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Environmental Assessment Report for the Environmental Impact Assessment: The Proposed Upgrade and new Construction related to the Development of the Swaziland Rail Link Project, from the Sandlane border, through Sidvokodvo to the Lavumisa border.

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Environmental Assessment Report for the Environmental Impact Assessment: The Proposed Upgrade and new Construction related to the Development of the Swaziland Rail Link Project, from the Sandlane border, through Sidvokodvo to the Lavumisa border.

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EXECUTIVE SUMMARY

INTRODUCTION

Aurecon South Africa (Pty) Ltd have been appointed by Transnet State Owned Company (SOC) Ltd (hereafter referred to as Transnet) in collaboration with Swaziland Railway to undertake an Environmental Impact Assessment process in an effort to obtain authorisation for the proposed Swaziland Railway Link and associated upgrades project.

PROJECT BACKGROUND AND MOTIVATION

Transnet in collaboration with Swaziland Railway identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland Rail Network, as a strategic project. The aim of the project is to unlock the potential of a multinational strategic rail corridor and divert general freight traffic off the dedicated heavy haul Richards Bay Coal Line which runs from Ermelo through rural KwaZulu-Natal to Richards Bay.

The project activities will consist of various works, including the upgrading of existing railway sections (including re-building certain sections), construction of an entirely new rail link from Lothair in South Africa to Sidvokodvo in Swaziland and construction of new rail yards.

The project holds significant advantages in relieving the general freight bound pressure on the Richards Bay Coal Line. It provides a strategic link to congested South African export ports, as well as encouraging economic and rail transport growth in Swaziland, thus in turn reducing the need for road transport and minimising damage to roads from heavy vehicles.

ENVIRONMENTAL ASSESSMENT REQUIREMENTS

According to The Environmental Management Act no 5 of 2002, no person shall undertake any project that may have an effect on the environment without the written approval of the Authority. The applicable Authority is the Swaziland Environmental Authority (SEA).

Furthermore, any person proposing to undertake such a project shall submit a project brief to the Authority containing sufficient information to enable the Authority to determine the potential impacts of the project on the environment. Such a project brief was submitted to the SEA by Swaziland Railway. It was the SEA's opinion that the proposed project is likely to have more than a minimal or insignificant effect on the environment and Aurecon was therefore required to conduct an environmental impact assessment (EIA).

This document outlines the EIA process followed, describes the proposed development and the context in which it will take place, and identifies the potential environmental impacts. It presents the identification of key issues or concerns as highlighted by the relevant authorities, Interested and/or Affected Parties (I&APs) and professional judgement of the Environmental Assessment Practitioner (EAP). The results of the specialist studies, a full assessment of the impacts and proposed alternatives form part of this EIA report.

PUBLIC PARTICIPATION AND STAKEHOLDER ENGAGEMENT

In order to afford the Interested and Affected Parties (I&APs) the opportunity to become involved and be part of the process the public participation process as set out in Chapter 4 was followed. During the process I&APs have been afforded the opportunity to raise issues of concern, which has been recorded and included in the Environmental Assessment Report.

The public participation process was initiated by the placement of an advertisement, in the prescribed format, in the following newspapers:

- Bhunya (7 & 13 August 2013);
- Luyengo (7 & 13 August 2013);
- Siphofaneni (7 & 14 August 2013); and
- Big Bend (7 & 14 August 2013).

The newspaper advertisements provided details of the activities proposed by Swaziland Railway, requested I&APs to register and to become involved in the EIA process of the proposed project.

The following Scoping meetings were also held where Swaziland Railway presented the proposed project to all I&APs present at the meeting:

- Bhunya: 19 August 2013;
- Luyengo: 21 August 2013;
- Siphofaneni: 21 November 2013; and
- Big Bend: 22 November 2013.

IDENTIFICATION OF KEY ENVIRONMENTAL ISSUES AND PLAN OF STUDY FOR THE EIR

A baseline description of the environment was gathered through visual inspections of the site and its surroundings, desktop studies as well as specialist findings. This information was used to assess the potential areas of study, as a result of the proposed development.

Construction phase impacts on the physical, biophysical and socio-economic environment that would occur during the construction phase of the proposed project were assessed. They are inherently temporary in duration, but may have longer lasting effects e.g. pollution of a wetland during construction could have effects that may last long after construction is over. Construction phase impacts could potentially include the following:

- **Direct impacts:**
  - Visual impact of the infrastructure;
  - Windblown dust from excavations and upgrade activities;
  - Impact on ambient noise levels;
  - Litter/waste production;
  - Impact on terrestrial flora
  - Impact on terrestrial fauna;
  - Impact on aquatic ecosystems;
  - Erosion;
  - Sedimentation;
  - Loss of topsoil;
  - Traffic impacts;
  - Deterioration of water quality; and
  - Temporary employment opportunities.
- **Indirect impacts:**
  - Windblown dust from access roads;
  - Disturbance to adjoining landowners;
  - Security risks; and
  - Social impact on local communities.

It should be noted that a Comprehensive Mitigation Plan (CMP) has been developed to regulate and minimise the impacts during the construction phase and forms part of this report. The CMP is attached in Appendix E.

The potential positive and negative operational phase impacts that were identified in the Scoping Phase can be divided into three categories; namely impacts on the biophysical environmental, impacts on the social, economic and cultural environment as well as impacts on health and safety. The following potential impacts are investigated in detail in Chapter 8.

- **Impacts on the biophysical environment:**
  - Ecological;
  - Geohydrological; and
  - Noise and vibration.
- **Impacts on the social, economic and cultural environment:**
  - Social;
  - Economic and socio-economic; and
  - Cultural, heritage and archaeological.
- **Impacts on health and safety:**
  - Health;
  - Safety; and
  - Security.

CONCLUSION

The EIR provides a description of the feasible alternatives and potential impacts identified during the Scoping and Environmental Phases. It also contains additional information on the affected environment, mostly drawn from the specialist studies conducted. There is a description and assessment of the potential impacts associated with the various feasible alternatives as well as an indication of potential mitigation measures, conclusions and various recommendations with regard to the way forward. A series of Appendices and Annexures containing relevant information, including the various specialist studies is attached to this report.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
AQIA	Air Quality Impact Assessment
BTC	Biodiversity and Tourism Corridors
C_6H_6	Benzene
CAPEX	Capital Expenditure
CMP	Comprehensive Mitigation Plan
CO	Carbon Monoxide
CV	Curriculum Vitae
dBA	Decibels
DP	Distributed Power
DRC	Democratic Republic of the Congo
EAARR	The Environmental Audit, Assessment and Review Regulations of 2000
EAP	Environmental Assessment Practitioner
ECC	Environmental Compliance Certificate
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity
EMA	Environmental Management Act, 5 of 2002
ENIA	Environmental Noise Impact Assessment
ERS	Economic Recovery Strategy
FDI	Foreign Direct Investment
FEL	Front End Loading
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GIS	Geographic Information System
GVA	Gross Value Added
HC	Hydrocarbon
HIA	Heritage Impact Assessment
HIV	Human Immunodeficiency Virus
ICT	Information and Communications Technology
IEE	Initial Environmental Evaluation
IFC	International Finance Corporation
IRR	Issues and Response Report
IUCN	International Union for Conservation of Nature
I&APs	Interested and Affected Parties
KBA	Key Biodiversity Areas
Km	Kilometre
Km/h	Kilometres per hour
kV	Kilo Volt
KZN	KwaZulu-Natal
LSD	Local Suppliers Development
LUSIP	Lower Usuthu Smallholder Irrigation Project

MAP	Mean Annual Rainfall
MDAC	Ministry of Agriculture and Cooperatives
MEPD	Ministry of Economic Planning and Development
Ml	Mega Litre
MNRE	Ministry of Natural Resources and Energy
MOAC	Ministry of Agriculture and Co-operatives
MOU	Memorandum of Understanding
MPAH	Maputaland-Pondoland-Albany Hotspot
MSA	Middle Stone Age
NHRA	National Heritage Resources Act no 25 of 1999
NGO	Non-Government Organisation
NO_x	Nitrogen Oxides
NRB	Natural Reserves Board
NSD	Noise Sensitive Development
OPEX	Operational Expenditure
PES	Present Ecological State
PM	Particulate Matter
PP	Public Participation
PPP	Public Participation Process
PoSfEIA	Plan of Study for Environmental Impact Assessment
RAP	Relocation Action Plan
RSA	Republic of South Africa
SAM	Social Accounting Matrices
SANS	South African National Standard
SEA	Swaziland Environment Authority
SG	Surveyor-General
SIA	Social Impact Assessment
SMME	Small, Medium and Micro Enterprises
SNA	System of National Accounts
SNL	Swazi Nation Land
SNTC	Swaziland National Trust Commission
SO_2	Sulphur Dioxide
SOC	State-Owned Company
SR	Scoping Report
Steercom	Steering Committee
T/annum	Tons per annum
TDL	Title Deed Land
TFR	Transnet Freight Rail
TRL	Transportation Research Laboratory
UNICEF	United Nations Children's Fund
VOC	Volatile Organic Compound
ZAR	South African Rand

GLOSSARY AND TERMS

Environment:	means the whole or any component of - Nature, including air, land, water, soils, minerals, energy other than noise, and living organisms other than humans; The interaction between the components of nature and between those components and humans; Physical, aesthetic and cultural qualities or conditions that affect the health and well-being of people; and Unless the context otherwise requires, refers only to the environment within the territory of Swaziland or over which Swaziland exercises rights of sovereignty.
Environmental Impact:	The direct effect of human activities and natural events on the components of the environment.
Environmental Impact Assessment (EIA):	The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of a proposed activity on the environment and the surrounding community prior to major decisions being taken and commitments made.
Comprehensive Mitigation Plan (CMP):	A document containing a description of the mitigation measures to be implemented that would prevent, reduce or otherwise manage the environmental impacts of a project and done according to the reporting requirements in the Second Schedule of the Environmental Audit, Assessment and Review Regulations, 2000.
Feasible:	Acceptable, capable of being used or implemented successfully, without unacceptably damaging the environment.
Pollution:	Any change in the environment which 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 of involving the public in order to identify needs, address concerns, choose options, inform decision making, plan and monitor in terms of a proposed project, programme or development.
Risk:	The scientific judgement of probability and significance of harm to the environment.

