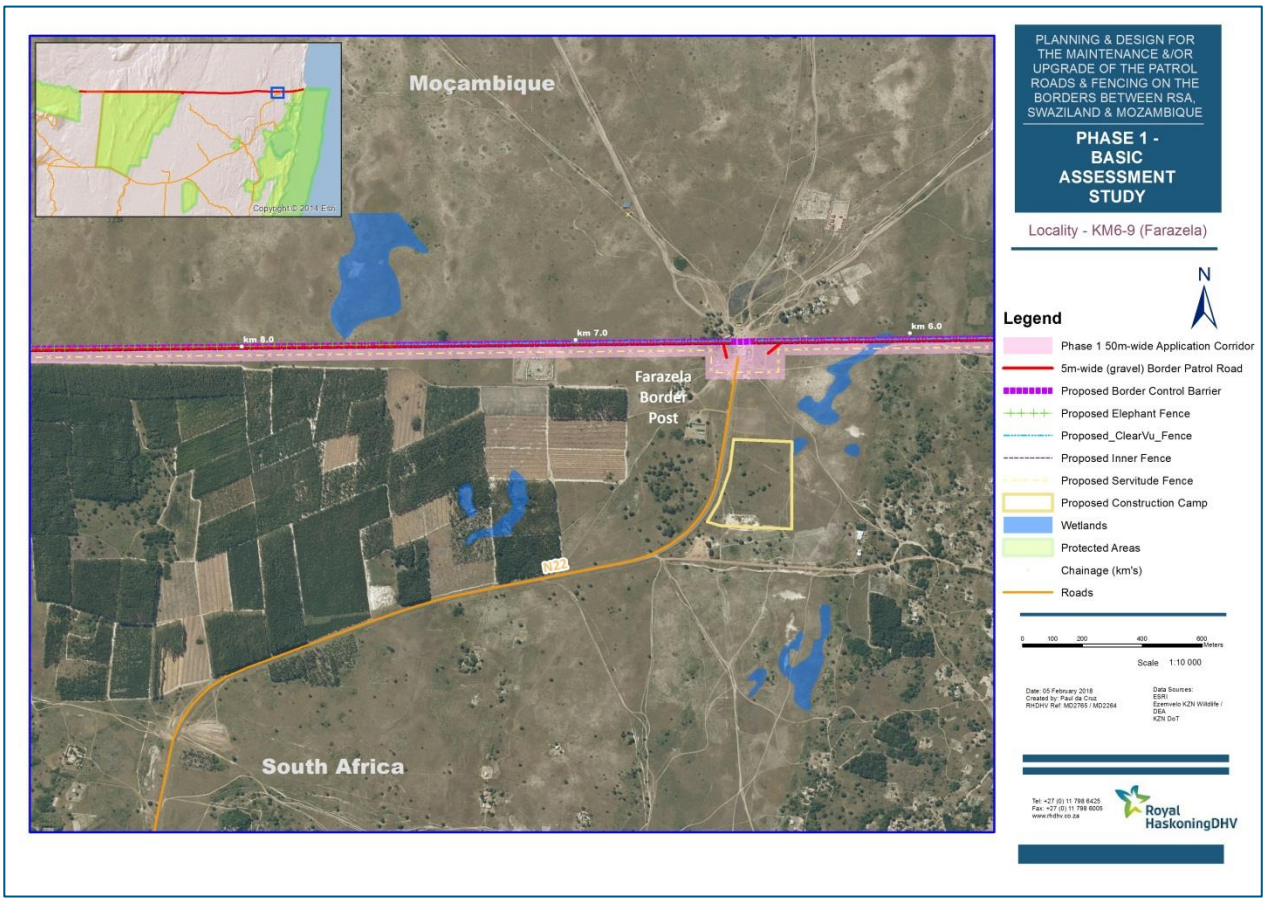

Figure 3-17: Location of the Proposed Construction Camp at Farazela

In addition to the Farazela Construction Camp, site camps will be required to be established along the Phase 1 alignment at 5km intervals for the storage of the materials and equipment. These camps are proposed to be typically 2 ha in size and will be located within the 50m-wide application corridor or within disturbed / transformed land such as existing forestry timber laydown areas. Construction of each site camp will include:

- Clear and grub of 2ha;
- Construction of temporary fence around the site camp;
- Import of gravel material to construct a hard surface and to prevent ponding;
- Storage of fuel for construction equipment;
- Construction of temporary ablution facilities;
- Construction of temporary offices for site staff;
- Construction of temporary kitchen for site staff;
- Construction of temporary accommodation units for site staff;
- Construction of temporary storage facilities;
- Construction of temporary workshop for the maintenance of equipment and vehicles;
- Temporary workspace for the in-situ construction of concrete structures, including barrier structures, culverts.

3.4 Project Motivation

3.4.1 Need & Desirability

Table 3-5: Project need, desirability and benefits

1. Is the activity permitted in terms of the property's existing land use rights?	**YES**	[redacted]	**Explain**
The land use within the Phase 1 study area is primarily subsistence livestock ranging and limited subsistence cultivation within the portions of the study area that do not fall within protected areas, in the context of the communal land tenure of the study area. Limited areas of plantation forestry occur in parts of the study area located west of the Farazela Border Post. The development and upgrading of the border infrastructure will not conflict with the existing land use rights in these areas, as existing border patrol infrastructure is located along the international border and very limited formal infrastructure (not related to border control) is located close to the international border for security reasons. Large portions of the Phase 1 study area are located within formally protected areas (TEP and IWP). These areas are set aside for the exclusive conservation and protection of the natural environment, although within iSimangaliso harvesting of natural resources by the local community is permitted. The development / upgrading of border control infrastructure will not conflict with this conservation usage as it will occur within a spatially limited areas where existing border protection infrastructure is located. In the context of the TEP, the development will occur within a narrow strip of land between the northern Tembe fence and the international border fence, and will thus not affect or result in the transformation of any land set aside for conservation in this context. It should also be noted that the development / upgrading of border control infrastructure is part of the default land use rights in immediate proximity to an international border. As such the DPW will be declaring a 100ft wide servitude for exclusive border control infrastructure and activities.			
2. Will the activity be in line with the following?			
(a) Provincial Spatial Development Framework (PSDF)	**YES**	[redacted]	**Explain**
The KwaZulu-Natal Spatial Economic Development Strategy (PSEDS) was formulated in 2007 as a spatial economic assessment of the areas of need and potential within the province. The PSEDS is intended as a guide to service delivery within the cluster to achieve the goals set in ASGI-SA to reduce poverty and unemployment by 2014 and the policy interventions as contained in the New Growth Path of 2010. The PSEDP is built on the principles of the National Spatial Development Strategy (NSDP) The principles or directives are as follows: ▪ Principle 1: Rapid economic growth that is sustained and inclusive as a prerequisite for the achievement of poverty alleviation; ▪ Principle 2: Fixed investment should be focused in localities of economic growth or economic potential; ▪ Principle 3: Where low economic potential exists investments should be directed at projects and programmes to address poverty and the provision of basic services in order to address past and current social inequalities; ▪ Principle 4: Future settlement and economic development opportunities should be channelled into activity corridors and nodes that are adjacent to or link the main centres			

This Spatial Development Vision, however, cannot be fully understood without a more detailed explanation. The Vision Statement is therefore unpacked in more detail below:

- People have emerged from poverty and deprivation;
- People have improved access to livelihoods and basic needs;
- People have increased income security from formal employment;
- People have increased access to municipal, social and economic services;
- People live in an environment that is safe, conducive for doing business and attractive for investment;
- People are prudent in the use of natural resources and actively reduce, reuse and recycle which has generated new economic opportunities within the Municipal Area;
- Economic growth and development is sustainable and is primarily driven by Agriculture and Tourism;
- The use of renewable sources has become a way of life for all, as well as the application of sustainable development principles and practice;
- The visual quality of the natural and built environment, where people do business, work, play and live, has improved;
- Settlements, towns and agricultural land are well organised, connected with each other (through a well-developed, efficient and well-maintained road network), and accessible in terms of basic social and economic services

Four key sectors have been identified as drivers of economic growth in the KwaZulu-Natal, namely:

- The Agricultural sector (including agri-processing and land reform)
- The Industrial sector (Including Manufacturing)
- The Tourism sector
- The Service sector (including government services)

The project will directly contribute towards the achieving of the aims of PSEDS as an infrastructure development project that will create a number of job opportunities (albeit on a short term basis) for unskilled workers and thus will make a contribution to the economy of the local area as well as the ability of those employed to support their livelihoods.

The project will also indirectly make a contribution to ensuring that the PSEDS objectives are able to be met. Economic development cannot be successfully achieved where criminal activity undermines economic activity through the theft of personal property. Although many of the vehicles illegally trafficked across the international order in the study area are from areas further afield than KZN, a large number are stolen / hijacked in the KZN province. The upgrading of the border infrastructure will enable the relevant authorities to more effectively undertake their mandate of protection of South Africa's borders and ensuring the safety of its citizens, and thus will foster a climate more conducive for the conducting of economic activities.

(b) Urban edge / Edge of Built environment for the area		**NO**	**Please explain**

The Urban Edge does not apply as the project is located outside of the Urban Edge.

(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	**YES**		**Please explain**
According to the uMhlabuyalingana Local Municipality (LM) Integrated Development Plan (IDP) 2017, The objectives of the IDP is realized in the development of Agriculture and Tourism, and of infrastructure and services in Mbazwana, Mseleni, Sikhemele, Phelendaba and Manguzi as a result of intergovernmental cooperation and increased investment by private sector in the place and the people. Although the project will not directly contribute towards the development of agriculture and tourism, as well as infrastructure and services, it will promote the undertaking of economic activity, by providing a degree of local employment as an infrastructure development project. However the project will directly assist in the addressing of one of the key threats to both the local and district municipalities in their respective IDPs of high crime rates through the improvement of the ability of the authorities to prevent criminal activities from being successfully perpetrated. The project will assist in the successful implementation of “Project UMkhanyakude”, a project to reduce crime in the municipality as detailed in the uMhlabuyalingana IDP and will address one of the key issues in the wider Manguzi area that that crime in this area is commonly caused by lack of securing in the border between Mozambique and South Africa. The project will be a key aspect of the local municipality social development goal, as specified in the IDP, of ensuring safe communities (i.e. making these communities safe from crime).			
(d) Approved Structure Plan of the Municipality		**NO**	**Please explain**
There is no approved structure plan of the municipality.			
(e) An Environmental Management Framework (EMF) adopted by the Department (e.g. 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**	**Please explain**
Not Applicable.			
(f) Any other Plans (e.g. Guide Plan)		**NO**	**Please explain**
Not Applicable.			
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**	**NO**	**Please explain**
The main purpose of the municipal SDF is to guide the spatial form and location of future developments within Umhlabuyalingana Municipality. Therefore the SDF attempts to address the spatial imbalances that were imposed during apartheid era in South Africa as well as the specific rural context of Umhlabuyalingana. Another purpose of the SDF is to give spatial effect to multi-sectoral projects identified in the IDP as well as assist the municipality to co-ordinate the			

implementation of the various sector plans.

The development and associated land use (border protection) along a narrow strip of land adjacent to the border does not conflict with any of the SDF priorities / focusses.

4. 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**	**NO**	**Please explain**

The proposed project will assist in fulfilling the constitutional mandate of a number of national and provincial governmental departments as well as the mandate of the SANDF in securing South Africa's borders, to protect its citizens and to preventing the spread of disease as well as the illegal movement of goods and people. The project is thus highly important at a national level. However the outcomes of the development will have a positive local-level impact. The level of crime in the northern parts of the Umhlabuyalingana LM has been partly attributed to the porosity of the international border and illegal activities related to trafficking of stolen goods, including vehicles and livestock into Mozambique. The community representatives have petitioned the relevant authorities to address this issue, hence the prioritisation of the Phase 1 project including the border barrier development, in response to these requests.

The Premier of KZN Mr TW Mchunu received numerous complaints from communities living within the Umkhanyakude District who claimed that they are being continuously victimised by the criminal syndicate(s) that are responsible for the theft and hijacking of vehicles that are subsequently illegally trafficked into Mozambique. These communities and businesses have indicated that this situation was becoming untenable and have made various pleas for government intervention. The Provincial Government of KwaZulu-Natal has subsequently established a steering committee comprising of head of departments to seek workable solutions to mitigate the illegal movement of vehicles across the border. The Premier of KZN petitioned national government (the Ministry in the Presidency) in late 2016 to assist in this matter. In response the Ministry of the Presidency noted the presence of severe systematic, organisational and infrastructural challenges regarding the implementation of national government's various border security responsibilities that impede government's capacity to ensure the territorial integrity of the country. Accordingly the response from government emphasised the government's intention to prioritise the following directives (inter alia) that directly relate to the project to remedy this situation:

- expediting the construction of border fences and establishment of border patrols
- repairing and strengthening facilities and infrastructure on the borderline

The urgency for decisive action to upgrade border security (fencing) and patrol infrastructure (access and patrol roads) was again emphasised when local community members reportedly demonstrated against the lack of security along the border and forced the temporary closure of the Kosi Bay Border Post on 28 January 2018. The upgrading of the border control infrastructure will make it more difficult for cross-border crimes to be perpetrated, and will address the concerns of the local communities.

The development can accordingly be considered to be required at a local level in order to improve the safety and security of affected local communities.

5. 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? (Confirmation by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as part of Appendix E.)	**YES**	**NO**	**Please explain**

The project activities (upgrade of Border Fencing and Patrol Infrastructure) do not require any electrical, water or sanitation infrastructure. Possible future electrification of border fencing (in particular elephant-proof fencing) can be achieved with solar panels.

There is however a need for regular maintenance of certain existing public roads that have been identified as strategic access routes to the border patrol routes to ensure adequate services are currently available, although for most of the project municipal services are not required. The ultimate responsibility for the project lies with DPW and the KZN DoT as implementing agent for certain project components with support provided by the local municipality for certain services such as water provision.

6. 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)? (Comment by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as part of Appendix E.)		**NO**	**Please explain**

Although the need for improved security along the border is highlighted in the Integrated Development Plans of some of the bordering Municipalities, the responsibility for border security infrastructure is not a Municipal function. The project is therefore not provided for in the infrastructure planning of the municipality. Where rural access roads (existing public roads) are identified as strategic access routes to the border, it is not expected that there will be any significant increase in the traffic flow along these routes. The responsibility for maintenance of these roads rests mostly with the Provincial Department of Transport and the respective District Municipalities The project will thus have no impact on the infrastructure planning of the municipality.

7. Is this project part of a national programme to address an issue of national concern or importance?	**YES**		**Please explain**

The project is one of a number of projects of the National Government of South Africa to upgrade border control infrastructure around the Republic's borders. These projects have also been declared as Presidential Projects. The Phase 1 project is also a strategic priority of Provincial Department of Transport (KZN).

This project is considered to be of national importance as it will improve the ability of a number of national government departments and their agencies to successfully perform their mandates. Accordingly the contribution of this project's deliverables towards protection of South Africa's borders serves to:

- prevent the illegal movement of people, goods (to avoid payment of duty) or contraband,
- prevent the movement of produce or livestock that may lead to the spread of infectious disease,
- promote the lawful entry and exit of goods and people, and
- prevent revenue loss due to customs avoidance / smuggling of goods

The project will accordingly assist in the remedying of a number of challenges facing national

government.

8. 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**		**Please explain**

The location factors favour this land use as the main activity (i.e. border patrolling and control) is already being undertaken in the area immediately adjacent to the border and existing infrastructure (fence and track) occurs along the vast majority of the Phase 1 alignment. Land immediately adjacent to an international border is reserved for border control activities. The slight expansion of the footprint of infrastructure (i.e. within a 50m-wide corridor) will not conflict with surrounding landuses as the predominant landuse is largely subsistence cattle ranging.

9. Is the development the best practicable environmental option for this land/site?	**YES**		**Please explain**

As stated above the main activity (i.e. the border control infrastructure in the form of a fence and patrol track) is already in place and is thus pre-existing. The slight increase in the footprint of this infrastructure within a 50m-wide corridor that will result in certain environmental impacts and a degree of transformation of natural habitats within the corridor is required in order to improve the degree to which border control activities can be performed. In highly sensitive sections of the route the design will be adapted (e.g. across Lake KuZilonde where a wooden boardwalk structure rather than a road will be constructed), or the development footprint will be narrowed (e.g. in the Tembe Game Reserve where upgraded infrastructure will be limited to the existing narrow strip of land between the Tembe outer fence and the international border fence) in order to minimise environmental impacts. The proposed development will also assist in the prevention of cross-border impacts on the protected areas situated along the Phase 1 alignment that are currently adversely impacting these areas (e.g. gill-netting in iSimangaliso that originates in Mozambique and poaching – in particular rhino poaching).

10. Will the benefits of the proposed land use/development outweigh the negative impacts of it?	**YES**		**Please explain**

The proposed development will occur within an area (immediately adjacent to, and the south of the international border line) within which an existing infrastructural footprint exists). This existing developed footprint will be increased, but cumulative loss of natural habitat will occur along the length of the Phase 1 alignment.

The strengthening of the border control infrastructure, in particular the erection of an elephant fence along the entire length of the Phase 1 alignment could be considered to be contrary to the wider objectives of the Lubombo TFCA, which was established to restore the natural movement of fauna, in particular elephant populations between protected areas in South Africa and Mozambique and could thus be considered to be a negative development in the context of cross-border conservation planning. The recent erection of an elephant proof (2-strand) electrical fence along the border should be noted in this context; this structure stretches from the eastern boundary of Tembe to Gate 6 and thus encompasses a wide stretch of the TFCA. This fence has been erected by eZemvelo KZN Wildlife for the explicit purpose of preventing elephants from Mozambique from entering South Africa along this stretch of the border that is located within the TFCA. The Tembe Elephant Park boundary fence has not been removed since the proclamation of the TFCA. The policy of the relevant conservation authorities in South Africa thus appears to be one of securing the border and preventing the movement of mega fauna, rather than opening it up to allow the free movement of such large animals, in particular in the context of increased cross-border ivory and rhino horn poaching activities that are currently afflicting protected areas located on South Africa's international borders. The erection of an elephant-proof fence along the Phase 1 alignment is thus in

concordance with this trend. A number of other priorities, including the prevention of livestock-borne disease and the prevention of illegal movement of people and prevention of illegal activities, including poaching are more important priorities currently than the facilitation of the free movement of mega fauna. Should the geo-political context change in the future, consideration should be given to enabling the movement of fauna, including mega fauna, through portions of the fence that are located adjacent to protected areas (Tembe) within the design of the infrastructure.

These negative environmental (biophysical and conservation planning) impacts are offset by the positive socio-economic impacts that will materialise of employment generation (albeit short term) and improved safety and security in the local area, as well as through the minimised prospects for livestock disease transmission that would adversely impact on subsistence cattle ranging which is key to the socio-cultural wellbeing of the area.

In addition the positive impact on protected areas discussed in 9 above will provide environmental benefits to those protected areas by lessening illegal activities that are currently impacting the fauna within them.

Lastly environmental impacts will be minimised and mitigated by certain design measures as discussed above and offsets for loss of terrestrial and freshwater habitat as recommended in the biodiversity and freshwater studies.

In this context the benefits of the proposed development will outweigh the negative aspects of it, and must be considered a key national infrastructural development requirement.

11. Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?		**NO**	**Please explain**

It is not foreseen that the proposed project will set any precedents for similar projects in the near future as the development of border control infrastructure is limited to the international border and is not replicated in any areas away from the border.

12. Will any person's rights be negatively affected by the proposed activity/ies?		**NO**	**Please explain**

Implementing the proposed fence and barrier will ensure better control and security measures between Mozambique and South Africa. A key aspect of this is the control of the illegal movement of people across the border. Movement of people does occur across the border in the Phase section, both legal and illegal. Through the agreement of local and traditional authorities on either side of the border movement of people to trade is permitted at 'Gate 6' (located between Tembe and Farazela) on a weekly basis (every Wednesday). It is anticipated that this arrangement will continue once the border infrastructure is upgraded.

Certain of the illegal movement of people occurs on a daily basis for the purpose of cultivating subsistence crops on the Mozambique side of the border, with people passing daily through holes in the existing fence. It is likely that such movement will be prevented unless this is formalised as part of the development. Stopping this movement could be considered to be an impact of the affected people's ability to sustain their livelihoods.

The intention of the project to upgrade fencing and patrol infrastructure along the border is not to disrupt current cross-border activities by local rural communities that are being accommodated and regulated by relevant Departments. Typical activities include periodical cross border trading at dedicated market places and accessing educational, health care and other social services. The necessary provision of V-gates, gates and control infrastructure will be accommodated in the detailed design and construction phase.

The public participation process conducted for this project will be utilised to identify all concerns related to the termination of the movement of people and the impact of the development in this way, to allow a determination of whether such movements must be catered for in the design of the project.

13. Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?		**NO**	**Please explain**

It is not foreseen that the proposed activities will compromise the "urban edge" as the proposed project falls outside this area as defined by the local municipality. The study area is completely rural in nature.

14. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?		**NO**	**Please explain**

No impacts to the SIPS could be identified.

15. What will the benefits be to society in general and to the local communities? **Please explain**

As discussed in points 2c and Points 4 above, the securing of the border will assist in policing of illegal activities and will thus address the concerns raised by local communities in the wider area relating to the impact of cross border illegal activities on safety and security, by making it much more difficult to traffic stolen items, especially vehicles, across the border. This will not only benefit local communities where crime has increased, but may have a wider positive impact in areas further afield such as the Greater Durban area and Gauteng from which 4x4 vehicles are typically stolen / hijacked in order to traffic these illegally into Mozambique.

In addition revenue loss due to customs avoidance / smuggling of goods across the international border will be minimised and this will result in greater revenue inputs to the South African Revenue Services (SARS) which will allow more money to be channelled to projects and services which benefit society.

Society and local communities will also be benefitted through the lessening of the possibility for livestock-related disease to be spread into the local area and into SA, which if it materialised, would result in a huge impact to the livestock production and export economy in South Africa and significant knock-on socio-cultural and wider economic impacts.

16. Any other need and desirability considerations related to the proposed activity? **Please explain**

N/A

17. How does the project fit into the National Development Plan for 2030? **Please explain**

The project will be consistent with certain of the objectives and actions of the NDP in that it will contribute, albeit on a localised scale, to the achievement of these objectives and actions. The Plan states that by 2030, people living in South Africa should feel safe and have no fear of crime.

One of the positive spin-offs of the project is the reduction in cross-border crime in this area which is likely to make the wider area safer. The project will also assist crime fighting and law enforcement agencies in more effectively combatting the trafficking of stolen 4x4 vehicles into Mozambique, and thus helping to combat the high levels of such vehicle theft and hijacking, a violent crime.

18. Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account.
The impacts associated with the proposed border control infrastructure will be identified, predicted and evaluated to minimise negative impacts, maximise benefits and promote compliance with the principles of environmental management set out in Section 2 of NEMA (refer to Section D). Mitigation and management measures to minimize negative impacts and maximize benefits from the proposed border control infrastructure have been included in the EMPr attached as **Appendix B** to this Report.
19. Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.
The proposed road, fences, barrier and associated culverts will be sustainable in terms of the following: ▪ Social: Local communities will benefit from the project in terms of receiving improved security between borders. The local community and society in general will also benefit from the project in terms of direct and indirect job creation; ▪ Economic: Provision of adequate border security infrastructure is a major contributor to the economic development within the Local Municipality. Society in general will benefit from the project in terms of indirect job creation as it will contribute to improving service delivery; and ▪ Environmentally: the proposed project will avoid any environmentally and socially sensitive areas such as human settlements and where this is not possible, design mitigation measures have been proposed to minimise the impact. ▪ A draft EMPr (**Appendix B)** has been compiled that 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 the anticipated negative environmental impacts.

3.4.2 Socio-economic Value

Table 3-6: Socio-economic value of the project

What is the expected capital value of the activity on completion?	R 129 million
What is the expected yearly income that will be generated by or as a result of the activity?	N/A – The project is however expected to reduce the financial loss as a result of theft and smuggling and social impact on victims of cross-border crime.
Will the activity contribute to service infrastructure?	No – The project is for the upgrade of security infrastructure.
Is the activity a public amenity?	No
How many new employment opportunities will be created in the development phase of the activity?	None
What is the expected value of the employment opportunities during the development phase?	R45 million
What percentage of this will accrue to previously disadvantaged individuals?	35%
How many permanent new employment opportunities will be created during the operational phase of the activity?	None
What is the expected current value of the employment opportunities during the first 10 years?	N/A
What percentage of this will accrue to previously disadvantaged individuals?	N/A

4 PROJECT ALTERNATIVES

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

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

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

4.1 Layout / Alignment Alternatives

4.1.1 Border Control Infrastructure Alignments

The nature of the project entails the upgrading / development of border control infrastructure along a section of the South Africa – Mozambique International Border. In the context of site alternatives it is very important to note that this infrastructure is required to be placed ***immediately alongside the international border*** as the primary aim of the infrastructure is to secure the border line (in the case of fencing) and to allow the patrolling of the border (in the case of the border patrol road and associated infrastructure including the wooden boardwalk structure and footpath that replace the road along certain sections of the Phase 1 alignment. It is thus technically not feasible to locate this infrastructure away from the border line, as the purpose of securing the border and in particular the patrolling of the border which requires visibility of the border line is not able to be achieved. In certain sections of the wider (Phase 2) project, the nature of the terrain (where terrain is very steep) has necessitated the alignment of the border road away from the border line for short sections, but there are no such technical constraints along the Phase 1 section along which the terrain is generally very flat. In addition for the majority of the length of the Phase 1 alignment, existing border patrol infrastructure is located along the border, and accordingly for technical and environmental reasons, there is no value in considering a (new) alternative alignment away from the border – environmentally this would result in the transformation of greenfield areas which is much less preferable than widening the existing impacted footprint.

In the pre-environmental application phase of the project during which specialist studies had been undertaken, consultation between the project design team (engineers) and environmental specialists identified certain areas of very high environmental sensitivity. One of the most environmentally sensitive areas along the Phase 1 alignment was identified as Lake kuZilonde and the wetlands associated with this freshwater lake. A recommendation made by the freshwater specialist team was that an alignment that avoided crossing the lake (the international border straddles the northern part of the lake) be considered. Due to the presence of numerous wetlands located west of the primary dune, such an alternative alignment would need to utilise an existing but seldom utilised track located within the iSimangaliso Wetland Park that runs southwards along the western foot of the primary dune to Kosi Mouth from where the existing tourist access route to the Kosi Mouth would be used, and then running north along existing local roads on the western side of the Reserve.

The technical feedback from the design team and project applicant (DPW) was that such an alternative was technically not feasible due to the reason discussed above of not being able to patrol the section of the border in question. The proposed alternative would involve driving patrol vehicles a long distance away from the border and would necessitate the upgrading (widening) of the existing poorly utilised track along the western foot of the primary dune that would entail the clearing of highly sensitive coastal forest vegetation. This option would also utilise the main IWP access to Kosi Lake and mouth and could adversely affect tourism activities in this part of the IWP. Accordingly for both technical and environmental reasons this proposed deviation was discarded and not considered as an alignment alternative.

When the border barrier project was initially conceptualised, an alignment located 100m to the south of the international border line was originally considered by the project design team. As the main purpose of the border barrier is to restrict the illegal movement of vehicles across the border, an alignment in direct proximity to the border was not required. However on consideration of the expense and technical difficulty posed by the very dense thicket and sand forest present along large section of the border barrier's alignment, it was decided to align the barrier structure along the international border, thus allowing this project to be subsequently aligned with the border patrol road and fencing project. As such no alignment alternatives for the border barrier have been identified, also considering that the border barrier design has been incorporated into the overall design of the Phase 1 infrastructure as indicated in the conceptual cross-sectional layout of the infrastructure within the 50m development corridor.

For these reasons, ***no alignment alternatives for the border patrol infrastructure*** have been considered in this basic assessment process.

4.1.2 Construction Camp – Layout Alternatives

The Construction Camp for the Border Barrier Structure is located just to the south of the Farazela Border Post. During the pre-environmental application phase of the project the environmental (EAP) team on the project engaged with the border barrier design team regarding the optimal environmental location of the construction camp.

The environmental team identified the forestry plantations located to the south-west of the Farazela Border Post as being environmentally optimal for the sighting of the construction camp as these areas have already been completely transformed by the planting of exotic trees (the proposed construction camp site is comprised of natural vegetation). On consideration of this recommendation, the design team ruled these out due to potential landowner issues and the likely requirement of purchasing this land and compensating the individual owners for loss of plantation area which may not be successful and which would likely delay the project. Due to the first component of the barrier structure planned to be constructed being located to the west of the Farazela Border Post, the construction camp needs to be located in the vicinity of the Farazela Border Post. Accordingly no other feasible alternative locations for the construction camp have been able to be identified and comparatively assessed.

4.2 Design Alternatives

Design alternatives were considered in relation to the conceptual design of the infrastructure components within the 50m corridor. Potential design alternatives of different infrastructure components were considered in consultation with the engineering design teams on the Phase 1 project for the following:

- Culverts (box culverts vs pipe culverts)
- Fence and Barrier (retention of these two components as separate components, vs the integration of these two components as one structure)

Neither of these components has been able to be utilised for the consideration of deign-related alternatives. It is important to note that no detailed design has yet been undertaken for the Phase 1 project. In the context of culverts it is not possible for the engineering design teams to determine whether pipe or box culverts will be optimal for use, considering the hydrology of each wetland crossed. The design specification for the project (refer to Section 3.3.4) refers to the use of both pipe and box culverts, as well as drift structures for use in the design, depending on local flow conditions in each wetland crossed. It is accordingly not practical to limit the design team to one or other type of culvert design as both types are likely to be utilised in the detailed design of infrastructure. It is nonetheless strongly recommended that a wetland specialist be appointed to review culvert designs at the time that detailed design is undertaken in order to advise whether the use of box or pipe culverts would be most optimal for the situation and for the receiving freshwater environment.

In the case of the potential assimilation of the elephant fence and the border barrier structure, this will also be only confirmed once detailed design has been undertaken. In certain sections of the alignment the two components may be combined in order to minimise the footprint of the infrastructure in sensitive areas, in particular wetlands where the increase in the footprint of the affected area should be minimised. In other areas the two structures are likely to be retained as separate to one another. It is not practical to specify one design as the preferred.

Accordingly no design alternatives have been able to be considered.

4.3 No-Go Alternative

Should the development not proceed, the existing infrastructure will remain. The activities related to border control and border patrol will still be able to be undertaken by the relevant law enforcement agencies within the Phase 1 section, as is currently the case due to the existence of the existing track and fence along the majority of the length of the Phase 1 alignment. However the benefits in terms of improved law enforcement, improved ability to secure the international border and in terms of the ability of government agencies will continue to be compromised by infrastructure that in a state of disrepair in certain parts of the route, or which hinders the ability of the illegal movement to be prevented due to poor access and patrol infrastructure which makes it difficult to patrol and respond to incidents. The non-development of the border barrier will not allow the current high levels of illegal trafficking of stolen / hijacked vehicles across the border to prevented and brought down through the prevention of the physical movement of these vehicles across the border.

If this infrastructure development project is not undertaken, the benefits to the local communities of short term employment opportunities as well as the safeguarding of these communities through the reduction in criminal activities that will be able to be more effectively performed by law enforcement agencies will be unlikely to materialise. The environmental benefits of the project, especially as they relate to the improved ability to prevent illegal activities such as illegal fishing and poaching within protected areas located along the border will not materialise, although it is important to note that the increased transformation of

sensitive natural habitats that would result from the increasing of the footprint of the border control infrastructure will not materialise.

In one particular part of the Phase 1 alignment which is highly environmentally sensitive – the area of Lake kuZilonde – the freshwater specialist team recommended the non-development of the road component of the border infrastructure in order to prevent the project from causing a very high degree of impact within this highly sensitive freshwater habitat during the pre-application phase of the project. The recommendation was made that the border patrol road should not be developed through the Lake and associated wetlands which incorporate highly sensitive swamp forest wetland habitat, in order to protect the integrity of this largely undisturbed freshwater habitat. The project applicant responded that the ability of law enforcement personnel to move across the lake and access the sections of the international border located east of the lake from the border to the west, between the lake and the Indian Ocean was of critical technical importance, especially considering the access constraints to this section of the border (discussed in section 4.1.1 above). However in order to mitigate the impacts of the project on this sensitive freshwater habitat, the development of a wooden boardwalk / bridge structure that will allow the movement of foot patrols and smaller (ATV) vehicles across the lake was proposed by the project applicant. The boardwalk only extends across the open water of the lake and one of the recommendations of the freshwater specialist study is that it be extended to also encompass the swamp forest and papyrus swamp wetlands to the east of the lake in order to minimise the impact of the development on these currently undisturbed wetland habitats. Although the no-go alternative in this part of the alignment has not been able to be implemented, design changes have nonetheless minimised the impact on a key sensitive area as identified by the freshwater specialist team.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

5.1 Topography, Geology & Soil

5.1.1 Geology

The Phase 1 alignment is underlain by two primary geological groups, the Maputaland Group and the Quarternary Superficial Deposits.

Maputaland Group

The Maputaland Group forms a layer of Tertiary and Cretaceous sequences. It was formed during the last glacial period when the earth was much colder than present day and the sea levels approximately 100 metres below present. The coastline thus extended far out in the sea, while large rivers eroded deep valleys along the coast. As the earth warmed the sea level rose and the valleys were infilled with estuarine muds and shelly sands which now forms the Maputaland Group (65 million years before present). A series of large coast-parallel dune complexes developed along most of the KwaZulu-Natal coastline and constitutes the Maputaland Group of Johnson et al (2009). These Pleistocene sediments form a thin blanket on the Tertiary and Cretaceous successions of the coastal plain of KwaZulu-Natal. The Maputaland Group consists of a number of formations, including (from oldest to most recent in vertical sequence) Uloa, Muzi, Bluff and Berea Formations.

During the Caenozoic the sea-levels retracted from the distinctive high levels experienced during the Cretaceous. The Tertiary calcrenite and limestone Uloa Formation overlies the St Lucia Formation. The Muzi Formation comprises of swamp deposits consisting of mottled, brown clayey sand. This formation is characterised by few outcrops. The Muzi Formation is overlain by the Port Durnford Formation which consists of mudstone, lignite clay and sand. In turn the Port Durnford Formation is overlain by the Bluff and Berea Formations. The coastal dune corridor is formed by the Bluff Formation which consists of a pale brown sandstone deposit. The Bluff Formation consists of red, orange and yellow Aeolian sand.

Quaternary Surficial Deposits

The KwaZulu-Natal coastline is still shaped by fluctuations in sea-level. Deposits of recent times consist of alluvium, sand and calcrete. The Masotchenei Formation consists of palaeosols of Cenozoic colluvial deposits. The surface of the study area is thus comprised of marine sands that have been redistributed (over the period of the recent geological past) to create a number of dune cordons (Partridge et al, 2010).

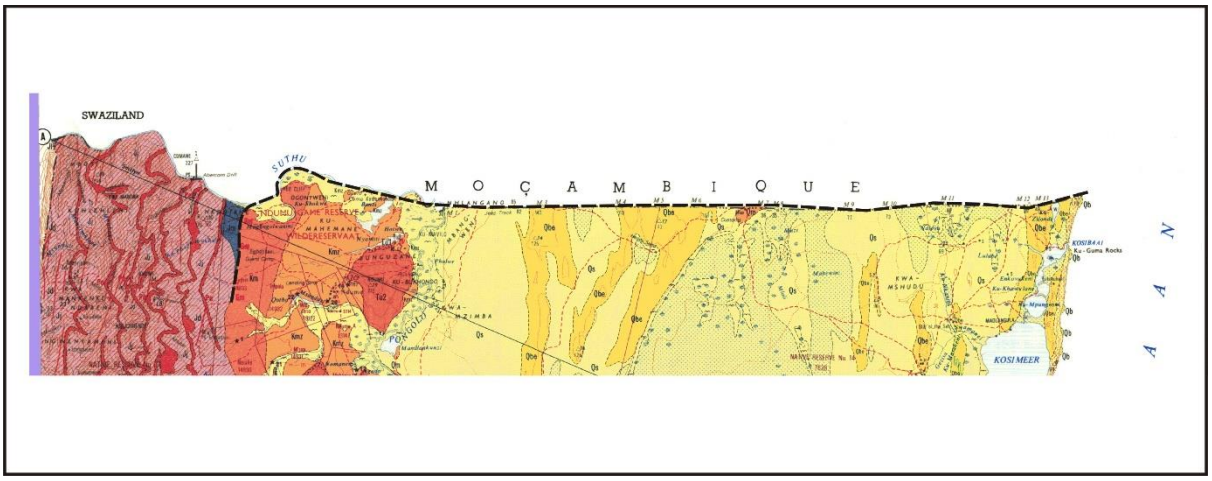

Figure 5-1: Geology of the Study Area (Council for Geosciences)[3]

5.1.2 Topography and Geomorphology

The study area is located within the Zululand Coastal Province Geomorphic Province (Partridge et al, 2010). The geomorphic province is characterised by being very flat and is the most extensive coastal plain in South Africa (Partridge et al, 2010). The province is an exposed marine platform that was exposed during retreat of the coast during the Cenozoic Era (Partridge et al, 2010).

As described above the surface of the study area is comprised of marine sands that have been redistributed (over the period of the recent geological past) to create a number of dune cordons (Partridge et al, 2010).The most prominent of these dune systems in the context of the SA-Mozambique border is the dune ridge that runs parallel to the current coastline (i.e. the primary dune, as referred to elsewhere in this report), rising 80-100 m above the coastline and rising 60 m and greater above the level of the adjacent coastal plain inland of the dune system. This coastal dune system is thus the most prominent topographical feature in the study area. The elevation profile along the Phase 1 alignment rises gradually east to west as one moves closer to the Lebombo Mountain range, located west of the Ndumo Game Reserve and forming the South Africa-Swaziland border.

[3] *In figure 5-1 the symbols indicate the following strata: Qs – yellowish redistributed sands (Quaternary); Qbe – Red Dune Cordon Sand of the Brea Formation; Qb – Calcareous Sandstone of the Bluff Formation;*

Figure 5-2: Undulating terrain along the international border located east of the Farazela Border Post with Lake KuZilonde and the primary dune visible in the background

To the west of the Lake kuZilonde (itself located west of the primary dune) the terrain is slightly undulating, with the presence of a number of parallel and north-south oriented paleo dunes present. The terrain becomes much flatter in the vicinity of the Farazela Border post and is largely flat with the exception of localised high points all the way to the eastern Tembe boundary at Muzi Camp. This very flat terrain is characterised by, and is conducive to the formation of a number of very wide wetland flats and valley bottoms, a significant part of the natural biophysical environment of this part of the study area. Within the Tembe section of the Phase 1 alignment, the topography is flat to gently undulating, with a number of north-south oriented palaeo dunes providing local relief. In the short corridor between the Tembe and Ndumo reserves the topography is generally very flat, sloping very gently down to the low point of the Phongolo River floodplain that forms the western extent of the Phase 1 section.

Figure 5-3: Flat terrain east of the TEP, as viewed looking westward from a local high point. The distant higher-lying points within the TEP are visible in background.

5.2 Drainage and Biophysical Context

The key biophysical features associated with the study area are summarised in Table 5-1.

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

Biophysical Aspects	Desktop Biophysical Details	Source
Elevation a.m.s.l.	Approx. 0m (high water mark of the Indian Ocean) – 120m a.m.s.l (high point of the primary dune west of the Indian Ocean and high point with the TEP).	National Geospatial Information – Topocadastral maps for the study area
Rainfall distribution	Weak rainfall seasonality near the coast tending toward summer rainfall towards the interior.	Mucina and Rutherford, 2006
Mean Annual Precipitation (Map)	Relatively high precipitation attaining annual values up to 1 200 mm in coastal localities, decreasing rapidly to the interior - MAP about 550-800 mm in the part of the study area east of the TEP and within the TEP. MAP	Mucina and Rutherford, 2006

Biophysical Aspects	Desktop Biophysical Details	Source
	decreases to a range of 500-700mm in the far western part of the study area.	
Annual Average Temperature	Mean monthly maximum and minimum temperatures for the far western part of the study area (Ndumo) 40.1°C and 6.2°C for January (summer) and July (winter), respectively. Mean maximum and minimum monthly temperatures for the eastern coastal part of the study area 35.3°C and 5.5°C for January (summer) and June (winter), respectively.	Mucina and Rutherford, 2006
Potential Evaporation (mm) Mean Annual A-pan Equivalent	1660 mm	Umhlabuyalingana Local Municipal IDP 2017-2022
Runoff Potential	For the Fernwood soil form which is the dominant soil form across the study area, the runoff potential is low to moderately low. A similar runoff potential exists for parts of the TEP where the Hutton soil form is dominant.	Schulze, 1998
Geology and soils	Sandy soil, Cretaceous to Miocene sediments	Partridge et al, 2010
Water management area	Usuthu to Mhlatuze	DWA, 1996
Quaternary catchment/s	W45B & W70A	DWA, 1996
Main collecting river in the catchment	Muzi (Futi)	National Geospatial Information – Topocadastral maps for the study area
DWA Ecoregion (Level 2)	Natal Coastal Plain (13)	DWA, 2007

5.3 Surface Water Drainage & Freshwater Resources

As described above, the extent of the proposed Phase 1 alignment under consideration is located within the Maputaland Coastal Plain and is located within the Zululand Coastal Plain Geomorphic Province. This geomorphic province is marine in origin and represents a marine terrace that was exposed during sea level retreat in the geological past (Partridge et al, 2010). Drainage alignment in this area has been influenced by pauses in the eastward retreat of the sea, with a number of north-south aligned dune cordons having formed during pauses in the retreat of the sea (Partridge et al, 2010). Drainage in the wider Maputaland Coastal Plain area is thus generally aligned in a north-south direction, especially as rivers and wetland approach the coast - rivers crossing the province have been deflected and obstructed by the highest of the dune ridges close to the present coast, so that the rivers run parallel to the present shore line producing important wetland systems (e.g. the Kosi lakes, Lake Sibayi, the Mkuzi Swamps and Lake St Lucia). Apart from the Phongolo (Pongola) River system, drainage systems are fragmented and active faults have caused lineations and displacements along many of these (Partridge et al, 2010).

5.3.1 Surface Water Typology and Occurrence

As described above, the drainage density within the Maputaland Coastal Plain is limited, and there are very few major rivers in this area. Accordingly no major rivers are crossed by the section of the proposed Phase 1 alignment (although two major river systems are located just to the west of the proposed alignment in Ndumo). Nonetheless surface water features are a critical component of the biophysical environment in the study area and the Phase 1 alignment wall crosses numerous wetlands, particularly in the part of the alignment located between the eastern boundary of the TEP and the western boundary of the IWP. Due to the flat nature of the terrain most surface water features are expressed as valley bottom, flat or pan-depression wetlands, most of which are naturally un-channelled.

Two major concentrations of valley bottom wetlands that are crossed by the section of the border wall under consideration between the TEP and the iSimangaliso WHS are encountered. The more westerly concentration (the Muzi wetlands) consists of a number of wide, marshy wetlands. The eastern cluster of wetlands consists of a number of similar wide palustrine valley bottom wetlands. It is important to note that many of the wetlands crossed within this cluster of wetlands are very extensive in length and in some cases the crossing length along the border line would be close to 1 km for certain individual wetland units.

An ecologically important and unique in the context of wetland HGM forms in the study area is the freshwater coastal lake – Lake kuZilonde. This is a large coastal lake located to the west of the primary dune is also associated with sensitive wetland habitats, including swamp forest. A number of the large (wide) valley bottom wetland systems located within the eastern cluster of wetlands (west of the Farazela Border Post) are characterised by the presence of Swamp Forest, an ecosystem that has been classified as being threatened under the National Biodiversity Assessment (NBA), 2011.

Refer to section 7.1 for the findings of the freshwater assessment.

5.4 Coastal Features

The most important large-scale oceanographic feature affecting the coastal environment is the south-flowing Agulhas current which brings warm water from the tropics. The Agulhas current follows the edge of the continental shelf, which is narrow in northern KwaZulu-Natal, flowing relatively close inshore along the coast. The coast is characterised by high-energy waves and large swells predominantly from the south-east (approximately 40% of the year) and easterly onshore swells prevailing for a further 40% of the time (although prolonged north-easterly winds can impose a north-easterly swell direction) (iSimangaliso Wetland Park IMP: 2017-2021).

It should be noted that the project will marginally affect the marine environment. The proposed elephant fence is proposed to be extended into the coastal public property at the Indian Ocean seashore. The elephant fence will be extended to the high water mark of the Indian Ocean, which is located on the beach, between the ocean and seaward side of the primary dune. No project components will accordingly directly affect any submerged marine features.

Figure 5-4: The foot of the primary dune and the transition to the seashore at the international border.

Figure 5-5: The beach at the international border, looking southwards.

Figure 5-6: The seashore at the international border, looking north into Mozambique.

5.5 Biodiversity

The study area falls within a very important area in a biodiversity management and conservation context. The entire Phase 1 alignment falls within the Maputaland Centre of Endemism (MCE). The MCE falls within southern Mozambique, north-eastern South Africa and western Swaziland and covers an area of approximately 17 000 km^2 (Smith et al, 2008). Its conservation importance is globally recognised, as it forms part of the Maputaland–Pondoland–Albany biodiversity hotspot and contains the iSimangaliso Wetland Park World Heritage Site, five Ramsar sites and ten Important Bird Areas (IBAs).

The geology and rainfall patterns of Maputaland combine to play a major role in determining biodiversity levels within the region, with spatial change in rainfall and substrate creating distinct ecological heterogeneity (Smith and Leader-Williams, 2006). Maputaland can be divided into five ecological zones, which from west to east are the: Lubombo, Cretaceous, Alluvial, Coastal Plain and Coastal Dune zones; these ecological zones are very distinct and respectively have a large number of associated species, which ensures the region has high levels of species richness (Smith and Leader-Williams, 2006). This species richness and biodiversity value is further enhanced by the location of Maputaland at the southernmost part of the East African coastal plain, as the region contains species that are typically found in both East and Southern Africa (Smith and Leader-Williams, 2006). In addition, Maputaland has high levels of endemism because much of the coastal plain is geologically recent and so many species and sub-species have evolved to fill new niches (Smith and Leader-Williams, 2006).

This floral diversity in the study area is reflected in the relatively large number of vegetation types that are encountered along the alignment of the section of the wall under consideration, and in the wider area (Figure 5-4). This floral diversity is enhanced by the occurrence of vegetation types from numerous biomes, including grassland, savanna and forest biomes. In addition a number of azonal vegetation types related to the extensive presence of water surface in the study area are present. A number of these vegetation types / ecosystems have been assessed to be threatened, in terms of the NBA, 2011.

A number of sensitive and threatened faunal species occur in the area. The designation of CBAs under the KwaZulu-Natal Systematic Conservation Plan partially reflects the presence of, and suitable habitat for a number of such sensitive or threatened faunal species. The presence of large areas of land that are conserved within PAs in the northern part of the South African component of Maputaland is significant for the conservation of such species. In spite of the presence of these PAs, they are not completely sufficient in the context of preserving ecological processes, many of which transcend the borders of the PAs. It is in this context that biodiversity importance needs to be considered outside of PAs, and in this context that the Lubombo TFCA has been established.

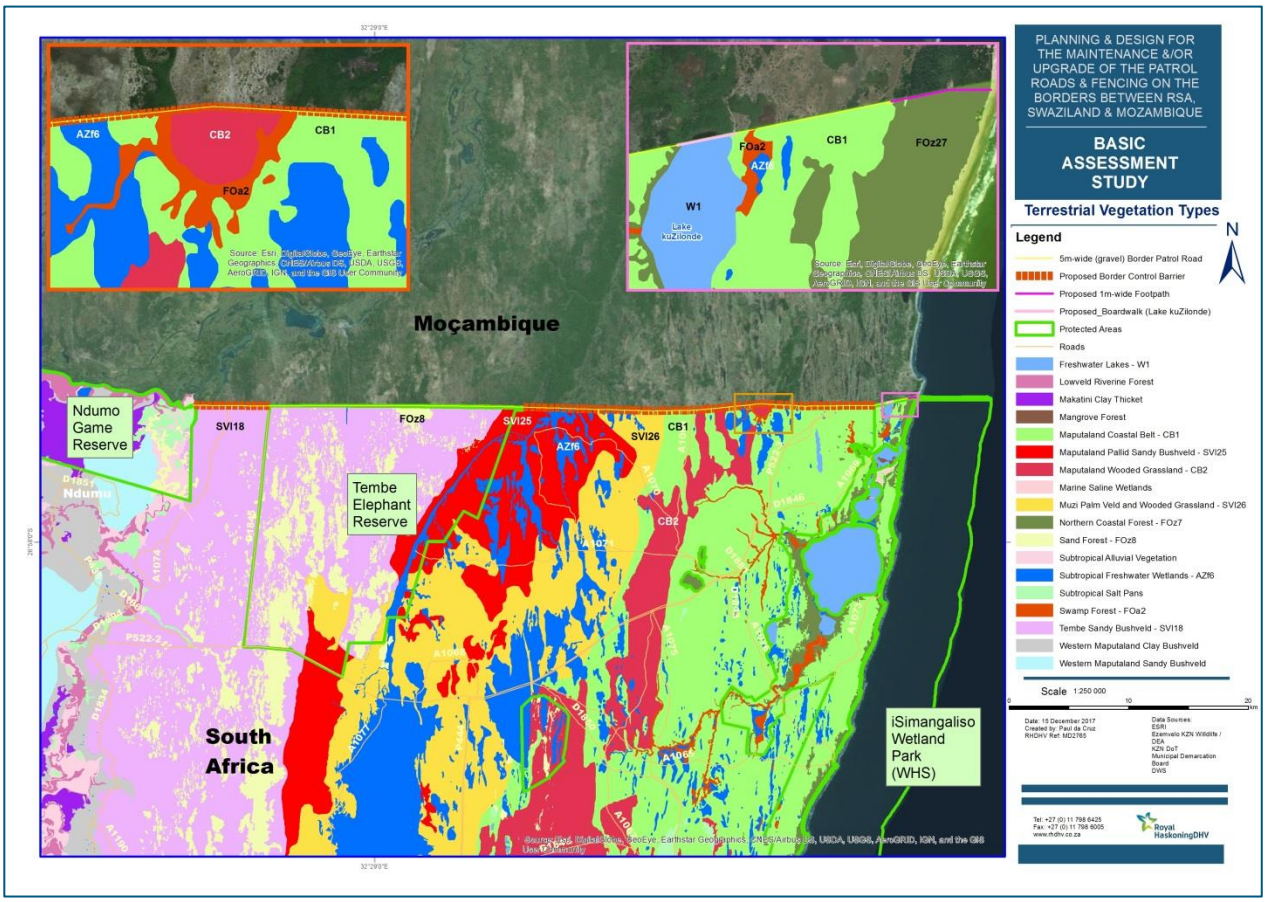

Figure 5-7: Terrestrial Vegetation Types within the study area

5.6 Conservation Context

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

5.6.1 Protected Areas

Provincial Nature Reserves

A number of formally protected areas are located in the study area, and are important in the context of the potential environmental impacts of the proposed project.

The western-most section of the Phase 1 alignment is located along a narrow strip of land between two protected areas – the Ndumo Game Reserve to the west and the Tembe Elephant Park to the east. Ndumo protects the extensive wetland and aquatic ecosystems associated with the floodplains of the Phongolo and uSuthu (Maputo) Rivers that flow through the reserve, as well as a number of differing vegetation types and the faunal assemblages that these support. It is important to note that the entire extent of the NGR is declared as a Ramsar Site.

The TEP was established in the early 1980s to offer protection to the herds of elephant that used to migrate between Maputaland and southern Mozambique.

The last PA in the study area is the iSimangaliso Wetland Park and World Heritage Site. This protected area is discussed in more detail in the subsequent section.

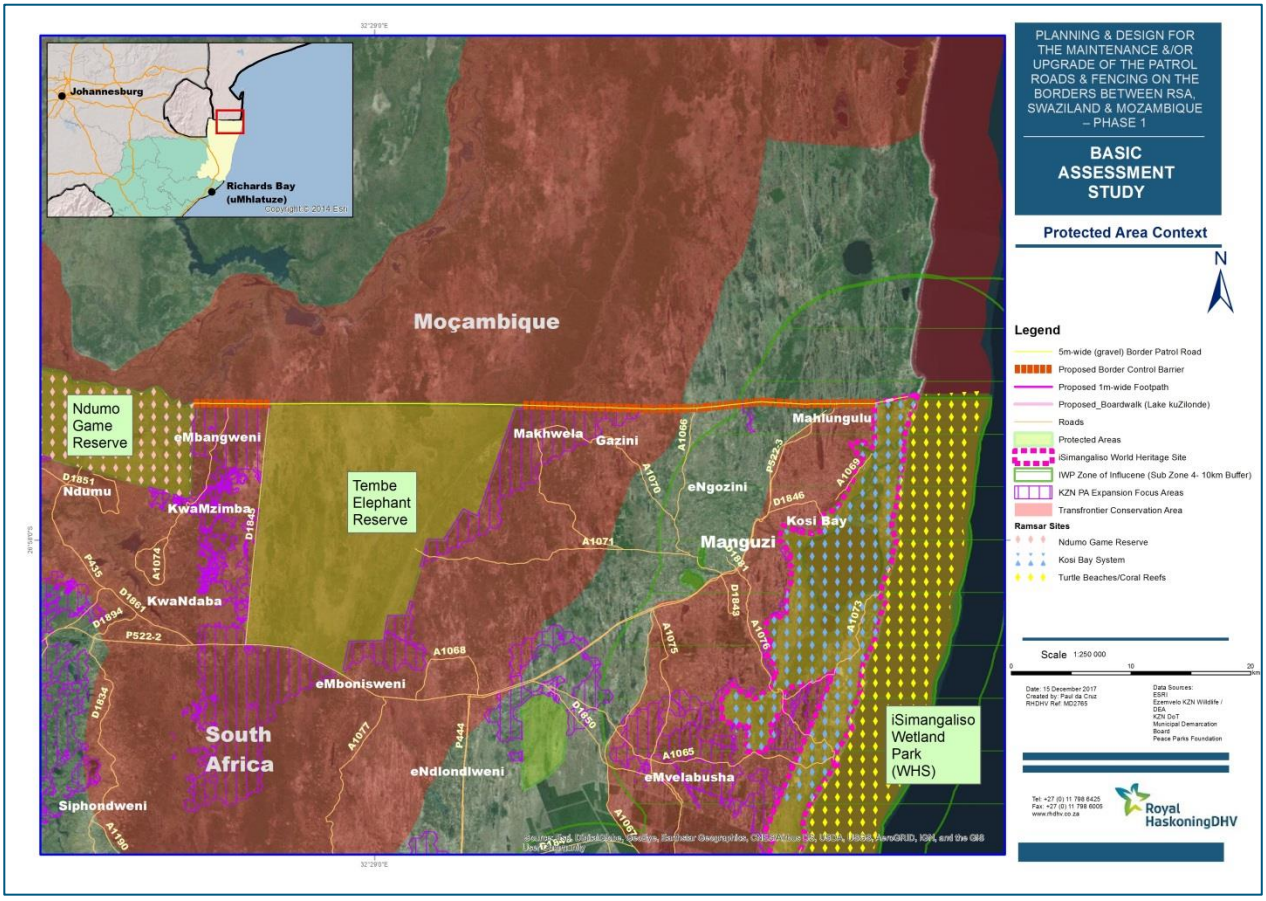

Figure 5-8: Protected Areas within the Study Area

World Heritage Sites

The iSimangaliso Wetland Park and World Heritage Site's northern boundary is located along the eastern-most part of the South Africa-Mozambique international border and encompasses the eastern-most section of the Phase 1 alignment (Figure 5-8).

The iSimangaliso Wetland Park was listed as South Africa's first World Heritage Site in December 1999 (declared under the World Heritage Convention Act, 1999 (Act No. 49 of 1999), an Act that incorporated the World Heritage Convention into South African legislation) in recognition of its superlative natural beauty and unique global values. According to the UNESCO World Heritage List[4] the Park is one of the outstanding natural wetland and coastal sites of Africa. Covering an area of 239,566 ha, it includes a wide range of pristine marine, coastal, wetland, estuarine, and terrestrial environments which are scenically beautiful and basically unmodified by people. These include coral reefs, long sandy beaches, coastal dunes, lake systems, swamps, and extensive reed and papyrus wetlands, providing critical habitat for a wide range of species from Africa's seas, wetlands and savannahs. The interaction of these environments with major floods and coastal storms in the Park's transitional location has resulted in continuing

[4] *http://whc.unesco.org/en/list/914*

speciation and exceptional species diversity. Its vivid natural spectacles include nesting turtles and large aggregations of flamingos and other waterfowl.

It is important to note that iSimangaliso attained World Heritage listing under not just one criterion (which is all that is necessary to attain listing) but three of the ten criteria (iSimangaliso Wetland Park Authority, 2016a):

- *Criterion vii*: to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.
- *Criterion ix*: to be an outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems, and communities of plants and animals.
- *Criterion x*: to contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

It is important to note that the iSimangaliso World Heritage Site (WHS) has a statutorily-defined buffer zone or zone of influence. In order to maintain the World Heritage values and status of the iSimangaliso Wetland Park, and meet obligations in terms of the World Heritage Convention Act and the Protected Areas Act, the iSimangaliso Wetland Park Authority has an obligation to optimise responsible development that will meaningfully uplift communities and provide sustainable employment to people living in the greater area of influence of iSimangaliso, while also conserving the ecological and cultural integrity of the park. To achieve this within the parameters of international best practice, iSimangaliso has delineated a Zone of Influence (including terrestrial, aquatic and marine environments) to protect the WHS from external threats. Sub-Zone 4 of the Park's Zone of Influence is 10km wide from the boundary of the WHS, in line with the Environmental Impact Assessment (EIA) Regulations, within which certain activities require environmental authorisation (iSimangaliso Wetland Park Integrated Management Plan (2017 – 2021)) – Figure 5-8.

Ramsar Sites

Ramsar sites are present in the wider study area and need to be considered as part of the assessment (Figure 5-5). The Ndumo Game Reserve (Site no. 887[5]) is designated as a Ramsar site (Figure 5-5) as it was recognised as forming the largest floodplain system in South Africa, consisting of five wetland types, from fresh to brackish, permanent to ephemeral lakes, marshes and pools, as well as riparian and gallery forest. Well known for its abundant bird life and diversity of species, internationally important numbers of several species are supported, including many that are rare or vulnerable[6].

The Phase 1 alignment does not directly affect this Ramsar site as the Ramsar site is restricted to the boundaries of the NGR in which the uSuthu-Phongolo floodplain is contained, however indirect impacts such as polluted runoff could potentially result, and the proposed Phase 1 infrastructure ends immediately adjacent to the boundary of the reserve.

[5] *https://rsis.ramsar.org/ris/887*
[6] *https://rsis.ramsar.org/ris/887*

The second Ramsar site is the Kosi Bay Ramsar site (Site no. 527[7]). The site which is restricted to the confines of the iSimangaliso Wetland Park (Figure 5-5) stretches from the SA-Mozambique border southwards to the Manguzi area and will be directly affected by the proposed development. The site is composed of four interconnected lakes subject to tidal influence, an estuarine channel, and three extensive swamps. Freshwater is derived from three permanent rivers. Principal habitats include swamp and mangrove forest, reedbeds, dune systems with associated woodland, and coastal grassland. The site supports a diverse bottom-dwelling invertebrate fauna (30 species) and a rich fish fauna, including eight endangered species. Several birds, mammals, butterflies, and plants are endemic, threatened or endangered[8].

The last Ramsar Site, which will also be affected by the proposed development as the elephant fence extends to the high water mark of the Indian Ocean, is the Turtle Beaches/Coral Reefs of Tongaland (Site No. 344[9]). The marine component of this Ramsar Site is an important transition zone between true reef and non-limestone substrates with reef communities. The flora is predominantly algal, and many species reach the southern limit of their distribution. Two sea turtle species nest on this stretch of coast, namely the Loggerhead Turtle *Caretta caretta* and the Leatherback Turtle *Dermochelys coriacea*. The turtle beaches host the only nesting populations of Leatherback Turtles in the Indian Ocean south of Sri Lanka in the western half of the ocean and south of Sumatra on the eastern side. The Loggerhead Turtle also nests on this coast and the nearest loggerhead nesting ground is in south-east Madagascar and this population is seriously threatened. The only other known populations are in Burma and Oman. Therefore this coastline is unique in acting as home to two species of marine reptiles that wander half of the Indian Ocean[10].

Other (Informal) Protected Areas & Protected Area Expansion Focus Areas

A number of other informal protected types exist in KwaZulu-Natal, including Community Conservation Areas, eZemvelo KZN Stewardship Sites and Natural Heritage Sites, however none of these conserved areas occur along the international boundary, and would not be affected by the proposed development.

Related to the presence of protected areas in the study area, a provincial scale assessment of priority / focus areas for the expansion of existing protected areas must also be considered. This provincial level assessment forms part of the National Protected Area Expansion Strategy 2008 (NPAES). This strategy has identified focus areas for land-based protected area expansion that are large, intact and un-fragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems[11].

A number of such areas exist along the Phase 1 alignment (Figure 5-8); the entire length of the corridor between Ndumo and Tembe and a strip of land extending approximately 8.5 km to the east of the Tembe Elephant Park have been earmarked as priority areas in this context. The presence of these protected area focus areas must be viewed in the context of the wider presence of the Transfrontier Conservation Area located in the area.

[7] *https://rsis.ramsar.org/ris/527*
[8] *https://rsis.ramsar.org/ris/527*
[9] *https://rsis.ramsar.org/ris/344*
[10] *https://rsis.ramsar.org/RISapp/files/RISrep/ZA344RIS.pdf*
[11] *http://bgis.sanbi.org/Projects/Detail/144*

Transfrontier Conservation Areas

A Transfrontier Conservation Area (TFCA) was established in 2000 by the governments of South Africa, Swaziland and Mozambique through the signing of a four protocols to establish the Lubombo Transfrontier Conservation and Resource Area[12]. The detailed protocol signed by the Ministers includes an extensive list of objectives as well as clear undertakings by the parties, and establishes a TFCA Conservation and Resource Area Commission. Four specific areas targeted in the original protocol were listed as:

- The Lubombo Ponto do Ouro-Kosi Bay marine and coastal area on the Mozambique-South African borders.
- The Ndumo-Tembe-Futi elephant reserves on the border of Mozambique.
- The Nsubane-Pongolo (Jozini) area on the border with Swaziland.
- The Lubombo Conservancy-Hlane-Mlawula/Goba area on the border of Mozambique and Swaziland.

The first two areas are relevant to the current proposed project, as they traverse sections of the international border along which the Phase 1 alignment is proposed.

The protocol lists the following major objectives:

- Economic development through appropriate maximum use of opportunities presented by the three countries' natural assets.
- Ecological and financially sustainable development, the sustainable use of the natural resource base and the maintenance of ecosystem function through holistic and integrated environmental planning and management.
- The development of joint strategies for transfrontier ecological planning and resource management.

On 14 June 2011, the Futi Corridor in Mozambique was proclaimed as an extension of Maputo Special Reserve, thereby expanding it by 24 000 ha[13]. The Futi Corridor extends southwards along the Futi River to the South African border. The aim of the corridor is to reunite the last naturally occurring coastal elephant population in Southern Africa, which historically moved freely along the Futi River and Rio Maputo floodplains. The Futi Corridor thus creates a movement corridor for elephants southwards to the TEP, with the current border fence being the only existing barrier to their movement.

In March 2014, the Lubombo Commission decided to merge the Lubombo Conservancy-Goba TFCA with the Usuthu-Tembe-Futi TFCA, linking the Lebombo Mountain Ecosystem with the coastal plains[14]. Also in 2014 a joint operations strategy for the Maputo Special Reserve / TEP component of the TFCA was signed into force by the relevant authorities and approved by the Lubombo Commission. The strategy called for the formation of a park management committee, which was formally established in July 2014.

In 2013, work started on drafting an integrated development plan for the Usuthu-Tembe-Futi (UTF) component of the TFCA. A joint operational strategy was also developed for the Maputo Special Reserve and Tembe components of the Usuthu-Tembe-Futi TFCA. Efforts to develop the infrastructure and community involvement in the park are ongoing[15]. The development of an elephant fence along the length of the Phase 1 alignment could be considered to be contradictory to certain of the aims of the TFCA. It should be noted however that 2m high single strand electrified fence has recently (in 2016) been erected

[12] *https://www.environment.gov.za/legislation/international_agreements/agreement_lubombo_transfrontier_conservationareas*
[13] *http://www.peaceparks.co.za/story.php?pid=1006&mid=1065*
[14] *http://www.peaceparks.co.za/story.php?pid=1006&mid=1065*
[15] *https://www.giz.de/en/downloads/giz2015-en-tfca-lubombo.pdf*

by eZemvelo KZN Wildlife along a certain section of the Phase 1 alignment to the east of the Tembe Elephant Park to prevent the movement of elephants from Mozambique into the study area. The erection of an elephant fence along the entire Phase 1 alignment is thus partly consistent with this action performed by the provincial conservation authorities in the context of elephant movement control, albeit on a larger spatial scale.

5.6.2 KwaZulu-Natal Biodiversity Sector Plan 2014

The Kwazulu-Natal Biodiversity Sector Plan (KZN BSP) has been produced to designate areas of both terrestrial and freshwater sensitivity in the province.

The objectives of the Biodiversity Sector Plan are to:

- Ensure aquatic and terrestrial biodiversity targets are met at the District level.
- Conserve representative samples of biodiversity pattern.
- Conserve the ecological and evolutionary processes that allow biodiversity to persist over time; and
- Serve as a first step towards the development of a Bioregional Plan.

The key purpose of this BSP is to assist and guide land use planners and managers within various district and local municipalities, to account for biodiversity conservation priorities in all land use planning and management decisions, thereby promoting sustainable development and the protection of biodiversity, and in turn the protection of ecological infrastructure and associated ecosystem services.

The plan has identified key areas for the preservation of biodiversity within the province and as such Critical Biodiversity Areas (CBAs), as well as Ecological Support Areas (ESAs). The KZN BSP was interrogated and a number of parcels of land along the proposed alignment have been designated as **Critical Biodiversity Areas (CBAs)**. (Refer to Figure 5-9).

Different categories of CBAs have been designated – Irreplaceable and Optimal; both categories are found in the study area and are intersected by the Phase 1 alignment. Each CBA parcel has been designated as being critical for the maintenance of biodiversity based on key habitat located within the land parcel, or based on the presence of threatened species within that area.

Two land parcels which have been designated as being irreplaceable CBAs are located within the corridor between Ndumo and Tembe. The other CBA designation along the Phase 1 alignment is for Optimal CBAs, within a number of land parcels within the area to the west of the Farazela Border Post, including two significant wetland (swamp forest) systems west of Farazela, and two other land parcels in the vicinity of Gate 6 (Figure 5-9).

These areas are important in an impact context, as impacts of the proposed development that could materialise would likely take on greater significance due to the potential impact (destruction and fragmentation) on these critical habitats which could have a knock on effect on populations of sensitive species or on highly sensitive habitat.

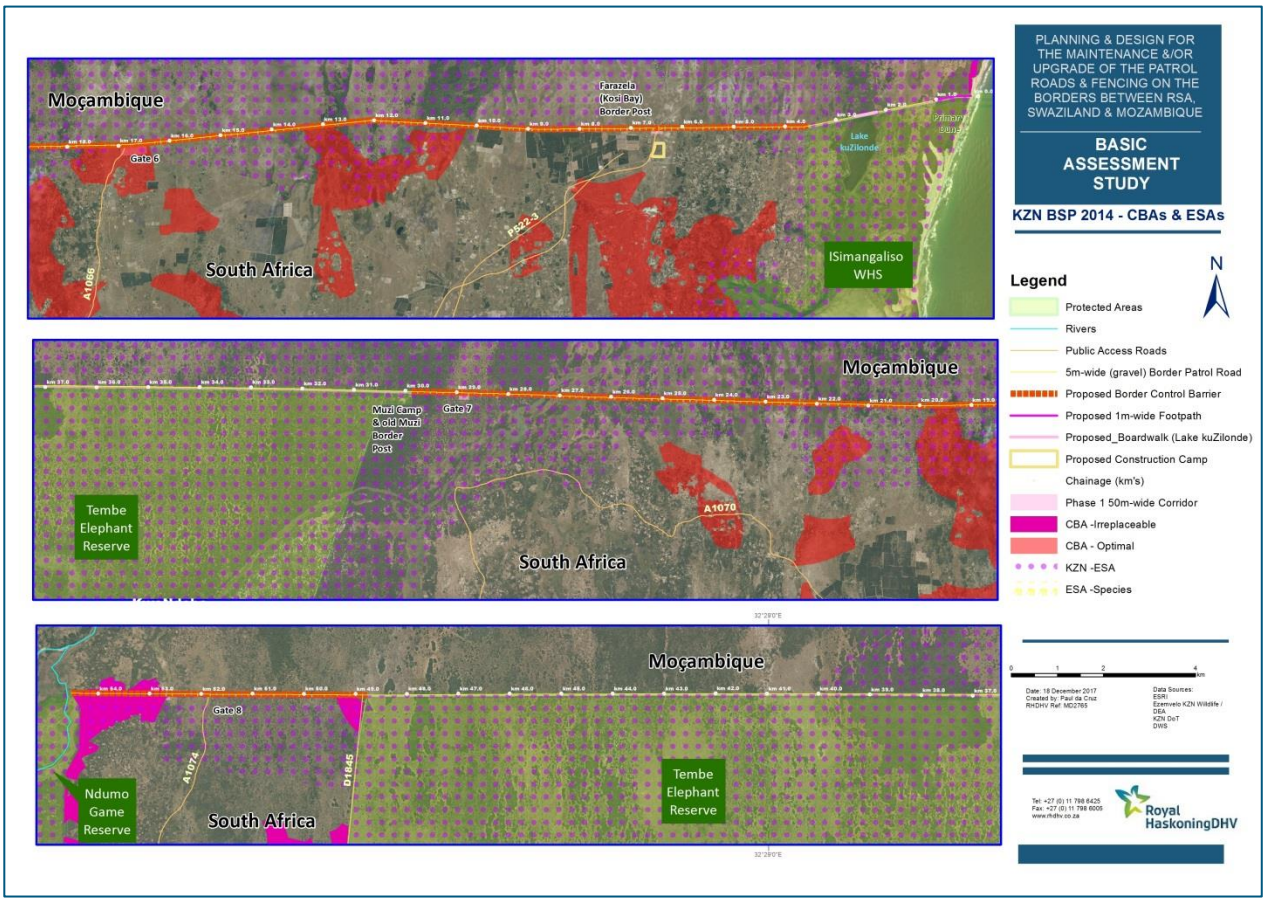

Figure 5-9: KZN BSP – Critical Biodiversity Areas and Ecological Support Areas

5.7 Socio-Economic Profile

The uMkhanyakude District is a Presidential Node as it is ranked as the second poorest and most deprived municipality in the country. According to the 2011 National Census, the surrounding districts have a population of 676,810. Over 80% of households live below the poverty line and an estimated 13% of the economically active population is formally employed. Of the population's citizens who are 20 years and older, 25.4% have matric and 4.9% have higher education. The unemployment rate is estimated to be approximately 43% of the total population and the average household income increased from R 19,173 p.a. per household in 2001 to R47,201 p.a. per household in 2011, which is 146% increase in income earned per household. The District economy is largely dependent upon the following sectors:

- general government services;
- wholesale and retail trade;
- accommodation and catering;
- transport and communication;
- finance and business services; and;
- agriculture, forestry and fisheries.

It is estimated that the uMkhanyakude District contributes about 2.1% to the provincial GDP (uMkhanyakude DM IDP 2016/2017).

The Phase 1 alignment is situated on a section of the international border between South Africa and Mozambique across which refugees often cross illegally. This section of northern Kwazulu-Natal is not without other problems too, particularly with regard to the somewhat antagonistic relations between the local communities adjacent to the protected areas and the protected areas themselves. This is largely as a result of the local people having been removed from this area when the reserves were proclaimed. This is evidenced by the destruction of the eastern border fence of the Ndumo Game Reserve and the subsequent invasion of this part of the reserve that has resulted in large-scale transformation of the natural environment within the reserve through slash and burn subsistence agricultural practices. The protected areas within the study area are surrounded by poor rural communities. Land claims and water abstraction by local populations is therefore a possible threat.

5.8 Land Use

A number of different land uses are encountered within the study area, but the majority of the study area (outside of the large protected areas) is characterised by areas of largely natural vegetation in which subsistence livestock (cattle) ranging occurs. Small areas are also characterised by subsistence agriculture, although very little of this practiced in direct proximity to the international border. Commercial forestry also occurs in a small part of the alignment located close to the Farazela Border Post. Within the Tembe and iSimangaliso Reserves conservation and ecotourism is the predominant landuses, although within the northern (Kosi Bay) section of iSimangaliso that is traversed by the Phase 1 alignment, harvesting of natural resources is permitted and cattle ranging extends into the Park. The study area is predominantly tribal land and is managed by the Ingonyama Trust Board (ITB).

The study area is almost exclusively rural in nature, with no large towns or urban centres occurring close to the section of the South Africa-Mozambique border under consideration. Historically (during the Apartheid era of South Africa's history) the entire length of the border between NGR and the coastline fell within the KwaZulu Homeland and accordingly the area was predominantly rural and has remained as such post the end of Apartheid. Human settlement occurs in the form of scattered individual family homesteads, but these are located away from the international border line and no areas of human habitation occur along the Phase 1 alignment, except at the Muzi Staff Camp on the north-eastern boundary of the Tembe Reserve and at the Farazela Border Post where small areas of staff housing are located.

There are a number of areas of human settlement, however, that are located within a 2km radius of the international border, and which could be affected, albeit over the short-term, by construction activities on the Phase 1 project. Areas of human settlement / occurrence which occur within a 2km radius of the international border are:

- The Mahlungulu area immediately to the south and south-east of the Farazela (Kosi Bay) Border Post, characterised by a number of scattered rural homesteads.
- The Farazela (Kosi Bay) Border Post where a small number of staff houses are located.
- The KwaThelizolo-St Joseph's area located to the south-west of the Farazela (Kosi Bay) Border Post, characterised be a number of scattered rural homesteads, set back at least 500m from the international border.
- The area immediately to the south of Gate 6, characterised by a number of scattered rural homesteads. Gate 6 is one of the locations along the Phase 1 section of the international border where people are able to informally cross between South Africa and Mozambique. Gate 6 is also a locally important location for the hosting of a weekly trading / market day where goods are able to be traded informally between the two countries by local residents.
- The Gazini area to the west of Gate 6 and east of the Muzi Swamp, characterised by a number of scattered rural homesteads, set back at least 700-900m from the international border.

- The area to the south and south-east of Gate 7 and the Muzi Camp (within the Tembe Elephant Park), characterised by a few scattered rural homesteads (a very low density of human settlement).
- The Muzi Camp 'Compound' on the north-eastern edge of the Tembe Elephant Park where a number of staff houses are located.
- The eMbangweni area immediately to the south of Gate 8 in the Bhekabantu Corridor between Ndumo and Tembe, characterised by a number of scattered rural homesteads. Informal trading of goods occurs at Gate 8.

As can be seen from the list above, all human settlement within 2km of the international border takes the form of scattered rural homesteads, with no other social services such as schools or clinics present within this area.

On a wider scale, the human settlement pattern in Umkhanyakude District Municipality (UKDM) is completely dominated by population residing in tribal or traditional areas (in excess of 90%) and is by far the highest figure of all districts within the province. Only 5.6% of the population resides in settlements classified as "urban" areas. According to the land-cover analysis of the district 4.3% of the district land area is classified as "built-up" of which 2.9% are low density settlements and only 0.5% as dense settlements (uMkhanyakude IDP 2016-2017).

6 PUBLIC PARTICIPATION PROCESS

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

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

The primary aims of the public participation process are:

- to inform I&APs and key stakeholders of the proposed application and environmental studies;
- to initiate meaningful and timeous participation of I&APs;
- to identify issues and concerns of key stakeholders and I&APs with regards to the application for the development (i.e. focus on important issues);
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information used for decision-making;
- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

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

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

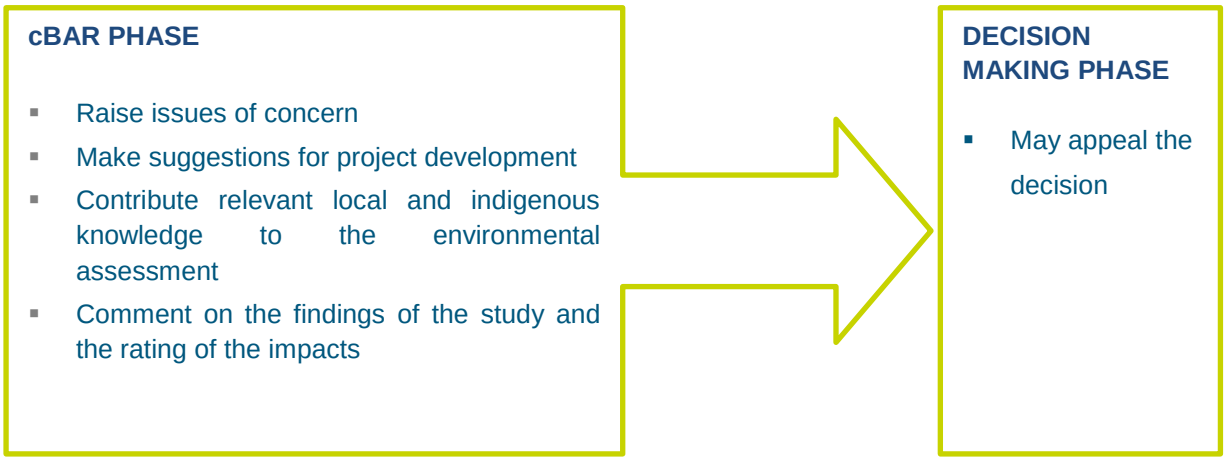

Figure 6-1: Responsibilities of I&APs

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

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

The proposed project PPP has entailed the following activities.