1 INTRODUCTION

1.1 Details of the EAP

The Environmental Assessment Practitioner for the project is Dr Pieter Botha. Dr Botha is assisted by Mrs Candice Dürr (environmental scientist). A summary of their experience and roles in the project is given below. Their full CVs can be found in Appendix A.

Dr Pieter Botha

Dr Pieter Botha holds a DSc from the North West University, Potchefstroom Campus (1981). He is a registered professional natural scientist with the South African Council for Natural Scientific Professions. Dr Botha is also registered as an Environmental Assessment Practitioner with the International Institution for Impact Assessment (South Africa).

Dr Botha joined Aurecon's Environmental Department in May 2010 as a Senior Environmental Practitioner, and has since been involved in various projects. These have included projects such as a Front End Loading (FEL) 1 and 2 studies of the Sishen-Saldanha ore line expansion project, and an Environmental Impact Assessment (EIA) for the Isundu-Mbewu power line project awarded to Aurecon by Eskom and the FEL-1 and 2 studies for the expansion of the Port of Richards Bay.

Following a career of three decades in the public sector, he established his own consultancy with a view to make a contribution in the area of natural resources management, environmental protection and agriculture in respect of policy and legislation formulation and review, as well as the provision of capacity building in the same areas. He has also undertaken and managed a variety of complex land restitution projects for the Commission on Restitution of Land Rights in Mpumalanga and North West Provinces.

Dr Botha has managed various sections and divisions during his tenure in the public sector, and has, in this regard, been responsible for personnel management, financial management and strategic leadership.

Research has formed a vital part of the projects he has been involved in. Dr Botha started his research career as a range management research officer in the Karoo Region and learnt about the dynamics of the arid areas of South Africa and, in particular, the agricultural systems applied in those areas.

He has over three decades of experience in environmental research, policy development and implementation in South Africa, as well as writing various environmental reports. He also has

knowledge and experience relating to biodiversity conservation and utilisation in the southern African region. Dr Botha has also been involved in the development and drafting of policy and subsequent legislation in various facets of the environmental field relating to biodiversity conservation, utilisation and rural development.

An important component of his varied expertise is his involvement in the public participation process as a principal element of his diverse projects, engaging with many, different and challenging stakeholders at various different levels of engagement.

Dr Botha has led or been part of delegations in various international meetings and conferences on behalf of South Africa. This required a comprehensive in-depth knowledge of relevant subjects and policies, as well as good negotiation skills.

A copy of Dr Pieter Botha's CV is attached in **Appendix A (annexure A)**.

Mrs Candice Dürr

Assist in conducting and managing the Environmental Assessment Process. Compilation and submission of the Final EIA and CMP to the relevant authority. Liaise with authorities, stakeholders and specialists. Compilation of the water use licenses for the entire alignment.

Mrs Dürr's main focus is on environmental management of related issues within a wide range of infrastructure development which includes environmental impact assessments and environmental management plans for listed activities under the various agencies' environmental legislation. To date Mrs Dürr has gained experience on various projects located in South Africa, including the Eskom Kusile Power Station Project. Mrs Dürr is a qualified Environmental specialist and obtained her Bachelor of Science from the North West University (Potchefstroom Campus). She is currently enrolled for the final year of her BSc Honours degree in environmental management at the University of South Africa.

A copy of Mrs Candice Dürr's CV is attached in **Appendix A (annexure B)**.

1.2 Introduction to the Project Team

Role in Project Team	Name	Company
Project Director	Mr Barend Smit	Aurecon
Project Manager and lead EAP	Dr Pieter Botha	Aurecon
EAP Assistant	Mrs Candice Dürr	Aurecon
Public Participation Practitioner	Ms Elise Vermeulen	Aurecon

Role in Project Team	Name	Company
Environmental practitioner – Swaziland counterpart	Mr Steve Mitchell	Lang Mitchell Associates
Heritage Impact Assessor	Mr Bob Forester	*Private*
Ecological Impact Assessor	Dr Brian Colloty	Scherman Colloty & Associates
Air Quality Impact Assessor	Mr Roelof Burger Dr Martin van Nierop Mrs Anja van Basten	Gondwana Environmental Solutions
Geohydrological Impact Assessor	Mr Louis Stroebel Mr Marius Terblanche	Aurecon
Hydrological Impact Assessor	Dr Nicolas Walker	Aurecon
Noise and Vibration Impact Assessor	Mr Morne de Jager	Enviro-Acoustic Research
Social Impact Assessor	Mr Tebogo Sebego Mrs Noeleen Greyling	Aurecon
Socio-economic Impact Assessor	Dr Stephan Jooste Mr Eben Vos Ms Justine Barnard	Aurecon
Ecological impact assessment reviewer	Ms Julian Mlangeni	ESMS
Hydrological impact assessment reviewer	Ms Julian Mlangeni	ESMS
Social impact assessment reviewer	Ms Julian Mlangeni	ESMS
Socio-economic impact assessment reviewer	Ms Julian Mlangeni	ESMS

1.3 Project background

Swaziland Railway and Transnet SOC Ltd identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland rail network, as a strategic project. The aim of the project is to unlock the potential of a multinational strategic rail corridor and divert general freight traffic off the dedicated heavy haul Richards Bay coal line.

Swaziland Railway and Transnet commissioned a concept level study in 2011 to investigate the provision of a rail link between Lothair (South Africa) and a suitable location along the existing Swaziland railway network. The concept unlocks potential for a multinational strategic rail corridor, while at the same time relieving pressure from the heavy haul Richards Bay coal line.

Regional support for this project was confirmed by the signing of the Inter-Governmental Memorandum of Understanding (MOU) between South Africa and Swaziland governments on 2nd

August 2012. The signing of the Inter Rail MOU by Transnet and Swaziland Railways on 23rd November 2012 cemented the relationship at business and technical levels.

Swaziland Railway provides their vision and mission statement as follows:

VISION:
"To provide an efficient transport system that offer total logistics to our clients".

MISSION:
"To be the total transportation service of choice for the Southern African community"
Through:

- Maintaining a service that is responsive to customer needs
- Ensuring safe and secure working conditions for employees and the general public, taking into account our physical impact on our country's environment
- Improving profitability through cost-effective measures and increasing market share
- Providing employees the opportunity for personal development and
- Maintaining the integrity of our relationship with our suppliers

Swaziland Railway moves a wide diversity of traffic, including Swaziland's export commodities of sugar, coal, canned fruit, wood pulp and timber, as well as imported goods such as petroleum products and general goods. The Railway also operates a state of the art Dry Port which is a satellite port for Durban Port.

The 300 km continuously welded Swaziland rail network with concrete sleepers cover the whole network. The network extends east from Matsapha Industrial Site to Phuzumoya where it connects with Northern rail link to access the South African ports of Durban and Richards Bay. The Mananga link to the North provides access to northern countries such as Zimbabwe, Zambia, and DRC.

Swaziland Railway presently has a staff of 327 and moves on average 4 million tonnes a year. About 75% of the traffic is transit traffic which makes the small railway a bridge railway. The Railway has capacity to move 80, 50 and 40 wagon trains which is unique in Africa.

In terms of Swaziland's Environment Management Act, 5 of 2002 the proposed development triggers activities which may significantly impact on the environment. As a result Swaziland Railway requires Environmental Authorisation from the competent authority, the Swaziland Environmental Authority (SEA) to commence with the development.

The "Equator Principles" established by the Equator Principles Financial Institutions are described for applicability to the project. Visible compliance to this set of voluntary guidelines for the financing industry in assessing environmental and social risks is a prerequisite for funding and investment purposes.

The project activities will consist of various works, including the upgrading of existing railway sections (including re-building certain sections) from Sidvokodvo to Lavumisa, construction of an entirely new rail link from Sandlane to Sidvokodvo and construction and upgrading of rail yards. These proposed works trigger the need for a full environmental impact assessment (EIA) and comprehensive public participation process to be conducted.

Transnet appointed Aurecon South Africa (Pty) Ltd to conduct the environmental authorisation process for the entire environmental authorisation process for the proposed upgrade and new construction related to the development of the Swaziland Rail Link project, from Davel (Mpumalanga) through Swaziland to Nsezi (KwaZulu-Natal), (see Figure 1 below). Part of Aurecon's appointment was to subsequently appoint a Swaziland Environmental Consultancy firm to conduct the environmental authorisation process in Swaziland. Aurecon's tender evaluation process was followed and Aurecon appointed Lang Mitchell Associates for this work. Thus, **Lang Mitchell Associates** will be corresponding with the Swaziland Environmental Authority (SEA) in all issues relating to the environmental authorisation process for this project. The CVs of Lang Mitchell Associates can be found in Appendix A.