6.1 Authority Consultation

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

Authority consultation included the following activities:

- Conducting a pre-application meeting with DEA on 01 March 2017 with respect to the border barrier structure
- Lodging on an Interpretation Query in March 2017.
- Conducting a pre-application meeting for the combined border control in infrastructure on the 29 January 2018

6.2 Consultation with Other Relevant Stakeholders

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

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

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

The identified stakeholders of this project are provided in **Table 6-1**.

Table 6-1: Key stakeholders

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE	
Ingonyama Trust Board	
eZemvelo KZN Wildlife	
iSimangaliso Wetland Park Authority	
LOCAL AUTHORITY	
Mr Sibusiso Bukhosini	uMhlabuyalingana Local Municipality
Mr. Bheki Makhoba - Acting HOD	uMkhanyakude District Municipality
Mr SP Mthethwa	Councillor (Ward 11)
STATE DEPARTMENTS	
Mrs Bernadet Pawandiwa	AMAFA KwaZulu-Natal
Ms Seokwang Modise	KwaZulu-Natal Department of Agriculture, Forestry and Fisheries
Mr. Andy Blackmore & Ms. Nerissa Pillay	*eZemvelo* KZN Wildlife
Ms Shamilla Ramburan	National Department of Water and Sanitation
Mr Sandile Dlalisa	Department of Rural Development and Land Reform

6.3 Site Notification

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

I&APs were identified primarily from responses received from the notices notify the public of the project and to invite the public to register as stakeholders and inform them of the PP Process.

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

6.4 Identification of Interested and Affected Parties

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

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

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

6.5 Briefing Paper

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

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

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

6.6 Public Open Days

Due to the pattern of human habitation in the study area in which there are very few concentrations of people (villages), it was deemed most effective to host a series of open days at different locations along the alignment at locations where people congregate at certain times. The public open day will allow people to engage one-on-one with members of the project team regarding the project.

6.7 Focus Group Meeting

A Focus Group Meeting will be held to allow key stakeholders to be individually consulted and to allow them to provide feedback on the project.

6.8 Advertising

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

- The Zululand Observer on ** 2018 (refer to ***Appendix E***).

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

6.9 Issues Trail

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

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

6.9.1 Key Issues Raised by the Public

No comments have been received to date.

6.10 Public Review of the draft Consultation BAR

The draft Consultation BAR (cBAR) is being made available for authority and public review for a total of 30 days from 20 March 2018 – 19 April 2018.

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

- Manguzi Public Library – Manguzi Main Road – P522 (opposite Manguzi Cash and Carry).
- Embonisweni Primary School

6.11 Final Consultation BAR

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

The final BAR (i.e. fBAR) is a product of all comments and studies and will be submitted to DEA for review and decision-making once the public participation process has been completed.

6.12 PPP Summary

A summary of the PPP is provided in **Table 6-2** below, with the documents provided in ***Appendix E***.

Table 6-2: Summary of Public participation process

Activity	Description
Identifying stakeholders	Stakeholders were identified and a database of all I&APs were compiled.
Publishing newspaper adverts	The Zululand Observer
Distribution of a BID	BIDs were distributed electronically and by hand to I&APs.
Erection of site notices	A number of A2 site notices were erected on the perimeter of the site.
Preparation of an on-going Issues Trail	Comments, issues of concern and suggestions received from stakeholders thus far have been captured in an Issues Trail.
Release of Draft Report	The draft Consultation Basic Assessment Report (cBAR) will be advertised and made available for a period of 30 days for public review and comment.
Focus Group Meeting(s)	Focus Group Meetings will be held with key stakeholder groups
Public Open Days	Public Open Days will be held to allow local residents and other Interested and Affected Parties to be informed about the project and to raise concerns and issues and to seek clarity on the proposed development.

7 SPECIALIST ASSESSMENT

7.1 Freshwater Assessment

7.1.1 Surface Water Drainage

The Phase 1 alignment is almost completely contained within one quarternary catchment – W70A. This quaternary catchment is very large in spatial extent, primarily due to the absence of large rivers within the Maputaland Coastal Plain in the far north-eastern part of KwaZulu-Natal which it occupies. As described in Section 5.3 above, there are very few large rivers in the study area. Apart from the wetland systems located between Farazela and Tembe, the only fluvial drainage system in this catchment is the Malangeni River system which flows northwards parallel to the Indian Ocean Coastline, being constrained by the presence of high (primary) dunes that run along the coastline. This river rises in close to the coast south of Manguzi and forms a series of coastal lakes including Kosi Lake, kuMpungwini, Makhawulani and Enkovukeni (Kosi Bay). Lake Sibhayi is located in the south-eastern part of this catchment.

A small part of the far western part of the alignment falls within the W45B quarternary catchment. This catchment comprises the lower most reach of the Phongolo River within South Africa, and encompasses the extensive floodplain formed by this river that falls within the Ndumo Game Reserve.

7.1.2 Wetland occurrence within the study area

As described above, the W70A quarternary catchment is a very large quaternary catchment, encompassing the entire Maputaland Coastal plain from the Indian Ocean to the Phongolo River at Ndumo (a distance along the international border of approximately 53km). Wetlands are not evenly distributed across this catchment and parts of this catchment have a very low density of wetlands, as evidence by the very low overall drainage density within the wider catchment, in particular the western part of the quarternary catchment comprising of the Tembe Elephant Park and the corridor west of the Park to Ndumo.

The section of the catchment from the primary dunes near the Indian Ocean to the eastern boundary of the Tembe Elephant Park is conversely characterised by a high number of wetlands, and importantly a number of wetlands of very wide extent (thus collectively comprising a very large area of wetland habitat). The occurrence of wetlands as traversed by the Phase 1 alignment is indicated in the map below (Figure 7-1). Detailed wetland maps are also included in Appendix F.

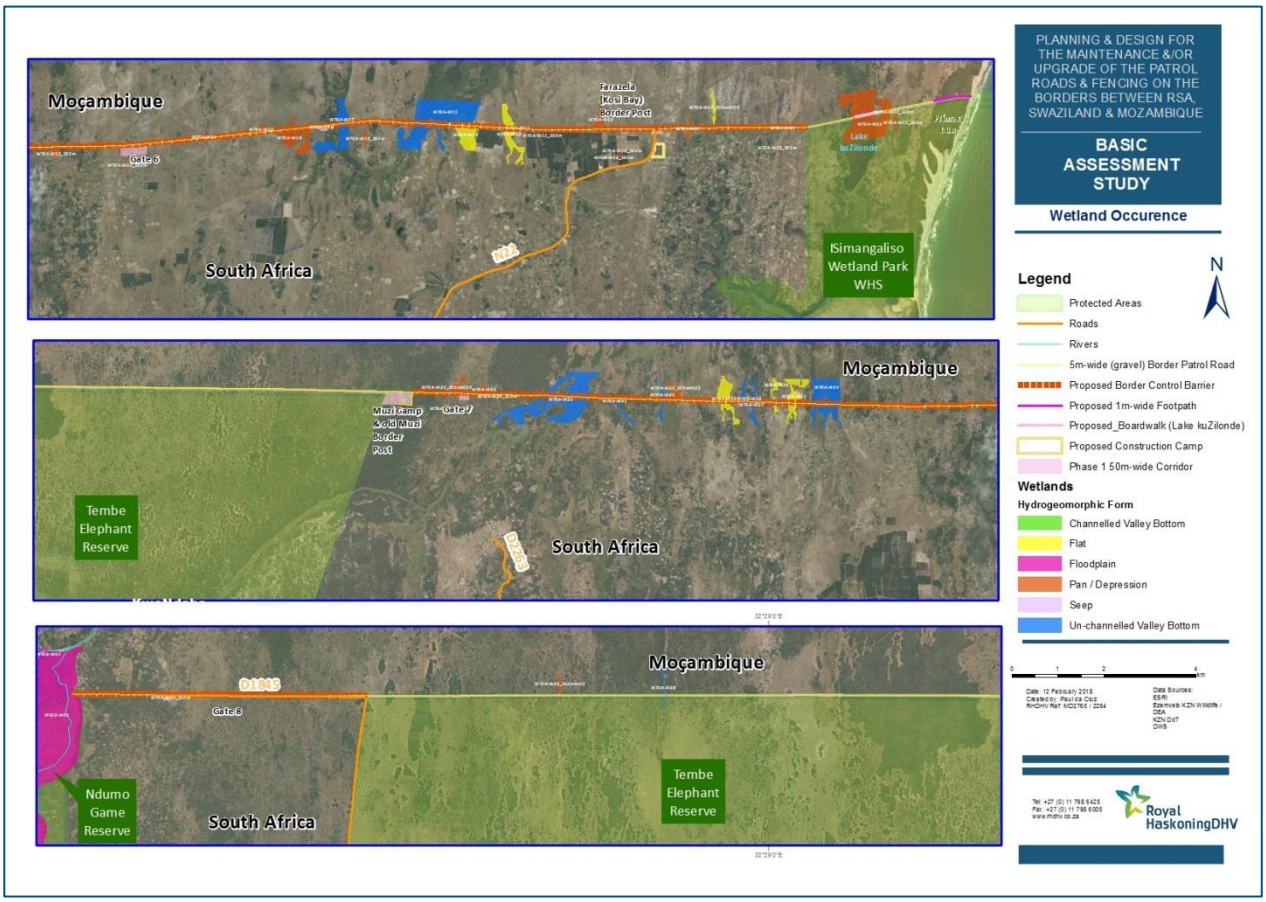

Figure 7-1: Wetland Occurrence in the Study Area

7.1.3 Wetland Typology and Classification

As described above, no major rivers are encountered along the Phase 1 alignment, although the Phongolo River (floodplain) is located immediately adjacent to the western end of the alignment at KM54. Due to the physical characteristics of the Maputaland Coastal Plain (which the Phase 1 alignment encompasses), i.e. the highly sandy nature of the substrate and the topography (refer to section 5.1 and Section 5.3.1) linear drainage has not developed as fluvial (riverine) features, but rather as wetlands which are largely characterised by groundwater inflows in the context of their hydrology.

Wetlands and surface water features can be found all across a landscape. The landscape can be divided up into a number of units, each of which can contain wetlands. Wetlands occurring on these different terrain units typically differ in terms of their formative processes and hydrological inputs, and thus differ in terms of their functionality. Wetlands can thus be grouped into different hydrogeomorphic (HGM) units. The classification of wetland form has been based upon the most updated wetland classification system for South Africa – the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al*, 2013).

The terrain in along the majority of the Phase 1 alignment is very flat with the exception of the eastern-most parts of the alignment located east of the Farazela Border Post (refer to Section 5.1). Accordingly three primary wetland HGM types occur in the study area – the un-channelled valley bottom wetland (most commonly occurring), as well as pans / depressions and wetland flats. Although not crossed by the Phase 1 alignment, the Phongolo River at the western end of the Phase 1 alignment occurs as part of a floodplain system.

Many of the un-channelled valley bottom wetlands along the Phase 1 alignment are wide in lateral extent, and are vegetatively diverse (refer to Section 7.1.4 below). The flat terrain setting of the area that is characterised by a low drainage network density facilitates the development of pans / depressions which are endorheic (inwardly draining), typically with no surface linkage to the surrounding drainage system. Such HGM wetland units primarily occur closer to the Farazela area and closer to the Indian Ocean. The large coastal lake - Lake kuZilonde, and a small number of depressions located at the foot of the primary dune system running parallel to the Indian Ocean (dune slacks) have been included in this HGM category. A number of wetland flats are located in the area west of Farazela, but differ from pan / depression wetlands in that they are not surrounded by closed elevation contours. Table 7-1 below outlines the characteristics of these wetland HGM types in greater detail.

Table 7-1: Summary of Wetland HGM units found in the Study Area

HGM Type	Description
Un-channelled Valley Bottom	Wetland systems located in valley floors with no channelled flow and associated channel banks. Flows within these systems are diffuse and confined to the valley sides, with dense hygrophilous vegetation (reedbeds, rushbeds) typically occurring across the lateral extent of the wetland. These systems typically occur as large, broad, gently sloping systems in the study area. A number of the larger un-channelled valley bottom wetlands are characterised by swamp forest vegetation
Pan / Depression	Pans and depressions are typically endorheic in character - inward-draining and not linked to the wider drainage network via surface outflows. These can also be exorheic in character - outward-draining and linked to the wider drainage network. These wetland systems where located in the study are typically located in areas of very flat topography where there is a low drainage density. Pans / depressions are seasonally / ephemerally inundated, typically in response to high rainfall. The only coastal lake (included in this HGM category) located in the study area is Lake kuZilonde located near Kosi Bay. A number of other depression wetlands are located close to this lake and the primary dune system in this area, while a small number of isolated wetland depressions of very small spatial extent are present in the relict (palaeo) dunes located between the Farazela (Kosi Bay) border post and Lake kuZilonde.
Flat	A level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.
Floodplain	Mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel under its present climate and sediment load, which is subject to periodic inundation by overtopping of the channel bank. Floodplains are typically characterised by a suite of geomorphological features associated with river- derived depositional processes, including point bars, scroll bars, oxbow lakes and levees. Floodplains are not only associated with the Phongolo River, with the

	Phase 1 alignment terminating at the eastern edge of the Phongolo River floodplain. A floodplain depression: a depression occurring as a feature within a broader floodplain wetland complex, including 'backwater depressions', 'floodplain pans', 'meander cut-offs', 'oxbow lakes' and other depressional features typically associated with a floodplain.

Un-channelled Valley Bottoms	
	
	

Pans (including freshwater coastal lakes)

Depressions

Figure 7-2: Illustration of Wetland HGM types encountered in the Study Area

7.1.4 Wetland Vegetative Characteristics

The subtropical, moist climate of the Study area coupled with very sandy substrate (marine deposits) gives rise to a with certain unique wetland vegetation communities in terms of structure and assemblage, as compared to other part of South Africa. As described above the very flat terrain and sandy substrate is conducive to the formation of a number of very wide wetland systems. A spatial distinction in wetland vegetation structure within the eastern part of the coastal plain (i.e. east of the Tembe Elephant Park) between the wetlands found in the eastern-most part of the coastal plain, and those found closer to Tembe has been identified.

With the exception of the coastal lake, Lake KuZilonde, and the dune slack wetlands at the foot of the primary dune, all wetlands located east of the Farazela Border Post and in the area west of the border to Gate 6, are characterised by a relatively dry hydroperiod (typically restricted to temporary wet wetland habitat) with a mix of grass and sedge species in a meadow-like structure – termed the *Eastern Maputaland Coastal Plain – moist (mesic) grassland (depressions)* wetland community. These wetlands typically occur as flats or as depressions of small extent and are different to the larger wetlands in that they can be characterised as moist grassland, with the number of hydrophytes being limited to a handful of species with the most dominant species being *Ischaemum fasciculatum* which was assessed to be a facultative hydrophyte in this setting. A number of small such depressions are located at the bases of the relict (palaeo) dunes located between the Farazela Border Post and Lake kuZilonde.

Wetlands located between Gate 6 and the eastern boundary of Tembe were noted to be different in vegetative structure to those wetlands to the west, and were grouped into the *Western Maputaland Coastal Plain - Mixed Hygrophilous grass & sedge marshland and moist grassland* community. Depending on the nature of the hydroperiod and HGM type, wetlands in this area were characterised by a lateral mix of different vegetation sub-communities within an individual wetland unit. This lateral matrix of different vegetation communities was interspersed with 'islands' or linear bands of non-wetland woodland or thicket vegetation located on slightly higher-lying ground. Many of the larger valley bottom wetland systems within this part of the coastal plain are characterised by such lateral changes in vegetation sub-community within one wetland unit and this heterogeneity is a key characteristic of the larger wetland systems in this part of the study area.

A number of wetlands in the coastal plain are unique in a study area context in that they contain Swamp Forest. Swamp Forest is characterised by dominance of mature trees forming a closed canopy within the HGM setting of un-channelled valley bottoms and coastal lakes (pan / depression) wetlands. The uniqueness of the swamp forest vegetation has allowed the wetlands units that predominantly contain swamp forest to be classified as a separate wetland vegetation community - *Maputaland Coastal Plain - Mixed swamp forest & peripheral hygrophilous grass & sedge marshland*. The Swamp Forest wetland units in the area typically shared the characteristics of mixed hygrophilous grass & sedge marshland and moist grassland communities, with the peripheries of these wetlands morphing from closed canopy forest to of a mix of marshland and meadow. It is important to note that a number of wetlands in the Maputaland Coastal Plain were assessed have been vegetatively predominated by Swamp Forest under natural conditions, but felling of trees for wood and to establish subsistence cultivation has transformed the vegetative structure of these wetlands from closed canopy forest to hygrophilous grass / sedge meadows and accordingly these wetland units are highly transformed.

The coastal lake, Lake kuZilonde, is also unique in a study area context in that it is the only natural permanently inundated lake / pan wetland unit. This lake is also characterised by a lateral distribution of vegetation sub-communities with the wetland unit. The central part of the wetland unit is characterised by open water containing aquatic (submerged) plant species on its margins. Beyond the margins of the lake a band of swamp forest occurs, which on the eastern side of the lake borders a wide *Cyperus papyrus* swamp.

The Phongolo River floodplain is the most prominent wetland feature of the lower-lying parts of the KZN-Mozambique Border that are located between the coastal plain and the higher-lying hilly ground situated to the west. This floodplain (located within the Ndumo Game Reserve) is characterised by extensive floodplain wetland communities and extensive reedbeds.

Table 7-2 describes the identified wetland vegetation communities in greater detail.

Table 7-2: Summary of Wetland Vegetation Communities found in the Study Area

Vegetation community	Description of vegetation structure	Characteristic dominant species
Eastern Maputaland Coastal Plain – moist (mesic) grassland (depressions)	Predominantly facultative wetland grass species forming a short lawn-type grassland with some sedge species, located in temporary wet flats / small depressions within wider costal grassland. Occurs west of the Farazela Border Post eastward to Lake kuZilonde, often in narrow depressions located at the foot of relict (palaeo) dunes.	*Ischaemum fasciculatum* is the most dominant species occurring in these moist grassland wetland meadows. Other locally common species include *Andropogon eucomus, Hermarthria alitssima* and *Miscanthus junceus*. Limited sedge species and a number of herb / forb species occur.
Western Maputaland Coastal Plain - Mixed Hygrophilous grass & sedge marshland and moist grassland communities	Lateral matrix within single wetland units of moist grasslands on wetland peripheries, with seasonally inundated mixed grass-sedge marshland in the wetter parts of the wetland interspersed with 'islands' of non-wetland habitat comprised of dense thickets.	The dominant grass species within the moist grassland on wetland peripheries is the creeping grass *Brachiaria chusqueoides*. Other common (locally dominant) grass species in these parts of the wetlands are *Ischaemum fasciculatum, Andropogon eucomus* and *Imperata cylindrica*. The exotic herb species *Hydrocotyle bonariensis* was noted to be locally very common in certain wetlands, especially within formerly cultivated (transformed) parts of wetlands. The fern species *Cyclolsorus interruptus* was noted to be locally common. In certain wetlands the tree species *Syzigium cordatum* was noted to be locally common on wetland margins and in temporary wet zones. The hygrophilous grass-sedge marshland community is characterised by the following most common grass species: *Leersia hexandra, Hermarthria altissima, Miscanthus junceus, Panicum maximum,* and the following sedge species forming locally dominant stands: *Cyperus prolifer, C. rotundus,* and *C. natalensis.* Stands of tall sedges, typically *Cyperus dives* and small stands of reeds, *Phragmites australis,* occur in certain wetter parts of the wetland units.[16]

[16] *It should be noted that many of these wetlands are heavily impacted by drains and corresponding mounds associated with former (some current) subsistence cultivation. This system of drains and mounds has altered the vegetative composition of many wetlands*

Vegetation community	Description of vegetation structure	Characteristic dominant species
		In one wetland (Muzi Swamp) *Phragmites australis* reedbeds are dominant.
Maputaland Coastal Plain - Mixed swamp forest & peripheral hygrophilous grass & sedge marshland	Swamp forest comprises the majority of the spatial extent of the wetland unit, with a closed canopy and most tree specimens taller than 4m. The wetland margins are characterised by a narrow band of marshland grading to moist grassland. Lake kuZilonde comprises open water of lake with submerged aquatic vegetation; flanked by band of swamp forest around both shorelines, with a band of *Cyperus papyrus*-dominated swamp forming the eastern-most part of the wider wetland complex.	The Swamp Forest sections consist of the most dominant tree species – *Syzigium cordatum, Ficus trichopoda, F. lutea, Vouacanga thouarsii.* The most dominant species encountered in the substratum was *Scleria angusta* and *Cyclosorus interruptus*. The marshland margins are characterised by the grass species *Ischaemum fasciculatum, Miscanthus junceus, Hermarthria altissima, Leersia hexandra*, as well as stands of the tall sedge *Cyperus dives*, and other locally-dominant sedge species including *C. prolifer* and *Fuirena pubescens*. Small stands of *Phragmites australis* and *Typha capensis* occurred in places with common occurrence of the fern species *Cyclosorus interruptus*. The eastern band of swampland within the Lake kuZilonde unit predominantly consists of *Cyperus papyrus*.

*with the ingress of terrestrial grass species into the wetlands (especially on the mounds) such as D*igitaria eriantha, Perotis patens, Cymbopogon excavatus, *with hydrophytes remaining in the drains.*

Figure 7-3 below provides photographic illustrations of these different vegetation communities.

Eastern Maputaland Coastal Plain – moist (mesic) grassland (depressions)

Western Maputaland Coastal Plain - Mixed Hygrophilous grass & sedge marshland and moist grassland communities

Maputaland Coastal Plain - Mixed swamp forest & peripheral hygrophilous grass & sedge marshland	
	
	

Maputaland Coastal Plain - Mixed swamp forest & peripheral hygrophilous grass & sedge marshland – Lake kuZilonde

Figure 7-3: Illustration of Wetland Vegetation Communities encountered in the Study Area

7.1.5 Wetland Soil and Landtype Characteristics

As with other aspects of freshwater occurrence, the Maputaland Coastal Plain is distinct from adjacent regions in a soils and landtype context. The Maputaland Coastal Plain is underlain by substrate of marine origin (refer to Section 5.1). Cretaceous to Miocene Era marine sands have been redistributed (over the period of the recent geological past) to create a number of dune cordons. The soils are accordingly highly sandy in nature.

The dominant landtypes in this part of the study area are *Ha* and *Hb* landtype groupings. These are characterised by the predominance of grey regic sands (either dominant or with other soils); mostly deep, grey, apedal (structureless) soils with a sandy texture. They are mostly found on coastal plains, the soils having a low fertility status. Other soils may occur to a greater or lesser degree.

Ah landtypes are also present in the western part of the coastal plain within the Tembe Elephant Park. These are similarly apedal in nature but differ from the Ha and HB landtypes in being red-yellow in colouration. The soils are typically characterised by very low clay content (< 15% clay) and thus have low fertility status. The soils usually have a sand or loamy sand texture and occur in moderately low rainfall areas (400-600 mm per annum). Wind-blown dunes may occasionally be present.

The various landtypes present within the coastal plain are characterised by the predominance of the Fernwood Soil Form. The Fernwood soil form is a wetland soil form that is characterised by the presence of an E horizon as the underlying (subsoil) horizon, with the E horizon being indicative of the sub-surface (lateral) movement of water within the soil profile. Within the *Ha* and *Hb* landtypes the Fernwood soil form however occurs across the landscape, and is not just restricted to wetlands. The predominance of the Fernwood Soil Form presents problems for wetland delineation in this part of the study area, as the entire landscape could be classified as a wetland based on soil form alone. Areas of non-wetland habitat were distinctly present, even within individual wetland units (refer to section 7.1.4 above) and in slightly higher lying ground between wetland units. Accordingly a combination of vegetation indicators and terrain indicators were used to delineate the boundaries of wetlands in the Maputaland Coastal Plain.

The Champagne Soil Form (a wetland soil form associated with permanently saturated wetland habitat and characterised by a very high degree of organic content) was found to occur in a number of the larger wetlands within the coastal plain in which field assessment was conducted and is the most typical soil form of the more saturated parts of these coastal plain wetlands.

The Phongolo River floodplain is characterised by the *Ia* family of landtypes, characterised by undifferentiated deep soil deposits. The soils within this landtype are typically deep pedologically youthful soils, which occur mostly along river courses, valley bottoms and in lower lying areas. Soils are usually weakly structured, with a great variety of colour (often mottled) and often, several layers have been deposited (usually by water) with different soil textures. The Phongolo River floodplain is characterised by extensive alluvial deposits and is thus a classical example of such a landtype. Extensive wetland soil forms occur within the Ia30 landtype that occurs within the Phongolo floodplain, in particular the Dundee wetland Soil Form that is typified by hydromorphic soils of alluvial origin.

P1: A soil sample from a Champagne Soil Form from a wetland in the Maputaland Coastal Plain, indicating the high level of organic material.

P2: A soil sample from a Fernwood Soil Form within a wetland in the Maputaland Coastal Plain east of the Tembe Elephant Park, showing the change in horizons to the lighter coloured E horizon from the orthic A horizon.

P3: Signs of wetness (iron and mottling) from an exposed soil face (within a wallow) in a wetland within the Tembe Elephant Park in the Maputaland Coastal Plain

P4: Examples of differing horizons from one soil sample showing an Orthic A horizon (above) and an E horizon (below) that comprise the Fernwood Soil Form

Figure 7-4: Illustration of Wetland Soil types encountered in the Study Area

7.1.6 Results of Present Ecological State Assessments

Assessments of Present Ecological State (PES) were conducted for the majority of wetlands located along the Phase 1 alignment. The assessment of PES is important to determine the current state (health) of the wetlands that will be impacted by the development of Phase 1 infrastructure and in order to provide a baseline against which to measure the impacts associated with the project on these wetlands.

The catchment W70A in which the Phase 1 alignment is located is characterised by wetland units that are either highly natural or highly degraded. A third of all wetlands in this catchment for which PES scores were calculated were assessed to be highly modified (PES class of D). This reflects a relatively high

degree of landuse-related wetland impact within large parts the Maputaland Coastal Plain. In most of the wetlands that were field surveyed in this part of the study area, historical subsistence cultivation (only one or two wetland units were noted be currently cultivated) had occurred which had resulted in much of the overall area of each wetland unit being physically disturbed – typically a hatched pattern of drains had been excavated within the wetland with the creation of associated cultivation mounds. This pattern of drains had thus significantly adversely altered the hydrological and vegetative state of these wetlands through the desiccation of much of the surface area of the wetland which in turn had allowed the colonisation of these parts of the wetlands by terrestrial (non-wetland) pioneer plants.

In certain of the wetlands assessed that were noted to have been characterised by the presence of Swamp Forest under natural / reference conditions, almost complete alteration of natural vegetative structure and composition was noted to have occurred through the removal (felling) of all woody vegetation associated with Swamp Forest that had naturally occurred in the wetland. This vegetative transformative impact was compounded by the widespread drainage within these wetlands.

Conversely nearly half of the wetlands assessed in the Study Area were assigned a natural / near natural state (PES = A/B). Certain of these wetland units assigned such a near natural state were located within protected area settings, the most significant example of which is the ecologically highly significant Lake kuZilonde (located in the iSimangaliso Wetland Park) and its associated swamp forest and papyrus swamp wetland components which was assessed to be in near natural state. Other wetland units assigned a near natural state included two of the larger Swamp Forest wetland systems and certain of the wetlands associated with the Muzi System (located east of the Tembe Game Reserve). These wetland units are subject to very low levels of human / land use-related disturbance and were located in settings where much of the immediate surrounds and catchment of the wetlands was still largely natural, hence their state remains near natural.

The relative contribution of hydrology, geomorphology and vegetation PES scores that contribute to the overall PES of wetlands has been summarised below. A very strong trend that emerges from the analysis of the relative contributions of these three factors is the relative absence of geomorphological impacts in all of the wetlands assessed in the study area. These wetlands were noted to be characterised by very little, if any erosion, or large scale disturbance of wetland substrate. In spite of the alteration of wetland substrate by (historical) subsistence cultivation, wetland units which had formerly been altered by cultivation and drainage were noted to be well-vegetated with no visible signs of erosion. A combination of very flat topography and absence of channelised water flow in many of the study area wetlands is a strong factor in maintaining the geomorphological stability of these wetlands.

Certain wetland units assessed were associated with high levels of hydrological impacts. Subsistence cultivation within many of these wetland units was the most significant factor in adversely altering wetland hydrology. As described above, subsistence cultivation within wetlands alters wetland hydrology through the common practice of digging a network of drains and by creating mounds with the excavated substrate on which crops are cultivated. The widespread network of drains lowers the water table within much of the wetland, thus drying out the wetland and resulting in wetland vegetation composition alteration.

Very few impoundments were observed in the wetlands assessed. In certain areas the existing border track which is raised above the surface of the wetland is responsible for effectively impounding water upstream of the track. This is compounded in certain wetlands by the low number if culverts / flow outlets under the road and in certain cases chanellisation of flows downstream of a culvert were noted.

Plantation forestry was also responsible for elevating hydrology impact scores in certain of the wetlands in the study area, in particular the wetlands located to the west of the Farazela Border Post. Although plantations do not typically extend into wetlands, the high degree of water use by the trees (mature trees in particular) prevents water inflow to wetlands from the catchment, thus depriving the wetlands of water and altering their hydrology. This is particularly significant from a hydrological context as the wetlands in

the study area derive much of their water inputs from sub-surface water (groundwater). The expansion of plantation forestry within the Maputaland Coastal Belt is accordingly a significant threat to wetlands in the study area.

Vegetative impacts were the most commonly encountered of the three modules assessed in assigning wetland health scores across the study area. Vegetative impacts mirrored hydrology impacts to a certain degree, as some of the hydrology impacts are directly related to in-wetland vegetation change / alteration, in particular current / historical subsistence cultivation that lowers the water table and which has facilitated the out-competition of wetland hydrophytes by terrestrial species. Levels of alien invasive vegetation infestation in the wetlands in the study area were however found to be very low.

The vegetative transformation of swamp forest wetland units through the felling and removal of all woody vegetation from certain wetland units naturally characterised by the presence of wetland vegetation has been mentioned above. While the felling of trees (typically associated with the draining of the wetland) has resulted in in a significant impact, a further vegetative impact was noted in one of the wetland units where vegetation die-off due to excess salinization was observed. It is postulated that the absence of trees in the wetland unit has led to the build-up of excess salts in the wetland substrate, with the grassy vegetation which has re-colonised the wetland being unable to tolerate these high levels of salts in the soils. This will have a knock-on impact of increasingly exposing soils and leading to their desiccation.

One of the other commonly encountered vegetative impacts (which is also a hydrological impact associated with the reduction in roughness of wetland vegetation, thus impairing the wetland's ability to impede or slow down water inflow) is the impact of intensive livestock grazing / trampling. Livestock grazing which is becomes too intensive when there is an overconcentration of livestock in wetlands in many cases reduces vegetative roughness and is responsible for altering species composition (through selective grazing of certain more palatable grass species that allows these species to be outcompeted by less palatable species). Very importantly the presence of cattle in wetlands often leads to the trampling of saturated soils which reduces vegetative cover through trampling that physically disturbs wetland vegetation, thus leaving soils vulnerable to desiccation and erosion. This is particularly an issue in certain of the more saturated larger wetlands in which cattle concentrate to drink and graze. This concentration of livestock leads to the trampling and exposure of the highly organic soils, thus drying these soils out.

P1: View of chanellisation of a section of a naturally un-channelled swamp forest wetland to the west of the Farazela Border Post due the flow concentrating effect of a single culvert.

P2: View of active subsistence cultivation within a wetland west of the Farazela Border Post, with associated drains and cultivation mounds.

P3: View of a drain in a historically cultivated area of a wetland in the Maputaland area

P4: view of vegetation die-off in part of a swamp forest wetland (from which all woody vegetation has been removed) due to excess salinity

Figure 7-5: Illustration of Wetland Impacts that adversely affect the health of the affected wetland

7.1.7 Wetland Ecological Importance and Sensitivity (EIS)

Ecological Importance and Sensitivity (EIS) is an expression of the importance of aquatic resources 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 occurred.

EIS scores vary for wetlands assessed. This variance in wetland scores can be due to a number of factors, including high levels of impact and associated poor wetland health of a wetland unit, which typically significantly limits the level of wetland functions performed. However it can reflect the size of the wetland unit and the degree of wetland habitat variance or rarity in a particular wetland. Wetlands that are small in size are limited in this way and do not provide significant degree of ecological goods and services that are associated with larger wetlands with large areas of intact habitat. These smaller wetland units are also not typically being associated with unique or high levels of wetland-dependent biodiversity.

The largely highly flat terrain and nature of the substrate (marine sediments that are highly sandy) have resulted in the development of very few larger riverine / fluvial drainage systems east of the Phongolo River floodplain. The coastal plain is rather characterised by the presence development of a number of wetlands of large lateral extent in the flat terrain setting that are hydrologically characterised by groundwater inputs rather than surface flows. These wetland types are thus characterised by factors which elevate ecological importance and sensitivity - in particular the large size of the wetlands and their distinct hydrological characteristics.

The sub-tropical nature of the climate is associated with the presence of forest habitat within the coastal plain. A sub-component of the forest habitat encountered within this part of the study area is Swamp Forest. Swamp Forest is a unique wetland vegetation type in the study area (refer to section 7.1.4 above) due to its structure (presence of a closed canopy of mature trees) and resultant floral and faunal species composition. The site assessment recorded the presence of a number of faunal species of conservation importance within this forest habitat -the Maputaland Coastal Plain is the southern extent of many tropical faunal species that are not found elsewhere in South Africa.

Due to the combination of a number of factors including these unique biodiversity characteristics and the high degree of hydrological functionality performed by swamp forest wetland habitat coupled with landuse-related threats to this wetland type, swamp forest wetland units were assigned a high degree of sensitivity and where intact swamp forest wetlands were encountered in the study area, these were assigned a high EIS score.

A number of wetland units in the W70A catchment were determined to naturally be swamp forest wetland, but were assessed to have been completely vegetatively transformed through the removal of all woody vegetation from within the wetland unit. It is worth noting that in spite of the low EIS score assigned to these individual wetland units, the EIS 'potential' of these wetlands should be considered to be high, as if the forest habitat were able to be restored to these wetlands through wetland rehabilitation efforts, the EIS score value of these wetland units would rise significantly.

Lastly it should be noted that the eastern-most extent of the W70A catchment contains the only example of a very rare wetland / freshwater type in a South African context within the study area – freshwater (coastal) lakes. Natural freshwater lakes are rare in South Africa. Lake kuZilonde located to the west of the primary dunes at Kosi Bay is such a freshwater (coastal) lake and importantly was assessed to be in a highly natural state. This wetland unit is characterised by a high degree of habitat diversity, including open water, marginal lacustrine wetland habitat, swamp forest and papyrus swamps. This wetland was accordingly assigned a high EIS score and must be considered a highly significant and sensitive freshwater ecosystem.

When one examines the different aspects of EIS – ecological importance, hydrological functionality and socio-cultural functionality, a number of trends become visible. Most of the land within the study area as traversed by the Phase 1 alignment is characterised by subsistence cultivation and communal land ownership (the study are forms part of the former homeland area of KwaZulu) and distinct patterns of social / human utilisation of wetlands were evident. In this former homeland area livestock is critical for maintaining livelihoods and has high socio-cultural value. A high presence of livestock in wetlands was noted in most parts of the study area outside of protected areas and it is important to note that wetlands are critical for sustaining cattle herds in these areas.

The presence of active cultivation of crops within wetlands in much of the study area was found to be relatively low, contrary to expectation. In most wetland units surveyed in the study area to the east of Tembe large parts of the wetlands had historically been modified through cultivation with the digging of drains and associated creation of mounds for cultivation of crops. However no active cultivation of crops was noted in most of these wetlands. And only in certain wetlands located west of the Farazela Border Post and was active cultivation of subsistence crops noted.

The harvesting of natural resources by the local population was also noted in certain wetland units within the areas of communal tenure within the study area, as well as within the iSimangaliso Wetland Park where communal harvesting of natural resources is permitted. Such harvesting of natural resources was noted especially in wetland units that were vegetatively characterised by swampy habitat / marshland where a number of the larger sedge / reed species are utilised for harvesting of their stems. Harvesting of trees for firewood and other purposes such as fencing was also noted in certain swamp forest wetlands within the study area, although in certain of the these wetland units the total removal of all woody vegetation had severely degraded these wetlands.

The ecological functionality and importance of wetlands was the highest scoring aspect of EIS recorded in the wetlands across the study area. The high scoring wetland EIS scores in the study area are largely related to the presence of suitable habitat for, and the recorded presence of species of conservation concern within these wetlands, thus reinforcing the ecological importance of these wetlands.

P1: View of a cattle herd drinking from a pan / depression wetland in Maputaland west of the Farazela Border Post.

P2: View of two local women cultivating crops in a Maputaland wetland to the west of the Farazela Border Post.

P3: View of swamp forest in a Maputaland wetland (on the Mozambique side of the border) that has been largely cleared for firewood and to establish subsistence cultivation

P4: View of harvesting of natural resources from Lake kuZilonde in the iSimangaliso Wetland Park

Figure 7-6: Illustration of the use of wetlands, and of wetland EIS factors in the Study Area

7.1.8 Assessment of Freshwater-related Impacts

When making inferences on the impact of the border control infrastructure construction and operation on water resources it is important to understand that these impacts speak specifically to their effect on the Present Ecological State (PES) and Ecological Importance and sensitivity (EIS) or functional value of water resources in the study area. All of these are linked to the physical components and processes of aquatic ecosystems, including hydrology, geomorphology and vegetation as well as the biota that inhabit these ecosystems. Impacts will vary across water resource types depending on natural site attributes that affect local sensitivity.

For the purposes of this assessment the 'physical habitat modification' associated with the border control infrastructure is defined as the primary impact causing activity. The secondary impacts associated with this activity form part -of the impact pathway that is initiated by this impact causing activity. For descriptive purposes an attempt had been made to sub-divide impacts associated with (a) Physical destruction and/or modification of aquatic habitat, (b) flow modification and erosion/sedimentation impacts and (c) water quality impacts. The significance of these impacts, however, has been assessed in terms of the 'ultimate consequences' to the receiving watercourse in terms of the following:

1. Impacts to water resources and the ability to meet water resource management objectives;
2. Impacts to ecosystem conservation and the ability to meet of ecosystem conservation targets;
3. Impacts to species conservation and the ability to meet species conservation targets; and
4. Impacts to ecosystem goods and services of direct value to communities and resultant potential impacts to human health, safety and livelihood.

The direct and indirect impacts associated with each of the impact causing activities is discussed in the sections that follow for both construction and operation phases.

Physical Destruction & Modification of Wetland Habitat – Construction Phase

This impact type refers the physical destruction or modification of wetland habitat and includes effects on wetland habitat (vegetation) condition and habitat suitability for biota caused by vegetation clearing, excavation and/ or infilling (i.e. within the construction zone) and associated indirect/ secondary habitat modification.

Direct habitat destruction and modification Impacts will result from border control infrastructure development as a result of vegetation clearing, excavation of wetland soils (substrate) infilling and where channels are present in wetlands, bed and bank modifications. The most noteworthy direct impacts will arise from vegetation clearing, wetland substrate excavation and infilling associated with the structural (road) foundations and culvert or other crossing structure installation. At an individual wetland unit level direct impacts from linear projects of this nature are generally localised to wetland crossings that occur within the construction servitude or development footprint. Direct impacts to wetland vegetation/habitat caused by construction taking place within and across the wetland's lateral extent will likely include the following:

- Destruction or modification of wetland habitat (vegetation and wetland soils) where the road foundations as well as culverts / other crossing structures such as vented drifts are installed within the wetland (wetland habitat modification). Vegetation is typically removed / destroyed by construction activities within the construction servitude and saturated soils may be compacted or their natural vertical stratification altered by the churning effect of heavy machinery or through excavation.

- Unintentional physical destruction or modification of wetland habitat outside of the construction zone caused by machinery and construction staff accessing areas upstream or downstream of wetland crossings. Heavy machinery can exert a significant impact on saturated wetland soils and associated vegetation by churning up soils and vegetation and by creating ruts on the surface.
- Sedentary (slow moving) fauna such as invertebrates, slow moving reptiles and amphibians may be killed within the construction servitude or forced to migrate into adjoining habitats.

It is important to note that the intensity of the impacts related to the various infrastructure components will differ due to differences in design and the use of existing infrastructure for certain components. The freshwater specialist study has assessed the impact of the border barrier to be low, as opposed to the other infrastructure components, in particular the road. The low rating reflects the proposed utilisation of the existing road structure for the barrier, which is largely raised above the mean ground level by approximately 1.5-2 m along most of the larger wetlands in which the barrier is proposed to be developed, thus meaning that wetland substrate will not be disturbed. The design of the barrier also utilises the existing culverts for the most part, although additional culverts are proposed to be developed. By contrast the proposed road will largely be constructed out of the footprint of the existing track, thus resulting in the transformation of wetland habitat and an associated higher degree of impact, as related to destruction of wetland habitat.

Indirect/secondary impacts to wetland vegetation/habitat caused by construction within the wetland could potentially include the following:

- Temporary noise, dust and light disturbance which will cause local fauna to move away from the construction zone in the short-term.
- Temporary in-wetland habitat fragmentation impacts from coffer dams and / or temporary diversions in channelled wetland settings which can inhibit or reduce the mobility of aquatic fauna between successive river reaches in the short-term.
- Pollution / contamination of wetland soils could result from leaks / spills of pollutants such as fuel from plant or machinery within the construction servitude.

An increase in the hunting/poaching/trapping of fauna as well as the harvesting of indigenous wetland plants for various uses such as firewood/medicinal use may also be associated with large construction projects of this nature. Movement of aquatic biota (e.g. invertebrates, frogs and fish) may also be temporarily disrupted by temporary barriers during construction activities. Noise and dust caused by construction activities will also affect use of adjoining habitat by various species.

Physical Destruction & Modification of Wetland Habitat – Operation Phase

During the operational phase of the project any disturbance caused during construction is likely to promote the establishment of disturbance-tolerant species, including Invasive Alien Plants (IAPs), weeds and pioneer species within wetland habitats, and particularly within the drier peripheries (temporary wet) of wetlands or within wetlands with a drier hydroperiod. Whilst initiated during construction, the persisting impact of invasive alien plants (IAPs) and pioneer plants is generally considered a long-term operational issue. Since these species of plants 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, IAPs are widely recognised as one of the single largest impacts on biodiversity in South Africa. Encroachment by alien plants will result in the deterioration of freshwater (wetland) habitat integrity if rehabilitation and monitoring are not implemented correctly.

Depending on the planned development type and the nature of the infrastructure design, road foundations, culvert / drift crossing structures and fence footings/ foundations have the potential to reduce wetland habitat connectivity. The highest potential impact of fragmentation is that associated with wetland habitat (in particular channelised wetland habitat in which fluvial conditions exist) and fauna such as fish and invertebrates which rely on movement between successive channel reaches or upstream / downstream reaches of the wetland at varying spatial scales for feeding, breeding and habitat colonisation.

As with rivers, crossings of channelised wetland habitat may present barriers to species movement by creating low light conditions, higher velocities for species with poor swimming abilities, shallow flow depths, lengthy shallow uniform runs with no resting areas, or impassable height barriers for aquatic species. In all valley bottom and floodplain wetland HGM settings culverts are prone to blockages by river substrate and debris and may cause temporary barriers to species movement in this respect. If installed above the natural channel bed level, culverts can also impose height barriers to smaller instream fauna with poor jumping, swimming and crawling abilities.

The degree to which instream structures will impact on the movement of aquatic fauna depends on the wetland HGM form, nature of the planned infrastructure and local aquatic faunal populations. For example, the use of small closed pipe culverts across larger valley bottom and floodplain wetlands will likely inhibit the movement of some fish and invertebrate species. Conversely, the use of smaller closed pipe culverts within other wetland HGM forms or smaller wetlands is unlikely to have any fragmentation impact as these systems may not be associated with perennial flow and thus long-term aquatic faunal populations.

Flow Modification & Erosion/ Sedimentation Impacts – Construction Phase

This impact category refers to the short term / temporary modification in local hydrological regimes as a result of construction activities occurring within a river channel, including coffer dams, diversions and dewatering activities. These activities will alter the volume, timing and pattern of flows within the immediate river reach and downstream, ultimately effecting the rate of erosion and/or the distribution of sediment.

During construction, flow related, erosion and sedimentation impacts are likely to occur as a result of the following activities:

- Flow diversion
- Dewatering
- Working within wetlands
- Working within close proximity to wetlands

Direct flow modification impacts likely to take place could potentially include:

- Coffer dams and/or temporary diversions can result in a reduction in flows downstream if environmental flows are not catered for, thus affecting the saturation of downstream reaches of the wetland / wetland channel by denying water inflows to downstream reaches. This impact particularly applies to channelled wetland systems in which water inflows are predominantly derived from the upstream channel.
- Inundation or back-flooding upstream of cofferdams altering the natural hydrology of the upstream reach of the wetland by flooding reaches of the wetland that are not naturally inundated.

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

- Disturbed and exposed soils will be susceptible to erosion and entrainment in flows, resulting in an increase in water column turbidity and increased rates of sedimentation within downstream reaches of the wetland.
- Dewatering of coffer dams and temporary diversion of flows around instream work areas (usually required to ensure a 'dry working area') can focus flows downstream, thus altering the rate and distribution of flows and resulting in potential bed and bank scouring/erosion, especially in channelled wetland settings. The concentration of flows could lead to headcut initiation, especially where soils and overlying vegetation have been disturbed and removed by construction activities.

Flow related erosion (i.e. scouring) and/or sedimentation and turbidity impacts will be more pronounced during rainfall events and higher rainfall periods of the year and are directly linked with flow volumes and velocities. The complete clearing of vegetation within the construction servitude within dynamic flow environments (especially within channelled wetland settings) during construction is likely to result in the transportation of significant volumes of silt into the downstream reaches of the wetland. This is likely to exert significant wetland habitat and associated key ecological consequences associated with the sedimentation of freshwater habitat and increased water turbidity, which include:

Partial to complete burial of wetland vegetation due to sediment deposition;

- Reductions in soil saturation rates of areas buried with sediment and/or eroded,
- Colonisation by alien invasive, weedy or pioneer terrestrial plant species associated with recent erosional and depositional features.
- The creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic (wetland) biota;
- Reduced density and diversity in invertebrate and other wetland biota communities as a result of reduced water quality (suspended solids impacting intolerant taxa).

Given the need for construction works within a river channel, flow and associated erosion and sediment regime impacts will be largely unavoidable but short-term in nature and can be managed though the correct timing of construction and the implementation of key mitigation measures. Overall flow modification and sedimentation impacts will cause localised modifications to riverine habitat although this will unlikely result in a reduction of the current health (PES) and ecological importance and sensitivity (EIS) of these habitats.

Flow Modification & Erosion/ Sedimentation Impacts – Operational Phase

The primary impacts referred to in this section are associated with border control infrastructure that may permanently alter natural drainage patterns within the wetland that will result in a significant impact on wetland habitat integrity. Crossing structures and the foundation of the road and other infrastructure components can alter the distribution of water within wetlands (which is particularly important from a habitat integrity and wetland functionality perspective), and in channelised wetland settings can alter the volume, timing and pattern of flows within the immediate channel reach and downstream, ultimately affecting the rate of erosion and/or the distribution of sediment. Key flow and water distribution pattern modifications during the operational phase of the border control infrastructure project may include:

- The foundations of the road, and the body of the road which would typically be raised above the ground level within the wetland, can effectively act as an impounding feature in the wetland by preventing water flows from passing downstream of the of the structure. This is particularly significant in crossings where the road is aligned perpendicular to the direction of flows within the wetland.

Should accommodation not be made in the design for flows to underpass the road then the hydrology of both the upstream and downstream sections of the wetland would be altered.

- Should insufficient numbers of culverts, or culverts of too small a size be included in the road design, the part of the reach immediately upstream of the road would become increasingly saturated with resultant changes in wetland vegetation that are associated with increased inundation and pooling. However more significantly the downstream reach of the wetland is deprived of water inputs and alteration of wetland vegetative composition typically results with die off of wetland hydrophytes that are often replaced with terrestrial pioneer species that colonise the wetland. This has a resultant adverse effect on wetland habitat quality and the biotic composition of the wetland.
- Culverts can result in concentrated flows that can channelise wetland flows downstream of the culvert outlet. The scouring effect of the concentrated flows coupled with a subsequent increase in flow velocities can initiate gulley erosion in the downstream reach of the wetland. Such gulley initiation and chanellisation is highly significant as the water table in the surrounding wetland is lowered and the eroded material causes excess sedimentation in downstream parts of the wetland. Other effects of such vertical incision in the wetland include:
  - Headcut migration upstream and subsequent deepening of the wetland channel (if the wetland is naturally channelised), or the chanellisation of the wetland if the wetland is naturally un-channelled.
  - Relatively higher channel banks that may exceed critical height resulting in mass failure (bank erosion).
  - Addition of sediment to the water column
  - Disconnection of floodplains from active stream channels.
  - Lowering of the local water table and subsequent desiccation of adjacent areas.
  - Drainage of shallow aquifers which affects riparian and wetland vegetation
- This chanellisation of flows is particularly significant in wetlands naturally characterised by diffuse flows. This process of chanellisation typically lowers the water table in adjacent parts of the downstream reach, thus altering wetland habitat quality in the manner detailed above.
- The impounding effect of a road may alter the sediment balance within a wetland. Should the road design not allow for sediment to be delivered into the downstream section of the wetland gulley erosion may result in this section of the wetland in order to restore the sediment balance within the downstream reaches of the wetland.
- Installation of culverts above or below the natural ground level within the wetland may cause an increase or decrease in flow velocities at crossing points, especially in channelled wetland settings. This may result in sedimentation upstream if installed above the bed level and headward erosion if installed below the bed level.
- A number of wetland HGM forms are characterised by seepage and sub-surface flows (interflow). In sloping wetland settings in particular, but also in wetland settings where the substrate is highly sandy, sub-surface foundations of structures such as roads can alter sub-surface hydrology by impounding sub-surface flows and preventing them from moving into downstream (downslope) parts of the wetland. The downstream reaches of the wetland are thus deprived of water inputs and can become desiccated, thus affecting wetland vegetation and wetland habitat quality.

It is important to note that impacts on the hydrology of a wetland are most pronounced in linear wetland systems characterised by movement of water through the system (i.e. valley bottoms, floodplains and

seep wetlands). Wetland HGM forms including pan / depression wetlands and wetland flats are less likely to be adversely affected by hydrological impacts as there is typically no flow through these systems.

A road will also intercept surface flows from the catchment of the wetland and will increase peak discharge volumes and velocities of surface run-off through impermeable surfaces. This essentially changes volume and timing of peak flows and the rate at which the wetland (channel) transmits flows within wetlands as runoff from the catchment is often discharged into the wetland. This increase in peak discharge subsequently increases the stream power within channelised wetland settings resulting in higher erosive force. Roads also alter the profile of drainage features, constrict and concentrate flows at low points (valleys) which cause increased velocity and flow erosivity, the ultimate result of which is localised scouring, erosion and channel incision.

While the impacts discussed above are all potentially possible, where planning and design recommendations are strictly followed, these impacts are easily manageable and should not result extensive scouring, channel incision and sedimentation impacts in the long-term.

Water Quality Impacts: Construction Phase

This impact refers to the alteration or deterioration in the physical, chemical and biological characteristics water that determine its fitness for a specific use, determined by substances which are either dissolved or suspended in the water (DWAF, 2001). Pollution of water resources is a human-induced impact and defined by the National Water Act No. 36 of 1998 as “the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:

a) Less fit for any beneficial purpose for which it may reasonably be expected to be used;

b) Harmful or potentially harmful –

a. to the welfare, health or safety of human beings;

b. to any aquatic or non-aquatic organisms;

c. to the resource quality; or

d. to property.”

In the context of this impact assessment, water quality refers to its fitness for maintaining water resources quality and health aquatic ecosystems.

Construction phase water quality modifications may arise from a variety of sources, these include:

- Polycyclic Aromatic Hydrocarbons (PAHs) (Fluoranthene, Pyrene, and Phenanthrene) - from petrol/ diesel leakages from vehicles or incomplete fuel combustion.
- Oils and grease - leakages from oil/grease stores and machinery/vehicles, spillages from poor handling and disposal practices.
- Heavy metals (Lead, Cadmium, Copper, Aluminium, Iron, Nickel, Zinc, Chromium and Manganese) - engine wear and fluid leakage, tire wear, break wear, vehicle component wear
- Cement - spillages from poor mixing and disposal practices.
- Sewage – leakages from and/or poor servicing of chemical toilets and/or informal use of surrounding bush by workers.
- Suspended solids – suspension of fine soil particles as a result of soil disturbance and altered flow patterns.
- Solid waste - litter or discarded construction materials.

These pollutants/contaminants may enter the aquatic environment as a result of construction activities within or near wetlands. The degree to which these pollutants will cause significant impacts depend on the type of pollutant, the likelihood of it occurring and the condition and sensitivity of the receiving aquatic ecosystem.

Reduced physico-chemical and biological water quality in receiving wetlands may negatively affect the integrity of aquatic habitats by modifying the background (current prevailing) abiotic components that structure the aquatic environment (i.e. the quality of water). Since aquatic biota (flora and fauna) are typically adapted to occur within a certain range of physico-chemical (abiotic) conditions, particularly intolerant species and those with narrow environmental ranges, the modification of physico-chemical drivers of aquatic ecosystems may cause a shift in the structure and composition of local aquatic biotic communities in the short term should a pollution event occur. These biotic populations are likely to recover following the completion of construction works through colonisation from upstream and downstream, reaches of the affected driver reach. Very sudden drastic changes in water quality, such as those associated with a major spill of fuel, oil and grease can have chronic toxic effects and lead to localised faunal fatalities. Such events are however unlikely, short-lived and should be immediately addressed though emergency clean-up actions.

The most notable water quality impacts will be that of suspended solids due to construction works within and adjacent to wetlands. These will be limited to active construction zones with wetlands and the local freshwater environmental immediately downstream. Wetlands that are characterised by surface flows or channelised flows will be the most affected by suspended solid impacts due to the presence of flow for at least part of the year. Overall constriction phase suspended solid impacts will be short-lived and watercourses will recover from these impacts in the short-term on the completions of the infrastructure.

Overall high risk water quality impacts from oils, grease and hydrocarbons are unlikely and highly probably water quality impacts associated with suspended solids will be short-lived and unlikely to result in the long-term deterioration in aquatic ecosystem integrity.

Water Quality Impacts: Operational Phase

Operation phase contaminants/pollutant may include:

- Suspended solids (turbidity) – from road run-off from unpaved surfaces containing high concentrations of fine suspended solids or from channel bed and bank erosion at road and fence crossings.
- Heavy metals (Lead, Cadmium, Copper, Aluminium, Iron, Nickel, Zinc, Chromium and Manganese) - engine wear and fluid leakage, tire wear, break wear, vehicle component wear
- Polycyclic Aromatic Hydrocarbons (PAHs) (Fluoranthene, Pyrene, and Phenanthrene), oils and grease - from petrol/ diesel leakages from vehicles or incomplete fuel combustion.
- Solid waste- from littering associated with vehicle drivers.

Based on the type of roads planned (gravel roads), suspended solid impacts are likely to be the most prominent impact to adjacent watercourses during road operation as sediment is transported via surface run-off during rainfall events into watercourses. This will result in high peaks in suspended solid concentrations which will stabilise following storm events. The proper design of road stormwater systems will also aid in the management of this impact.

Operation phase suspended solid impacts are likely to be of low to moderate intensity for a project of this nature and are unlikely to have a negative biotic response within the receiving river habitat.

While low usage unpaved roads are typically associated with low pollution risks, some heavy metals, PAHs and solid waste will accumulate on the road surface and be flushed into adjacent wetlands after rainfall events albeit to a very low level. Operation phase water quality impacts of this nature therefore

likely to be of very low intensity for a project of this nature and are unlikely to have a negative biotic response within the receiving river habitat. Fence and barrier structures will have a negligible impact of water quality within watercourses.

Collectively, operation phase water quality impacts will be of low intensity, limited to rainfall events with recovery of local water quality expected in affected watercourses in the short-term. Furthermore, existing pollution levels of water resources in the study are considered to be fair to good due to the

7.1.9 Recommended Measures for Mitigation of Impacts

The approach to impact mitigation undertaken in the freshwater specialist report was in line with the principles of the mitigation hierarchy and a number of steps have been recommended to ensure that impacts could be avoided or minimised as far as possible through pre-construction planning and design, sensitivity assessments, realignment recommendations and conceptual road design recommendations.

Design Phase Mitigation

Road Embankment Design Recommendations for Wetland crossings:

- Fill embankments located within the larger valley bottom wetland features should incorporate culverts to allow for the dissipation of flood water across there features during flood events.
- Ensure fill embankments are stabilised and vegetated with good grass cover
- Where possible, road batters must be designed to a minimum of a 1:3 slope in order to minimise unstable eroding slopes. Slopes steeper than 1:2 are more prone to erosion, slumping and washouts.

Road Stormwater Design Mitigation Measures

Key design considerations for the management of stormwater and erosion linked with road development have been included below:

- Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of discharge directly into watercourses / wetland and subsequent erosion.
- The location and design of road drainage and discharge points shall be done in a manner that minimises peak discharge to downstream aquatic resources by considering the following:
  - Decreasing volume of water reaching wetlands as surface flow by encouraging infiltration; and
  - Decreasing velocity of flows entering aquatic resources (either through structural or vegetative means).
- In order to reduce the volume and velocity of stormwater runoff received by watercourses, road runoff should be removed from roads via road drainage infrastructure constructed at regular intervals to avoid point source scouring at the outlets.
- Wherever possible, all outlets must be located outside of the delineated watercourses (wetlands/river).
- When designing stormwater outlets, many small outlet discharges must be favoured over a few large outlets to reduce outlet flow volumes and velocities.
- All outlets must have adequately designed erosion protection and energy dissipation measures e.g. Reno-mattresses, stone-pitching) suitable to reduce anticipated discharge velocities to levels that do not pose an erosion risk.
- Armouring of the downstream buffer zones area (e.g. reno-mattresses with vetiver bands) must be installed below all storm water outlets prior to flows entering downstream watercourses.

- Wherever possible, vegetated swales/side drains should be specified rather than concrete lined drainage channels (e.g. concrete V-drains). Vegetated swales/side drains should be well-vegetated with appropriate species and stabilized by means of gabion or concrete cut-off walls to prevent erosion and vertical incision. Similarly outlets should not be piped outlets but open vegetated channels or vegetated mitre drains.
- Water should be discharged at regular intervals along road segments on the approach to watercourses / wetlands so that the volume and velocity of flows reaching final discharge point into a watercourse is reduced as far as possible.
- Appropriate outlet structures and energy dissipater blocks are to be specified at all discharge points to break the energy of the storm water.
- Where possible, construct attenuation features (e.g. stilling basins) at the discharge points of the side drains to control the flows entering the water courses.

Wetland Crossing Design Considerations

- Coarse bedding material or geotextile wrapped dump rock must be used wherever the roads crosses wetland characterised by diffuse subsurface flows. Based on the nature of wetlands in the study area, this is likely most wetlands, in particular un-channelled valley bottoms.
- A series of portal (preferably) culverts must be installed across the width of any broad un-channelled valley bottom wetlands so as to maintain diffuse surface flows to downstream wetland areas.
- For large floodplains and channelled valley bottom wetland systems characterised by intermittent or infrequent overtopping of its banks, design must include secondary culverts on the floodplain or flood bench features outside the main channel to facilitate flooding across the full width of the valley floor.
- Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that headcut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert;
- In some instances it may be appropriate to construct a drop inlet structure on the upstream side of the culvert with overflow walls raised slightly above the natural ground level. This will encourage the development of an area that will remove sediment from the water as well as lead to the establishment wetland habitat that will enhance water quality.
- Under no circumstance should a river or wetland be impounded / dammed in such a manner as to totally restrict the flow and cause flooding/inundation upstream of the road embankment. This includes the impoundment of sub-surface flows (interflow).
- Where existing roads are utilised as the border patrol road, an assessment of whether sufficient numbers of existing culverts are located across the extent of the wetland as crossed by the road must be made. If insufficient numbers of existing culverts are located within the existing road structure to allow flows across the width of the wetland to be maintained, additional culverts must be included in the design of the upgraded road.

Site-specific Measures

A number of construction measures are specified for specific wetlands along the Phase 1 alignment:

Lake kuZilonde

- It is recommended that the boardwalk structure not only traverse the lake, but should traverse the wetlands to the east of the lake, in particular the swamp forest wetland which is highly sensitive. No fences apart from the international (elephant border fence) should traverse the swamp forest as cattle and other livestock are unlikely to be able to move through this area of swamp forest that is likely to be

permanently inundated. Inner and servitude fences can however be erected in the 'dry' non-wetland section of the border line between 26°51'40.40"S 32°52'20.35"E (KM2.08) and 26°51'39.56"S 32°52'24.41"E (KM1.89).

- For the construction of the boardwalk and elephant fence across the lake, swamp forest and papyrus swamp which is permanently saturated, an elevated running track must be constructed between the fence and the road alignment, so that a single running track is able to be used for both the fence and the boardwalk construction. The purpose of the running track is to allow tracked construction vehicles (such as excavators) to move across the lake for construction purposes without causing damage to the lake substrate.
- The running track must not be wider than the width required for one excavator to move along it, and must be kept as narrow as possible.
- It is recommended that the running track be constructed from rip rap or similar large sized rock and boulders that will be able to be fully removed once construction is complete.
- Once construction of the boardwalk and fence is complete the running track must be fully removed, with care taken not to remove the lake substrate. No material that will prevent the free movement of fish and other aquatic fauna must be retained within the lake.
- If possible, the design of the international border fence through the open water section should allow the free movement of hippopotami (Hippopotamus amphibius) to the northern section of the lake.

Mitigation measures for Swamp Forest Wetlands

- In addition to Lake kuZilonde, there are two large swamp forest wetlands (W70A-W17/18 & W70A-W15 as named in the freshwater report) that are highly sensitive as they are in a largely natural state. It is imperative that the footprint of the infrastructure be kept as narrow as possible through these two wetlands.
- It is strongly recommended that the border barrier structure through these wetlands be constructed along the existing road and that the elephant fence be incorporated into the barrier at through these wetlands. The (new) border patrol road should be developed in immediate proximity to the barrier with the inner fence being placed immediately adjacent to the south side of the patrol road.
- It is recommended that the existing culverts along the existing patrol road be lengthened to accommodate through flows under the road. Additional pipe culverts should be placed under the road in line with the spacings in the barrier to allow diffuse (surface and subsurface) flows to underpass the infrastructure.
- It is strongly recommended that no servitude fence be developed through these two wetlands as this would result in the impacting of swamp forest habitat away from the road where no impact currently exists.
- In wetland unit W70A-W15 these measures must be implemented between 26°51'47.73"S 32°46'55.47"E (KM11.225) and 26°51'48.29"S 32°47'6.54"E (KM10.9).
- In wetland unit W70A-W17/18 these measures must be implemented between 26°51'49.18"S 32°45'55.88"E (KM12.875) and 26°51'47.64"S 32°46'9.73"E (KM12.485)

Compilation of Method Statements for Wetlands

As part of the finalisation of the Environmental Management Programme (EMPr), detailed method statements must be compiled for all construction activities confirmed to occur within wetlands crossed by the Phase 1 alignment. The following methods statements have been developed in this regard by the Freshwater Specialist Team and are to be incorporated by the EAP and engineer for the project:

- Method statement for road construction across watercourses / wetlands.
- Method statement for temporary cofferdams and flow diversions.
- Method statement for rehabilitation of disturbed watercourses / wetlands.

Construction Phase Mitigation

Site Establishment and Access Control - General Recommendations and Wetland Demarcation

- The construction/work servitude must accommodate all construction related activities, including materials storage, soil stockpiles, access routes etc.
- Where possible, access must be confined to the existing road infrastructure and disturbed areas.
- Vegetation clearing/stripping within the construction footprint must only be done as the construction front progresses.
- The extent of disturbance must be limited to the extent of the construction footprint. No areas outside the construction footprint may be cleared.
- For construction of the 5.5m Gravel Road, fence and border barrier structure, a maximum construction servitude of 10m is recommended.
- For construction of the wooden boardwalk, a maximum construction servitude of 5m is recommended.
- At wetland crossings, the outer edge of the construction servitude/working area/corridor as defined above must be clearly demarcated for the entire construction phase using plastic orange bonnox/other hazard fencing. All areas outside of this demarcated corridor must be considered 'No-Go' areas.
- Under no circumstances must any wetland outside of the permitted construction footprint be impacted by temporary access roads. In this regard, all temporary access routes located outside of the construction servitude must be existing accesses.
- Wetlands outside of the demarcated construction area (i.e. downstream of the infrastructure upgrade) are strictly 'No Go' areas. These areas should not be accessed by machinery or workers for any reason. This includes and water resources originally rated as of low to very low risk during the desktop mapping and risk screening.
- All demarcation work must be signed off by the ECO before any work commences.
- Any contractors found working inside the 'No-Go' areas (areas outside the working servitude) should be fined as per fining schedule/system setup for the project.
- Wetland areas outside of the construction servitude that are disturbed during the construction phase must be rehabilitated immediately (as per the recommendations of the Freshwater Report). All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO as per the relevant re-vegetation/re-planting plan.
- Where channels within valley bottom wetlands have been disturbed, the channels should be re-graded, stabilised using erosion control measures and re-vegetated as per the recommendations contained in the freshwater report.

Specific Measures for Working within or near Rivers and Wetlands

- Any direct modification of wetland and river channels for the installation of culverts and road drainage must be limited to the construction servitude.
- Before any work commences, sediment control/silt capture measures (e.g. bidim/silt curtains) must be installed downstream/downslope of the active working areas. Quantities of silt fences/curtains shall be decided on site with the engineer, contractor and ECO. The ECO should be present during the location and installation of the silt curtains.

- Silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. When de-silting takes place silt must not be returned to the wetland / watercourse.
- Temporary stormwater control measures must be implemented within the construction servitude, especially where sloping ground is encountered in close proximity to wetlands. This includes the use of stormwater retardation measures such as low earth bunds / sand bags to manage and prevent the un-controlled ingress of stormwater surface flows into wetlands.
- Any topsoil removed from watercourses must be stockpiled separately from subsoil material and be stored appropriately for use in rehabilitation activities.
- Indigenous wetland and riparian vegetation removed from the road footprint and suitable for rehabilitation activities must be carefully removed and stored in an appropriate facility for rehabilitation purposes.
- Movement of construction vehicles across wetlands must be minimised as much as possible.
- Excavated sediments from the construction zone, including any foreign materials, should not be placed within the delineated wetlands in order to reduce the possibility of material being washed downstream.
- No physical damage should be done to any aspects of the channel and banks of any wetland channel other than those necessary to complete the works as specified. Channel bed and bank materials are not to be removed from the watercourse or used for construction purposes.
- Prior to the stripping, infilling, excavation and re-shaping of the wetland habitat within the development footprint/corridor, a search and rescue of indigenous flora and fauna must be undertaken.
- Thereafter, any topsoil and vegetation from areas to be excavated should be stripped and stored at the designated soil stockpile area outside of the aquatic zone for use later in rehabilitation.
- Soil and other material required for construction purposes must not be derived from any river or wetland.
- Any indigenous vegetation suitable for rehabilitation should be stored appropriately for later use.
- Where possible, vegetation should be cut to ground level rather than removing completely so as to assist with binding/stabilising the soil during land-clearing operations.
- The ECO will need to mark any indigenous wetland and trees (within swamp forests) or sensitive plant species adjacent to the construction servitude that are not to be damaged during construction.
- No persons may remove, damage, deface, paint or disturb of any flora (plants) outside of the demarcated construction areas, unless specifically authorised by the ECO in consultation with the resident engineer.
- All cleared and trimmed vegetation shall be removed from the wetland upon completion of clearing in order to prevent the risk of flooding/snagging
- Heavy machinery will be likely to need to work in saturated or inundated situations in a number of the larger wetlands along the route. Such machinery (e.g. excavators) could potentially cause a lot of damage to saturated soils (wetland substrate) if they were to move directly on these soils, by both compacting the soils and churning. For wetlands that are saturated at the time of construction it is recommended that a form of running track be constructed into the wetland to allow such heavy machinery to move and work within the construction footprint without exerting excess impacts on wetland soils and vegetation. Running tracks can be constructed from materials such as bogmats or crushed stones to form a raised track above the ground level of the wetland. It is important that the material utilised to create the running track be fully removed from the wetland at the conclusion of construction at each site (wetland).

Alien Plant Control

- All alien invasive vegetation that has colonised the construction site must be removed, preferably by uprooting. The contactor should consult the ECO regarding the method of removal.
- All bare surfaces across the construction site must be checked for alien invasive plants at the end of every month and alien pants removed by hand pulling/uprooting and adequately disposed.
- Herbicides should be utilised where hand pulling/uprooting is not possible. Only herbicides which have been certified safe for use in freshwater habitats by independent testing authority to be used. The ECO must be consulted in this regard.

Flow Modification & Erosion/ Sedimentation Impacts

- It is recommended that construction across wetlands take place preferably during the dry/winter months where possible to reduce risk of erosion and sedimentation associated with summer rainfall in the region. Such timing in seasonal and ephemeral wetlands (especially in channelled settings) will greatly reduce suspended solid and erosions and sedimentation impacts and will allow for easier isolation works (coffer dams and diversion where required) and less risk of compromising the construction process due to unplanned high water levels and flooding.
- For the Phase 1 project no water is to be abstracted from wetlands for use in construction activities and all water must be obtained from municipal sources.

Soil Management (Stockpile areas)

- No soil stockpile areas must be located within 50m of any wetland.
- All stockpile areas must be established well within the construction servitude. The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared.
- Erosion/sediment control measures such as silt fences, concrete blocks and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles.
- Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled topsoil must be kept moist and this can be achieved through irrigation of topsoil stockpiles on a weekly basis.
- If soil stockpiles are to be kept for more than 3 months they must be hydro-seeded.
- The slope and height of stockpiles must be limited to 2m and are not be sloped more than 1:2 to avoid collapse.
- Spoil material must be hauled to a designated spoil site or landfill site. No spoil material must be pushed down slope or discarded on site.

Flow and Erosion/Sedimentation Control Measures

Stormwater and erosion control measures must be implemented during the construction phase to ensure that erosion and sedimentation impacts to the water resources are minimised or possibly avoided. In this regard, the following measures should be implemented:

- Vegetation/soil clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- Construction activities should be scheduled to minimise the duration of exposure bare soils on site.

- Run-off generated from cleared and disturbed areas/slopes that drains into watercourses must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment.
- Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope. Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage.
- Berms, sandbags and/or silt fences employed must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation.
- Any flow diversions are to be done so in such a manner that water does not result in concentrated flow downslope that could initiate soil erosion.
- Ensure that any trenches or excavations are closed and compacted immediately after construction is completed.
- During construction, the contractor must check the site for erosion damage after every rainfall event, and rehabilitate this damage immediately.

Management of Construction Material and Building Rubble

- No building material, soils or rubble is to be disposed of within any wetland.
- Rubble generated from demolishing of existing infrastructure must be loaded onto a dump truck as soon as it is generated. A dump truck must be on standby while culverts are being demolished for example.
- Once loaded onto the truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe disposal.
- Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area – which must be approved by the ECO and located outside of sensitive wetland/river areas designated as ‘No-Go’ areas.

Prevention of Water Quality Impacts

- Hazardous storage and refuelling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. The bund wall should be high enough to contain at least 110% of any stored volume. The surface of the bunded area should be sloped to the centre so that spillage may be collected and satisfactorily disposed of.
- The proper storage and handling of hazardous substances (e.g. Fuel, oil, cement, bitumen, paint, etc.) needs to be administered. Storage containers must be regularly inspected so as to prevent leaks.
- 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.
- Drip trays should be utilised at all dispensing areas.
- No refuelling, servicing or chemical storage should occur within 50m of the delineated aquatic habitat or within the 100-year flood line, whichever is applicable.
- No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site.

- Vehicle maintenance should not take place on site unless a specific bunded area is constructed for such a purpose.
- Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage.
- All equipment to be used within the sensitive working areas (within the channel) must be checked daily for oil and diesel leaks before gaining access to these working areas.
- An emergency spill response procedure must be formulated and staff are to be trained in spill response. All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site.
- 44-gallon drums must be kept on site to collect contaminated soil. These should be disposed of at a registered hazardous waste site.
- Fire prevention facilities must be present at all hazardous storage facilities.
- Sanitation - portable toilets (1 toilet per 10 users) to be provided where construction is occurring. Workers need to be encouraged to use these facilities and not the natural environment. Toilets must not be located within the 1:100yr flood line of a watercourse / wetland or closer than 50m or from any natural water bodies including rivers, streams and riparian areas. Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor. Toilet facilities must be serviced weekly and in a responsible manner by a registered waste contractor to prevent pollution and improper hygiene conditions.
- Contaminated water containing fuel, oil or other hazardous substances must never be released into the environment. It must be disposed of at a registered hazardous landfill site.

Operational Phase Mitigation Measures

Alien Plant Monitoring and Control

It is the responsibility of the developer/applicant to eradicate and control alien invasive plants that invade all areas disturbed by the construction and operation of the proposed road. In terms of section 75 of NEMBA, the following applies to the control & eradication of invasive species:

- The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs;
- 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; and
- The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.
- It is recommended that bi-annual annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.

Maintenance of Infrastructure

- Blocked or obstructed fences crossing channels must be inspected and cleared of sediment and debris on a regular basis.

- Erosion headcuts, eroding river banks and scouring downstream for fence foundations in wetlands (where applicable) must be stabilised immediately to avoid damage to the wetland and to infrastructure. Eroding and/or unstable road batters must also be stabilised and rehabilitated for the same reasons
- Major structural maintenance of infrastructure (i.e. replacement or major repairs) within wetlands must take into account the construction phase mitigations measures above.
- Regular monitoring and clearing of sediment laden roadside drains is recommended to avoid excessive accumulation of sediment in drains which will eventually render them useless.
- Unless absolutely necessary (under special circumstances), patrol vehicles of any type must remain on roads and are not to create unauthorised tracks or roads. These informal roads and tracks cause unnecessary disturbance, adversely affect surface hydrology by creating ruts that can act as paths of preferential flow (thus affecting diffuse flow settings) and induce erosion where the groundcover has been disturbed. This is particularly important in depression and other un-channelled valley bottom wetland types where the wetland is characterised by moist grassland which is particularly susceptible to this type of impact.
- Quad patrols must make use of the same tracks and not create a series of tracks. Similar impacts to those detailed in the point above are applicable.

Maintenance of the border 'Detection Zone'

- Grass Mowing: Grass mowing particularly on gentle to flat areas has been identified as a preferred method to keep grass short and maintaining a clear Detection Zone. In this regard, it is recommended that tall grass be mowed biannually. The first cut can be made prior to the start of the wet season (August – September) and the second cut towards the end of the wet season (February - March).
- Veld Burning: In areas where mowing is not feasible, veld burning may be a viable alternative used to maintain visibility within the Detection Zone. This requires a cool burn (downwind fire) that will proceed through the grassland as quickly as possible so as to cause the least damage to herbaceous plants. Ideally grass must be burnt only in winter (May - June) when temperatures are low. Use of fire requires a firebreak system to ensure effective management of controlled burns.

Implementation & Monitoring Recommendations

Monitoring of wetlands crossed by the infrastructure is particularly important during the first few years post construction. Thereafter the need for longer-term monitoring should be re-evaluated on a site by site basis by the ECO and/or authorities.

Monitoring Objectives - Pre-construction monitoring

ECO or wetland specialist to take fixed point photos of sensitive watercourse crossing and associated attributes for the purposes of monitoring during the construction phase of the project.

Monitoring Objectives - Construction monitoring:

Key monitoring objectives during the construction-phase include:

- Ensuring that management and mitigation measure are adequately implemented to limit the potential impact on aquatic resources.
- Ensuring that disturbed areas have been adequately stabilised and rehabilitated to minimise residual impacts to affected resources.

Operational monitoring:

Key monitoring objectives during the operation-phase include:

- Ensuring that road maintenance activities reduce anticipated potential impacts to water resources.
- To minimise the risk to sensitive ecosystems identified to ensure that impacts are appropriately rectified through maintenance and rehabilitation activities.

Construction phase monitoring requirements

Prior to construction commencing, the ECO or wetland specialist to take fixed point photos of wetland crossings and associated attributes for the purposes of monitoring during the construction phase of the project.

During construction, the ECO and contractors must perform routine checks to ensure that mitigation measures proposed in the Freshwater Specialist Report are successfully implemented and maintained. Key ecological concerns during the construction phase requiring monitoring include.