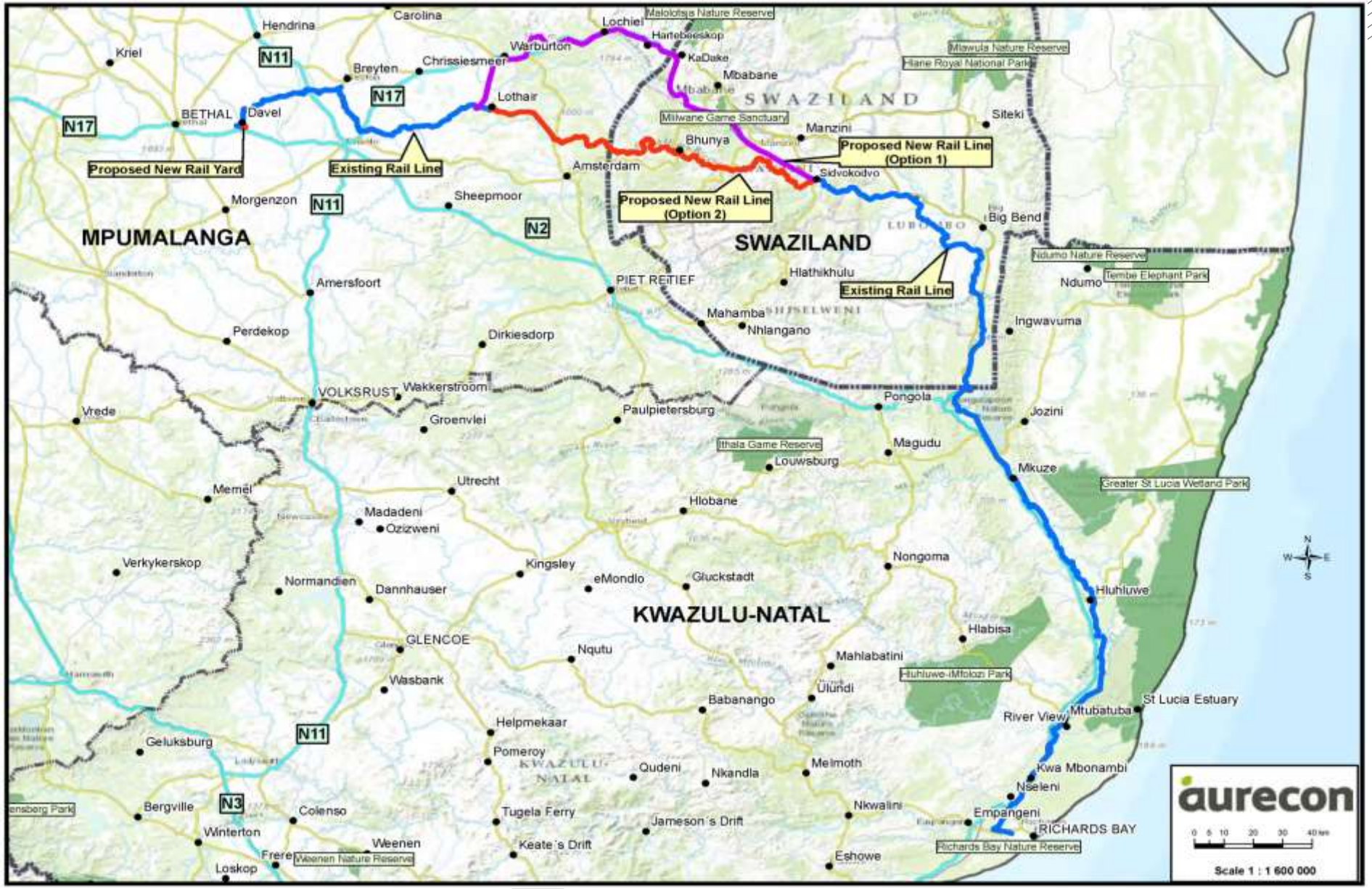


Figure 1: General layout of the entire Swaziland Railway Link from Davel to Nsezi, The red (preferred) and purple (second alternative) lines indicated the new link alternatives from Lothair to Sidvokodvo.

1.4 Need for the project

Swaziland Railway and Transnet commissioned a concept level study in 2011 to investigate the provision of a new rail link between Lothair (Mpumalanga, South Africa) and a suitable tie-in location along the existing Swaziland railway network. The concept unlocks the potential for a multinational strategic rail corridor, while at the same time relieving pressure from the heavy haul Richards Bay Coal Line and the general freight Eastern Mainline to Maputo. While the heavy haul Richards Bay Coal Line will mainly be used to transport all coal to Richards Bay, this Swaziland Railway Link line may also be utilised as a coal line should the need arise. However, it will mainly be utilised for the transportation of general freight.

Regional support for this project was confirmed by the signing of the Inter-Governmental Memorandum of Understanding (MOU) between the South African and Swaziland governments on 2 August 2012. The signing of the Inter Rail MOU by Transnet and Swaziland Railway on 23 November 2012 cemented the relationship at business and technical levels.

A Memorandum of Understanding (MOU) at inter-Governmental level between South Africa (represented by the Department of Public Enterprises) and the Kingdom of Swaziland (represented by the Ministry of Public Works and Transport):

- The MOU addresses the governance of a number of matters of commercial interest to both parties, including the Swaziland Rail Link project.
- Multinational governance is vested in an Executive Steering Committee (Steercom).
- A Memorandum of Understanding at inter-Railway level between South Africa (Transnet) and the Kingdom of Swaziland (Swaziland Railway).
- The MOU cements the areas addressed in terms of the project structure, governance and accountability at Management (policy, control and governance) levels as well as the functional and discipline-specific fields described in terms of Project work streams.
- Inter-railway governance is vested in an inter-railway Steercom.

Inter-Governmental and inter-Railway has been practiced in the development stage through:

- Inter-government meeting and cooperation, culminating in the formal signing of the MOU on August 2012.
- Media presentations in South Africa and Swaziland.
- Inter-railway Steercom and joint Project Steercom meetings on a regular basis.
- Inter-railway workshops and work stream technical collaboration meeting in South Africa as well as Swaziland.

The creation of a strategic link between South Africa and the export ports of Richards Bay, and Maputo through Swaziland has been found to be technically feasible, with certain risks attached.

The additional demand on parts of the network brought about by increases in traffic volume from sources other than Mpumalanga and central Gauteng make upgrades of the network a critical planning driver. Network upgrades required to achieve the full capacity potential of the project are critical, extensive and expensive.

The project holds significant advantages in relieving the general freight bound pressure on the Richards Bay coal line. It provides a strategic link to congested South African export ports, as well as encouraging economic and rail

transport growth in Swaziland, thus in turn reducing the need for road transport and minimising damage to roads from heavy vehicles.

The Swaziland portion of this proposed railway line commences at the Sandlane border and travels through Sidvokodvo to Phuzumoya and the Lavumisa border. This proposed route consists of an entirely new alignment from Sandlane to Sidvokodvo and an upgrade of the existing line from Sidvokodvo to Lavumisa. This route also has the following advantages:

- The route reflects comparative savings in cost (capital as well as operational), construction, safety, environmental and social disturbance when compared with alternatives;
- It is possible to design and construct a route meeting compromise design criteria fully;
- It allows the realisation of the full tonnage capacity planned for the Swaziland Rail Link.

Also, this route alternative creates the design base for the later establishment of a railway service to Ka Dake. It creates the possibility to reinstate and upgrade the Ka Dake to Matsapha to Sidvokodvo sections respectively, as a self-contained spur line, if and when commercial imperatives render this necessary.

With the proposed increase in train traffic, the risk to local residents having to cross the railway line in their daily activities is also increased. It is therefore envisaged that, where possible, level crossings will be eliminated.

Traffic studies conducted found that many new producers plan to enter the market and use Transnet Freight Rail (TFR) for rail transportation. The implications for the Swaziland Rail Link system is that when combined with Western (new link) traffic, the estimated Limpopo traffic places severe capacity demands on the sections between Phuzumoya and Nsezi.

1.5 Project description

The following information was made available to Aurecon by Transnet. Detailed information regarding the location of construction roads, bridges, location and size of borrow pits etc. were not available at the time of the compilation of this report.

The operation of trains is planned around a single railway line with crossing loops originally at 40 km apart. This spacing is to be changed to 20 km apart when traffic increases warrant it. This arrangement will provide a practical capacity, at 65% operating efficiency, of 8 and 16 trains per day respectively, assuming 336 operational days per year will be achieved.

The Sidvokodvo to Phuzumoya upgrade is a relatively short (37 km) section of line adjoining the new line (Lothair to Sidvokodvo), which in effect also requires a new line. It is envisaged that this section can be upgraded under operational conditions, with extended and well planned tie-in line occupations.

The Phuzumoya to Lavumisa upgrade section comprises the construction of an entirely new 26 ton axle load line between these two end points. This is due to poor geotechnical conditions rendering the existing line unsuitable for anywhere near the projected traffic load for this section.

The minimum width of the servitude/railway corridor to be acquired is 35 m, fenced in with standard TFR small stock fencing. The final width is determined by the final earthworks footprint, with due allowances for parallel services, drainage and a maintenance road.

The drainage works include box and pipe culverts, side ditches and protection works, as well as sub-surface drainage in cuttings. Where possible, minimum size of pipe culverts will be Φ 900 mm, and for box culverts 900 mm wide x 500 mm high.