- Unstable, eroding or slumping soil profiles.
- Scouring and/or any form of erosion affecting the bed and banks of watercourses (including the lowering of a stream bed or wetland profile).
- Sedimentation of aquatic resources.
- Erosion upslope of watercourses.
- Unauthorised alteration or modification of any component of watercourses including hydrology, geomorphology and vegetation.
- Pollution of water resources (with particular focus on turbidity and hazardous substances).

These risks can be monitored visually onsite by the ECO with relative ease and should be reported on regularly during the construction process. Any concerns noted should be prioritised for immediate action and implemented as soon as practically possible.

Directly after construction the ECO, along with the contactor, needs to perform routine checks of rehabilitation effectiveness with the initial focus on stabilising and vegetating disturbed soils. This can be achieved through basic visual inspections documenting inadequacies in the rehabilitation outcomes for remediation. Once complete it is recommended that an independent aquatic specialist is consulted to ensure the success of rehabilitation and to identify shortcomings that will need to be addressed.

Operation monitoring requirements

A part of the maintenance of the roads and fences, contractors should monitor key operational risks posed by the infrastructure. As identified in the impact assessment, flow, erosion and sedimentation impacts are the most notable threats to watercourses during operation. As such any signs of these impacts must be monitoring by maintenance and patrol staff and where necessary addresses timeously. This can also be achieved through basic visual inspections documenting issues such as:

- Headward erosion advancement.
- Channel incision upstream and/or downstream of road crossings.
- Scouring and deposition associated with road run-off points.
- Scouring around or under road infrastructure at crossings (including bridge and culvert structures).
- Failure of drainage infrastructure such as culverts to maintain base levels within a water resourcing.

- Bank erosion and slumping
- Undercutting of road embankments by channels
- Sedimentation upstream of road crossings

7.1.10 Freshwater-related mitigation: Offset Recommendations

It is important to note that one of the key recommendations of the freshwater (and terrestrial ecology) study is that an offset has been recommended in order to remedy the impacts of planned infrastructure on freshwater (and terrestrial) habitats. The freshwater and terrestrial ecology reports have considered the policy context of biodiversity-related offsets in South Africa, as detailed (on a national level) by the Draft National Policy on Biodiversity Offsetting in South Africa (DEA, 2017) and (at a provincial level) by the KwaZulu-Natal Policy on Biodiversity Offsets (EKZNW, 2013). The process of determining offsets and the recommendations of the biodiversity and freshwater studies in this regard are detailed in Section 7.2.5 below.

It is important to note that the need and desirability for such an offsetting process will need to be assessed and specified as necessary or unnecessary by the relevant determining authority (DEA), in consultation with the relevant provincial authorities (EKZNW in KZN). Should offsets be deemed to be required as part of an environmental authorisation for the project, the nature and implementation of such offsets would need to be determined through consultation between the applicant, DEA and the commenting authorities, taking into account the economic and ecological benefits to biodiversity that will be provided by the project, as detailed in Section 7.2.5. Any offset recommendations specified as such by DEA must be adhered to in the development of the project.

7.2 Biodiversity Assessment

7.2.1 Regional and Local Biophysical Setting

Spatial Distribution of Biomes, Bioregions and Vegetation Types in the Study Area

The proposed development Phase 1 development infrastructure traverses three biomes – the Indian Ocean Coastal Belt (in the eastern part of the alignment), Savannah (west of the Tembe eastern boundary) and small land parcels that fall within the forest biome (Mucina and Rutherford, 2006).

At a bioregional scale, the Phase1 study area falls within the following bioregions: Seashore Vegetation, Indian Ocean Coastal Belt (located in the eastern half of the alignment), Lowveld (located in the far western part of the alignment) and Zonal & Intrazonal Forests (Mucina and Rutherford, 2006). At the regional vegetation type scale, the study area comprises nine different terrestrial vegetation types (Scott-Shaw and Escott, 2011; Mucina & Rutherford, 2006). Further detail on each vegetation type is provided in Table 7-3 below. A map of the terrestrial vegetation types is indicated in Figure 5-4 in section 5.5.

Table 7-3: Summary of Wetland HGM units found in the Study Area

Vegetation Type	National Threat Type	Provincial Threat Type	Description	Location	Total Area (Ha)	Condition Assessment
Subtropical Seashore Vegetation (AZd 4)	LT	LT	Open grassy herbaceous and to some extent also dwarf-shrubby, often dominated by a single pioneer species.	KM 0.12-0.15	0.2	Largely Intact – 100%
KwaZulu-Natal Dune Forest: Maputaland Dune Forest (FOz 7)	LT	EN	Species-rich, tall/medium-height subtropical coastal forests occur on coastal (rolling) plains and stabilised coastal dunes.	KM 0.15-1	3.8	Largely Intact – 100%
KwaZulu- Natal Coastal Forests: Maputaland Moist Coastal Lowlands Forest (FOz7)	LT	EN	Species-rich, tall/medium-height subtropical coastal forests occur on coastal plains and stabilised coastal dunes. Forests of the coastal plains are dominated by *Drypetes natalensis, Englerophytum natalense, Albizia adianthifolia, Diospyros inhacaensis* etc. On dunes, these forest have well-developed tree, shrub and herb layers.	KM2.6-2.8	1.2	Largely Intact: 1.85% Slightly modified: 98.15%
Maputaland Coastal Belt	VU	EN	Characterised by primary and secondary grasslands comprising dry grasslands,	KM 1 – 2.3 and 3.5 – 19.3	94.2	Slightly Modified: 53.65 Moderately Modified:

Vegetation Type	National Threat Type	Provincial Threat Type	Description	Location	Total Area (Ha)	Condition Assessment
(CB 1)			hygrophilous grasslands and thickets. This vegetation type is moderately protected in KwaZulu-Natal.			15.70% Seriously Modified / Secondary: 21.43% Transformed: 9.21%
Maputaland Wooded Grassland (CB 2)	VU	EN	Characterised by a mix of grasses, geoxylic suffrutices, dwarf shrubs, small trees and very rich herbaceous flora.	KM 11.5 – 16.9	21.7	Slightly Modified: 59.16% Moderately Modified: 40.84%
Muzi Palm Veld and Wooded Grassland	VU	LT	Characterised by two broad plant communities in a patchwork pattern namely (i) *Hyphaene coriacea* dominated seasonally wet Palm Veld lacking in shrubs and herbs (ii) wooded grassland several to many meters above the water table (in average rainfall years) rich in shrubs, dwarf shrubs, geoxylic suffrutices and herbs.	KM 19.3 – 24.6	31.6	Slightly Modified: 81.28% Transformed: 18.72%
Maputaland Pallid Sandy Bushveld (SVI 25)	LT	LT	An open to closed evergreen woodland with canopy 5 – 10m tall and bushlands	KM 24.6 - 32	39.8	Slightly Modified: 82.83% Moderately Modified: 5.75% Largely Modified: 3.66% Seriously Modified / Secondary: 7.76%

Vegetation Type	National Threat Type	Provincial Threat Type	Description	Location	Total Area (Ha)	Condition Assessment
Tembe Sand Bushveld (SVI 17)	LT	LT	Characterised by open to closed woodland with canopy dominated by leguminous woody species and *Terminalia sericea,* with species-rich shrub layer and grassy undergrowth.	KM 32 – KM 56	153.9	Largely Intact: 30% Moderately Modified: 28% Largely Modified: 2% Seriously Modified / Secondary: 28% Transformed: 12%
Licuati Sand Forests: Eastern Sand Forest (FOz8)	LT	LT	Characterised by dense thickets short to tall forests with a canopy reaching 15m, with well-developed shrub layer and very poorly developed ground layer.	KM 33; 36.8 – 39.6 & 47.6 – 49	15.2	Largely Intact: 54% Secondary: 43%

Vegetation Type (Ecosystem) Threat Status

The threat status of the identified vegetation types fall into one of the following categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT) – refer to Table 7-3 above. Figure 7-7 below presents a summary of the threat status of vegetation types within the KwaZulu-Natal (KZN). The percentages are based on the area of vegetation communities within the 50m study corridor within the province. The results show that 8% of KZN vegetation types are CR, 22% are EN, 14% are VU and 56% are LT. It is important to note that no vegetation types along the Phase 1 alignment have been assigned to the CR class, with three vegetation types being assigned an EN rating.

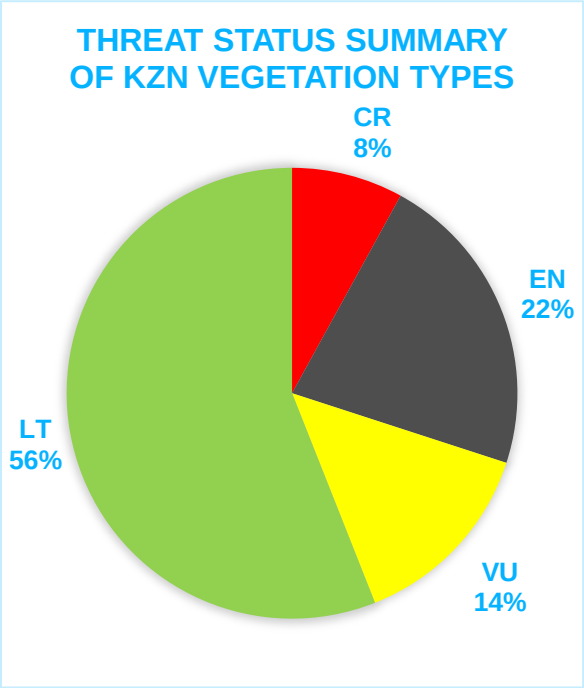

Figure 7-7: Summary of threat statuses of vegetation types found within the study area and within the KZN (Note this encompasses the Phase 1 and parts of Phase 2 alignment found within KZN)

KZN Systematic Conservation Assessments (SCAs)

The Systematic Conservation Assessments (SCAs) is a strategic conservation plan developed in 2016 by the Provincial Conservation Authority, eZemvelo KZN Wildlife (EKZNW), to ensure that representative samples of biodiversity are conserved. It is used as a land use decision support tool in KwaZulu-Natal and replaced the 2010 Terrestrial Systematic Conservation Plan (MINSET). The SCAs are derived from merging the Provincial Terrestrial Systematic Conservation Plan with other conservation datasets.

In terms of terrestrial conservation three conservation categories were developed including

(i) CBA: Irreplaceable,

(ii) CBA: Optimal, and

(iii) Ecological Support Area (ESA).

These conservation categories are described in Table 7-4 below. The outputs of the KZN SCA were used to inform the sensitivity analysis conducted in the biodiversity study. Protected Areas and CBA: Irreplaceable units were treated as being the most sensitive, followed by CBA: Optimal, then ESA and ESA: Species specific units being the least sensitive.

Table 7-4: Summary of Wetland HGM units found in the Study Area

Conservation Category	Description
Critical Biodiversity Area: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Area: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible.
Ecological Support Area	ESA are functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs.

The location of CBAs and ESAs along the Phase 1 alignment is indicated in Figure 5-6 and the location of CBAs respective to the Phase 1 alignment is discussed in Section 5.6.2.

Desktop Sensitivity Assessment

A weighted composite terrestrial sensitivity analysis was conducted as part of the biodiversity study and the results are indicated Figure 7-8 below. This highlights the importance and sensitivity of Provincial CBA's, protected areas and remaining critically endangered and endangered ecosystems. It is important to note that large parts of the Phase 1 alignment have been designated as being high or very high ecological sensitivity.

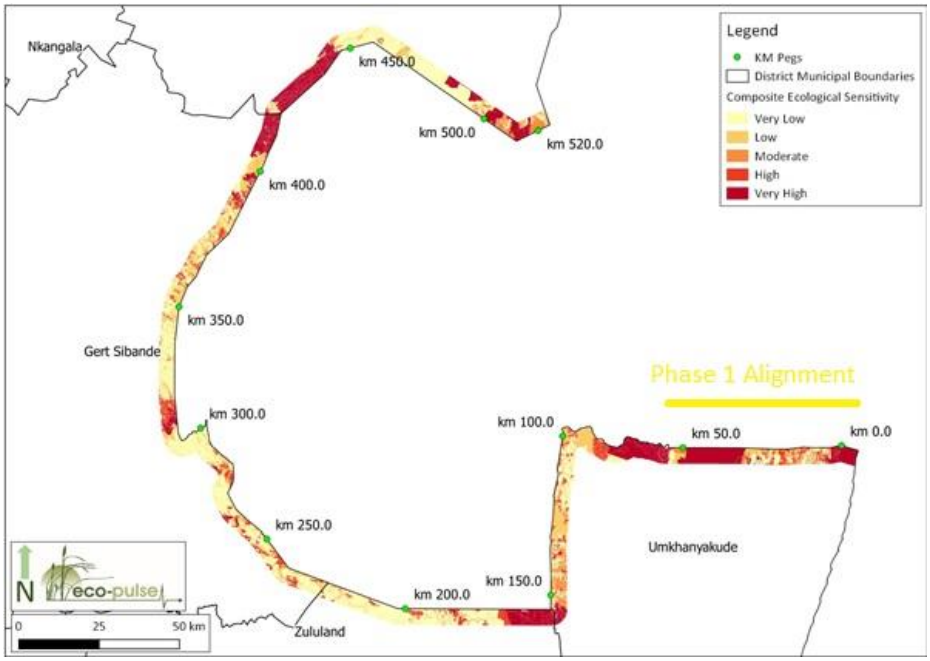

Figure 7-8: Composite Ecological Sensitivity

7.2.2 Findings of Assessment

Ecological Condition Assessment

The condition of each vegetation community was qualitatively assessed based on information collected in the field (species composition, structure, existing impacts/signs of habitat degradation, etc.). In instances where the vegetation sub-community was not visited, an estimated condition rating was assigned based on a rapid desktop review of aerial imagery and adjoining sub-communities that were visited. Note that calculations are based on the area of vegetation types within the 50m wide study area. A summary of the ecological condition assessment for the vegetation types occurring in the study area is provided in Table 7-3 above.

For KZN, 75% of the vegetation the vegetation habitat falls within the ecological condition category of 'largely intact', 'slightly modified' and 'moderately modified'. These are vegetation communities that are considered to be in generally 'good' condition. A further 16% is considered to be in poor condition and this is reflected in the ecological condition ratings of 'largely modified', 'seriously modified / secondary', whilst 9% of the areas are considered 'transformed' (i.e. under infrastructure, plantation forestry, sugarcane/crop cultivation, etc.). The comparatively low levels of degradation of the vegetation/habitat in KZN, and within much of the Phase 1 alignment is linked with

(i) the numerous protected areas where vegetation types are formally protected (including ISimangaliso WP and Tembe EP,

(ii) limited agricultural practises along the border within the coastal plain (i.e. along the Phase 1 alignment, and

(iii) limited number of human settlements along the border.

It should be noted that the findings of the vegetation impact assessment conducted on the primary dune at Kosi Bay noted that the vegetation on the primary dune, primarily Northern Coastal Forest (FOz 7) was untransformed and in a pristine state.

Potential Occurrence of Conservation Important Plant Species

A two-phased approach was undertaken in assessing the occurrence of conservation important plant species. The initial phase was to undertake a desktop flora potential occurrence (POC) assessment through the interrogation of SANBI's online threatened species database (POSA) for the quarter degree grid square (QDGS) traversed by the proposed development infrastructure.

The second step involved the undertaking of field visits to prioritised focal areas to sample vegetation, with a focus on verifying the results of the initial desktop POC assessment (i.e. confirming the presence of conservation important species flagged by the POC Assessment).

The results of the assessment indicated that no critically endangered species are likely occur within the KZN province section of the route, and thus within the Phase 1 part of the wider study area. Several threatened and protected plant species were identified within the wider study area. The removal or translocation of these species will require either Ordinary Permits or Licences in respect of protected trees and natural forests. A total of 30 threatened and protected plants were recorded at sampling points visited by the ecologists over the wider project extent (Phase 1 and 2). Of these 6 are nationally protected trees including 1 Near Threatened tree (*Elaeodendron transvaalense* – which could potentially occur in the Phase 1 study area), 4 Least Concern trees and 1 tree that has not been evaluated in terms of its threat status and 24 are provincially protected plants, 20 forbs and shrubs of Least Concern and 3 forbs of unknown threat status owing to failure to identify plants to their species level.

Table 7-5 below indicates plants of conservation importance that were likely to occur in the Phase 1 study area.

Table 7-5: Plant Species of Conservation Importance found in the Study Area

Botanical name	Common name	Plant type	Conservation status	Legislation
Afzelia quanzensis	Pod Mahogany	Tree	LC	NFA
Aloe parvibracteata		Succulent herb	LC	NNCO
Balanites maughamii subsp. maughamii	Green Thorn	Tree	Not Evaluated,	NFA
Breonadia salacina	Matumi	Tree	LC	NFA
Crinum delagoense	Candy-striped Crinum	Bulbous herb	LC	NNCO
Elaeodendron croceum	Common Saffron	Tree	Declining	
Elaeodendron transvaalense	Bushveld Saffron	Tree	NT	NFA
Ficus Trichopoda	Swamp Fig	Tree	LC	NFA
Gladiolus densiflorus		Bulbous herb	LC	NNCO
Ledebouria asperifolia	Large Ledebouria	Succulent herb	LC	NNCO
Mimusops caffra	Coast Red-milkwood	Tree	LC	NFA
Ornithogalum sp.			Unknown	NNCO
Sclerocarya birrea subsp. caffra	Marula	Tree	LC	NFA
Sideroxylon inerme subsp. inerme	White Milkwood	Tree	LC	NFA

Ecological Importance & Sensitivity of Vegetation Communities

Ecological Importance and Ecological Sensitivity (EIS) of the terrestrial vegetation communities and habitats supporting flora/fauna was qualitatively assessed as part of the biodiversity specialist study. The EIS results for the KZN segment of the wider project indicate that 64% of the vegetation communities fall within a moderate to high EIS range, of which 8% are considered to be highly important and sensitive to external disturbance, 21% are considered to be of moderately-high EIS and 35% of moderate EIS.

Of the vegetation types in the Phase 1 study area falling into these moderate to high EIS classes two forest vegetation types – KwaZulu-Natal Coastal Forests: Maputaland Moist Coastal Lowlands Forest and

KwaZulu-Natal Dune Forests: Maputaland Dune Forest – were assigned High or Moderately High EIS scores. A majority of the area covered by the Maputaland Coastal Belt and the entirety of the Maputaland Wooded Grassland have been assigned a Moderately High EIS score. The remainder of the dominant vegetation types in the area have been assigned moderate or moderately low EIS scores.

Table 7-6: EIS Scores for Vegetation Types in the Study Area

Vegetation Type	EIS Ratings					Transformed
	High	Moderately-High	Moderate	Moderately-Low	Low	
KwaZulu-Natal Coastal Forests : Maputaland Moist Coastal Lowlands Forest	2%	98%				
KwaZulu-Natal Dune Forests : Maputaland Dune Forest	100%					
Licuati Sand Forests : Eastern Sand Forest			54%		43%	3%
Licuati Sand Forests : Western Sand Forest			75%	8%	17%	
Maputaland Coastal Belt		69%		21%		9%
Maputaland Pallid Sandy Bushveld			83%	6%	11%	
Maputaland Wooded Grassland		100%				
Muzi Palm Veld and Wooded Grassland			81%			19%
Subtropical Seashore Vegetation			100%			
Tembe Sandy Bushveld			42%	28%	30%	

The relatively high importance/sensitivity for most vegetation communities encountered in KZN and within the Phase 1 alignment can be linked back to the generally good ecological condition of the majority of vegetation communities within the KZN portions of the study area (75%). A total of 9% of vegetation types were considered to be 'transformed' by agriculture/development land use and were not rated in terms of EIS as these transformed areas provide minimal ecological functioning or habitat to support key species or ecological processes.

7.2.3 Biodiversity-related Impact Identification and Description

Natural ecosystems are inherently vulnerable to human activities and these activities can often lead to irreversible damage or longer term, gradual/cumulative changes to ecosystems. Threats to terrestrial ecosystems and biodiversity include processes and activities which reduce system persistence, affect landscape structure and composition and alter community diversity and patterns, including reduced genetic diversity. One such threat to biological process could be the loss of important species due to loss or transformation of habitat. When making inferences on the potential impacts or risks that development activities place on ecosystems, it is important to understand that these impacts speak specifically to their effect on the ecological condition and/or functional importance/value of these ecosystems.

Generally, environmental impacts can be grouped into the following four (4) broad categories:

- Direct impacts: are those impacts directly linked to the project (e.g. clearing of land, destruction of vegetation and habitat).
- Indirect impacts: are those impacts resulting from the project that may occur beyond or downslope/downstream of the boundaries of the project site and/or after the project activity has ceased (e.g. migration of pollutants from development sites).
- Induced impacts: are impacts that are not directly attributable to the project, but are anticipated to occur because of the presence of project (e.g. impacts of associated developments, establishment of residential settlements with increased pressure on biodiversity).
- Cumulative impacts: are those impacts from the project combined with the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity or natural resources (e.g. a number of developments in the same catchment or ecosystem type collectively affecting or impacting the same ecosystem types or local endemic species).

For the purposes of this assessment, the potential impacts to the mapped terrestrial habitats and local terrestrial biodiversity resulting from the proposed activities have been grouped into the following four (4) impact categories:

- Physical habitat destruction and modification
- Indirect erosion, sedimentation and pollution
- Impacts on biodiversity processes: connectivity
- Ecological disturbance and nuisance

Physical habitat destruction and modification Impacts

This impact refers to the physical destruction and/or modification of terrestrial vegetation and habitat during the construction phase and residual impacts that are likely to remain during the operational phases of the project and includes direct vegetation and habitat loss as well as habitat degradation impacts (e.g. loss of species, compositional and structural changes and the impact of weeds and invasive alien plants on natural vegetation communities and habitat).

Construction Phase

The construction of the border patrol road, fence and obstacle barrier will require partial to complete clearing of the vegetation/habitat within the construction servitude, with the width of disturbance/clearing varying depending on the proposed activity:

- The construction of the border patrol road will result in the irreversible transformation of 5.5m wide construction footprint to a gravel road.
- The construction of the border fence will entail removing the existing fence (where relevant), excavations to found new fence posts and installation of a new 2.4m high elephant-proof fence will be installed.
- Furthermore, a 10m wide corridor will need to be cleared in order to serve as a 'Detection Zone' established along the entire border fence with South Africa to allow for patrols to effectively monitor the border. All woody vegetation within the proposed Detection Zone will need to be removed. The construction of the fence will therefore will result in the destruction and / or modification of a 10 – 13m wide area along the border.
- Construction of the proposed border control barrier will require excavating a 0.7m deep x 1.7m wide trench over a distance of approximately 32km.

The impacts on vegetation will be most significant in areas that are still largely natural and which contain or support important fauna and flora. Given that the total area of transformation includes already transformed areas and vegetation communities in different conditions and with variable sensitivities and risk to different anthropogenic pressures, it is important to standardise the extent of area to be transformed using the concept of "Hectare Equivalents". For the purposes of this assessment, "a hectare equivalent is a quantitative expression of the ecological condition of a terrestrial vegetation functional area under a given land use and/or a measure of terrestrial vegetation functional area" (adapted from Macfarlane et al, 2016). The area of the respective vegetation classes (per vegetation threat type) and the area of hectare equivalents that will be lost is contained within the biodiversity specialist report.

In addition to terrestrial vegetation and habitat that will be irreversibly lost within the development footprint, there are likely to be additional areas that will be temporary modified or disturbed. These are (i) areas adjoining the construction footprint but within the construction servitude (used as stockpile and work areas) or (ii) areas off-site to be used as temporary sites camps and equipment/plant laydown areas for the duration of the construction phase. Following the completion of construction, these areas will be rehabilitated and should, over time, return to their pre-development state if rehabilitation is successful. If rehabilitation is undertaken poorly, these areas may become overrun by weeds and IAPs and thus fail to return to their pre-development state resulting in the net loss of functional habitat. Areas with a high IAP seed source and propagules will be of higher risk than those without IAP seed sources.

Both the permanent loss and temporary modification of habitat during the construction phase will likely result in the loss of threatened as well as nationally/provincially protected plant species. If these species are not rescued and translocated to areas outside the construction servitude or replaced then their loss could possibly increase their risk of extinction, particularly those with a threat status of CR, EN and VU.

The Primary Dune Vegetation Impact Assessment has addressed the impact of the construction and development of an elephant fence and footpath across the primary dune located immediately west of the Indian Ocean coastline. The primary impact on the forest is the loss of biodiversity that will result from the clearing of forest vegetation along the construction servitude. The alignment of the fence as marked on site by the surveyor was noted to be completely natural forest with trees growing in the planned fence alignment and servitude. Trees will have to be cut down to facilitate the construction of the fence line. This will open gaps in the canopy of the forest allowing the salt laden sea breeze to blow into the heart of the forest desiccating the trees causing the gaps to expand. This would lead to fragmentation of the forest which would constitute an impact of high significance.

Operational Phase

Whilst no planned direct habitat destruction impacts are expected during the operational phase, poor rehabilitation efforts, poor design and construction of infrastructure as well as poor management of the operational phase will likely result in the gradual modification of onsite and adjoining terrestrial habitats. During operation, the spread of Invasive Alien Plants (IAPs) and weeds into remaining untransformed vegetation is a particular risk/concern and which can alter vegetation composition and structure by replacing and outcompeting native species.

Following construction, the potential disturbance of soil and vegetation within natural areas (and adjacent habitats) encourages the establishment of pioneer vegetation, in many cases creating an ideal opportunity and optimal conditions for weeds and Invasive Alien Plants (IAPs) to invade both disturbed and adjacent undisturbed areas. 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 chemistry and stability, promote erosion, change litter accumulation, reduce food supply for fauna and soil properties and promote of 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 naturally occurring vegetation community. Clearing and disturbance can also result in an increase in edge habitat immediately adjacent to disturbed areas. Edge habitat is characterised 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. Edge effects will be typically lower for grasslands when compared with wooded communities such as forests, in particular the sensitive northern coastal forest on the primary dune. The spread of existing alien plants within natural areas can be exacerbated if not properly managed, and new alien plant species may be introduced to natural areas as a result of human disturbance and re-vegetation using undesirable plants species that are not naturally common to the region or study area. IAPs likely to be a problem (based on their confirmed presence during focal field surveys) may include the following NEM:BA listed species: *Chromolaena odorata, Lantana camara, Tithonia diversifolia, and Ricinus communis.*

Impact 2: Indirect Erosion, Sedimentation and Pollution Impacts

This impact refers to the indirect impacts of adjacent land cover modification, transformation and working within or adjoining terrestrial habitats during both the construction and operational phases of the project. Such indirect impacts include erosion, sedimentation and environmental pollution from sources of liquid and/or solid waste.

Construction Phase

Construction activities will involve the clearing and stripping of topsoil and vegetation within the construction servitude and result in the exposure of bare areas and soil stockpiles to the elements (rain and wind). This is likely to lead to localised soil erosion and result in sedimentation of adjacent terrestrial habitat and the probable smothering of vegetation. Some of the key ecological effects related to the erosion/deposition of sediment may include:

- Habitat alteration due to increased sediment deposition or erosion of areas;
- Reductions in photosynthetic activity and primary production caused by sediments impeding light penetration;
- Reduced density and diversity of organisms as a result of habitat degradation, blanketing of sites and the establishment of more tolerant taxa or exotic species; and
- Exposure of disturbed sites to invasion by weeds and other undesirable plants

The risk of erosion of soils is particularly significant and has a high probability of occurrence along the primary dune at the Indian Ocean. The Dune Vegetation Impact Assessment has flagged this as a critical issue, due to the vert steep slope of the dune and the highly sandy nature of the soil which means that the soil is highly unconsolidated and unstable. Lots of movement of people up and down the dune slope will cause significant damage with loose soil becoming dislodged leading to a long term ripple effect whilst the dune re-establishes the angle of repose. The removal of vegetation would also leave soils vulnerable to erosion by water and wind. It is thus very important that mitigation measures be applied in both the construction and operational phases to minimise this impact.

During the construction phase, there is also the risk that soils, water and vegetation may be contaminated by pollutants. Potential contaminants and their relevant sources are listed below:

- 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
- Sewage – leakages from and/or poor servicing of chemical toilets and/or informal use of surrounding bush by workers.

Pollutants can potentially enter the surrounding environment either directly through disposal/mismanagement of waste products/pollutants or more indirectly through surface runoff during rainfall events. If the above mentioned contaminants are poorly handled or mismanaged during the construction phase, there is a risk that soils and surfaces will be contaminated. During rainfall events, such contaminants could be washed into adjacent intact terrestrial habitats. If significant concentrations of contaminants are spilled / leaked and washed into adjacent habitats, this could result in plant mortalities (when highly toxic pollutants come into contact with plants they often result in the destruction of plant parts ultimately resulting in the death of the plant) and/or increased levels of plant stress which could decrease the competitive ability of the affected plants and ultimately result in changes in plant species composition in favour of more tolerant species likely manifesting in increased abundances of ruderals, weeds and/or IAPs.

Furthermore, because these pollutants linger in the soil for extensive periods of time, they may inhibit the establishment of vegetation during rehabilitation of disturbed areas, with the planted species being outcompeted by undesirable ruderals, weeds and/or invasive alien plants and an increase the abundance of undesirable seed sources and propagules.

Operational Phase

During the operational phase of the border patrol road, stormwater generated by the compacted gravel surface of the border patrol road will be conveyed and discharged into adjoining terrestrial habitats via point source outlets. This will result in the concentration of runoff and an increase in the velocities of runoff discharged into the environment, ultimately resulting in enhanced risk of erosion and sedimentation. If the stormwater management infrastructure is poorly designed and / or poorly constructed, particularly in terms of unnecessarily concentrating runoff, erosion below the proposed outlets is likely to occur with associated downslope sedimentation impacts. Erosion risks will be most apparent on erodible slopes (steep slopes and/or erosive soils. Furthermore, the concentrated discharge of surface runoff at outlets will likely alter the natural soil moisture levels and alter species composition in favour of opportunistic and/or water loving species. If substantial erosion occurs, low-lying terrestrial areas are likely to experience sedimentation, with similar negative ecological consequences as discussed under the construction phase (see above).

Areas affected by sedimentation will be susceptible to the establishment of ruderals, weedy plants and IAPs which could alter the species composition of the vegetation community and ultimately contribute to habitat degradation outside of the development servitude.

Pollution impacts during the operational phase of the project could be associated with the use of the road by vehicles (4x4 trucks, quadbikes, etc.). Well-used roads are known to generate numerous pollutants, namely: nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether (MTBE). Such pollutants generally enter the environment via surface runoff, particularly during a first flush of rain. Acting either as a fertilizer (nitrogen), growth stimulator (carbon dioxide) or pollutant (heavy metals), vehicular emissions can influence plant stress and growth and play a significant role in transforming road verge plant populations and increasing the intensity and extent of edge effects. Given that the border patrol road will attract limited traffic volumes, low concentrations of pollutants will be generated. Therefore, the intensity of this impact is expected to be particularly low/negligible and unlikely to have a noticeable influence on terrestrial vegetation/habitat unless a major accidental fuel spill event occurs from a patrol vehicle for example.

Impact 3: Impacts on Biodiversity Processes (Connectivity) and Direct Impacts on Faunal Movement

This impact refers to the alteration of ecological processes that are important for the maintenance of terrestrial biodiversity (flora and faunal species). The emphasis of this impact is on the alteration of ecological connections during both the construction and operational phases of the project, especially the impact on fauna. One of the challenges in this regard is matching the technical requirement to prevent the movement of cloven-hoofed mammals in order to prevent the spread of infectious livestock diseases, in particular foot and mouth disease, with the ecological requirement to allow the movement of fauna within natural habitats that are bisected by the international border.

Construction Phase

The construction of the border patrol road, fence and barrier will require partial to complete clearing of the vegetation/habitat within the construction servitude, with the width of disturbance/clearing varying depending on the proposed activity. The destruction of terrestrial vegetation may result in the direct loss of small sedentary/slow-moving faunal species such as invertebrates, chameleons, hatchlings, and other young faunal species utilising the habitat. Given that a large portion of the road is an upgrade of the existing road infrastructure and that mobile faunal species are likely to relocate away from the disturbance-causing activities and thus avoid being harmed, the probability and intensity of the impact on faunal species is likely to be limited to the reduction in habitat, with direct mortalities unlikely in most cases.

Excavations for development of infrastructure could have a direct impact on subterranean species such as moles and could have a deleterious impact on ants. Nocturnal species such as hares would generally avoid disturbance through their nocturnal activities and habits

Operational Phase

Vegetation clearing and the permanent transformation of natural habitat not only reduces the availability of habitat (refugia/breeding/nesting sites) and food for local wildlife but may also temporarily or even permanently restrict corridor movement between natural areas through associated fragmentation of natural habitat and the severing of natural ecological linkages/corridors. This will be of particular significance where relatively un-impacted areas may be affected, especially for existing local wildlife movement corridors. It is important to note that with the exception of small areas along the route (refer to

section 3.3.1) an existing fence is present along the entire length of the Phase 1 alignment, which would limit faunal movement to a certain degree. The current fence is comprised of a number of horizontal barbed wire strands, but as detailed in Section 3.3.1, it has been damaged in many places by people and elephants and small antelope are likely to be able to move through the fence. In certain parts of the alignment – i.e. the section of the alignment that runs along the northern boundary of the Tembe Elephant Park, faunal movement across the international border is likely to be even more restricted, due to the presence of the outer boundary fence of the reserve and the presence of an electrified strand fence on the inside of the park boundary adjacent to its border fence.

The most important potential faunal (movement) impacts associated with fences (after Mbaiwa & Mbaiwa, 2006; and Ferguson & Hanks, 2012) are:

- impermeable fences can fragment habitat into small islands of resources, and prevent access to critical resources (such as food, water, cover, breeding grounds) or increase the energy required for wildlife to take advantage of resources;
- fences impede mobility/restrict the movement of native wildlife, particularly migratory species, as well as restricting the frequency of movements of localised populations of common species;
- fences disrupt the feeding, migration, breeding and social patterns of wild animals, can cause genetic isolation and alter behaviours that may be important to the long-term survival of the populations or species involved;
- fences can result in faunal mortalities (animals typically die from dehydration and entanglement/impalement in the fence);
- fences can result in increased incidences of poaching (animals trapped by fences become easy targets for poachers); and
- there could be a variety of additional indirect effects, such as increase in physiological stress, all impacting on species' demographics and population growth.

The ideal fence from a wildlife standpoint is one that can be seen easily and can be leapt over or scurried under without injury (Hanophy, 2009), however in the context of the project's technical requirements it may not be possible for these wildlife movements to be accommodated.

In examining the impact of the project on faunal populations it will be difficult to determine whether particular species form part of cross-border populations and what the size of cross-border populations may be without having investigated this aspect in detail. It is important to note that the impacts in this context may vary according to habitat type - the effect of fragmentation will generally be greater for fauna than for flora and is typically lower for grasslands when compared with wooded/forest communities.

The construction of an elephant fence is likely to further limit the cross border movement of elephants. The recent erection of a two-strand elephant fence along part of the Phase 1 alignment between the eastern boundary of the Tembe Elephant Park (at Muzi Camp) in the west and Gate 6 in the east has been discussed elsewhere in this report (refer to sections 3.3.1 and 3.4.1). Along with the electrified fence in the Tembe Elephant Park, movement of elephant herds and individual animals across the border is likely to accordingly be effectively prevented along the entire stretch of the Phase 1 section between the western boundary of Tembe and Gate 6. There is much evidence along certain parts of the border of elephants from within Mozambique attempting to move across the international border fence by breaking the thin wooden posts in the fence. The erection of an elephant-proof fence along the entire length of the international border will effectively prevent any movement of elephants from Mozambique into South Africa, especially in parts of the Phase 1 alignment where no elephant movement prevention measures currently exist.

The erection of an elephant fence along the entire length of the Phase 1 alignment is likely to restrict the movement of most large game / wildlife, including most antelope species that will be unable to scale the fence. Elephant proof fencing will not allow for species to jump over the border fence, as the requirement of 'game proof fence' to prevent humans and livestock/animals from crossing the border will entail hat the height will be likely to be too great for most mammals.

Mammals and other animals with the ability to burrow may be able to burrow under the fence, especially in the context of the soft, sandy substrate that exists along most parts of the Phase 1 alignment. This includes species such as Warthog (*Phacochoerus africanus*) and Bushpigs (*Potamochoerus larvatus*). Warthogs and Bushpigs may carry foot and mouth disease; These species will be able to burrow under the fence, however this will be very difficult to stop unless the fence mesh / wiring is buried at a suitable depth, which does not form part of the current design specifications.

The development would probably have a relatively minor impact on very small mammals such as rodents and shrews and other animals including reptiles which will be able to move through small gaps in the fence, twinned with sufficient adjacent habitat being retained for the overall impact to be slight.

The fragmentation of habitat is also particularly important in the context of the impact of faunal species that are arboreal or largely arboreal– relating to specifically to forest habitats with a closed canopy. This includes mammal species of monkey or bushbaby (galagos), as well as certain reptile species, in particular chameleons or certain snake species. The effect of fragmentation of forest (continuous) canopy habitat can split populations and force such species to move onto the ground, leaving them vulnerable to predation.

Faunal impacts must also consider the impact on avifauna (birds) as well as bats. The ability of bats and most bird species to fly introduces another aspect related to the potential impact on fencing on this group of animals.

Most bird injuries or mortalities from fencing are due to lack of visibility. For example, raptors in pursuit of prey and waterfowl or wading birds attempting to land on a water body, are particularly vulnerable to fence impacts (Arizona Game & Fish Department). Impacts on nocturnal or crepuscular bird species may be more pronounced, as the fence strands would be less visible in low light conditions. Electrically charged fences (hot wires) also have the potential to electrocute animals such as small birds landing on the wires. Fencing that crosses watercourses may also dramatically reduce usability for bats, which typically drink on-the-fly and the presence of an obstacle may eliminate accessibility, present a hazard, or increase the energy expenditure for obtaining water (Arizona Game & Fish Department).

The Dune Vegetation Impact Assessment has identified that the development of a fence would exert a significant localised impact on the fauna that inhabits the dune causing long-term negative effects on the forest health due the fragmentation of the forest. Natural corridors of movement for some mammals will be cut off and will make lateral movement impossible.

A number of mitigation measures have been recommended to avoid or minimise the potential impacts detailed above (refer to section 7.2.4).

Impact 4: Ecological disturbance and nuisance impacts

This refers to the alteration of the ambient environment by nuisance factors such as dust, noise, vibrations, etc. produced by people, machinery and vehicles during the construction and operational phases of the project.