1.5.1 Gradients

The aspirational ruling gradient of the system infrastructure in the predominantly loaded direction towards the ports is 1:160, corresponding to that of the existing Coal Line. This gradient could not be accomplished throughout the route during detail engineering design and a compromise gradient of 1:120 was eventually achieved.

The ruling gradient in the return direction against trains primarily conveying empty wagons is equal to that of the Coal Line at 1:66. It was endeavoured to engineer the minimum length of all continuous up or down grade sections to at least 1500 m. This is to allow for acceptable train handling practises by minimizing transitional longitudinal in-train forces.

Minimum departure gradients achieved are 1:177 in the direction of the ports and 1:95 in the return direction. This ensures the availability of sufficient locomotive adhesion whilst charging the train brake system as well as when bringing trains into motion after having stopped at a crossing loop.

1.5.2 Curvature

The design of the horizontal alignment is based on achieving maximum curvature within practical constraints. Inherent advantages include:

- larger curve radii are less prone to wear and consequent maintenance; and
- lateral forces in the rail as the result of high tractive and compressive in-train forces are reduced.

The minimum curve radius achieved is 300 m with the aspirational radius at 400 m achieved in many instances. It is recommended that the aspirational minimum curvature for FEL-3 design must be 550 m.

1.5.3 Train speed

The system design is based on the following maximum permissible train speeds:

- Speed in yards: 15 km/h;
- Maximum line speed: 80 km/h;
- Maximum train speed: 60 km/h and 80 km/h for loaded and empty trains respectively. Loaded trains can reach maximum speeds of 80 km/h when using train momentum and when no other more restricting speed is applicable;
- Down grade speed: 40 km/h for loaded trains on 1:66 down gradients of 2 km and longer in length; and
- Special speed restriction: 40 km/h on the environmentally sensitive section in the vicinity of Lavumisa to Kingholm in order to reduce noise generation.

1.5.4 Structures and tunnels

Concrete structures will be required for culverts, river crossings, services crossings, rail and road bridges. The geometrical design of these structures will be carried out in terms of the relevant Authority requirements, or size designs (TFR, Minister of Public Works and Transport, SEA, etc.).

Structures will be designed to carry the train axle loading allowed for of 26 ton per axle, or road loading in terms of the TMH-7 design code, whichever is applicable.

All structures will allow for future 25kV AC electrification readiness.

Where tunnels are required, these will be designed in terms of TFR geometric standards for an electrified single line. Structural design is implemented in accordance with best industry and professional practice.

All rail-over-river bridges on this line have steel superstructures comprising of steel plate girders or through girders, or a combination of these. Whilst the condition of most of these structures is fair, there are nevertheless localised elements in poor condition which will need to be strengthened or replaced.

At the river crossings the new track is generally at a higher level than the existing track because of gradient easing. As a consequence, most of the existing river bridges will be abandoned. This is not of significant consequence as many of the existing river bridges are of steel construction and are nearing the end of their economic lives in terms of steel corrosion. Many of these structures are also of the “through-span” type which constitutes a risk to the rail operation in the case of derailment owing to a high probability of the bridge being destroyed.

1.5.5 Traction

The mode of traction is diesel locomotives. Class 43 type diesel electric locomotives have been assumed for the entire train service. The locomotive requirements for different train loads on selected gradients are given in the table below.

Table 1: Train traction requirements

Mass per wagon in tons (Gross)	Number of wagons per train	Ruling gradient 1:	Number of locomotives required per train	Payload per train in tons	Train load in tons (Gross)
80	50	50	3	3000	4000
		66	2	3000	4000
		80	2	3000	4000
80	60	50	4	3600	4800
		66	3	3600	4800
		80	2	3600	4800
80	80	66	4	4800	6400
		80	3	4800	6400
80	100	66	4	6000	8000

		80	4	6000	8000
80	120	80	4	7200	9600

1.5.6 Level crossings

The use of level crossings will be kept to an absolute minimum. All public roads crossings will be designed as grade separation structures. Where grade separation structures are not feasible, road deviations or relocations will rather be considered.

Level crossings will be used on non-public roads, where the Priority Rating P is such that a level crossing can be allowed.

Operational designs (signage) will be provided in terms of the document “SA Road Traffic Signs Manual, Chapter 7, Signing of Railway Crossings” or other ruling documentation applicable in Swaziland.

1.5.7 Socio-economic benefit – labour component

A project of this extent will have significant direct socio-economic benefit during the construction and operational phases. Construction related jobs for the entire Swazi Rail Link alignment (from Davel, through Swaziland to Nsezi) created is estimated at 3 400 in RSA and 2 700 in Swaziland, attributable to all aspects of construction and material supply. Jobs related to the operational phase of the project is estimated at 300 in Swaziland.

The estimated annual labour element in operations and maintenance in Swaziland accumulates to approximately R34.5 million.

Potential receivers of socio-economic benefits are identified at a general level. Communities and specific service providers will be identified and pursued during the later design stage.

1.5.8 Service roads

During construction as well as the operational phase, the project will endeavour to utilise existing service roads as far as possible. However, it is very likely that new roads for construction purposes as well as maintenance purposes will be constructed. Gravel maintenance roads will typically be 4 m wide, generally following the natural ground level.

New roads to serve as access roads for neighbouring landowners may also be required, depending on the conditions agreed upon between the landowners and Swaziland Railway during the land acquisition process. Access roads will also be constructed as gravel roads at a 6 m width, with vertical curves based on design speed.

These roads will be constructed as far from sensitive areas as possible.

1.5.9 Borrow pits

Swaziland Railway envisages the need of approximately thirty (30) borrow pits along the **entire** Swaziland Rail Link alignment (i.e. from Davel in Mpumalanga to Nsezi in KwaZulu-Natal) for construction requirements. It is assumed that borrow pits along the Sandlane to Lavumisa alignment will also be required to prevent the long haul of materials needed for construction purposes. However, detail of the location and size of the borrow pits is not yet known and will be determined during the later design stage. Once the detail has been made available, an application for authorisation of borrow pits will be made to the Ministry of Natural Resources and Energy (MNRE). It is recommended that a botanical survey as well as a brief hydrogeological and heritage impact study be undertaken once these locations are known. All concerns, issues and mitigation measures identified by the specialists during the impact assessments will be taken into consideration during the planning of the location and operations of the borrow pits.

1.6 Proposed alignment alternatives for the Swaziland Railway Link Project

Initial concept-level routes identified for a possible South Africa-Swaziland link as per the Transnet Group Planning's Swaziland Rail Link FEL-2 Study are provided in Figure 2. Due to the fact that the project will aim to stay within the boundaries of the existing Swaziland Railway's servitude from Sidvokodvo to Lavumisa, the alternative routes being considered during the EIA are only for the envisaged **new rail link** from Lothair in South Africa with the existing Swaziland railway network as seen in Figure 2. Therefore, the alternative routes under consideration at concept level were the following four possible connections to the Swaziland Railway network:

- New route option 1: Lothair to Ka Dake with the possibility of resuscitating the Ka Dake to Matsapha line and upgrading of the section from Matsapha to Phuzumoya Junction
- New route option 2: New line from Lothair to Matsapha and upgrading of the Matsapha to Phuzumoya Junction
- New route option 3: New line direct from Lothair to Phuzumoya Junction
- New route option 4: New line direct from Lothair to Mpaka

Mpaka to Maputo was also considered, however Transnet in collaboration with Swaziland Railway decided that this option would be revisited at a later stage and is thus not part of this project.

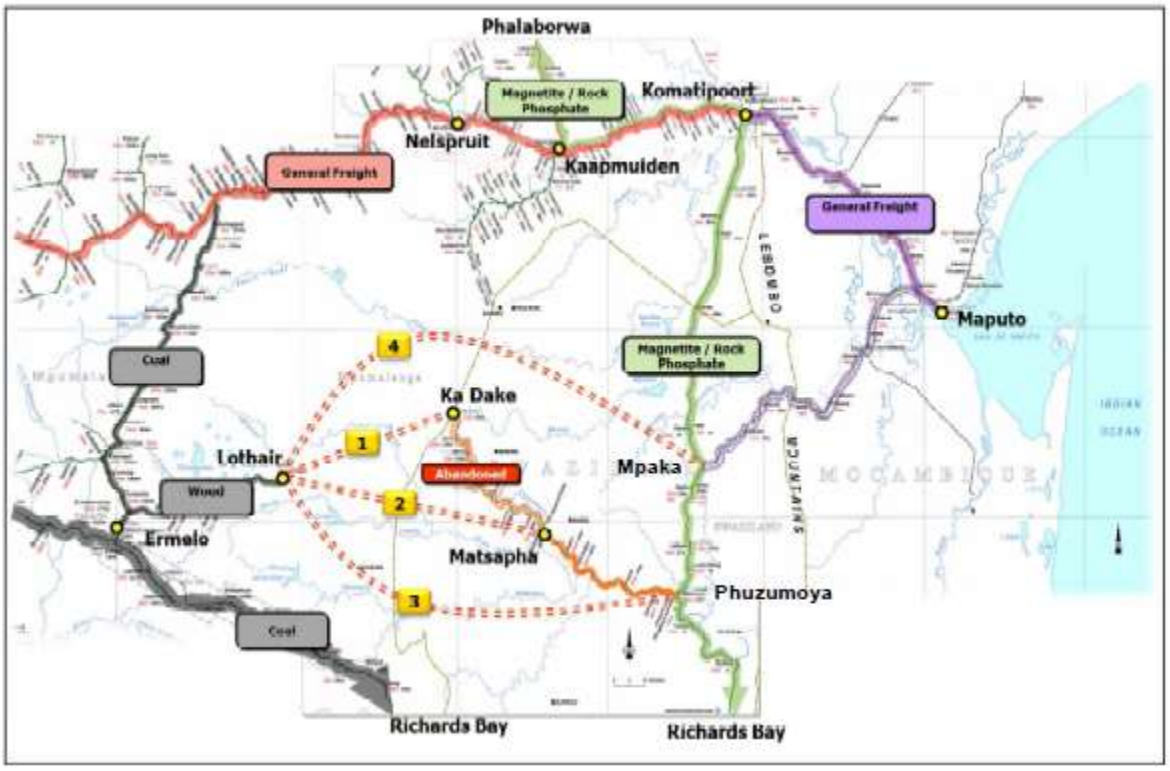


Figure 2: Initial alternative routes identified for the Swaziland Railway Link alignment

The alternatives for the **upgrading of existing lines** from Sidvokodvo to the border were not considered due to the fact that such upgrades are existing infrastructure and will be kept inside the Swaziland Rail reserves. However, as a result of the increase in the axle tonnages to a 26 ton axle (i.e. a stronger railway line to accommodate a heavier 200 wagon train) which prevent the railway line from making steep turns, certain servitude boundaries (especially around bends) will be exceeded at times. Note that while the entire route alternative is explained, **this report only pertains to the section from Sandlane border to the Lavumisa border**. Sidvokodvo to the Lavumisa border will consist of various upgrade construction activities, whilst Sandlane border to Sidvokodvo is envisaged as a new railway line to be constructed (i.e. not in an existing servitude).

Therefore, the four "new route options" as set out above were considered as the alternatives for the entire Swaziland Railway Link project.

Concept level assessments for the new rail link

To ascertain whether the above mentioned four new route alternatives would be feasible, the following approach and methodology was adopted:

Approach

The study comprised a high-level investigation of available literature and data (including mapping) for the four routes in order to identify environmental fatal flaws, considerations and possible constraints.

Methodology

The four new route options for the possible connection of the Swaziland Railway network were overlaid on available Geographic Information Systems (GIS) maps of South Africa and Swaziland including protected areas, perennial rivers and inland water bodies, plantations, towns and urban and rural settlements. This information was supplemented by satellite imagery. Additional information on proposed protected areas and vegetation types was also utilised.

Apart from noting areas of concern as per the overlaid maps, available literature was researched with respect to environmental sensitivities identified within the study area.

Where possible, the alignment was compared with any geo-referenced information available in the literature.

Conclusion

Utilising available information such as possible freight demand projections, land use, geological, topographical and existing infrastructure maps, geotechnical investigations, land surveys, early pre-feasibility assessments conducted by Transnet in collaboration with Swaziland Railway and the appointed engineering consultancy firms deemed new route options 3 and 4 technically and financially unfeasible. As such, these two options were disregarded for further assessment and will not be looked at during the EIA process.

On the basis of the above findings being included and approved in the feasibility level report, only the two potential new route options 1 and 2 as mentioned below were taken forward for further study, namely:

- New route option 1: A new line from Lothair to Ka Dake with the possibility of resuscitating the Ka Dake to Matsapha section and the upgrade of the existing Matsapha to Phuzumoya line; or,
- New route option 2: A new line from Lothair to Sidvokodvo (and the upgrade of the existing section to Phuzumoya Junction).

To ensure all options were taken into account, possible variations to both of these two new route options were considered as well.

Alternative option for new route 1

- *Route option 1A – Restore the status quo*

A variant on route option 1, namely to merely reinstate the Ka Dake to Matsapha section to its former alignment geometry and not carry out any upgrading between Matsapha and Sidvokodvo could be considered.

The consequences of such an option would be that the section would only carry 40 wagon trains or 40 % of the potential traffic load. This in turn affects the viability of Route Option 1, since this ruling train length and load applies to the whole corridor envisaged under Route Option 1. This constraint when viewed from a system perspective is deemed to constitute a project variance of such significance as to constitute a fatal flaw in the option.

Alternative option for new route 2

- *Route option 2A – New route with spur line from Sidvokodvo to Ka Dake*

Coupled to route option 2 (new link between Lothair and Sidvokodvo), the possibility exists to reinstate and upgrade the Ka Dake to Matsapha and Matsapha to Sidvokodvo sections respectively. This would serve as a self-contained spur line, if and when commercial imperatives render this necessary. This implies restoring the *status quo* and reverting to a shuttle service method of train operation and traffic planning practised previously when the Ngwenya mine was in operation.

The work comprises reinstatement and upgrading work according to the existing alignment with no external deviation or easing of curves and grades, in this sensitive environment. By implication:

- The line operates as a spur (40 / 50 wagon trains) at 20 t / axle;
- The lower capacity of the spur does not affect the capacity of the export corridors planned from Lothair to Richards Bay or Maputo, since mainline standard traffic does not travel across it;
- Sidvokodvo functions as a consolidation yard for Ka Dake traffic, roughly as in the past;
- From Sidvokodvo, Ka Dake traffic could be consolidated into longer freight haul (maximum 100 wagon consists) consigned to Maputo or Richards Bay. This economy of scale, albeit at a lighter axle load, was not available previously on the existing, non – upgraded Sidvokodvo to Phuzumoya section linking to the Swaziland Rail north – south line; and
- Work associated with Route Option 2 in no way sterilises the potential implementation of Option 2A. Network planning in and around Sidvokodvo can be readily adapted to cater for this eventuality.

Option 2A can be implemented if and when the commercial demand warrants the investment. However, the current development does not include the further implementation of this option.

1.6.1 Alternatives taken forward

- New route option 1: A new line from Lothair to Ka Dake with the possibility of resuscitating the Ka Dake to Matsapha section and the upgrade of the existing Matsapha to Phuzumoya line; or,
- New route option 2: A new line from Lothair to Sidvokodvo (and the upgrade of the existing section to Phuzumoya Junction).

Due to the fact that new route option 1 (Lothair to Ka Dake) was found to traverse the Milwane Nature Reserve in Swaziland, this option was considered to be **fatally flawed** and was therefore not assessed during the EIA phase of the project.

1.7 Project location

The project runs from the Sandlane border, through Swaziland to the Lavumisa border as in the options detailed above. The study area in Swaziland relates to the areas within the railway line servitude and associated infrastructure, and affects the Manzini, Shiselweni and Lubombo regions, as indicated in the figure below. Six Tinkhundla in the Manzini Region, four Tinkhundla in the Lubombo Region and one Inkhundla in the Shiselweni Region will be affected.

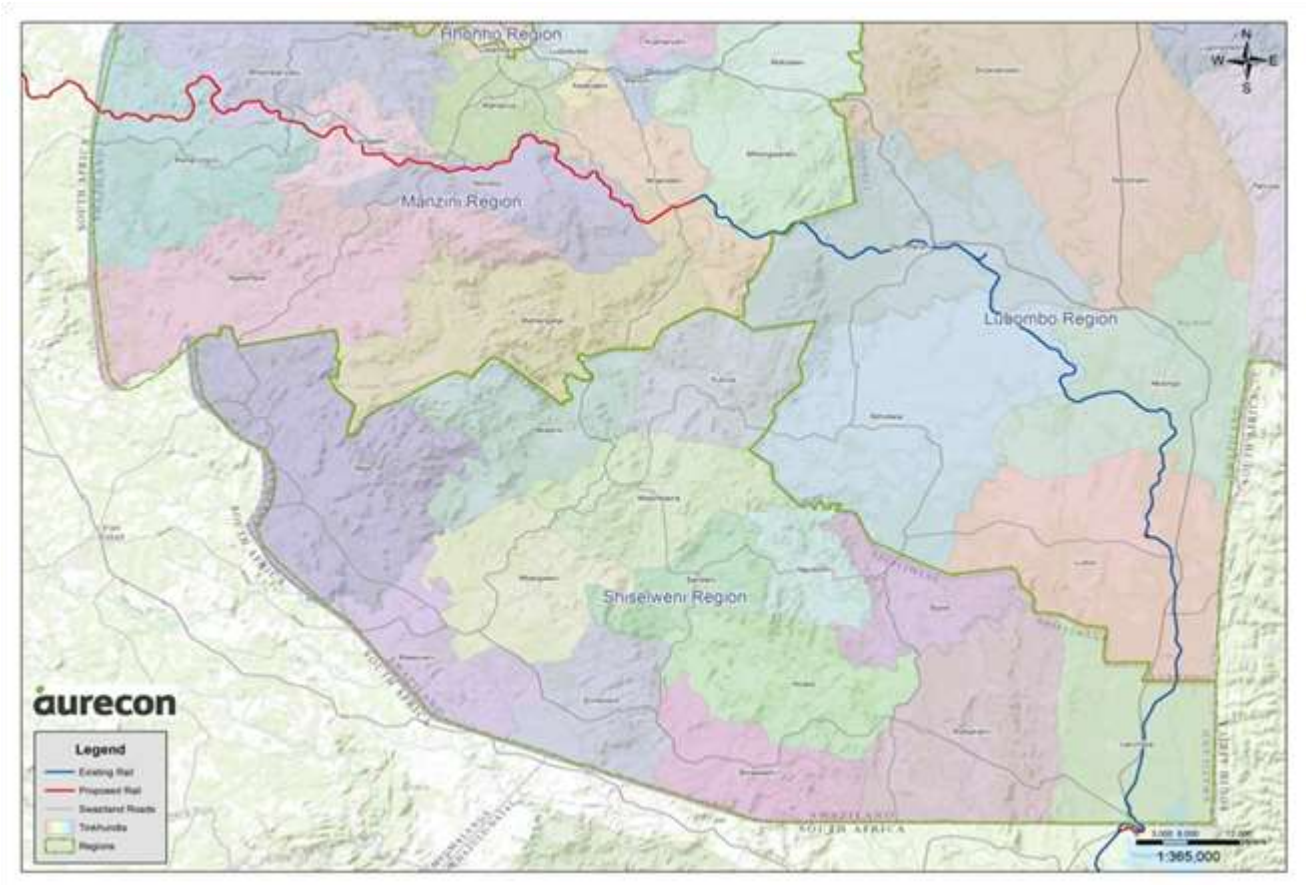


Figure 3: Regions affected by the proposed development – the red line indicates the new link line proposed to be constructed. The blue line indicates the proposed upgrading of the existing railway line.