Construction Phase

The construction of the proposed infrastructure will require use of heavy machinery to excavate and move/place construction materials. Such activities are known to generate substantial amounts of dust,

noise and vibrations. Local wildlife (fauna) generally responds to disturbances caused by human activities according to the magnitude, timing, and duration of the particular disturbance. Human activities can affect an animal's ability to feed, rest, and breed if it is unable to habituate to the disturbance caused. Anthropogenic activities occurring within a close proximity to natural habitats containing fauna (wildlife) can lead to both the physical disturbance of habitats supporting animal life by construction machinery/labourers (already discussed above) as well as the disturbance of fauna due to noise and artificial light pollution at the site during construction. Locally common species are likely to be less sensitive to noise/light disturbance can probably become habituated at the site. Furthermore, these impacts are generally short lived and limited to the construction period.

Excessive dust generated during the construction phase will settle on plant leaves and thus reduce the pigmentation of leaves and thus reduce the rate of photosynthesis and productivity of affected plants. This impact is likely to be a concern within intact vegetation communities in the dry season when dust cannot be washed off leaves by rain. Its effect on species composition and vegetation structure is likely to be limited given the short duration of the construction period that generates dust.

Potential uncontrolled fire outbreaks resulting from construction activities such as welding operations, cooking with open fires and/or the inappropriate disposal of cigarettes may negatively impact on the species composition and structure of vegetation communities, particularly wooded grasslands or vegetation communities dominated by woody plants. If the fire is intense, woody plants may be killed. Only moribund grasslands stand to benefit from fire outbreaks as this will remove old plant growth and thus creating opportunities for new growth.

Operational Phase

Ecological disturbances and nuisance impacts during the operational phase of the project will likely be limited to only the use of the road infrastructure by patrol vehicles. This activity will generate limited noise impacts at a low frequency of occurrence, which may have a negligible impact on faunal species that are sensitive to noise pollution.

Positive Impacts on Biodiversity

The proposed border control infrastructure is also likely to result in a number of POSITIVE impacts to biodiversity. These are likely to be associated with improved security provided by the fence/barrier and more regular patrols of the border facilitated by the improved access, which is likely to result in:

- Improved security along the perimeter of Protected Areas along the Phase 1 alignment.
- Reduced occurrences of illegal activities such as poaching, illegal harvesting of natural resources, etc.

7.2.4 Biodiversity-related Mitigation Measures

Design phase (Pre construction) Mitigation

Border Patrol Road Stormwater Management Recommendations

The following general stormwater recommendations are recommended for the border patrol road:

- The road must be designed such that it does not impound surface flows. Where impoundment of surface flows is inevitable, adequate drainage must be provided.
- Wherever possible, stormwater generated by the road must be conveyed using open channels and/or swales. Ideally these swales must be grassed with a mix of dense runner and tufted grasses. The swales must be sized according to anticipated flow volumes and velocities.

- Where swales are not feasible, it is recommended that stone-pitched, rock bolstered and/or gabion mattress-lined open drains be established particularly in areas characterised by moderate to steep slopes where runoff velocities are expected to be significant and could induce soil erosion.
- In terms of the discharge of stormwater into the environment, many small discharge points are favoured over a few large ones which tend to concentrate flows and induce erosion. This is important for reducing the volume and velocity at each discharge point and thus minimise the risk of soil erosion. Furthermore, as a general principle, steeper longitudinal sloping road surfaces must have comparatively a greater number of discharge points than gentler sloping surfaces.
- All stormwater discharge points must have suitable erosion protection and energy dissipation measures (e.g. Reno-mattresses, baffles etc.) which must be designed to ensure that discharge velocities are at acceptable levels such that this does cause erosion of soils.

Border Patrol Road Design Recommendations

The following road design recommendations are recommended:

- The alignment of the new border patrol road must utilise transformed areas as much as possible to minimise increased habitat destruction.
- Cut and fill must be kept to a minimum as far as practically possible (taking into account road operational safety requirements) in order to reduce the extent of habitat clearing and reduce the risk of secondary impacts associated with habitat clearing (e.g. soil erosion, weed and IAP infestation).
- Where possible, road batters must be shaped to a 1:3 slope in order to minimise erosion. Slopes steeper than 1:2 are more prone to erosion and washouts and if saturated, the entire slope may fail.

Recommendations for the Border Fence and other Fences

When the detailed design of all fencing components is undertaken, the potential for accommodating animal movement through the fence, taking into account and not compromising the technical requirements of the project, must be considered. The following mitigation measures must be considered in the detailed design of the fences:

Fence design must include a suitable mesh size that will be large enough for small mammals, reptiles and amphibians to pass through. Alternatively, underpasses must be considered in fence design. For smaller vertebrates, low-level mesh fences can be added to guide the individuals towards passages.

Fine-meshed fencing that is extended into the ground (buried) has been successfully used in association with pipe culverts for small animal connectivity under roads and can be applied to fences as well in this instance. In this instance the mesh fencing is used to guide small animals into the culvert or similar type of underpass.

Rope bridges should be considered in forested habitats to allow arboreal species such as Samango Monkey (*Cercopithecus albogularis*) to cross the border, and are cost-effective to install. Such measures, however would need to be implemented in consultation with, and approval of the relevant Mozambican authorities

It is important to note that high visibility helps wildlife negotiate fences. Visibility is especially important in grasslands and within wetlands to protect low-flying birds, such as owls and waterfowl. Accordingly fence visibility must be increased in areas with high bird traffic/activity and across wetlands or fences with previous known bird mortalities. Fence design could incorporate the following to increase fence visibility:

- enclosing the wire in a light weight length of white high density polyethylene (HDPE) pipe
- attaching reflective or colourful weather-resistant and ‘audible’ flagging materials such as plastic strips/flappers, plastic flags, metal tags, aluminium cans, etc.)

- cover the barbs on existing barbed fences: can be covered with tubing, particularly in entanglement hot spots

In addition the following design recommendations are recommended:

- The border fence and the two other fences should be clearly visible to game. This can be achieved by attaching strips of high visible material to the fence at regular intervals (say 5 – 10m). The focus should be on fence lines within the vicinity of nature / game reserves; in the context of the Phase 1 alignment this is most applicable in the iSimangaliso Wetland Park, as in Tembe, a separate boundary fence of the park is located to the south of the border line.
- The fence must be kept clear of vegetation in order to prolong its lifespan and for easy monitoring.

Protected Plant Search & Rescue and Permit/Licence Requirements

There are three key pieces of legislation in South Africa that provide for the protection of threatened plant species in need of protection to ensure their survival in the wild in the context of the province of KZN and the Phase 1 alignment. Furthermore, they provide for the protection of ecosystems that are threatened or in need of protection. These include the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the National Forest Act, 1998 (Act No. 84 of 1998) and the Natal Nature Conservation Ordinance, 1974 (No. 15 of 1974).

Nationally protected trees require a licence in respect of protected trees from the KwaZulu-Natal DAFF whist provincially protected plants located in KwaZulu-Natal require Ordinary Permits from EKZNW if they are to be destroyed or handled during the construction phase.

Table 7-5 in section 7.2.2 above lists the species that were either encountered, or which have distributions which encompass the Phase 1 study area.

Given the large regional extent of the project area and the numerous vegetation community types and habitats that stand to be negatively impacted (transformed and/or disturbed during construction), the need for a systematic approach to protected plant search and rescue was deemed necessary and relevant to the project. A systematic approach that considers prioritising protected plant species search and rescue activities within vegetation communities considered to be: (i) in good to fair condition (i.e. Ecological Category A – C) and (ii) subject to high levels transformation due to planned construction of new infrastructure and further (iii) communities that qualify as a 'natural forest' according to the National Forest Act has been advocated by the biodiversity specialists on the project.

Prior to transformation or temporary disturbance of vegetation communities identified as being priority for search and rescue, a plant search and rescue/translocation exercise must be undertaken (preferably to be undertaken by a qualified and experienced botanist prior to construction activities occurring). This will be essential in mitigating the potential loss of protected/conservation important flora. Further details of the search and rescue operation are provided in the impact tables in section 8.3.1.

Conservation-important plants falling just outside the construction footprint must be fenced off / demarcated to minimise any accidental impacts such as destruction. The following techniques can be used to demarcate protected plants: fencing off or using perimeter stakes and high visibility netting / barrier tape.

It should be noted that all applications for licences in respect of protected trees and natural forest must be made to the relevant provincial DAFF office. As for threatened and specially protected plants, an application for a plant permit must be made to the EKZNW.

In the context of the primary dune which is a particularly sensitive part of the study area, the dune vegetation study has recommended that a plant rescue operation prior to the commencement of the

construction to rescue sensitive plants and rehabilitation material from the construction footprint be undertaken. The focus of this operation would be on plants in the understorey that would be able to be used as part of the rehabilitation of the understorey of the dune forest. It is recommended that the rescued plants be maintained in a nursery during construction. The rescued plants should then be re-planted in the disturbed area outside of the 3m-wide footpath after construction is complete to minimise the disturbed area.

Construction Phase Impact Mitigation Guidelines

In terms of Section 2 and Section 28 of NEMA (National Environmental Management Act, 1998), the relevant land owner/developer/applicant is responsible for any environmental damage, pollution or ecological degradation caused by their activities "inside and outside the boundaries of the area to which such right, permit or permission relates". In dealing with the range of potential ecological impacts to natural ecosystems and biodiversity highlighted in this report, a suite of project-specific mitigation measures have been recommended for implementation during the construction phase of the project. In preparing this section, the author acknowledges use of a construction guideline document by DWAF (2005). The following mitigation measures must be implemented in conjunction with any generic measures provided in the Environmental Management Programme (EMPr).

Finalisation of Road, Fence and Obstacle Barrier Designs and Plans

The following plans and drawings will need to be completed and approved prior to commencement of construction:

- Final layout plans of all infrastructure that incorporate the recommendations made in the BAR and specialist studies
- An EMPr that incorporates all below listed mitigation measures must be complied by the Environmental Assessment Practitioner (EAP).

Defining the Construction/Development Footprint and 'No-Go' areas

In highly sensitive terrestrial and freshwater habitats, the construction servitude / construction footprint must be narrowed as far as possible. This applies particularly to sensitive habitats and vegetation types, in particular all forest vegetation types, including coastal forest (on the primary dune), swamp forest and sand forest.

In addition:

- The construction/work servitude must accommodate all construction related activities, including materials storage, soil stockpiles, access routes etc.
- Where possible, access must be confined to the existing road infrastructure and disturbed areas.
- Vegetation clearing/stripping within the construction footprint must only be done as the construction front progresses.
- The extent of disturbance must be limited to the extent of the construction footprint. No areas outside the construction footprint may be cleared unless authorised.
- Where required (particularly in open areas such as grasslands), the construction servitude must be demarcated using high visibility materials to prevent any accidental destruction or modification of terrestrial habitat outside the construction servitude.
- All demarcation work must be signed off by the ECO.
- Working right of ways / construction servitudes must be limited to the widths specified in the construction methodology for each infrastructure component.

Minimisation of Habitat Destruction / Transformation of the Primary Dune Forest

The dune forest is highly significant, and measures must be taken to minimise destruction of the forest. The removal / fragmentation of the forest canopy through the felling of large trees would lead to knock on impacts such as disruption of movement of arboreal faunal species and through the exposure of the understorey to (salt laden) wind and sunlight which would lead to the die-off of plant species in the undergrowth. Accordingly measures must be taken when the footpath through the dune is constructed to minimise the removal of the forest canopy:

- Allow for slight deviations in the fence line to miss specific protected (marked with danger tape with the letter “P”) and mature trees.
- Limit the pruning of trees only to the removal of side branches that are in direct conflict with the fence line leaving the main trunk of the tree and the canopy intact.

Stormwater Management

Stormwater Management mitigation measures are explored in Section 7.1.9 above, specifically for construction work in wetlands and in their catchments, however construction-phase stormwater management is highly important in the context of the sensitive and steeply sloping primary dune. Temporary stormwater engineering controls (berms and sandbags, soil curtains across the slope contour) must be implemented at the dune to ensure effective control of stormwater during construction.

Temporary Site Camp Establishment

- All temporary site camps must be established on disturbed habitats of low or moderately low EIS subject to approval by the ECO (e.g. existing homestead yards or forestry timber laydown areas).
- Ideally site camps should be located within the 50m application corridor.
- Avoid site camps within intact habitat, especially those containing identified protected plants and native woody plant species such as areas with abundant trees and shrubs.
- Ideally, site camps must be located on flat ground to prevent any need for alteration of the ground level which will increase the risk of soil erosion problems.
- Fewer, densified site camps spread along the border patrol road or border fence are recommended over many Site Camps.
- All site camps must be fenced off to limit any accidental vegetation disturbance outside the approved area.
- Vegetation clearing must be kept to an absolute minimum, with grass/vegetation to be mowed/cut to ground level rather than cleared entirely.

Financial penalty clause

Given the need to maintain intact areas in pristine condition and minimise all unnecessary impacts to the environment, the following financial penalty clause is recommended to encourage the contractor and developer to adhere to the recommendations of the specialists as well as recommendations contained in the EMPr. The financial penalty clauses as detailed in the impact tables and EMPr must be included in the EMPr and contract for the project.

Soil Management (Stockpile areas)

- The topsoil layer must be stripped from the construction footprint and stockpiled separately from overburden (subsoil and rocky material).

- Topsoil is to be handled twice only – once to strip and stockpile, and once to replace and level.
- In the absence of a recognizable topsoil layer, strip the upper most 300mm of soil
- All stockpile areas must ideally be established on disturbed flat ground.
- Stockpile topsoil stripped from different sites separately, as reapplication during rehabilitation must be site specific.
- Where necessary, erosion/sediment control measures such as silt fences and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles.
- Soil stockpiles are to be kept free of weeds and are not to be compacted.
- The slope and height of stockpiles must be limited to 2m to avoid soil compaction and destruction of soil microbes.
- Spoil material must be hauled to a designated spoil site. No spoil material must be pushed down slope or discarded on site.
- For the border barrier it is recommended that stockpiling of occurs along the trench given that the construction footprint of the obstacle barrier is flat, sandy and transformed. The soil stockpile will need to be established between the existing border fence and the trench.

Erosion control measures

The following measures must be implemented particularly in areas where there is a significant risk of soil erosion:

- Vegetation/soil clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- Any vegetation clearing should be done immediately before construction activities to avoid prolonged exposure of the soil to weather elements.
- All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of sediment barriers (e.g. silt fences, sandbags, hay bales, earthen diversion berms).
- Sediment barriers should be regularly maintained and cleaned so as to ensure effective drainage.
- After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with appropriate material and re-shaped.

Pollution prevention measures

The following pollution prevention measures must be implemented at temporary site camps and construction sites:

- The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, etc.) needs to be administered.
- Construction materials at risk spilling are to be stored in appropriate containment structures (e.g. drip-trays).
- Hazardous storage and re-fuelling areas must be bunded. 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.

- Cement/concrete batching is to be done on an impervious surface such as wooden shutter boards or heavy duty sail. No batching activities shall occur directly on the ground. Furthermore, the site for batching must first be approved by the ECO.
- Concrete must be mixed off site and brought to the site ready mix. The ready mix cement should then be carried in to the site bags or buckets. It is very important that this measure be applied in all wetlands and within the (primary) dune forest.
- Provide drip-trays beneath standing machinery/plant.
- No refuelling, servicing or chemical storage should occur outside the established construction camp.
- Spillages of fuels, oils and other potentially harmful chemicals should be cleaned up immediately and contaminants properly disposed of using appropriate spill kits. Any contaminated soil from the construction site must be removed and rehabilitated or disposed appropriately.

Management of solid waste

- Provide adequate rubbish bins and waste disposal facilities on the construction site and at site camps.
- All bins must be animal proof.
- Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed.
- The construction site must be kept clean and tidy and free from rubbish.
- Recycling/re-use of waste is to be encouraged.
- No solid waste may be burned on site.

Invasive Alien Plant control

- All alien invasive vegetation that colonise the construction site must be removed, preferably by uprooting. The contactor should consult the ECO regarding the method of removal.
- All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed.
- Herbicides should be utilised where hand pulling/uprooting is not possible.

Wildlife management

- Education of workers/employees onsite on not to harm wildlife unnecessarily will assist in mitigating this impact. Contractor induction and staff/labour environmental awareness training needs are to be identified and implemented through staff/contractor environmental induction training. This should include basic environmental training based on the requirements of the EMPr, including training on avoiding and conserving local wildlife.
- No wild animal may under any circumstance be hunted, snared, captured, injured, killed, harmed in any way or removed from the site. This includes animals perceived to be vermin (such as snakes, rats, mice, etc.).
- Any fauna that are found within the construction zone must be moved to the closest point of natural or semi-natural habitat outside the construction corridor.
- The handling and relocation of any animal perceived to be dangerous/venomous/poisonous must be undertaken by a suitably trained individual.
- All vehicles accessing the site should adhere to a low speed limit (30km/h is recommended) to avoid collisions with susceptible species such as reptiles (snakes and lizards).

- No litter, food or other foreign material should be disposed of on the ground or left around the site or within adjacent natural areas and should be placed in demarcated and fenced rubbish and litter areas that are animal proof.
- Ensure that workers accessing the site conduct themselves in an acceptable manner while on site, both during work hours and after hours.
- Temporary noise pollution should be minimized by ensuring the proper maintenance of equipment and vehicles, and tuning of engines and mufflers as well as employing low noise equipment where possible.
- No activities should be permitted at the site after dark (between sunset and sunrise), except for security personnel guarding the development site.

Fire management

- No open fires to be permitted on construction sites. Fires may only be made within the construction site camps and only in areas and for purposes approved by the ECO.
- Fire prevention facilities must be present at all hazardous storage facilities.
- Ensure adequate fire-fighting equipment is available and train workers on how to use it.
- Ensure that all workers on site know the proper procedure in case of a fire occurring on site.
- Smoking must not be permitted in areas considered to be a fire hazard.
- Ensure that no refuse wastes are burnt or buried on the construction site or on surrounding areas.

Operational Phase Impact Mitigation Guidelines

While construction-related impacts are to be addressed through best management practices and drafting of an Environmental Management Programme (EMPr) for the development project, there are a range of longer-term aspects that need to be addressed to ensure that operational-phase impacts are managed in such a way as to limit impacts on terrestrial habitats and biodiversity. Operational-phase environmental impact/risk management and mitigation guidelines have been provided in this regard and are included below:

Undertaking road/fence repair/maintenance work

All unforeseen repair work to will need to comply with recommendations and guidelines provided for the construction phase.

Invasive Aline Plant Control

In line with the requirements of the NEM: BA, which obligates the landowner/developer to control IAPs on his property, it is recommended that IAPs be controlled on an on-going basis and in line with recommendations and guidelines provided for the construction phase.

Maintenance of the border 'Detection Zone'

- Grass Mowing: Grass mowing particularly on gentle to flat areas has been identified as a preferred method to keep grass short and maintaining a clear Detection Zone. In this regard, it is recommended that tall grass be mowed biannually. The first cut can be made prior to the start of the wet season (August – September) and the second cut towards the end of the wet season (February - March).

- Veld Burning: In areas where mowing is not feasible, veld burning may be a viable alternative used to maintain visibility within the Detection Zone. This requires a cool burn (downwind fire) that will proceed through the grassland as quickly as possible so as to cause the least damage to herbaceous plants. Ideally grass must be burnt only in winter (May - June) when temperatures are low. Use of fire requires a firebreak system to ensure effective management of controlled burns.

Maintenance of Border Patrol Infrastructure

- Maintenance of the Road Infrastructure: The border patrol road must be inspected daily by SANDF personnel while undertaking their daily patrols. Should any damage be detected, maintenance/repairs of the road infrastructure must be done in accordance with construction mitigation measures provided.
- Maintenance of Stormwater Infrastructure: Stormwater infrastructure must be inspected preferably on an annual prior to the start of the rainy season. Blocked infrastructure will need to be unblocked while silted structures will need to have excess sediment removed.
- Maintenance of the fences and barrier: this infrastructure must be inspected by SANDF personnel while undertaking their patrols. Should any sections be damaged and require replacement, this must be done in accordance with construction mitigation measures provided.

Erosion control and slope stability concerns

Where soil erosion or embankment instability concerns persist, particularly in rehabilitated areas and areas with steep terrain, it is recommended that such areas are monitored to inform the need for further intervention. Interventions such as slope stabilisation or additional habitat/vegetation rehabilitation may need to be undertaken as per the conceptual rehabilitation plan compiled as part of the biodiversity study.

Erosion of the substrate of the primary dune is a particularly significant potential impact that will occur if mitigation measures are not implemented. A number of measures specific to the dune footpath and adjacent construction footprint that will need to be rehabilitated must be implemented:

- Measures to secure the sandy substrate along the footpath must be implemented as part of the design and construction of the footpath across the dune. It is recommended that branches cut off trees to open up the fence line and footpath servitude be laid across the slope on the contour and pegged into place to serve as steps and to limit soil movement. Sandbags can also be utilised to create a stepped or terraced footpath.
- Soft engineering measures, e.g. sand filled Bidim bags must be used to stabilise the toe of the dune slope to prevent the slumping of the dune and submerging of vegetation where vegetation has been removed
- In addition to the plants retained as part of the search and rescue operation, the exposed soil along the fence line and in other parts of the construction footprint where vegetation was removed must be revegetated with local, low growing, salt-tolerant, drought resistant ground cover to help stabilise the dune.

7.2.5 Biodiversity-related mitigation: Offset Recommendations

It is important to note that one of the key recommendations of the terrestrial ecology (and freshwater) study is that an offset has been recommended in order to remedy the impacts of planned infrastructure on terrestrial (and freshwater) habitats. The terrestrial ecology (and freshwater) report has considered the policy context of biodiversity-related offsets in South Africa, as detailed (on a national level) by the Draft National Policy on Biodiversity Offsetting in South Africa (DEA, 2017) and (at a provincial level) by the KwaZulu-Natal Policy on Biodiversity Offsets (EKZNW, 2013).

As defined in the draft national policy offsets biodiversity offsetting is defined as:

"The process of establishing and quantifying the residual negative effects on biodiversity and ecological infrastructure resulting from an activity after every effort has been made to avoid, prevent, reduce, moderate, minimise and rehabilitate impacts and then counter-balancing these residual effects through interventions that avoid, prevent, reduce, moderate, minimise and rehabilitate impacts or impacted areas elsewhere in order to achieve a net biodiversity and ecological infrastructure gain" (DEA,2017).

The objective of the biodiversity offsets policy in KwaZulu-Natal, is aligned with the National Policy and aims to ensure that residual impacts on biodiversity and ecosystem services that are of medium to high significance are duly compensated by developers in such a way that a material contribution is made to implementing provincial and/ or municipal level conservation plans and reaching associated targets, and to safeguarding valued ecosystem services. An additional objective is to achieve development and conservation objectives more effectively by creating opportunities for conservation beyond the site of development, rather than focusing only on that site (EKZNW, 2013).

The need for a biodiversity offset is typically evaluated based on the significance of residual impacts to biodiversity, including direct, indirect and cumulative impacts. The terrestrial ecology and freshwater studies have applied a significance assessment methodology developed by Eco-Pulse Consulting that is aligned with the provincial offsetting guideline, and which has been developed to specifically cater for biodiversity impacts by customizing impact descriptions such that they integrate threat status into the assessment of extent and intensity as part of the impact significance process. The method also specifically addresses different components of biodiversity by considering impacts to (i) ecosystems (different vegetation types), (ii) species of conservation concern and (iii) ecosystem services provided by natural habitats. As part of this assessment, consideration is also given to direct, indirect and cumulative impacts on biodiversity pattern and process (specifically impacts that affect species movement).

Residual impacts have been specifically quantified as part of the terrestrial ecology and freshwater assessments, and are used as a basis for assessing the need for biodiversity offsets to compensate for negative impacts to different biodiversity attributes that will be impacted by the proposed infrastructure development. Cumulative losses of terrestrial (and freshwater) habitat have been calculated for the entire project (incorporating Phases 1 and 2 combined) in the two specialist studies and an associated area of land to be secured, incorporating 'low' and 'high' scenarios, under which a smaller or greater area is required to be secured for conservation purposes is calculated.

The calculation of offsets, if deemed necessary by the determining authority, will need to take into account the monetary value and other economic benefits to biodiversity in the study area that are being provided by the proposed project. Through the securing of the border, the project will be very likely to reduce cross-border wildlife crimes such as poaching and illegal gill netting by people illegally entering these reserves from Mozambique. Offsets have been considered in the context of the wider project and although not falling within the Phase 1 project, the nearby Ndumo Game Reserve (the eastern boundary of Ndumo is in direct proximity to the western end of the Phase 1 alignment) will benefit substantially from upgrades to its border fence and the patrol road within it. The project will upgrade the entire perimeter fence of the reserve to an elephant fence, an upgrade from a non-electrified game proof fence on its southern and western boundaries, as well as re-surfacing the existing gravel road along its southern and western perimeters. However it is in the context of the re-erection of the eastern boundary fence that the reserve will be most greatly benefitted from both an economic and ecological perspective. The eastern fence of the Ndumo Game Reserve was removed and destroyed by neighbouring local communities; in 2008 members of the Mbangweni and Bhekabantu clans living in the Mbangweni Corridor removed Ndumo's eastern fence and began clearing land for farming[17] and the part of the reserve between the eastern boundary fence and the Phongolo River has been subject to subsequent land invasions though which

[17] *https://www.news24.com/Archives/Witness/Land-invasions-and-poaching-threaten-famed-KZN-game-reserve-20150430*

much of this part of the reserve (including parts of the highly sensitive Phongolo River floodplain) has become totally transformed through the clearing of natural vegetation for subsistence cultivation.

eZemvelo KZN Wildlife currently has no budget for the re-erection of the fence and the re-establishment of a patrol road along its eastern boundary. If the wider border control infrastructure project were not being proposed, it would thus be highly unlikely that this part of the reserve would be able to be secured and effectively be 'reincorporated' into it. The infrastructural upgrades associated with the project will allow this part of the reserve to be rehabilitated, but possibly more importantly will prevent further transformation of this part of the reserve and the possible invasion of parts of the reserve located to the west of the Phongolo River in the future. In a biodiversity and conservation context the reserve is a declared Ramsar Site (refer to section 5.6.1) and the land invasions and subsequent transformation of the reserve threaten not only the integrity of the reserve but its Ramsar Site status. The cost benefit of the re-erection of the fence and re-establishment of the patrol road, along with the cost benefits of the indirect positive impacts such as increased patrolling of the reserve's borders and the prevention of further degradation of currently unimpacted parts of the reserve must be calculated, and considered in the wider consideration of the cost of offsetting of biodiversity loss impacts as recommended in the biodiversity and freshwater studies.

It is important to note that the need and desirability for such an offsetting process will need to be assessed and specified as necessary or unnecessary by the relevant determining authority (DEA), in consultation with the relevant provincial authorities (EKZNW in KZN). Should offsets be deemed to be required as part of an environmental authorisation for the project, the nature and implementation of such offsets would need to be determined through consultation between the applicant, DEA and the commenting authorities, taking into account the economic and ecological benefits to biodiversity that will be provided by the project, as detailed above. Any offset recommendations specified as such by DEA must be adhered to in the development of the project.

7.3 Heritage Assessment

Archaeological sites occur throughout the wider (Phase 2) project area along the border with Swaziland. However no sites have been recorded in the Desktop Heritage Assessment as being located along the Phase 1 alignment. The closest archaeological sites to the Phase 1 alignment are located to the west, within the Ndumo Game Reserve and at Border Cave which is located near Abercorn's Drift.

7.3.1 Baseline Description of the Study Area and Results of the Ground Survey

Historical period: archaeology and built environment

No historical period sites relating to the period of European settlement are reflected on any of the existing data bases as occurring closer than 50m to the proposed alignment. However, it is highly unlikely that no historical period sites occur in the near environs of the proposed Border Road. The various Border Posts along the wider Phase 1 and Phase 2 alignments, of which Farazela (Kosi Bay) is the only active Border Patrol Post along the Phase 1 alignment, have been operating as entrances to and from Swaziland and Mozambique for many decades. It is highly likely that some of the earlier buildings and structures associated with these Border Posts are older than 60 years and they will therefore have heritage value. In the context of the Farazela Border Post, no existing buildings will be physically affected by the proposed development, as the only significant infrastructural upgrades developments in this part of the Phase 1 alignment are the upgrading of the existing border fence to a Clear Vu-type fence and the erection of the border barrier in immediate proximity to the border line. No structures are located within the proposed footprint of the Construction Camp at Farazela.

Indigenous African homesteads that appear to belong to the historical period do, however, occur in the extreme southern and eastern sections of the wider project area, of which the latter are relevant to the

Phase 1 alignment. It is important to note that very little built infrastructure is related in immediate proximity to the existing border line, with most of the homesteads of the inhabitants of the area being set away from the border. Exceptions to this are the Muzi Camp within the north-eastern part of the Tembe Elephant Park, a cluster of DAFF-operated buildings at Gate 7 located just to the east of Muzi Camp, structures at Gate 6 (located to the west of Farazela) and structures at Gate 8, located within the narrow corridor between Ndumo and Tembe. With the exception of these areas no structures are located within the 50m wide environmental application corridor.

Graves

No graves or cemeteries are indicated on existing data bases for the wider project area or for the Phase 1 alignment. However, large sections of the proposed alignments pass through communal or tribal areas, including Phase 1. It is expected that some of the existing homesteads of these areas do contain associated grave sites. However no grave sites were located by the archaeological study in the immediate environs of the Phase 1 alignment.

Cultural landscapes and sense of place

The cultural landscape is an aspect of heritage not defined in the NHRA but nevertheless listed as part of the National Estate. A cultural landscape is “a set of ideas and practices embedded in a place” (Julian Smith and Associates Contentworks Inc., 2004) and serves to “map our relationship with the land over time” (The Cultural Landscape Foundation, 2015). While the cultural landscape is itself a heritage resource, it also unites the physical cultural resources of an area (tangible heritage) and its associated memories, perceptions, stories, practices and experiences (living heritage) in order to give a particular place or region its meaning. Because heritage sites are embedded in, and interwoven with, their landscape settings, the cultural landscape also gives these resources their sense of place and belonging through the provision of physical and metaphysical context. The concept of cultural landscape is thus very broad. Like the warp threads of a tapestry, the cultural landscape is the setting which holds together all the other aspects of heritage discussed.

However, despite initial expectations the heritage specialist could not find evidence for any known cultural landscapes along the wider project alignment and along the Phase 1 alignment. It can be argued that the areas around exiting Border Posts could be classified as cultural landscapes, however, the existing evidence is not convincing. It is nevertheless proposed that the developers initiate a Phase Two Heritage Impact Assessment, by a built heritage specialist, before any development takes place in the immediate environs of existing Border Posts. In the context of the Phase 1 alignment, this recommendation applies to the Farazela Border Post.

Living Heritage

Living (or intangible) heritage encompasses all those ideas, traditions, customs and memories that are passed from generation to generation. It includes things such as language, folklore, traditional medicine and healing, music, songs, dances and recipes. Skills and practices related to the local economy, such as sheepherding, animal husbandry and transhumance between summer and winter grazing areas, are also important because without them early African and colonial settlers and even modern day small-scale subsistence farmers would never have survived. These are all aspects that contribute to the identity of a group (Orton et al 2016). The Department of Arts and Culture (2009:5) defines living heritage as “cultural expressions and practices that form a body of knowledge and provide for continuity, dynamism, and meaning of social life to generations of people as individuals, social groups, and communities.” Part of the importance of living heritage is that it helps to create a new national identity and promotes heritage that was repressed by missionaries, colonists and the apartheid regime.

The living heritage of the project area has not been researched and is not represented in any data base. However the heritage assessment has concluded that systematic ethnographic surveys of the project area

may produce natural and man-made features with living heritage values. In addition, it is important to refer to indigenous perceptions relating to the 'symbolic water complex'. This complex of beliefs occur amongst all indigenous groups (African and Khoisan descendants) along the eastern seaboard and further afield (Bernard 2010). It has also been documented amongst Zulu, Swazi, and Thonga groups (ibid) and is therefore relevant to the wider project area, and the Phase 1 alignment which is inhabited by people belong to the amaZulu People. It is also almost certain that some of the prominent other natural features in the greater project area and along the Phase 1 alignment (of which the primary dune at Kosi Bay is the only such topographical feature along the Phase 1 alignment) may have 'living heritage" values. However the Heritage Specialist could not find any 'living heritage' sites in the near environs of wider proposed alignment which included the Phase 1 alignment.

7.3.2 Recommendations of the Heritage Study

The following areas may contain heritage sites and should be avoided where possible:

- Bodies of natural and unpolluted water such as certain pools, waterfalls and rivers/streams may also have 'living heritage' values associated with the indigenous "symbolic water complex" and should be avoided. Again the consultant could not identify any such sites within 50m from the proposed Border Road and associated Borrow Pits. However Lake kuZilonde which is a highly natural pristine waterbody, and certain of the wetlands crossed by the alignment may hold such living heritage values.
- Older buildings and structures such as bridges etc. do occur in association with some of the Border Posts in the project area. Those older than 60 years old are protected by heritage legislation. The specialist study proposes that the developers initiate a Phase Two Heritage Impact Assessment, by a built heritage specialist, before any development takes place in the immediate environs of the existing Farazela Border Posts.
- A buffer zone of at least 30m must be maintained around any graves that could be encountered and which may not have been documented in the heritage study (although no such graves were encountered along the phase 1 alignment). No development may occur within the buffer zone around the grave. Should it not be possible to respect a buffer zone then the developer would need to motivate for a Phase Two Heritage Impact Assessment in order to investigate potential grave exhumation and reburial.
- Various open-air Stone Age sites occur along the proposed wider project, but none have been identified along the Phase 1 alignment. Most of these have a low to medium rating as they are situated 'out of context' with little research value. Should any such sites be encountered, however, mitigation is necessary and a buffer zone of at least 10m must be maintained around them. No artefacts may be collected or removed from these sites.

7.4 Palaeontological Assessment

Palaeontological resources are strongly related to the underlying geology. The geology of the Phase 1 Study Area is detailed in Section 5.1.1 above.

7.4.1 Palaeontology of the Study Area

Maputaland Group

Within the Maputaland Group, The largest portion of the Uloa Formation consists of approximately 5 metres of unbedded calcirudite, known as the "Pecten Bed", due to the richness of the bivalve *Aeqipectenuloa*. Brachiopods, coralline algae, corals, echinoids, foraminifera and Gastropods are present in this formation, as well as isolated teeth of the extinct giant shark *Carcharodon megalodon*. This Group has a high Palaeontological sensitivity.

No fossils have been documented from the Muzi Formation. The Bluff Formation has local fossiliferous zones whereas the Berea Formation, Masotcheni Formation and recent alluvial and sand deposits, do not contain significant fossil remains.

The Port Durnford Formation contains a sequence of carbonaceous muds and sand, comprising fossils of terrestrial vertebrates for example antelope, buffalo, elephant, hippopotamus, rhinoceros as well as marine fossils including crustaceans and fish, foraminifera, marine molluscs and fragments of turtles and crocodiles. This Group has a high palaeontological sensitivity.

The Bluff Formation is a nearly unbroken outcrop with fossils recorded from small deposits of coral limestone. The Berea Formation is not known to contain significant fossil vertebrates but petrified wood has been described from this Formation.

In the recent alluvium, sand and calcrete and Masotcheni Formation of the coastal plains of Kwazulu-Natal no significant fossil remains have been described.

Quarternary Surficial Deposits

Cenozoic deposits are largely confined to coastal areas where very rich assemblages of marine fossils (KwaZulu-Natal and Eastern and Western Cape coasts) are recorded. In a palaeontological context the Quaternary superficial deposits have been relatively neglected in the past but they may sometimes contain important fossil biotas. These superficial deposits contain pedocretes (colluvial slope deposits, wasted surface gravels, river alluvium or/and wind-blown sands) as well as spring and pan sediments. The Quaternary fossil assemblages are typically sparse, low in diversity, and occur over a wide geographic area. These fossil biota may include bones, teeth and horn cores of mammals and reptiles, non-marine bivalves and gastropods, ostrich egg shells, trace fossils (faeces and termitaria), and plant remains in organic-rich alluvial horizons. This Group has a high palaeontological sensitivity.

7.4.2 Potential Palaeontological Impacts associated with the development

When assessing the potential impacts of the proposed development on palaeontological resources, it must be noted that there are significant limitations in the existing desktop information on which the assessment has been based. Vast areas of South Africa have not been studied palaeontologically. Fossil data gathered from different areas but in similar Assemblage Zones might provide information on the probable presence of fossils in an unmapped area. Desktop studies thus generally assume the presence of unexposed fossil heritage within the development areas of similar geological formations. Where extensive exposures of bedrocks or potentially fossiliferous superficial sediments are present in the development area, the accuracy of a Palaeontological Impact Assessment may be improved through a field-survey.

The proposed project is underlain by a number of sedimentary formations of which the Quaternary has a high Palaeontological sensitivity. As part of the Palaeontological Impact Assessment, a field-survey of the development footprint was conducted to assess the potential risk to palaeontological material (fossil as well as trace fossils) in the proposed footprint of the development. The field survey included an assessment of the construction camp at Farazela.

As part of the physical field-survey of the proposed alignment (i.e. the sections of the alignment that are underlain by Quarternary deposits) and the construction camp footprint conducted on foot and by vehicle, ***no fossiliferous outcrops were found in the development footprint***. For this reason, a low palaeontological sensitivity is allocated to the development footprint along the Phase 1 alignment. Although fossils are uncommon and only occur periodically a solitary fossil may be of scientific value as many fossil taxa are known from a single fossil. The recording of fossils will expand our knowledge of the Palaeontological Heritage of the development area.

The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the proposed development will be of a low significance in palaeontological terms. The palaeontological impact assessment has therefore concluded that the proposed Phase 1 development will not lead to detrimental impacts on the palaeontological resources of the area.

In the unlikely event that fossil remains are uncovered during any phase of construction, either on the surface or unearthed by new excavations and vegetation clearance, the ECO for the project must be immediately informed of such findings. These discoveries should be protected (preferably *in situ*) and the ECO must report to SAHRA so that appropriate mitigation (e.g. recording, collection) can be undertaken by a professional palaeontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies proposed by SAHRA.

8 IMPACT ASSESSMENT

8.1 Introduction

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

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

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

As the project entails the upgrading of existing infrastructure and development of new infrastructure for border control and patrolling which will be permanent, decommissioning is not applicable to this project, as border control infrastructure is a continuous requirement to secure the borders of sovereign states. In time infrastructure may be replaced by new infrastructure of technologies, but this will be addressed at the time that such new infrastructure / technology becomes available or is needed to be developed.

8.2 Impact Assessment Methodology

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

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

The criteria to be used for the rating of impacts are provided in Table 8-1.

Table 8-1: Criteria to be used for the rating of impacts

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

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

Table 8-2: Criteria for the rating of classified impacts

	Class	Description
+	**Any value**	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.
–	**Low impact (4 -6 points)**	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	Medium impact (7 -9 points)	Mitigation is possible with additional design and construction inputs.
	High impact (10 -12 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
	Very high impact (12 - 14 points)	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
Status		Denotes the perceived effect of the impact on the affected area.
Positive (+)		Beneficial impact.
Negative (-)		Deleterious or adverse impact.
Neutral (/)		Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.		