2 LEGISLATIVE FRAMEWORK

The management and mitigation of the environmental impacts experienced during construction is governed by environmental legislation. It is of utmost importance that this project is constructed in compliance with all relevant environmental legislation.

The environmental legislative framework and components for Swaziland can best be unpacked and summarised as follows.

2.1 The Constitution of the Kingdom of Swaziland Act

The Constitution of the Kingdom of Swaziland Act, 2005 (Act No: 001 of 2005) in section 210 declares all land, minerals and water as national resources. The section also obliges the State to in the interest of the present and future generations, to protect and make rational use of its land, mineral and water resources as well as its fauna and flora, and shall take appropriate measures to conserve and improve the environment.

In terms of section 216(1) every person has the responsibility to promote the protection of the environment and section 216(3) obliges the State to ensure a holistic and comprehensive approach to environmental preservation and shall put in place an appropriate environmental regulatory framework.

2.2 The Environmental Management Act No 5 of 2002

The stated purpose of the Environment Management Act, 5 of 2002 (s4) is to provide for and promote the enhancement, protection and conservation of the environment and where appropriate, the sustainable management of natural resources.

The Act goes further and establishes guiding environmental principles in section 5 and in section 6(1) obliges any person or body exercising powers or functions or making decisions under this Act shall give effect to the purpose of this Act and the principles. Section 6(2) obliges any Cabinet Minister, Government Officer or other person exercising a public function that is likely to affect the protection, conservation or enhancement of the environment or the sustainable management of natural resources to in the course of exercising that public function apply and provide for these principles in exercising that public function.

In section 9 the Swaziland Environment Authority is established and its functions is listed in section 12(2) and includes amongst others –

- to administer licences issued under the Act in accordance with the provisions of the Act;
- to review environmental impact assessment reports and strategic environmental assessments reports;
- to facilitate public involvement in decision making concerning the environment including establishing procedures to facilitate the submission of comments on licence applications under this Act;

Section 32(1) states that no person shall undertake any project that may have an effect on the environment without the written approval of the Authority, or in the case of a review, of the Minister, and except in accordance with any conditions imposed in that approval.

The various subsections of section 32 establish the process that needs to be followed in obtaining approval to undertake a project which may have an impact on the environment. The section also prescribes the content of the various reports required and the process that needs to be followed by the SEA in advising the Minister on such an application.

Section 33 provides for the Minister responsible for environmental affairs to make regulations for the better administration of amongst others environmental impact assessments and may prescribe *inter alia* –

- categories of projects that may have an impact on the environment;
- procedural requirements for public hearings;
- information be included in environmental impact assessment reports and comprehensive mitigation plans;
- administration fees for applications.

2.2.1 The Principles of the EMA

In achieving the purpose of this Act, the following principles shall be applied:

- The environment is the common heritage of present and future generations;
- Adverse effects should be prevented and minimised thorugh long term integrated planning and the coordination, integration and co-operation of efforts, which consider the entire environment as a whole entity;
- The precautionary principle, which requires that where there is a risk of serious or irreversibvle adverse effects occurring, a lack of scientific certainty should not prevent or impair the taking of precautionary measures to protect the environment;
- The polluter pays principle, which requires that those causing adverse effects shall be required to pay the full social and environmental costs of avoiding, mitigating, and/or remedying those adverse effects;
- The generation of waste should be minimised wherever practicable;
- Waste should, in order of priority, be re-used, recycled, recovered and disposed of safely in a manner that avouids creating adverse effects or if this is not practicable, is least likely to cause adverse effects;
- Non-renewable natural resources should only be used prudently, taking into account the consequences for the present and future generations; and
- Renewable resources and ecosystems should only be used in a manner that is sustainable and does not prejudice their viability and integrity.

An Environmental Compliance Certificate (ECC) is issued by the SEA when all the necessary environmental documentation has been submitted and approved by the authority for a proposed project. The assumption underlying the issuance of an ECC is that the proposed project is not likely to cause unacceptable environmental impacts and that the proponent will manage the construction and operation of the project in accordance with an approved comprehensive mitigation plan. In Swaziland, the term ‘project’ is defined as:

“a plan, operation, undertaking, construction, development, change in land use or other entity, or alteration which may not be implemented without a permit, licence, consent or approval from an authorising agency.”

There are several other important permits and licences required in terms of other environmental legislation in Swaziland relating to environmental issues.

2.3 Other applicable legislation

2.3.1 The Natural Resources Act no 25 of 1968

A Natural Resources Board (NRB) was established by this Act. The Act provides for the conservation and improvement of natural resources. The Act also covers matters related to health concerns and the prevention of soil erosion during landscaping and excavation of site works, protection of water sources, public streams, disposal and control of storm water, sewage and other bio-hazardous effluents. The NRB is empowered in terms of this Act to order the conservation of natural resources, and such orders may relate to:

- The construction and maintenance of soil conservation works;
- The preservation and protection of the source, course or banks of rivers and streams;
- The control of water including storm water; and
- The control or prohibition of the burning of grass.

It is important, particularly because of the size of the project, that both the Minister responsible and the NRB pay attention to the project at the design, construction and operation phases to see to it that provisions of the Act are not violated.

2.3.2 Water Act of 2003

The Water Act provides for the protection and management of water resources. Section 34 stipulates that it shall not be necessary for a person or community to obtain a permit for the use of water for primary purposes. As the water likely to be used in construction, such as compacting and dust suppression is not a primary use the project may be required to apply for a water permit. Section 81 stipulates that a person shall not alter or divert a water course without permission from the Water Apportionment Board (or River Basin Authority where one is in place in the river basin concerned). This is applicable to this project where any replacement of a river crossing will involve diversion of the water course to enable construction.

As this Act is relevant to the project (mainly due to bridges which will be built to cross rivers and streams), a water permit will be applied for, consisting of a management report providing the following:

- Project description;
- Project background;
- Baseline environmental and Social aspects;
- List of river and stream crossing impacted by the project (these include the co-ordinates and information relevant for each crossing);
- Technical design of crossing;
- Motivation for the project;
- Risk assessment and mitigation measures to prevent or reduce the impact; and
- Rehabilitation plan.

Once the report is completed and finalised it will be submitted to the Swaziland National Water Authority for approval.

2.3.3 The Flora Protection Act of 1958

This Act promotes the conservation and protection of certain plants, through the use of a Schedule, trees, shrubs and vegetation and any living or dead portion of plants from destruction. If any protected flora exists in the project

area and is likely to be cut or uprooted, this requires a permit from the Ministry of Agriculture and Co-operatives (MOAC). Very few protected plants or trees will be affected by the project, and every measure should be undertaken to protect these plants if possible.

2.3.4 The Forests Preservation Act no 28 of 1910

This Act protects indigenous timber land. The Minister of Agriculture has to grant permission for clearing and cultivating any government or Swazi National Land within 30 yards of an area in which indigenous vegetation is growing. Thus any person who recklessly sets fire to any indigenous or brushwood is deemed to be guilty of an offence.

2.3.5 The Public Health Act of 1969

Swaziland Public Health concerns, and ways of dealing with them, have been expressed in the principal legislation: the Public Health Act 5 of 1969. The Act defines the Authority for prescribing and enforcing preventative and remedial measures for the protection of public health in Swaziland. However in recent years there has been increasing concern expressed by the environmental health officials, health officers and others that the Act fails to provide the back-up required to control risks to public health, and that it fails to meet the present day environmental health needs.

2.3.6 The National Trust Commission Act of 1972

This Act provides for the operation of cultural institutions and the proclamation of national parks, monuments and related matters. This Act grants the National Trust Commission powers to proclaim national parks and monuments. It can acquire or alienate movable and immovable property subject to this Act with the approval of the Deputy Prime Minister. Section 25 states that " The Minister may make recommendations in the national interest to proclaim: as a national monument, any area of land having a distinctive or beautiful scenery or geological formation, or any area of land containing rare or distinctive or beautiful flora or fauna or any area of land containing objects of archaeological, historical, or scientific interest or valley or any waterfall, cave, grotto, avenue of trees, old building, or another place or object whether natural or constructed by man of aesthetic, historical, archaeological, sacred, or religious value or interest."

2.3.7 Human Settlements Authority Act of 1988

The act established the Human Settlements Authority and its objects and functions. It provides policy support to Government and the orderly development of human settlements by allowing for and outlining procedures for the establishment of Human Settlements. It also makes provision for the development of human settlement development plans, the revocation or modification of development plans and finance mechanisms for the supply and maintenance of improved shelter and infrastructure.

2.3.8 Town Planning Act of 1961

This act makes provision for the preparation and carrying out of town planning schemes in declared urban areas. It establishes the Town Planning Board, its functions, powers and duties. It authorizes the preparation of town planning schemes, the approval of schemes, variation of schemes, enforcement of schemes and compensation for injurious affection.

2.3.9 Urban Government Act of 1969

This Act provides the basis for the establishment of local authorities in Swaziland as a primary legal instrument defining the parameters under which city councils conduct their affairs. The act outlines the duties and powers of Councils; makes provision for meetings of Councils and Committees, Management Committees and staff; designates towns, land, streets and public places; and the administration and audit of Council accounts.

2.3.10 Explosives Act of 1961

The Explosives Act and the accompanying Explosives Regulations control the use of explosives during construction activities. While the use of explosives is not contemplated, should the eventuality arise these regulations would come into play.

2.3.11 Factories, Machinery and Construction Works Act of 1972

The act deals with the regulation of working conditions and the use of machinery at factories and construction sites. Section 19 requires the reporting of accidents in the workplace and therefore any accident during the project is to be formally reported. Section 20 requires that safety devices not be interfered with, that employees shall use safety equipment provided and that no persons shall do anything that places their own safety and that of others at risk.

2.3.12 Occupational Safety and Health Act of 2001

The Occupational Safety and Health Act provides for the safety and health of persons at work and at the workplace, and for the protection of persons other than those at the workplace against hazards to safety and health arising from work activities. Relevant aspects of this act are section 9 which stipulates the duties of the employer to ensure safe and healthy working conditions, make employees aware of the hazards of the workplace, provide personal protective equipment, provide training and supervision of employees, prevent exposure of non-employees to hazards arising from the works; section 11 which stipulates the duties of the employee to cooperate and follow the instructions of the employer, use equipment and safety devices provided by the employer, report accidents and unsafe conditions to the employer; section 28 which requires the employer to record and report minor and major accidents and dangerous occurrences to the Labour Inspector.

2.3.13 Plant Control Act of 1981

This act is concerned with the prevention of plant disease. It controls the import and export of plants. It also controls the registration of nurseries and regulates the sale of plants through control of nurseries. The use of plants for rehabilitation falls under these controls.

2.3.14 Workmen's Compensation Act of 1983

The Act provides for the compensation and medical treatment of workmen who suffer injury or contract work-related diseases in the course of their employment. Relevant to this project is section 25 which requires the employer to be insured against liability for work-related injuries.

2.4 Regulations

2.4.1 Building Operations Regulations of 1969

The regulations control building activities and the safety of buildings. Regulation 54 requires a person carrying out building work to minimize any public nuisance such as noise, dust and unsightliness caused by the work. This is relevant to the project in terms of potential noise and dust.

2.4.2 Environmental Audit, Assessment and Review Regulations of 2000

Under the SEA the Environmental Audit, Assessment and Review Regulations, 2000 have been issued which regulate the EIA process and place requirements on reporting techniques. Three categories of project are assigned by the Authority, having due regard to environmental sensitivity. Category 1 is the least impactive and requires little study. Category 3 projects are deemed to have ".significant adverse impacts whose scale extent and significance cannot be determined without in-depth study". The project under review has been assigned a Category 2 in accordance with these regulations. The depth of study and reporting format are in accordance with the regulations.

2.4.3 Factories, Machinery and Construction Works Regulations of 1974

The regulations control health and safety working conditions and the use of machinery at factories and construction works. Regulation 9 requires that machinery be kept in good and safe working condition and used safely which is relevant to construction vehicles and other equipment; Regulation15 requires the training and supervision of inexperienced personnel using machinery which is relevant to the machine operators; Regulation 151 requires that hearing protection be provided and used in noise zones which is relevant for operators of noisy machinery (above 85 decibels); Regulation 152 requires that no person under the influence of alcohol be permitted into the workplace.

2.4.4 Standard Building Regulations of 1969

These regulations provide for the control of building activities and the safety of buildings. Relevant to this project is Regulation 70 which stipulates that no lavatory or pit latrine shall be constructed within 30.5 m of any water source. This is relevant with regard to temporary toilets for the construction camp site.

2.4.5 Swaziland Building (Grade II) Regulations of 1966

These regulations provide for the control of building activities and the safety of buildings. Of relevance to this project is Regulation 11 which stipulates that no person shall dump or dispose of any debris or rubbish except at such places and in such a manner as may be appointed by the local authority. This is relevant with respect to the disposal of any rubble arising from the removal of existing structures such as culverts.

2.4.6 Waste Regulations of 2000

The Waste Regulations control the collection, transport, sorting, recovery, treatment, storage and disposal of waste collection and disposal of waste. Waste generation is anticipated during this project and hence the relevance of these Regulations.

2.4.7 Water Pollution Control Regulations of 2010

The regulations control the discharge of effluents exceeding acceptable effluent standards for the preservation of water quality. If any person intentionally or negligently discharges potentially polluting substances into a water body above acceptable standards, that person will be guilty of an offence. Activities during establishment and operation that may cause pollution will be subjected to these regulations. This is particularly pertinent given the potential disposal of waterborne wastes.

2.4.8 Workmen's Compensation Regulations of 1983

These Regulations control the reporting of workplace accidents and work-related diseases, the provision and payment of medical treatment of injured employees and the compensation of such employees.

3 THE EIA PROCESS DESCRIPTION

The Government of Swaziland has formulated several policies, strategies and action plans aimed at achieving sustainable development in the country. Among these are the National Development Strategy, the Economic and Social Reform Agenda and the Poverty Reduction Strategy and Action Plan. The National Development Strategy outlines the country's development goals for 25 years, starting in 1997.

3.1 The Swaziland Environmental Authority

The key institutions involved in the management of environmental impact assessments (EIA) are the Swaziland Environment Authority (SEA) and the Ministry of Economic Planning and Development (MEPD). The SEA, created by an Act of Parliament in 1992, is directed by a management board that sets policy priorities. The format, protocols and procedures of the authority are set out in detail in the First Schedule of the Act. The authority has initiated a process by means of which it would become an autonomous body operating outside of government, but would still largely depend on government funding. This process has been finalised with the enactment of the Environmental Management Act No. 5 of 2002 which establishes SEA as a body corporate with perpetual succession to be successor to the Swaziland Environment Authority established under the Swaziland Environment Authority Act No. 15 of 1992.

The main functions of the SEA are to:

1. Establish standards and guidelines relating to the pollution of water, land and air as well as those relating to noise and other forms of environmental pollution.
2. Develop, in cooperation with other government authorities, economic measures to encourage environmentally sound and sustainable activities.
3. Promote training and education programmes in the field of the environment to create national awareness of environmental issues.
4. Ensure the observance of proper safeguards in the planning and execution of all development projects, including those already in existence, that are likely to interfere with the quality of the environment.
5. Initiate measures for the coordination and enforcement of environmental protection legislation.

3.2 EIA procedural framework in Swaziland for new projects

Screening:

The First Schedule of the Environmental Audit, Assessment and Review Regulations (EAARR) contains lists of projects divided into three categories, depending on the likely impact on the environment. It is up to the SEA to determine whether a proposed project will have any significant impacts on the environment and to determine into which category the project falls. This is known as a screening exercise.

When assigning projects to Category 1, 2 or 3, SEA will consider whether the proposed site is in or near an environmentally sensitive area. Generally, proposed projects which are located in (completely or partially) or near an environmentally sensitive area may merit more detailed environmental studies and review than might have been the case if a location was elsewhere.

Not all environmentally sensitive areas have statutory or non-statutory forms of designation and protection. Some types of habitat, for example wetlands, may have no protection and be used as a resource by local people. Such habitats should be considered environmentally sensitive because, *inter alia,* they are rare, unusual or endangered and/or they provide a useful environmental service to local communities, and perhaps, the nation as a whole.

Examples of such environmentally sensitive areas are:

- Indigenous forests
- Wetlands
- Semi-arid areas and zones prone to desertification
- Areas/habitats which contain or support populations or rare or endangered species
- Water catchments containing major sources of public water supply
- Zones prone to flooding or other hazardous events
- Zones with high incidences of natural or manmade erosion processes
- Areas of historical and archaeological interest
- Areas of cultural or religious significance (e.g. burial grounds, topographic features)
- Degraded areas which are subject to existing or proposed rehabilitation measures
- Areas used extensively for recreation and aesthetic reasons
- Zones of high biological diversity.

In assigning a proposed project to Category 1, 2 or 3, designated and no designated environmentally sensitive areas should be taken into account to the fullest extent possible.

Category 1 projects are those which are unlikely to cause any significant impact on the environment, and therefore do not require an EIA. The types of projects which may be allocated to Category 1 include, for example, small scale commercial buildings, small-scale social infrastructure projects such as rural clinics, and remote (non-intrusive) prospecting for groundwater, minerals and hydrocarbons. If the SEA is satisfied that the project falls under Category 1, an Environmental Compliance Certificate (ECC) will be issued and the project can proceed (see Figure 14.2).

Category 2 projects are those that could have some significant adverse environmental impacts, but whose scale and magnitude is relatively easy to predict without having to do a detailed EIA. Such projects require an *Initial Environmental Evaluation (IEE)* (not a full EIA) and a *Comprehensive Mitigation Plan (CMP).* The types of projects which may be allocated to Category 2 include: medium-scale agro-industries, rural electrification projects, renewable energy production, tourism infrastructure, rural water supply and sanitation.