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

8.3 Potential Impacts and Significance

The following sections will provide a description of the potential impacts as identified by the specialist assessment, EAP and through the PPP as well as the assessment according to the criteria described in **Table 8-1** and **8-2**.

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

8.3.1 Planning Phase Impacts

Table 8-3: Planning phase impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Planning & Design	**Aspect:** Preparation of servitude for construction. **Impact:** Unnecessary impact on fauna and flora in and adjacent to the servitude Impact on protected plant species within the servitude (especially construction footprint)	**Without**	2	3	2	4	-11	**High**
		With	1	1	1	1	-4	**Low**

		Key mitigation measures:
		▪ It should be noted that all applications for licences in respect of protected trees and natural forest must be made to the relevant provincial DAFF office. As for threatened and specially protected plants, an application for a plant permit must be made to the EKZNW.
		▪ The areas (vegetation types) as specified in the biodiversity specialist study that have been prioritised for search and rescue must be subject to a walkdown, preferably undertaken by a suitably qualified botanist.
		▪ The appointed botanist/specialist must:
		  ▪ visit priority vegetation communities;
		  ▪ identify and geo-reference the location of all threatened and protected plants at risk of destruction/damage;
		  ▪ identify vegetation communities that qualify as a 'natural forest' as defined by DAFF
		  ▪ prepare a suitable plant rescue translocation plan that considers species requirements and identifies suitable receiving areas for rescued plants; and
		  ▪ assist with undertaking and/or supervising the relevant plant rescue and translocation.
		▪ A plant rescue operation to rescue sensitive plants and rehabilitation material from the construction footprint **along the primary dune** must be undertaken. The focus of this operation would be on plants in the understorey that would be able to be used as part of the rehabilitation of the understorey of the dune forest.
		▪ It is recommended that the rescued plants be maintained in a nursery during construction. The rescued plants should then be re-planted in the disturbed area outside of the 3m-wide footpath after construction is complete to minimise the disturbed area.
		▪ Conservation-important plants falling just outside the construction footprint must be fenced off / demarcated to minimise any accidental impacts such as destruction. The following techniques can be						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		used to demarcate protected plants: fencing off or using perimeter stakes and high visibility netting / barrier tape. ▪ The construction area must be clearly designated in sensitive environmental areas (in particular wetlands) and no extension of the permitted construction footprint must be allowed. All wetland boundaries must be clearly designated prior to construction commencing. Design to Minimise Impacts on Fauna When the detailed design of all fencing components is undertaken, the potential for accommodating animal movement through the fence, taking into account and not compromising the technical requirements of the project, must be considered. The following mitigation measures must be considered in the detailed design of the fences: ▪ Fence design must include a suitable mesh size that will be large enough for small mammals, reptiles and amphibians to pass through. Alternatively, underpasses must be considered in fence design. For smaller vertebrates, low-level mesh fences can be added to guide the individuals towards passages. ▪ Fine-meshed fencing that is extended into the ground (buried) has been successfully used in association with pipe culverts for small animal connectivity under roads and can be applied to fences as well in this instance. In this instance the mesh fencing is used to guide small animals into the culvert or similar type of underpass. ▪ Rope bridges should be considered in forested habitats to allow arboreal species such as Samango Monkey (Cercopithecus albogularis) to cross the border, and are cost-effective to install. Such measures, however would need to be implemented in consultation with, and approval of the relevant Mozambican authorities It is important to note that high visibility helps wildlife negotiate fences. Visibility is especially important in grasslands and within wetlands to protect low-flying birds, such as owls and waterfowl. Accordingly fence visibility must be increased in areas with high bird traffic/activity and across wetlands or fences with previous known bird mortalities. Fence design could incorporate the following to increase fence visibility: ▪ enclosing the wire in a light weight length of white high density polyethylene (HDPE) pipe ▪ attaching reflective or colourful weather-resistant and ‘audible’ flagging materials such as plastic					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		strips/flappers, plastic flags, metal tags, aluminium cans, etc.) ▪ cover the barbs on existing barbed fences: can be covered with tubing, particularly in entanglement hot spots In addition the following design recommendations are recommended: The border fence and the two other fences should be clearly visible to game. This can be achieved by attaching strips of high visible material to the fence at regular intervals (e.g. 5 – 10m). The focus should be on fence lines within the vicinity of nature / game reserves; in the context of the Phase 1 alignment this is most applicable in the iSimangaliso Wetland Park, as in Tembe, a separate boundary fence of the park is located to the south of the border line.					

8.3.2 Soils

Table 8-4: Impact on soils

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities (site clearing). **Impact:** Physical degradation due to the removal of soil during construction activities. Impacts arising from stockpiling, in particular erosion of stockpiles and pollution of freshwater resources.	**Without**	1	2	2	3	-8	Medium
		With	1	1	1	1	-4	Low
		Key mitigation measures: ▪ Erosion / sediment control measures such as silt fences placed around the stockpiles to limit sediment runoff from stockpiles. ▪ Subsoil and topsoil must be stockpiled separately, in particular where there is a marked difference between topsoil with more organic material content (darker) and the underlying subsoils – particularly in wetlands. Stockpiled soil must be replaced in the reverse order to which it was removed (subsoil first followed by topsoil). ▪ Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils. ▪ The stockpiles may only be placed within demarcated stockpile areas. A recommended set-back distance of at least 30 m from the wetland boundaries is recommended. ▪ The contractor must, avoid stockpiling materials in vegetated areas that will not be cleared. ▪ Stockpiled soils must be kept free of weeds and must not be compacted. ▪ The stockpiled soil must be kept moist using some form of spray irrigation on a weekly to bi-weekly basis. ▪ The height of stockpiles must be limited to 2m to avoid soil compaction and destruction of soil micro-organisms.						
	Aspect:	**Without**	1	2	2	3	-8	Medium
		With	1	1	1	2	-5	Low

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	Construction activities (site clearing). **Impact:** Physical degradation due to soil: erosion as a result of exposed soil and topsoil.	**Key mitigation measures:** ▪ Construction activities must be scheduled to minimise the duration of exposure to bare soils on site, especially where sloping ground is encountered. ▪ The unnecessary removal of groundcover from slopes must be prevented. ▪ All bare slopes and sloping surfaces to be exposed to the elements of weather during clearing and earthworks must be protected against erosion using rows of silt fences and sandbags. ▪ Sediment barriers such as berms, sandbags and/or silt fences must be monitored for the duration of the construction phase and repaired immediately when damaged. ▪ Sediment barriers must only be removed once vegetation cover has successfully re-colonised the embankments. ▪ After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. ▪ Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gulley for additional protection until grass has re-colonised the rehabilitated area. ▪ Where required sand bags must be used to retain banks vulnerable to collapse. ▪ Construction-phase stormwater management is highly important in the context of the **sensitive and steeply sloping primary dune**. Temporary stormwater engineering controls (berms and sandbags, soil curtains across the slope contour) must be implemented at the dune to ensure effective control of stormwater during construction. ▪ Dune forest understorey vegetation must be rescued and propagated in a nursery during construction, and then be replanted on disturbed sloping ground on the primary dune to prevent erosion of the sandy, unconsolidated dune soils. Salt-tolerant plants must also be utilised for rehabilitation of these surfaces. ▪ Measures must be taken to secure the toe of the dune to prevent slumping and submerging of vegetation.					

8.3.3 Geohydrology

Table 8-5: Geohydrology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** ▪ Improper storage of fuels, chemicals, etc. ▪ Construction equipment, vehicles, workshop and wash bay areas. ▪ Inadequate ablutions. ▪ Incorrect cement mixing / batching **Impact:** Groundwater contamination as a result of: ▪ Spillage of fuels, lubricants and other chemicals. ▪ Construction equipment, vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source. ▪ Lack of provision of ablutions that may lead to the creation of informal ablutions. ▪ Ingress of cement into the soil that will alter soil chemical properties.	**Without**	2	3	3	2	-10	**High**
		With	1	1	1	2	-5	**Low**
		Key mitigation measures: ▪ Potentially hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time. ▪ No potentially hazardous substances must be placed within 50m of the boundary of any wetland. ▪ Material safety data sheets (MSDSs) are to be clearly displayed for all hazardous materials. ▪ The integrity of the impervious surface and bunded area must be inspected regularly and any maintenance work conducted must be recorded in a maintenance report. ▪ Employees should be provided with absorbent spill kits and disposal containers to handle spillages. ▪ Train employees and contractors on the correct handling of spillages and precautionary measures that need to be implemented to minimise potential spillages. ▪ All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability. No repairs may be undertaken beyond the Farazela Construction Camp or any other subsequently environmentally authorised contractor laydown areas. ▪ Immediate reporting and rectification of any incident that might lead to pollution. Implementation of best practice methods to prevent potential incidents from occurring e.g. an Environmental Management System (EMS) reporting and monitoring system. ▪ An Emergency Preparedness and Response Plan will be developed and implemented should an incident occur. ▪ Access to storage areas on-site must be restricted to authorised employees only. ▪ Contractors will be held liable for any environmental damages caused by spillages.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ The construction workforce must have adequate sanitation facilities. ▪ The sanitation facilities should be on-site before the extended workforce is employed to ensure that no unauthorised sanitation practices are implemented on-site. ▪ Potential construction practices that might lead to groundwater contamination should be conducted on areas with impervious surfaces to avoid infiltration of contaminated substances into the groundwater aquifer. ▪ All contaminated stormwater should be treated before being discharged into the surrounding natural environment.					

8.3.4 Biological Environment (Fauna and Flora (Vegetation)

Table 8-6: Biodiversity-related impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Clearing of vegetation for the construction of infrastructure. **Impact:** Physical Habitat Destruction - degradation of sensitive terrestrial and wetland habitat.	**Without**	1	3	3	3	-10	**High**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ The construction servitude should be limited to the proposed development footprint and a 10 m working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc. ▪ Under no circumstances must the construction servitude encroach out of the 50m authorisation corridor, or any other approved construction area (e.g. the Farazela Construction Camp) ▪ The outer edge of the construction servitude/working area (as defined above) must be clearly demarcated for the entire construction phase using a brightly coloured hazard fence. All areas outside (including upstream and downstream) of this demarcated construction servitude must be considered 'No-Go' areas. ▪ Consideration of the narrowing of the construction servitude must be given to construction work in sensitive areas – i.e. sensitive habitats and vegetation types, in particular coastal forest (on the primary dune), swamp forest and sand forest. ▪ The construction/work servitude must accommodate all construction related activities, including materials storage, soil stockpiles, access routes etc. ▪ Where possible, access must be confined to the existing road infrastructure and disturbed areas. ▪ Vegetation clearing/stripping within the construction footprint must only be done as the construction front progresses. ▪ The extent of disturbance must be limited to the extent of the construction footprint. No areas outside the construction footprint may be cleared unless authorised. ▪ Working right of ways / construction servitudes must be limited to the widths specified in the						

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

construction methodology for each infrastructure component.

Measures for minimising the destruction of the forest canopy in the Primary Dune Forest.

- Allow for slight deviations in the fence line to miss specific protected (marked with danger tape with the letter "P") and mature trees.
- Limit the pruning of trees only to the removal of side branches that are in direct conflict with the fence line leaving the main trunk of the tree and the canopy intact.

Temporary Site Camp Establishment:

- All temporary site camps must be established on disturbed habitats of low or moderately low EIS subject to approval by the ECO (e.g. existing homestead yards or forestry timber laydown areas).
- Ideally site camps should be located within the 50m application corridor.
- Avoid site camps within intact habitat, especially those containing identified protected plants and native woody plant species such as areas with abundant trees and shrubs.
- Fewer, densified site camps spread along the border patrol road or border fence are recommended over many Site Camps.
- All site camps must be fenced off to limit any accidental vegetation disturbance outside the approved area.
- Vegetation clearing must be kept to an absolute minimum, with grass/vegetation to be mowed/cut to ground level rather than cleared entirely

Financial Penalty Clauses

- The penalty clause for stripping vegetation within the construction footprint without prior approval from the ECO shall be in the order of R50, 000 per incident.
- The penalty clause for stripping vegetation outside the construction footprint without prior approval from the ECO shall be in the order of R100, 000 per incident and the disturbed areas shall be re-vegetated with trees saplings to match the tree density of adjoining habitats.
- The penalty clause for destroying/damaging protected species of flora without any relevant plant permits and licences shall be in the order of R100, 000 per incident.

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Aspect: General Construction Activities. **Impact:** Indirect Erosion, Sedimentation and Pollution Impacts.	**Without**	2	2	2	3	-9	**Medium**
		With	1	2	1	1	-5	**Low**
		Key mitigation measures: Soil Management (Stockpiling): ▪ The topsoil layer must be stripped from the construction footprint and stockpiled separately from overburden (subsoil and rocky material). ▪ Topsoil is to be handled twice only – once to strip and stockpile, and once to replace and level. ▪ In the absence of a recognizable topsoil layer, strip the upper most 300mm of soil ▪ All stockpile areas must ideally be established on disturbed flat ground. ▪ Stockpile topsoil stripped from different sites separately, as reapplication during rehabilitation must be site specific. ▪ Where necessary, erosion/sediment control measures such as silt fences and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles. ▪ Soil stockpiles are to be kept free of weeds and are not to be compacted. ▪ The slope and height of stockpiles must be limited to 2m to avoid soil compaction and destruction of soil microbes. ▪ Spoil material must be hauled to a designated spoil site. No spoil material must be pushed down slope or discarded on site. ▪ For the border barrier it is recommended that stockpiling of occurs along the trench given that the						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		construction footprint of the obstacle barrier is flat, sandy and transformed. The soil stockpile will need to be established between the existing border fence and the trench. Erosion Control Measures: ▪ Vegetation/soil clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. ▪ Any vegetation clearing should be done immediately before construction activities to avoid prolonged exposure of the soil to weather elements. ▪ All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of sediment barriers (e.g. silt fences, sandbags, hay bales, earthen diversion berms). ▪ Sediment barriers should be regularly maintained and cleaned so as to ensure effective drainage. ▪ After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with appropriate material and re-shaped. ▪ Construction-phase stormwater management is highly important in the context of the **sensitive and steeply sloping primary dune**. Temporary stormwater engineering controls (berms and sandbags, soil curtains across the slope contour) must be implemented at the dune to ensure effective control of stormwater during construction. Pollution Prevention Measures: ▪ The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, etc.) needs to be administered.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Construction materials at risk spilling are to be stored in appropriate containment structures (e.g. drip-trays). ▪ Hazardous storage and re-fuelling areas must be bunded. 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. Concrete must be mixed off site and brought to the site ready mix. The ready mix cement should then be carried in to the site bags or buckets. It is very important that this measure be applied in all wetlands and within the (primary) dune forest. ▪ Cement/concrete batching is to be done on an impervious surface such as wooden shutter boards or heavy duty sail. No batching activities shall occur directly on the ground. Furthermore, the site for batching must first be approved by the ECO. ▪ Provide drip-trays beneath standing machinery/plant. ▪ No refuelling, servicing or chemical storage should occur outside the established construction camp. ▪ Spillages of fuels, oils and other potentially harmful chemicals should be cleaned up immediately and contaminants properly disposed of using appropriate spill kits. Any contaminated soil from the construction site must be removed and rehabilitated or disposed appropriately Management of Solid Waste: ▪ Provide adequate rubbish bins and waste disposal facilities on the construction site and at site camps. ▪ All bins must be animal proof.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed. ▪ The construction site must be kept clean and tidy and free from rubbish. ▪ Recycling/re-use of waste is to be encouraged. ▪ No solid waste may be burned on site. Invasive Alien Plant Control: ▪ All alien invasive vegetation that colonise the construction site must be removed, preferably by uprooting. The contactor should consult the ECO regarding the method of removal. ▪ All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed. ▪ Herbicides should be utilised where hand pulling/uprooting is not possible. Fire Management: ▪ No open fires to be permitted on construction sites. Fires may only be made within the construction site camps and only in areas and for purposes approved by the ECO. ▪ Fire prevention facilities must be present at all hazardous storage facilities. ▪ Ensure adequate fire-fighting equipment is available and train workers on how to use it. ▪ Ensure that all workers on site know the proper procedure in case of a fire occurring on site. ▪ Smoking must not be permitted in areas considered to be a fire hazard. ▪ Ensure that no refuse wastes are burnt or buried on the construction site or on surrounding areas.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Ideally, site camps must be located on flat ground to prevent any need for alteration of the ground level which will increase the risk of soil erosion problems.					
	Aspect: General Construction Activities **Impact:** Impacts on Biodiversity Processes (Connectivity)	**Without**	1	2	2	2	-7	**Medium**
		With	1	2	1	1	-5	**Low**
		Key mitigation measures: ▪ The construction servitude should be limited to the proposed development footprint and a 10 m working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc. ▪ Under no circumstances must the construction servitude encroach out of the 50m authorisation corridor, or any other approved construction area (e.g. the Farazela Construction Camp) ▪ The outer edge of the construction servitude/working area (as defined above) must be clearly demarcated for the entire construction phase using a brightly coloured hazard fence. All areas outside (including upstream and downstream) of this demarcated construction servitude must be considered 'No-Go' areas. ▪ Consideration of the narrowing of the construction servitude must be given to construction work in sensitive areas – i.e. sensitive habitats and vegetation types, in particular coastal forest (on the primary dune), swamp forest and sand forest. ▪ The construction/work servitude must accommodate all construction related activities, including materials storage, soil stockpiles, access routes etc. ▪ Where possible, access must be confined to the existing road infrastructure and disturbed areas. ▪ Vegetation clearing/stripping within the construction footprint must only be done as the construction front progresses. ▪ The extent of disturbance must be limited to the extent of the construction footprint. No areas outside the construction footprint may be cleared unless authorised. ▪ Working right of ways / construction servitudes must be limited to the widths specified in the construction methodology for each infrastructure component.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		Temporary Site Camp Establishment: ▪ All temporary site camps must be established on disturbed habitats of low or moderately low EIS subject to approval by the ECO (e.g. existing homestead yards or forestry timber laydown areas). ▪ Ideally site camps should be located within the 50m application corridor. ▪ Avoid site camps within intact habitat, especially those containing identified protected plants and native woody plant species such as areas with abundant trees and shrubs. ▪ Fewer, densified site camps spread along the border patrol road or border fence are recommended over many Site Camps. ▪ All site camps must be fenced off to limit any accidental vegetation disturbance outside the approved area. ▪ Vegetation clearing must be kept to an absolute minimum, with grass/vegetation to be mowed/cut to ground level rather than cleared entirely					
	Aspect: General Construction Activities **Impact:** Ecological disturbance and nuisance impacts	**Without**	2	2	2	3	-9	**Medium**
		With	2	2	1	2	-7	**Medium**
		Key mitigation measures: Wildlife Management: ▪ Education of workers/employees onsite on not to harm wildlife unnecessarily will assist in mitigating this impact. Contractor induction and staff/labour environmental awareness training needs are to be identified and implemented through staff/contractor environmental induction training. This should include basic environmental training based on the requirements of the EMPr, including training on avoiding and conserving local wildlife. ▪ No wild animal may under any circumstance be hunted, snared, captured, injured, killed, harmed in					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		any way or removed from the site. This includes animals perceived to be vermin (such as snakes, rats, mice, etc.). ▪ Any fauna that are found within the construction zone must be moved to the closest point of natural or semi-natural habitat outside the construction corridor. ▪ The handling and relocation of any animal perceived to be dangerous/venomous/poisonous must be undertaken by a suitably trained individual. ▪ All vehicles accessing the site should adhere to a low speed limit (30km/h is recommended) to avoid collisions with susceptible species such as reptiles (snakes and lizards). ▪ No litter, food or other foreign material should be disposed of on the ground or left around the site or within adjacent natural areas and should be placed in demarcated and fenced rubbish and litter areas that are animal proof. ▪ Ensure that workers accessing the site conduct themselves in an acceptable manner while on site, both during work hours and after hours. ▪ Temporary noise pollution should be minimized by ensuring the proper maintenance of equipment and vehicles, and tuning of engines and mufflers as well as employing low noise equipment where possible. ▪ No activities should be permitted at the site after dark (between sunset and sunrise), except for security personnel guarding the development site Fire Management: ▪ No open fires to be permitted on construction sites. Fires may only be made within the construction site camps and only in areas and for purposes approved by the ECO. ▪ Fire prevention facilities must be present at all hazardous storage facilities. ▪ Ensure adequate fire-fighting equipment is available and train workers on how to use it.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ Ensure that all workers on site know the proper procedure in case of a fire occurring on site. ▪ Smoking must not be permitted in areas considered to be a fire hazard. ▪ Ensure that no refuse wastes are burnt or buried on the construction site or on surrounding areas.						
Operations	**Aspect:** Operational Use / presence of border control infrastructure **Impact:** Physical Habitat Modification	**Without**	2	3	2	2	-9	**Medium**
		With	1	2	1	1	-5	**Low**
		Key mitigation measures: Invasive Alien Plant Control: ▪ All alien invasive vegetation that colonise the servitude must be removed, preferably by uprooting. Similar methods of removal to that of the construction phase regarding the method of removal. ▪ All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed. ▪ Herbicides should be utilised where hand pulling/uprooting is not possible. Undertaking road/fence repair/maintenance work: ▪ All unforeseen repair work to will need to comply with recommendations and guidelines provided for the construction phase Maintenance of Border Patrol Infrastructure: ▪ Maintenance of the Road Infrastructure: The border patrol road must be inspected daily by SANDF personnel while undertaking their daily patrols. Should any damage be detected, maintenance/repairs of the road infrastructure must be done in accordance with construction mitigation measures provided.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Maintenance of Stormwater Infrastructure: Stormwater infrastructure must be inspected preferably on an annual prior to the start of the rainy season. Blocked infrastructure will need to be unblocked while silted structures will need to have excess sediment removed. ▪ Maintenance of the fences and barrier: this infrastructure must be inspected by SANDF personnel while undertaking their patrols. Should any sections be damaged and require replacement, this must be done in accordance with construction mitigation measures provided. Erosion control and slope stability concerns: ▪ Where soil erosion or embankment instability concerns persist, particularly in rehabilitated areas and areas with steep terrain, it is recommended that such areas are monitored to inform the need for further intervention. Interventions such as slope stabilisation or additional habitat/vegetation rehabilitation may need to be undertaken as per the conceptual rehabilitation plan compiled as part of the biodiversity study.					
	Aspect: Operational Use / presence of border control infrastructure **Impact:** Indirect Erosion, Sedimentation and Pollution Impacts	**Without**	1	3	2	2	-8	**Medium**
		With	1	2	1	1	-5	**Low**
		Key mitigation measures: ▪ All SANDF and other vehicles utilising the patrol road must properly maintained to prevent leaks of fuel and other pollutants into the environment. Erosion control and slope stability concerns ▪ Where soil erosion or embankment instability concerns persist, particularly in rehabilitated areas and areas with steep terrain, it is recommended that such areas are monitored to inform the need for further intervention. Interventions such as slope stabilisation or additional habitat/vegetation rehabilitation may need to be undertaken as per the conceptual rehabilitation plan compiled as part of the biodiversity study.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		Measures specific to the primary dune: ▪ Erosion of the substrate of the primary dune is a particularly significant potential impact that will occur if mitigation measures are not implemented. A number of measures specific to the dune footpath and adjacent construction footprint that will need to be rehabilitated must be implemented: ▪ Measures to secure the sandy substrate along the footpath must be implemented as part of the design and construction of the footpath across the dune. It is recommended that branches cut off trees to open up the fence line and footpath servitude be laid across the slope on the contour and pegged into place to serve as steps and to limit soil movement. Sandbags can also be utilised to create a stepped or terraced footpath. ▪ Soft engineering measures, e.g. sand filled Bidim bags must be used to stabilise the toe of the dune slope to prevent the slumping of the dune and submerging of vegetation where vegetation has been removed ▪ In addition to the plants retained as part of the search and rescue operation, the exposed soil along the fence line and in other parts of the construction footprint where vegetation was removed must be revegetated with local, low growing, salt-tolerant, drought resistant ground cover to help stabilise the dune.					
	Aspect: Operational Use / presence of border control infrastructure **Impact:** Positive Impact on Biodiversity Features (especially within protected areas) by ensuring reduced occurrences of illegal activities such as poaching, illegal fishing, etc. Offsetting of loss of habitat though	**Without**	1	3	1	2	+7	**Medium**
		With	3	3	1	3	+10	**High**
		Key mitigation measures: ▪ Maintaining of all border control infrastructure to acceptable standards to ensure illegal crossings do not occur. ▪ Application of biodiversity offset measures, as specified by the determining authority.						

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

8.3.5 *Freshwater Resources (Wetlands)*

Table 8-7: Freshwater Resources impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities within wetlands. **Impact:** Physical destruction and / or modification of aquatic habitat	**Without**	2	3	2	4	-11	**High**
		With	1	2	2	4	-9	**Medium**
		Key mitigation measures: ▪ Site Establishment and Access Control - General Recommendations and Wetland Demarcation ▪ The construction/work servitude must accommodate all construction related activities, including materials storage, soil stockpiles, access routes etc. ▪ Where possible, access must be confined to the existing road infrastructure and disturbed areas. ▪ Vegetation clearing/stripping within the construction footprint must only be done as the construction front progresses. ▪ The extent of disturbance must be limited to the extent of the construction footprint. No areas outside the construction footprint may be cleared. ▪ All demarcation work must be signed off by the ECO. ▪ For construction of the 5.5m Gravel Road, fence and border barrier structure, a maximum construction servitude of 10m is recommended. ▪ For construction of the wooden boardwalk, a maximum construction servitude of 5m is recommended. ▪ At wetland crossings, the outer edge of the construction servitude/working area/corridor as defined above must be clearly demarcated for the entire construction phase using plastic orange bonnox/other hazard fencing. All areas outside of this demarcated corridor must be considered 'No-Go' areas. ▪ Under no circumstances must any wetland outside of the permitted construction footprint be impacted by temporary accesses. In this regard, all temporary access routes located outside of the construction servitude must be existing accesses. ▪ Wetlands outside of the demarcated construction area (i.e. downstream of the infrastructure upgrade)						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		are strictly 'No Go' areas. These areas should not be accessed by machinery or workers for any reason. This includes and water resources originally rated as of low to very low risk during the desktop mapping and risk screening. ▪ Any contractors found working inside the 'No-Go' areas (areas outside the working servitude) should be fined as per fining schedule/system setup for the project. ▪ Wetland areas outside of the construction servitude that are disturbed during the construction phase must be rehabilitated immediately (as per the recommendations of the Freshwater Report). All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO as per the relevant re-vegetation/re-planting plan. ▪ Where channels within valley bottom wetlands have been disturbed, the channels should be re-graded, stabilised using erosion control measures and re-vegetated as per the recommendations contained in the freshwater report. Specific Measures for Working within or near Rivers and Wetlands ▪ Prior to the stripping, infilling, excavation and re-shaping of the wetland habitat within the development footprint/corridor, a search and rescue of indigenous flora and fauna must be undertaken. ▪ Any direct modification of wetland and river channels for the installation of culverts and road drainage must be limited to the construction servitude. ▪ Indigenous wetland and riparian vegetation removed from the road footprint and suitable for rehabilitation activities must be carefully removed and stored in an appropriate facility for rehabilitation purposes. ▪ Movement of construction vehicles across wetlands must be minimised as much as possible. ▪ No physical damage should be done to any aspects of the channel and banks of any wetland channel other than those necessary to complete the works as specified. Channel bed and bank materials are not to be removed from the watercourse or used for construction purposes. ▪ Thereafter, any topsoil and vegetation from areas to be excavated should be stripped and stored at					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		the designated soil stockpile area outside of the aquatic zone for use later in rehabilitation. ▪ Soil and other material required for construction purposes must not be derived from any river or wetland. ▪ Any topsoil removed from watercourses must be stockpiled separately from subsoil material and be stored appropriately for use in rehabilitation activities. ▪ Indigenous wetland and riparian vegetation removed from the road footprint and suitable for rehabilitation activities must be carefully removed and stored in an appropriate facility for rehabilitation purposes. ▪ Where possible, vegetation should be cut to ground level rather than removing completely so as to assist with binding/stabilising the soil during land-clearing operations. ▪ The ECO will need to mark any indigenous wetland and trees (especially within swamp forests) or sensitive plant species adjacent to the construction servitude that are not to be damaged during construction. ▪ No persons may remove, damage, deface, paint or disturb of any flora (plants) outside of the demarcated construction areas, unless specifically authorised by the ECO in consultation with the resident engineer. ▪ Heavy machinery will be likely to need to work in saturated or inundated situations in a number of the larger wetlands along the route. Such machinery (e.g. excavators) could potentially cause a lot of damage to saturated soils (wetland substrate) if they were to move directly on these soils, by both compacting the soils and churning. For wetlands that are saturated at the time of construction it is recommended that a form of running track be constructed into the wetland to allow such heavy machinery to move and work within the construction footprint without exerting excess impacts on wetland soils and vegetation. Running tracks can be constructed from materials such as bogmats or crushed stones to form a raised track above the ground level of the wetland. It is important that the material utilised to create the running track be fully removed from the wetland at the conclusion of construction at each site (wetland).					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Alien Plant Control ▪ All alien invasive vegetation that has colonised the construction site must be removed, preferably by uprooting. The contactor should consult the ECO regarding the method of removal. ▪ All bare surfaces across the construction site must be checked for alien invasive plants at the end of every month and alien pants removed by hand pulling/uprooting and adequately disposed. ▪ Herbicides should be utilised where hand pulling/uprooting is not possible. Only herbicides which have been certified safe for use in freshwater habitats by independent testing authority to be used. The ECO must be consulted in this regard. ▪ No building material, soils or rubble is to be disposed of within any wetland. Site-specific Measures A number of construction measures are specified for specific wetlands along the Phase 1 alignment: Lake kuZilonde ▪ It is recommended that the boardwalk structure not only traverse the lake, but should traverse the wetlands to the east of the lake, in particular the swamp forest wetland which is highly sensitive. No fences apart from the international (elephant border fence) should traverse the swamp forest as cattle and other livestock are unlikely to be able to move through this area of swamp forest that is likely to be permanently inundated. Inner and servitude fences can however be erected in the 'dry' non-wetland section of the border line between 26°51'40.40"S 32°52'20.35"E (KM2.08) and 26°51'39.56"S 32°52'24.41"E (KM1.89). ▪ For the construction of the boardwalk and elephant fence across the lake, swamp forest and papyrus swamp which is permanently saturated, an elevated running track must be constructed *between the fence and the road alignment*, so that a single running track is able to be used for both the fence and the boardwalk construction. The purpose of the running track is to allow tracked construction vehicles (such as excavators) to move across the lake for construction purposes without causing damage to the lake substrate.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ The running track must not be wider than the width required for one excavator to move along it, and must be kept as narrow as possible. ▪ It is recommended that the running track be constructed from rip rap or similar large sized rock and boulders that will be able to be fully removed once construction is complete. ▪ Once construction of the boardwalk and fence is complete the running track must be fully removed, with care taken not to remove the lake substrate. No material that will prevent the free movement of fish and other aquatic fauna must be retained within the lake. ▪ If possible, the design of the international border fence through the open water section should allow the free movement of hippopotami (*Hippopotamus amphibius*) to the northern section of the lake. Mitigation measures for Swamp Forest Wetlands ▪ In addition to Lake kuZilonde, there are two large swamp forest wetlands (W70A-W17/18 & W70A-W15 as named in the freshwater report) that are highly sensitive as they are in a largely natural state. It is imperative that the footprint of the infrastructure be kept as narrow as possible through these two wetlands. ▪ It is strongly recommended that the border barrier structure through these wetlands be constructed along the existing road and that the elephant fence be incorporated into the barrier at through these wetlands. The (new) border patrol road should be developed in immediate proximity to the barrier with the inner fence being placed immediately adjacent to the south side of the patrol road. ▪ It is recommended that the existing culverts along the existing patrol road be lengthened to accommodate through flows under the road. Additional pipe culverts should be placed under the road in line with the spacings in the barrier to allow diffuse (surface and subsurface) flows to underpass the infrastructure. ▪ It is strongly recommended that no servitude fence be developed through these two wetlands as this would result in the impacting of swamp forest habitat away from the road where no impact currently exists.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		▪ In wetland unit W70A-W15 these measures must be implemented between 26°51'47.73"S 32°46'55.47"E (KM11.225) and 26°51'48.29"S 32°47'6.54"E (KM10.9). ▪ In wetland unit W70A-W17/18 these measures must be implemented between 26°51'49.18"S 32°45'55.88"E (KM12.875) and 26°51'47.64"S 32°46'9.73"E (KM12.485)						
	Aspect: Construction activities within wetlands. **Impact:** Flow modification and erosion/sedimentation impacts: .	**Without**	2	3	2	3	-10	**High**
		With	1	2	2	2	-7	**Medium**
		Key mitigation measures: Wetland Crossing Design: ▪ Fill embankments located within the larger valley bottom wetland features should incorporate culverts to allow for the dissipation of flood water across there features during flood events. ▪ Ensure fill embankments are stabilised and vegetated with good grass cover ▪ Where possible, road batters must be designed to a minimum of a 1:3 slope in order to minimise unstable eroding slopes. Slopes steeper than 1:2 are more prone to erosion, slumping and washouts. Road Stormwater Design Mitigation Measures ▪ Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of discharge directly into watercourses / wetland and subsequent erosion. ▪ The location and design of road drainage and discharge points shall be done in a manner that minimises peak discharge to downstream aquatic resources by considering the following: ▪ Decreasing volume of water reaching wetlands as surface flow by encouraging infiltration; and ▪ Decreasing velocity of flows entering aquatic resources (either through structural or vegetative means). ▪ In order to reduce the volume and velocity of stormwater runoff received by watercourses, road runoff should be removed from roads via road drainage infrastructure constructed at regular intervals to avoid point source scouring at the outlets. ▪ Wherever possible, all outlets must be located outside of the delineated watercourses						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		(wetlands/river). ▪ When designing stormwater outlets, many small outlet discharges must be favoured over a few large outlets to reduce outlet flow volumes and velocities. ▪ All outlets must have adequately designed erosion protection and energy dissipation measures e.g. Reno-mattresses, stone-pitching) suitable to reduce anticipated discharge velocities to levels that do not pose an erosion risk. ▪ Armouring of the downstream buffer zones area (e.g. reno-mattresses with vetiver bands) must be installed below all storm water outlets prior to flows entering downstream watercourses. ▪ Wherever possible, vegetated swales/side drains should be specified rather than concrete lined drainage channels (e.g. concrete V-drains). Vegetated swales/side drains should be well-vegetated with appropriate species and stabilized by means of gabion or concrete cut-off walls to prevent erosion and vertical incision. Similarly outlets should not be piped outlets but open vegetated channels or vegetated mitre drains. ▪ Water should be discharged at regular intervals along road segments on the approach to watercourses / wetlands so that the volume and velocity of flows reaching final discharge point into a watercourse is reduced as far as possible. ▪ Appropriate outlet structures and energy dissipater blocks are to be specified at all discharge points to break the energy of the storm water. ▪ Where possible, construct attenuation features (e.g. stilling basins) at the discharge points of the side drains to control the flows entering the water courses. Wetland Crossing Design Considerations ▪ Coarse bedding material or geotextile wrapped dump rock must be used wherever the roads crosses wetland characterised by diffuse subsurface flows. Based on the nature of wetlands in the study area, this is likely to include most wetlands, in particular un-channelled valley-bottoms. ▪ A series of portal (preferably) culverts must be installed across the width of any broad un-channelled valley bottom wetlands so as to maintain diffuse surface flows to downstream wetland areas. ▪ For large floodplains and channelled valley bottom wetland systems characterised by intermittent or infrequent overtopping of its banks, design must include secondary culverts on the floodplain or flood bench features outside the main channel to facilitate flooding across the full width of the valley floor. ▪ Crossings that are installed below the natural ground level are to be constructed with an appropriate					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		drop inlet structure on the upstream side to ensure that headcut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert; ▪ In some instances it may be appropriate to construct a drop inlet structure on the upstream side of the culvert with overflow walls raised slightly above the natural ground level. This will encourage the development of an area that will remove sediment from the water as well as lead to the establishment wetland habitat that will enhance water quality. ▪ Under no circumstance should a river or wetland be impounded / dammed in such a manner as to totally restrict the flow and cause flooding/inundation upstream of the road embankment. This includes the impoundment of sub-surface flows (interflow). ▪ Where existing roads are utilised as the border patrol road, an assessment of whether sufficient numbers of existing culverts are located across the extent of the wetland as crossed by the road must be made. If insufficient numbers of existing culverts are located within the existing road structure to allow flows across the width of the wetland to be maintained, additional culverts must be included in the design of the upgraded road. Specific Measures for Working within or near Rivers and Wetlands ▪ Any direct modification of wetland and river channels for the installation of culverts and road drainage must be limited to the construction servitude. ▪ Before any work commences, sediment control/silt capture measures (e.g. bidim/silt curtains) must be installed downstream/downslope of the active working areas. Quantities of silt fences/curtains shall be decided on site with the engineer, contractor and ECO. The ECO should be present during the location and installation of the silt curtains. ▪ Silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. When de-silting takes place silt must not be returned to the wetland / watercourse. ▪ Temporary stormwater control measures must be implemented within the construction servitude, especially where sloping ground is encountered in close proximity to wetlands. This includes the use of stormwater retardation measures such as low earth bunds / sand bags to manage and prevent the un-controlled ingress of stormwater surface flows into wetlands.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ Excavated sediments from the construction zone, including any foreign materials, should not be placed within the delineated wetlands in order to reduce the possibility of material being washed downstream. ▪ Thereafter, any topsoil and vegetation from areas to be excavated should be stripped and stored at the designated soil stockpile area outside of the aquatic zone for use later in rehabilitation. ▪ Where possible, vegetation should be cut to ground level rather than removing completely so as to assist with binding/stabilising the soil during land-clearing operations. ▪ All cleared and trimmed vegetation shall be removed from the wetland upon completion of clearing in order to prevent the risk of flooding/snagging ▪ Heavy machinery will be likely to need to work in saturated or inundated situations in a number of the larger wetlands along the route. Such machinery (e.g. excavators) could potentially cause a lot of damage to saturated soils (wetland substrate) if they were to move directly on these soils, by both compacting the soils and churning. For wetlands that are saturated at the time of construction it is recommended that a form of running track be constructed into the wetland to allow such heavy machinery to move and work within the construction footprint without exerting excess impacts on wetland soils and vegetation. Running tracks can be constructed from materials such as bogmats or crushed stones to form a raised track above the ground level of the wetland. It is important that the material utilised to create the running track be fully removed from the wetland at the conclusion of construction at each site (wetland). Flow Modification & Erosion/ Sedimentation Impacts ▪ It is recommended that construction across wetlands take place preferably during the dry/winter months where possible to reduce risk of erosion and sedimentation associated with summer rainfall in the region. Such timing in seasonal and ephemeral wetlands (especially in channelled settings) will greatly reduce suspended solid and erosions and sedimentation impacts and will allow for easier isolation works (coffer dams and diversion where required) and less risk of compromising the construction process due to unplanned high water levels and flooding. ▪ For the Phase 1 project no water is to be abstracted from wetlands for use in construction activities and all water must be obtained from municipal sources. Soil Management (Stockpile areas) ▪ No soil stockpile areas must be located within 50m of any wetland.					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ All stockpile areas must be established well within the construction servitude. The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. ▪ Erosion/sediment control measures such as silt fences, concrete blocks and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles. ▪ Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled topsoil must be kept moist and this can be achieved through irrigation of topsoil stockpiles on a weekly basis. ▪ If soil stockpiles are to be kept for more than 3 months they must be hydro-seeded. ▪ The slope and height of stockpiles must be limited to 2m and are not be sloped more than 1:2 to avoid collapse. ▪ Spoil material must be hauled to a designated spoil site or landfill site. No spoil material must be discarded on site. Flow and Erosion/Sedimentation Control Measures ▪ Vegetation/soil clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. ▪ Construction activities should be scheduled to minimise the duration of exposure bare soils on site. ▪ Run-off generated from cleared and disturbed areas/slopes that drains into watercourses must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. ▪ Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope. Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage. ▪ Berms, sandbags and/or silt fences employed must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		areas post-rehabilitation. ▪ Any flow diversions are to be done so in such a manner that water does not result in concentrated flow downslope that could initiate soil erosion. ▪ Ensure that any trenches or excavations are closed and compacted immediately after construction is completed. ▪ During construction, the contractor must check the site for erosion damage after every rainfall event, and rehabilitate this damage immediately. Management of Construction Material and Building Rubble ▪ No building material, soils or rubble is to be disposed of within any wetland. ▪ Rubble generated from demolishing of existing infrastructure must be loaded onto a dump truck as soon as it is generated. A dump truck must be on standby while culverts are being demolished for example. ▪ Once loaded onto the truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe disposal. ▪ Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area – which must be approved by the ECO and located outside of sensitive wetland/river areas designated as 'No-Go' areas.						
	Aspect: **Construction activities within wetlands.** Impact: **Impacts on water quality due to potential contaminants (hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste) released into watercourses.**	**Without**	2	2	2	3	-9	**Medium**
		With	1	1	1	2	-5	**Low**
		Key mitigation measures: ▪ Hazardous storage and re-fuelling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. The bund wall should be high enough to contain at least 110% of any stored volume. The surface of the bunded area should be sloped to the centre so that spillage may be collected and satisfactorily disposed of. ▪ Concrete must be mixed off site and brought to the site ready mix. The ready mix cement should then be carried in to the site bags or buckets. It is very important that this measure be applied in all						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		wetlands. ▪ Cement/concrete batching is to be done on an impervious surface such as wooden shutter boards or heavy duty sail. No batching activities shall occur directly on the ground. Furthermore, the site for batching must first be approved by the ECO. ▪ The proper storage and handling of hazardous substances (e.g. Fuel, oil, cement, bitumen, paint, etc.) needs to be administered. Storage containers must be regularly inspected so as to prevent leaks. ▪ 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. ▪ Drip trays should be utilised at all dispensing areas. ▪ No refuelling, servicing or chemical storage should occur within 50m of the delineated aquatic habitat or within the 100-year flood line, whichever is applicable. ▪ No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site. ▪ Vehicle maintenance should not take place on site unless a specific bunded area is constructed for such a purpose. ▪ Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage. ▪ All equipment to be used within the sensitive working areas (within the channel) must be checked daily for oil and diesel leaks before gaining access to these working areas. ▪ An emergency spill response procedure must be formulated and staff are to be trained in spill response. All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. ▪ 44-gallon drums must be kept on site to collect contaminated soil. These should be disposed of at a					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		registered hazardous waste site. ▪ Fire prevention facilities must be present at all hazardous storage facilities. ▪ Sanitation - portable toilets (1 toilet per 10 users) to be provided where construction is occurring. Workers need to be encouraged to use these facilities and not the natural environment. Toilets must not be located within the 1:100yr flood line of a watercourse / wetland or closer than 50m or from any natural water bodies including rivers, streams and riparian areas. Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor. Toilet facilities must be serviced weekly and in a responsible manner by a registered waste contractor to prevent pollution and improper hygiene conditions. ▪ Contaminated water containing fuel, oil or other hazardous substances must never be released into the environment. It must be disposed of at a registered hazardous landfill site.						
Operations	**Aspect:** Presence / Utilisation of Border Patrol Infrastructure **Impact:** Physical alteration of Wetland habitat (primarily through alien invasive vegetation proliferation).	**Without**	**2**	**3**	**2**	**2**	**-9**	**Medium**
		With	1	3	1	1	-6	**Low**
		Key mitigation measures: Alien Plant Monitoring and Control ▪ It is the responsibility of the developer/applicant to eradicate and control alien invasive plants that invade all areas disturbed by the construction and operation of the proposed road. In terms of section 75 of NEMBA. ▪ The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs. ▪ 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; and						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner. ▪ It is recommended that bi-annual annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible. ▪ Maintenance of Infrastructure ▪ Erosion headcuts, eroding river banks and scouring downstream for fence foundations in wetlands (where applicable) must be stabilised immediately to avoid damage to the wetland and to infrastructure. Eroding and/or unstable road batters must also be stabilised and rehabilitated for the same reasons ▪ Major structural maintenance of infrastructure (i.e. replacement or major repairs) within wetlands must take into account the construction phase mitigation measures above. ▪ Unless absolutely necessary (under special circumstances), patrol vehicles of any type must remain on roads and are not to create unauthorised tracks or roads. These informal roads and tracks cause unnecessary disturbance, adversely affect surface hydrology by creating ruts that can act as paths of preferential flow (thus affecting diffuse flow settings) and induce erosion where the groundcover has been disturbed. This is particularly important in depression and other un-channelled valley bottom wetland types where the wetland is characterised by moist grassland which is particularly susceptible to this type of impact. ▪ Quad patrols must make use of the same tracks and not create a series of tracks. Similar impacts to those detailed in the point above are applicable. Maintenance of the border ‘Detection Zone’ ▪ Grass Mowing: Grass mowing particularly on gentle to flat areas has been identified as a preferred					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		method to keep grass short and maintaining a clear Detection Zone. In this regard, it is recommended that tall grass be mowed biannually. The first cut can be made prior to the start of the wet season (August – September) and the second cut towards the end of the wet season (February - March). ▪ Veld Burning: In areas where mowing is not feasible, veld burning may be a viable alternative used to maintain visibility within the Detection Zone. This requires a cool burn (downwind fire) that will proceed through the grassland as quickly as possible so as to cause the least damage to herbaceous plants. Ideally grass must be burnt only in winter (May - June) when temperatures are low. Use of fire requires a firebreak system to ensure effective management of controlled burns.						
	Aspect: Presence / Utilisation of Border Patrol Infrastructure **Impact:** Flow Modification & Erosion/ Sedimentation Impacts.	**Without**	2	3	2	3	-10	**High**
		With	1	2	2	2	-7	**Medium**
		Key mitigation measures: ▪ Maintenance of Infrastructure ▪ Blocked or obstructed fences crossing channels must be inspected and cleared of sediment and debris on a regular basis. ▪ Erosion headcuts, eroding river banks and scouring downstream for fence foundations in wetlands (where applicable) must be stabilised immediately to avoid damage to the wetland and to infrastructure. Eroding and/or unstable road batters must also be stabilised and rehabilitated for the same reasons ▪ Major structural maintenance of infrastructure (i.e. replacement or major repairs) within wetlands must take into account the construction phase mitigations measures above. ▪ Regular monitoring and clearing of sediment laden roadside drains is recommended to avoid excessive accumulation of sediment in drains which will eventually render them useless. ▪ Unless absolutely necessary (under special circumstances), patrol vehicles of any type must remain on roads and are not to create unauthorised tracks or roads. These informal roads and tracks cause						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		unnecessary disturbance, adversely affect surface hydrology by creating ruts that can act as paths of preferential flow (thus affecting diffuse flow settings) and induce erosion where the groundcover has been disturbed. This is particularly important in depression and other un-channelled valley bottom wetland types where the wetland is characterised by moist grassland which is particularly susceptible to this type of impact. ▪ Quad patrols must make use of the same tracks and not create a series of tracks. Similar impacts to those detailed in the point above are applicable.						
	Aspect: Presence / Utilisation of Border Patrol Infrastructure **Impact:** ▪ Water Quality Impacts.	**Without**	2	3	2	2	-9	**Medium**
		With	1	3	1	1	-6	**Low**
		Key mitigation measures: ▪ All SANDF and other vehicles utilising the patrol road must properly maintained to prevent leaks of fuel and other pollutants into the environment. ▪ Surfaces of gravel roads within wetlands, and within the catchment of wetlands must be monitored for the presence of developing erosion that could lead to sedimentation in the downstream wetland. Erosion control and slope stability concerns ▪ Where soil erosion or embankment instability concerns persist, particularly in rehabilitated areas and areas with steep terrain, it is recommended that such areas are monitored to inform the need for further intervention. Interventions such as slope stabilisation or additional habitat/vegetation rehabilitation may need to be undertaken as per the conceptual rehabilitation plan compiled as part of the biodiversity study.						

8.3.6 Heritage Resources

Table 8-8: Heritage impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities. **Impact:** Destruction / Physical Alteration of Heritage Resources. No heritage resources have been identified along the Phase 1 alignment, but may exist at certain key points. The Farazela Border Post may contain buildings of heritage age that need to be protected.	**Without**	-1	-4	-2	-2	-9	**Medium**
		With	-1	-1	-1	-2	-5	**Low**
		Key mitigation measures: ▪ Older buildings and structures such as bridges etc. do occur in association with some of the Border Posts in the project area. Those older than 60 years old are protected by heritage legislation. A Phase Two Heritage Impact Assessment must be undertaken by a built heritage specialist before any development takes place in the immediate environs of the existing Farazela Border Post. ▪ Any graves encountered within the 50m wide application corridor must have a buffer zone of at least 30m maintained around the grave site. No development may occur within the buffer zone around the grave. Should it not be possible to respect a buffer zone then the developer would need to motivate for a Phase Two Heritage Impact Assessment in order to investigate potential grave exhumation and reburial. ▪ Various open-air Stone Age sites occur along the proposed wider project, but none have been identified along the Phase 1 alignment. Should any such sites be encountered, however, mitigation is necessary and a buffer zone of at least 10m must be maintained around them. No artefacts may be collected or removed from these sites. ▪ The developers must undertake a Phase Two Heritage Impact Assessment, by a built heritage specialist, before any development takes place in the immediate environs of the Farazela Border Post. In the context of the Phase 1 alignment, this recommendation applies to the Farazela Border Post						

8.3.7 *Palaeontological Resources*

Table 8-9: Palaeontological impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities (i.e. clearing of vegetation and other excavations) **Impact:** Destruction of Fossil Heritage through excavations of substrate.	**Without**	1	4	1	2	-8	**Medium**
		With	1	3	1	1	-6	**Low**
		Key mitigation measures: ▪ Mitigation measures are not deemed necessary by the palaeontological specialist due to the low risk of encountering and disturbing palaeontological resources associated with the development. However in the event of palaeontological resources being discovered the following measures must be implemented: ▪ The ECO in charge of these developments must be immediately notified. ▪ The discoveries must be protected (preferably *in situ*) and the ECO must report to SAHRA so that appropriate mitigation (e.g. recording, collection) can be undertaken by a professional palaeontologist. ▪ Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an approved collection which comprises a museum or university collection, while all fieldwork and reports should meet the minimum standards for palaeontological impact studies proposed by SAHRA.					

8.3.8 Waste

Table 8-10: Waste impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities **Impact:** Waste generation during the construction phase will have a negative impact on the environment if not controlled adequately. Waste includes demolished (existing) infrastructure, general construction rubble and hazardous waste (used oil, cement and concrete etc.).	**Without**	1	3	2	3	-9	**Medium**
		With	1	1	1	1	-4	**Low**
		Key mitigation measures: ▪ Eating areas must not be located within 50 m of the outer boundary of any wetland habitat. ▪ Waste bins must be provided at the eating areas. ▪ Bins and/or skips need to be supplied at convenient intervals on site for disposal of waste within the construction camp. The bins should have liner bags for easy control and safe disposal of waste. ▪ Bins should be provided to all areas that generate waste e.g. worker eating and resting areas and the construction camp. General refuse and construction material refuse should not be mixed. ▪ Regular clearing of bins is required. ▪ Rubble generated from demolishing of existing infrastructure must be loaded onto a dump truck as soon as it is generated. A dump truck must be on standby while all existing infrastructure is being demolished. ▪ Once loaded onto a truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe disposal. ▪ Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area - which must be approved by the ECO.					

8.3.9 *Air Quality*

Table 8-11: Air quality impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities (site clearing; operation of vehicles, equipment etc.). **Impact:** Fugitive dust emissions from debris handling and debris piles; mobile plant/machinery and general construction activities. Other air quality impacts including vehicle emissions and odours from chemical toilets	**Without**	1	2	2	3	-8	Medium
		With	1	2	1	2	-6	Low
		Key mitigation measures: Dust Management ▪ Dust must be suppressed on the construction site during dry periods by the regular application of water. ▪ Water used for this purpose must be used in quantities that will not result in the generation of runoff. ▪ Dust dispersion from construction activities, roads, soil stockpiles and other construction locations will be limited and suppressed to the maximum extent practical. ▪ Surplus fill material sites and stockpiles will be positioned such that they are not vulnerable to wind erosion. ▪ Skips and trucks which are loaded with construction materials must be covered. ▪ All piles should be maintained for as short a time as possible and should be enclosed by wind-breaking enclosures of similar height to the pile. ▪ Stockpiles should be situated away from wetlands and nearby receptors and should take into account the predominant wind direction. ▪ A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas or near stockpiles. ▪ Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary. ▪ Emissions from equipment and vehicles						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		▪ All mobile plant and equipment must be in good working order. ▪ A register must be maintained for vehicle maintenance. ▪ All mobile plants that are unable to be repaired immediately must be removed from service until such time as they are in good working condition. Odour Prevention ▪ Chemical toilets must be provided and cleaned on a regular (weekly) basis. ▪ Servicing receipts must be maintained and kept on site within the site environmental file. ▪ Waste must be cleaned daily from site					

8.3.10 Noise

Table 8-12: Noise impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction staff, vehicles and equipment. **Impact:** Increase in noise pollution from construction vehicles and construction staff.	**Without**	2	2	2	3	-9	**Medium**
		With	1	2	1	2	-6	**Low**
		Key mitigation measures: ▪ All construction activities must be undertaken within daylight working hours. ▪ The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order. ▪ All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability. ▪ Construction staff working in an area where the 8-hour ambient noise levels exceed 75 dBA must have the appropriate Personal Protective Equipment (PPE). ▪ All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993). ▪ Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities (blasting and excavations). ▪ A Complaints Register is to be kept at the Site Office at all times. ▪ The management of the Farazela Construction Camp must take potential noise receptors such as nearby homesteads into account and potentially noisy activities must be limited to daytime hours. Should construction staff by housed within the construction camp potentially noisy social activities must be kept to a minimum.					

8.3.11 Socio-economic & Health

Table 8-13: Socio-economic impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction activities. **Impact:** The project will contribute to job creation jobs during the construction phase.	**Without**	2	2	2	1	+7	**Medium**
		With	2	2	2	3	+9	**Medium**
		Key mitigation measures: ▪ All labour (skilled and unskilled) and Contractors should be sourced locally where possible. ▪ A labour and recruitment policy must be developed, displayed and implemented by the contractor. ▪ Recruitment at the construction site must not be allowed. ▪ A CLO must be appointed to deal with the employment of local labour and to interface between the contractor and the local community. ▪ Where possible, labour intensive practices (as opposed to mechanised) should be implemented. ▪ The principles of equality, BEE, gender equality and non-discrimination must be implemented.						
	Aspect: Construction activities. **Impact:** Contractors, the influx of people and potential job creation will result in the proliferation of social ills and issues such as crime, prostitution, the spread of HIV / AIDS, informal settlements etc. Lack of provision of ablutions that may	**Without**	3	2	3	2	-10	**High**
		With	2	2	1	1	-6	**Low**
		Key mitigation measures: ▪ The developers need to be actively involved in the prevention of social ills associated with contractors. ▪ If possible all labour should be sourced locally. ▪ Contractors and their families may not stay on-site. ▪ No informal settlements will be allowed.						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	lead to the creation of 'informal ablutions' within or close to surface water resources.	▪ Contractors must be educated about the risk of prostitution and spread of HIV and AIDS. ▪ Strict penalties will be built into tenders to deal with issues such as petty crime, stock theft, fence cutting, trespassing etc. ▪ No poaching of wildlife or selling of firewood will be allowed.						
	Aspect: Construction activities. **Impact:** Public and construction staff safety during construction.	**Without**	2	3	3	2	-10	**High**
		With	1	2	1	1	-5	**Low**
		Mitigation measures: ▪ Members of the public adjacent to the construction site must be notified of construction activities in order to limit unnecessary disturbance or interference. ▪ Construction activities must be undertaken during daylight hours. ▪ Ensure the appointment of a Safety Officer to continuously monitor safety conditions during construction. ▪ The Contractor and Safety Officer must maintain daily communication with the SANDF units responsible for patrolling the international border. The Phase 1 alignment is located along an area in which much criminal activity in the form of illegal movement of vehicles and other stolen goods occurs and accordingly safety and security must be a priority. The SANDF must be informed daily of construction numbers and progress, especially with respect to the demolishing and replacing of the border fence. ▪ All construction camps must be fenced and patrolled 24 hours a day by security personnel. ▪ It is recommended that construction workers be accompanied by members of the SANDF or SAPS in order to prevent any incidents of conflict with the Mozambican authorities related to construction activities close to, or on the border line that could lead to South African construction workers being detained. In this context it is recommended that the safety officer set up a communication protocol with the relevant Mozambican authorities to inform them of construction areas and progress to						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		facilitate safe working conditions and to minimise the possibility of any international incidents. ▪ All construction staff must have the appropriate PPE. ▪ The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents. ▪ Report and record any environmental, health and safety incidents to the responsible person ▪ Implement traffic accommodation measures during construction of the culverts.					
Operations	**Aspect:** Presence of Improved Border Control Infrastructure. **Impact:** Socio-economic Benefits to the local area due to prevention of illegal cross border activities and the prevention of spread of livestock disease	**Without**	3	3	1	3	+10	**High**
		With	3	3	2	4	+12	**High**
		Mitigation measures: ▪ The border control infrastructure must be maintained in a good condition and patrolled regularly ▪ The livestock exclusion zone must be strictly maintained as such, and all damaged to inner fences be repaired so that livestock do not enter this zone.					

9 ENVIRONMENTAL IMPACT STATEMENT

9.1 Key Findings

The proposed Phase 1 development of a number of different infrastructure components including the upgrading of the existing border patrol road and fence (to a 5.5m wide gravel road and elephant fence respectively) as well as the development of a border barrier structure and other fences is located within an area characterised by a number of biophysical environmental sensitivities due to a number of factors:

- low levels of human habitation,
- large number of large wetland systems, of which certain wetland types are rare in a South African context (freshwater coastal lakes) or contain unique and threatened swamp forest habitat
- large areas of undisturbed natural outside of protected areas,
- the presence of two large protected areas which are traversed by the proposed development,
- the project's location within a biological centre of endemism at the southern extent of the east African coastal plain which entails that many plant and animals reach their southern-most extent of distribution and occur nowhere else in South Africa.

A synthesis of these factors engenders the receiving natural environment with a high degree of environmental sensitivity. The proposed development will thus stand to impact a number of sensitive terrestrial and aquatic habitats.

Based on the nature of the project and the receiving terrestrial and aquatic environment along the Phase 1 alignment, key negative biophysical impacts were identified, namely the physical destruction and / or modification of terrestrial and aquatic habitat, as well as flow modifications and erosion / sedimentation impacts and water quality impacts within the wetlands crossed by the alignment. A particularly sensitive freshwater habitat that exists along the route is Lake kuZilonde, a freshwater coastal lake within the iSimangaliso Wetland Park that is not currently affected by any existing border control or other infrastructure. The development of the full complement of border control infrastructure would constitute an impact of high intensity and significance on this freshwater resource and this surface water feature has been flagged as highly sensitive.

A number of other wetlands along the Phase 1 alignment have been identified to be highly ecologically and hydrologically sensitive, in particular some of the large wetland systems which are comprised of extensive wetland habitat in a largely unmodified state, including a number of wetland units forming part of the Muzi Swamp wetland system, and two swamp forest wetlands in the eastern part of the alignment which are relatively unmodified and which perform a high degree of wetland related functionality.

Highly sensitive terrestrial habitats, including a number of which have been designated as being threatened (Vulnerable) on a national and provincial (Endangered) scale occur in the study area. The forest ecosystem types as well as the Maputaland Coastal Belt and Wooded Grassland Vegetation types are threatened. These vegetation types have been assigned a high or moderately high degree of ecological importance and sensitivity (EIS). These factors twinned with the occurrence of protected areas and critical biodiversity areas (CBAs) have resulted in large parts of the alignment being designated as being highly or very highly sensitive in a terrestrial ecological context. The coastal forest vegetation occurring on the primary dune at the Indian Ocean has been identified to be pristine and highly sensitive in the context of the proposed development. Significant impacts on natural habitat could thus result due to the proposed increase in the footprint of the border infrastructure if not mitigated.

A comprehensive series of mitigation measures have been identified in the biodiversity and freshwater reports in order to reduce the impacts of the project to acceptable levels. These mitigation measures are directed at preventing the different types of biophysical impacts from materialising, including direct impacts such as physical transformation of habitat and indirect / secondary impacts, including downstream (hydrological) and adverse impacts on ecological processes such as loss of ecological connectivity and fragmentation. Site-specific impacts have been specified certain freshwater and terrestrial habitats that are highly sensitive, including the coastal forest on the primary dune, Lake kuZilonde and two swamp forest wetlands along the Phase 1 alignment.

The application of sound environmental management and the application of all of the mitigation measures specified for biophysical impacts will allow the development to proceed without resulting in significant impacts on natural habitat, that will allow ecological processes to continue, and that will permit recommended management objectives for areas of natural habitat to be maintained.

It is important to note that the involvement of the biophysical specialist teams and EAP team in the planning and design of the project has allowed design measures to be implemented that comprise mitigation measures in their own right. The inclusion of design-related mitigation measures, in particular the replacement of a road across Lake kuZilonde with a wooden boardwalk structure, the non-development of a road across the primary dune at the Indian Ocean and the narrowing of the servitude as it traverses the Tembe Elephant Park will assist in the mitigation / minimisation of impacts in highly sensitive natural habitats along the Phase 1 alignment.

It should also be noted that one of the mitigation measures specified in both the freshwater and biodiversity specialist studies is the recommendation that the loss / transformation of terrestrial and freshwater habitat be offset, thus the recommendation that has been made that ecological offsets be implemented. It is important to note that the need and desirability for such an offsetting process will need to be assessed and specified as necessary or unnecessary by the relevant determining authority (DEA), in consultation with the relevant provincial authorities (EKZNW in KZN). Should offsets be deemed to be required as part of an environmental authorisation for the project, the nature and implementation of such offsets would need to be determined through consultation between the applicant, DEA and the commenting authorities, taking into account the economic and ecological benefits to biodiversity that will be provided by the project, as detailed above. Any offset recommendations specified as such by DEA must be adhered to in the development of the project

Very limited negative impacts that would result from the project development have been identified on the heritage and palaeontological environments in the area. Mitigation measures have been specified to ensure that archaeological or palaeontological resources be documented or protected should these be uncovered in the process of constructing the project infrastructure.

The overall negative biophysical impacts associated with the loss of natural habitat are counter balanced by the presence of existing border control infrastructure along the international border, and accordingly the presence of an existing impact on the natural and freshwater habitat that is associated with this infrastructure. In addition positive impacts are likely to accrue due to the project in the form of the securing of the two large protected areas along the Phase 1 alignment and the concomitant reduction of illegal cross-border impacts on biodiversity that are likely to materialise as a result.

The socio-cultural and socio-economic impacts of the project are largely positive in nature. The project is a large-scale infrastructure development project and will thus generate employment opportunities during the construction phase which will assist inhabitants of the project area to maintain their livelihoods should local inhabitants be employed by the project. In addition the infrastructure upgrades will secure the section of the border which is currently subject to a high degree of illegal movement of people and stolen goods, in particular stolen and hijacked vehicles. The infrastructure upgrades will enable a number of government departments and agencies, in particular the SANDF to more effectively perform their mandate which will

assist in the securing of the border area which is subject to high levels of crime, much of which is related to the illegal cross-border activities. This will bring positive socio-economic benefits to this part of the uMhlabuyalingana Local Municipality. In addition the securing of the border is likely to result in positive impacts on the two large protected areas traversed by the Phase 1 infrastructure by preventing poaching and illegal gill-netting which are currently significant cross-border impacts on the biota within these reserves. The positive conservation impacts are counter-balanced by the further limiting of free movement of fauna (especially large fauna – i.e. elephants) between South African and Mozambique which is one of the key objectives of the Lubombo Transfrontier Conservation Area which has been established based on a number of formal protocols signed by South Africa and Mozambique, and which is traversed by large sections of the Phase 1 alignment.

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

Table 9-1: Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
Planning Phase		
Impact related to protected plant species and habitat if pre-construction planning not undertaken	High (-11)	Low (-4)
Construction Phase		
Physical degradation of soils due to removal and compaction	Medium (-8)	Low (-4)
Soil erosion as a result of exposed soils	Medium (-8)	Low (-5)
Groundwater contamination (spillage of fuels, chemicals and lubricants; lack of ablution facilities; wash bay areas)	High (-10)	Low (-5)
Biodiversity – Direct Impacts - Physical Habitat Destruction (degradation of sensitive terrestrial habitat) and killing of fauna	Medium (-10)	Low (-4)
Biodiversity - Indirect Erosion, Sedimentation and Pollution Impacts	Medium (-9)	Low (-5)
Biodiversity - Impacts on Biodiversity Processes (Connectivity)	Medium (-9)	Low (-5)
Biodiversity – Ecological Disturbance and Nuisance Impacts	Medium (-9)	Medium (-7)
Freshwater - Physical destruction and / or modification of aquatic habitat	High (-11)	Medium (-9)
Freshwater - Flow modification (Hydrological) and erosion/sedimentation impacts	High (-10)	Medium (-7)
Freshwater (Surface Water) - Impacts on water quality due to potential contaminants	Medium (-9)	Low (-5)
Heritage – Impacts on heritage resources through vegetation clearing, excavation and possible destruction of structures with heritage value	Medium (-9)	Low (-5)
Palaeontological – Impacts on undiscovered palaeontological resources through vegetation clearing and excavation	Medium (-8)	Low (-6)

Impacts	Without Mitigation	With Mitigation
Waste – physical waste generation during construction	Medium (-9)	Low (-4)
Air quality impacts - Dust emissions, emissions from equipment and vehicles and odour from chemical toilets	Medium (-8)	Low (-6)
Noise Pollution - Increase in noise pollution from construction vehicles and construction staff.	Medium (-9)	Low (-6)
Socio-economic Impacts – job creation	Medium (+7)	Medium (+9)
Socio-economic impacts - Proliferation of social ills and issues such as crime, prostitution, the spread of HIV/AIDS, informal settlements	High (-10)	Low (-6)
Public and construction staff safety during construction	High (-10)	Low (-5)
Operational Phase Impacts		
Biodiversity: Residual Habitat Modification	Medium (-9)	Low (-5)
Biodiversity - Indirect Impacts – Erosion, Sedimentation and Pollution	Medium (-8)	Low (-5)
Biodiversity - Positive Impacts on biodiversity features, esp. in protected areas	Medium (+7)	High (+10)
Freshwater - Residual physical alteration of wetland habitat	Medium (-9)	Low (-6)
Freshwater - Flow Modification & Erosion/ Sedimentation Impacts	High (-10)	Medium (-7)
Socio-economic – positive Impacts on the local economy due to prevention of illegal cross border activities and the prevention of spread of livestock disease	High (+10)	High (+12)

9.2 Conclusion and Recommendations

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

In order to protect the environment and ensure that the development or upgrading of infrastructure as part of the Planning & Design for the Maintenance and/or Upgrade of the Patrol Roads and Fencing on the Borders between RSA, Swaziland & Mozambique – Phase 1 Project is constructed and operated in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that have been taken into account during this study. These include:

Table 9-2: Summary of Key Legislation

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations 2014 (as amended in 2017)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Environmental Management: Air Quality Act (Act No. 39 of 2004)
National Environmental Management: Integrated Coastal Management Amendment Act, 2008 (Act No. 24 of 2008)(as amended)
National Water Act (Act No. 36 of 1998)(as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
KZN Nature Conservation Ordinance (Ordinance No.15 of 1974)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)
Construction Regulations (2014)

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

The conclusions of this BAR will be updated to include comments and concerns from I&APs to ensure that all issues captured and to ensure that a comprehensive BA study is conducted. The public consultation process will make every effort to be inclusive, and every effort will be made to include representatives of all stakeholders within the process.

The project is envisaged to have an overall ***"Medium Negative"*** significance rating prior to the application of mitigation measures proposed, and a ***"Low Negative"*** significance rating post application of mitigation measures proposed.

9.3 Assumptions, Uncertainties or Gaps in Knowledge

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

- All information provided by the Engineering team to the EAP was correct and valid at the time it was provided.

- The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process.
- All data from unpublished research is valid and accurate.
- The scope of this investigation is limited to assessing the potential environmental impacts associated with the upgrading or development of border control infrastructure (border patrol road, fencing, as well as certain sections where a border barrier structure, wooden boardwalk and footpath will be developed) **along the Phase 1 section (KM0-54) only**.

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

Biodiversity Assessment

- 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.
- Given limited time in the field and access problems, not all vegetation communities were visited in the field, and for those that were visited only limited information was documented such as dominant species, conservation important plants and fauna, level of IAP infestation and the condition of the vegetation community.
- Rapid sampling and vegetation/habitat assessment methods were used due to time and budget constraints. Thus formal vegetation plots and detailed vegetation/habitat sampling and analyses were not undertaken, limiting the resolution of the information captured and produced in this study.
- Areas that were not ground-truthed / verified in the field were assessed at a low level of confidence.
- Field assessments of the border infrastructure were undertaken late in the summer/growing season (March to April 2017) and winter flowering cryptic forbs may have therefore been over-looked. The assessment therefore does not cover the full seasonal variation in conditions in the area of study.
- The locations of individual specimens of protected species were not recorded. Instead a general location of the site was recorded to which protected plants can be referenced to. GPS accuracy was limited to 3 – 5m and recording points beneath tree cover is likely to have further reduced GPS accuracy.
- 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 flora 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.
- No detailed survey of fauna was conducted during this assessment. Any fauna documented in this report are based on site observations during a limited time spent in the field and do not reflect the overall faunal composition of the site. It is assumed that based on the nature of the project, that faunal impacts are likely to be limited.
- Habitat condition and structure was used as a surrogate to assess habitat sensitivity from the perspective of harbouring conservation important species of flora and fauna, in the absence of detailed floral surveys and faunal surveys, with intact habitat/vegetation considered to be more ecologically important and sensitive in this regard in comparison to degraded/transformed habitat.

- Due to the complexities of ecological systems and the sensitive dependence on initial conditions, any predictions of the effects of perturbation are made with low confidence.
- All calculations of areas to be transformed are based on agreed construction footprints for different components of the proposed development.
- 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 nationally and for the province of KZN at the time of the assessment

Freshwater

- The freshwater report deals exclusively with a defined area and the extent and nature of freshwater/aquatic ecosystems in that area.
- The field assessments focused on prioritised wetlands as per the prioritisation methodology outlined in the freshwater report for the wider (Phase 2) project. However for the Phase 1 section of the project (KM0-54) which encompasses the border barrier (which initially comprised a separate project), the field assessment of the majority of wetlands was undertaken.
- Sampling by its nature, means that generally not all aspects of ecosystems can be assessed and identified.
- Soil samples and vegetation indicators were often inconclusive in determining the outer boundary of the wetlands onsite in some of the field assessment locations due to extensive historic and on-going disturbance of soils caused by agricultural practices.
- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked.
- While disturbance and transformation of habitats can lead to shifts in the type and extent of freshwater ecosystems, it is important to note that the current extent and classification is reported.
- Infield soil sampling and vegetation observations were only undertaken at strategic sampling points within the habitats likely to be negatively affected. Between sampling points the outer boundary had to be extrapolated using aerial photography and as such the accuracy of such extrapolated sections has limitations and is open to the interpretation of the assessor/delineation practitioner.
- The accuracy of the delineation is based solely on the recording of the onsite wetland indicators using a GPS. GPS accuracy will therefore influence the accuracy of the mapped sampling points and therefore water resource boundaries and an error of 3–5m can be expected.
- All vegetation information recorded was based on the onsite observations of the author and no formal vegetation sampling was undertaken. Furthermore, the vegetation information provided only gives an indication of the dominant and/or indicator riparian species and only provides a general indication of the composition of the vegetation communities. Thus, the vegetation information provided has limitations for true botanical applications i.e. accurate and detailed species lists and rare / Red Data species identification.
- 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 nature and physical properties of certain soil types in the study area presents difficulties for wetland boundary delineation utilising the standard delineation methodology for wetlands in South Africa (DWAF,2005). In the context of the Phase 1 study area most of the Maputaland Coastal Plain is

characterised by very sandy soils of marine origin. There is a universal presence of an E horizon within these soils and the Fernwood Soil Form (a wetland soil form) is widespread across the landscape, and not just in wetlands. A slightly altered delineation methodology based largely on plant communities and the relative abundance of hygrophilous species, along with terrain setting was accordingly used to delineate the outer boundaries of wetlands in this part of the study area.

- Inferences made about the ecological integrity/health of the wetlands/rivers assessed were based on selected variables, sampled on selected occasions at selected geographic locations. This limits the degree to which this information can be extrapolated spatially and temporally (i.e. over seasons). Wetlands by nature can be highly variable ecosystems and can display fine and large scales changes in the structure, composition and quality of the habitat over periods of time.
- No wetland fauna sampling or faunal searches were conducted. The assessment was primarily habitat-based.
- The site was surveyed in late summer and early autumn (February to April 2017). The field surveys therefore do not cover the full seasonal variation in conditions for the entire site. However, seasonality is not such an issue for the target study area as the field surveys were conducted during the growing season. In addition the need for comprehensive seasonal surveys is not warranted.
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. Effort has been made to substantiate all claims where applicable and necessary.
- 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. The health assessment was undertaken based on field assessment for all of the wetlands assessed, and is based on observations of the wetland within a 500m radius of the border line and not the entire wetland.
- The setting of the hypothetical reference state for wetland and riverine nits assessed was extremely difficult in certain cases due to the transformed and modified nature of certain of these systems and a lack of information regarding reference state. Therefore, the reference states presented should be considered speculative with a low level of confidence in certain situations.
- The Ecological Importance and Sensitivity assessment did not specifically address all the finer-scale biological aspects, including detailed faunal biodiversity assessments.
- 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 projects.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report.

Heritage

- Available heritage databases are incomplete. Parts of the study area have never been surveyed from a heritage perspective.
- The existing data bases are biased in terms of prehistoric archaeological sites. Historical period sites and cemeteries have not been recorded and do not appear on any existing data base. Sites belonging to African on African conflict as well as 'living heritage sites' need to be researched and added to available data bases.

- The project area has never been systematically surveyed for other categories of cultural heritage. It is expected that such systematic surveys will produce more sites especially in the categories of struggle-era and 'living heritage' sites.

Palaeontology

- The accuracy of Palaeontological Desktop Impact Assessments is reduced by old fossil databases that do not always include relevant locality or geological formations. The geology in various remote areas of South Africa may be less accurate because it is based entirely on aerial photographs. The accuracy of the sheet explanations for geological maps is inadequate as the focus was never intended to be on palaeontological material.
- The entire extent of South Africa has not been studied palaeontologically. Similar Assemblage Zones but in different areas might provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations generally assume that unexposed fossil heritage is present within the development area.

9.4 Recommendations

9.4.1 Recommendations to the Competent Authority

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. The project is a critical strategic importance on a national level and forms part of the National Government's obligations to secure the borders of South Africa and to protect its citizens from illegal activities. Therefore, the EAP recommends that the development / upgrading of the proposed infrastructure be authorised.

Construction is expected to commence in March 2018 and will last 36 months (for the border barrier). An EA with a validity of 10 years is recommended.

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

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

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

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

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

a) The Developer is not excluded from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:

   i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);

   ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);

iii. Provisions of the National Forests Act (Act No. 84 of 1998); and

iv. Provisions KwaZulu-Natal Nature Conservation Ordinance (Ordinance No. 15 of 1974).

b) The Developer must appoint a suitably experienced Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) A botanist must be appointed to oversee the search and rescue of plants in parts of the alignment as directed by the terrestrial ecology study.

d) An Ordinary Permit from the *eZemvelo* KZN Wildlife (*E*KZNW) is required to handle and remove any protected plant species as detailed in Schedule 12 (Specially Protected Plants) of the KZN Nature Conservation Ordinance (No. 15 of 1974) from the construction servitude.

e) A permit is required from the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of all protected tree species as listed by the Notice of the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998).

f) All other necessary permits, licences and approvals must be obtained prior to the commencement of construction.

g) The site specific mitigation measures for the sensitive areas along the alignment as detailed in this report (i.e. at the primary dune at the Indian Ocean, Lake kuZilonde and at the two Swamp Forest Wetlands) must be strictly adhered to. A wetland specialist must be appointed to oversee the design and implementation of construction through these wetlands.

9.4.2 Recommendations to the Applicant

The Applicant must adhere to the recommendations provided by the specialists and the EAP. The EMPr summarises these recommendations. The Applicant must take full responsibility for the execution of the project in a manner which does not negatively impact on the environment by ensuring that responsible decisions are made. A financial provision for all of the proposed and recommended mitigation measures must be allowed for in all contractual documentation and the EMPr must be submitted to all tenderers in order for them to accurately cost the proposed project.

9.5 Declaration by the EAP

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

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

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Signed: Malcolm Roods EAPASA.

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Appendix A

Pre-application Correspondence with the DEA

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Appendix B

Environmental Management Programme

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Appendix C

Specialist Studies

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Appendix D

EAP CV and Knowledge Group Profile

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Appendix E

Public Participation Summary Report and Record of Public Participation

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Appendix F

Maps

Appendix G

Environmental Screening Investigation for the Mozambique Barrier Structure

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Appendix H

Other Items

Royal HaskoningDHV

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

Our connections

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

Memberships

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

All Royal HaskoningDHV consultants, architects and engineers are members of their individual branch organisations in their various countries.

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