Category 3 projects are those that are likely to have significant adverse impacts on the environment. A scoping report and an in-depth *EIA study* is therefore required to adequately predict the scale and magnitude of the impacts of these projects on the environment, together with an appropriate *Comprehensive Mitigation Plan* (CMP). Typical Category 3 projects include dams and reservoirs, large scale irrigation and flood control schemes, mining projects, resettlement schemes, thermal and hydropower schemes.

The proposed Swazi Rail Link project constitutes a Category 3 project. Therefore, as per the Swaziland Environmental Management Act, a scoping report and an in-depth EIA study must be done. The EIA study will be conducted as described in the plan of study for the EIA in Chapter 7.

The contents of an EIA report are specified in the Second Schedule of the EAARR and are as follows:

Executive Summary: A brief account (no more than 10 pages) of the findings of the EIA with the emphasis on the key issues for consideration by decision makers in the Swaziland Environment Authority, the authorising agencies and members of the public.

Introduction: Purpose of the EIA. Boundary of the study area and time horizon for which the impacts will be predicted (speculated future date or time).

Description of the Environment: An overall evaluation of the types and quality of the environment (bio-physical and social components and processes) within the study area with specific information presented only when relevant to the prediction and evaluation of impacts. Description of any expected changes to the "baseline" environmental situation before implementation of the project subject to an EIA (the "no project" alternative).

Prediction and Evaluation of Impacts: For all alternatives:

- Distinguish between significant, adverse and beneficial impacts;
- Identify irreversible impacts;
- Allocate significance against international and or national regulations, standards and quality objectives governing:
    - Health and safety;
    - Protection of environmentally sensitive areas;
    - Land use; and
    - Ambient pollution levels.
- Identify significant data deficiencies and assumptions made; and
- Determine the spatial and temporal distribution of impacts.

Analysis of Alternatives and Selection of Preferred Option: Select preferred alternative on the basis of the comparison of the environmental impacts of each option.

Impact Management Plan (for Preferred Alternative): Action to enhance benefits and prevent or reduce adverse impacts.

Schedule for implementation: Technical and institutional requirements for successful implementation.

Consultations: Results of any consultation held with government agencies, NGOs and the public during EIA work.

Details of the CMP:

The EIA report must be accompanied by a Comprehensive Mitigation Plan (CMP), which should focus on the significant impacts identified in the EIA report. The contents of the CMP are set out in the Second Schedule of the Regulations and are listed below.

The CMP must contain details relating to:

- Impacts to be prevented or reduced in severity;

- Benefits to be enhanced;
- Mitigation measures to achieve the above;
- Costs, institutional and training requirements;
- Monitoring programmes to track project related impacts and implementation of mitigation measures; and
- Community liaison procedures needed.

The plan must also contain:

- Schedules for implementation/targets;
- Reporting procedures;
- Work programmes budget; and
- Staffing and training requirements.

The proponent must submit the EIA and CMP to the authorising agency (if not SEA) or the MEPD which shall forward the documents to the SEA within *10 days* of receipt. The SEA then has *20 days* to decide whether the IEE report and the CMP conform to the prescribed reporting requirements or guidelines specified in the Second Schedule of the EAARR, and whether these documents contain the necessary breadth, depth and types of analysis to allow for informed decision-making. If the documents do not conform to the specified requirements, the project proponent is requested to resubmit an amended set of documents for consideration by SEA.

Should the SEA decide that it is necessary to conduct a public hearing (as explained in the next chapter), the following will apply:

Regulation 7 states that the SEA shall, within *20 days* of receipt of the public hearing report or inquiry, or within *20 days* after a public hearing or inquiry is judged not to be warranted, make a decision:

a) Allowing the proponent to proceed with the project and issue the proponent with an ECC; or
b) Disallowing the proponent from proceeding with the project as planned, if it would bring about unacceptable environmental impacts, or that the mitigation measures are inadequate. In this instance, the proponent is allowed to submit revised documents for the Authority's consideration.

The Authority's decision must be communicated as follows:

a) In writing to the authorising agency or the MEPD giving reasons, conditions and comments on its decision;
b) By publishing the decision in a medium to be decided by the Authority;
c) By publishing a detailed statement of the decision for public inspection by notification to all key stakeholders and interested and affected parties, by display in public places and through the media; and
d) By sending a copy of the decision to any persons who have in writing submitted comments or lodged an objection to the Authority in terms of the Regulations.

3.3 Assumptions and limitations

In undertaking this investigation and compiling this EIA the following has been assumed or are limitations of the study, unless otherwise indicated:

- All information provided by Swaziland Railway and Transnet are correct and that Aurecon has received the latest engineering information. Where adequate technical information has not been made available to Aurecon, such is stated in this report.

Notwithstanding the aforementioned limitations, this study is consistent with the requirements of content of the EIA report as stipulated in the EMA 2002 EIA requirements.

4 THE PUBLIC PARTICIPATION PROCESS (PPP)

Consultation with the public forms an integral component of the environmental authorisation process. The PP Process in particular allows interested & affected stakeholders and other identified stakeholders to be informed about potential decisions that may affect them, and it affords them the opportunity to influence those decisions. Through effective Public Participation informed decision making by the SEA stakeholders is ensured, as the views of all parties affected by a proposed activity has been considered.

4.1 Public review of the EIA and CMP reports

Immediately after the SEA has received the EIA and CMP, it is required (in terms of Regulation 11(7)) to:

a) Distribute copies of the documents to affected ministries, local authorities, parastatals, non-governmental organisations and any other stakeholder;
b) Display conspicuously such copies in public places or such places in the vicinity of the site of the proposed project; and
c) Place a notification:
    i. In the Government Gazette;
    ii. On the Swaziland Broadcasting Service; and
    iii. In a newspaper circulating in Swaziland twice a week and for two consecutive weeks, specifying the place and the times where copies may be available for inspection and the procedure for the submission of comments and objections.

The public is allowed *20 days* to submit comments on Category 3 projects, but this period can be extended by the SEA for a period not exceeding 10 days if the project is considered to be sensitive. Where the SEA believes a project is likely to have significant impacts on the environment of a neighbouring country or that country requests, the Authority shall forward the relevant reports and documents to that country at the same time that the documents are made available for public review in Swaziland.

Public Hearing:

Following the public review period, the SEA has 5 days to decide whether or not a public hearing is necessary. This decision is usually based on one or both of the following:

a) If after examining the documents and the reports, the SEA is of the opinion that the project is of such a sensitive nature that the public should have the opportunity to make submissions or comments at a public hearing; or
b) If the public concern over the project is great and the number of written and substantiated objections exceeds ten.

Notice of the public hearing is given by the SEA, which has to ensure that:

a) A notice is published at least once a week for two consecutive weeks, in a newspaper circulating in Swaziland stating the date and place where the public hearing is to be held at least 15 days before the public hearing is held and the expenses in respect of the publication of the notice shall be borne by the proponent;

b) All reports, documents, written comments and objections during and after the period of public review are displayed and made available until the public hearing is finalised; and

c) Any party who has an interest in the outcome of the public hearing, including the project proponent, the authorising agency, the commenting agency and any other person, must be called upon to attend the public hearing or solicit in writing comments from other government agencies or offices with expertise or regulatory power over the proposed project.

The public hearing will be presided over by persons nominated by SEA in terms of regulation 12. The chairperson of the public hearing has to produce a report, approved by all the officers assigned to the hearing, within 15 days of the public hearing. This report will also be made available for public inspection.

4.2 The Public Participation Process up to date

The following activities in relation to the PPP have been conducted to date:

Table 2: PPP to date

Activity	Date
Identification of communities involved for the new link section from Sandlane to Sidvokodvo	3 May 2013 – 13 May 2013
Identification of communities involved for the upgrade section from Sidvokodvo to Lavumisa	13 August 2013
Community liaison (new link)	13 June 2013 – 1 August 2013
Community liaison (upgrade)	13 September 2013 – 31 October 2013
1st Newspaper advertisement (Bhunya & Luyengo)	7 August 2013
2nd Newspaper advertisement (Bhunya & Luyengo)	13 August 2013
Scoping meeting at Bhunya	19 August 2013
Scoping meeting at Luyengo	21 August 2013
1st Newspaper advertisement (Siphofaneni & Big Bend)	7 November 2013
2nd Newspaper advertisement (Siphofaneni & Big Bend)	14 November 2013
Scoping meeting at Siphofaneni	21 November 2013
Scoping meeting at Big Bend	22 November 2013

4.3 Predicted schedule for the EIA

Table 3: Public consultation for the EIA - proposed dates

Activity	Date
Public and authority review of the EIA and CMP	7 April 2014 – 7 May 2014
Decision on public hearing	11 June 2014

Notification of public hearing	12 June 2014 – 25 June 2014
Public hearing	26 June 2014
Findings on public hearing	27 June 2014 – 17 July 2014
Public review of findings	18 July 2014 – 14 August 2014
SEA decision period	18 August 2014 – 12 September 2014

5 BASELINE ENVIRONMENTAL DESCRIPTION

In order to determine the baseline (existing) environmental description the appointed specialists were requested to supply the EAP with an input into the Scoping Report to ensure the baseline conditions are adequately described. Such a description of both the physical and biophysical environment is contained in this chapter and can be compared to the predicted impacts described in Chapter 8 of this report.

5.1 Physical environment

5.1.1 Climate

Mucina and Rutherford (2006) describe the climate in the four regional vegetation types present along the rail line route, as follows:

KaNgwane Montane Grassland (Gm 16)

The Eastern Highveld Grasslands is classified as “GM 12” in Mucina and Rutherford (2006). The “GM” refers to the Mesic Highveld Grassland units.

Climate

Early summer rainfall with a MAP of 910 mm. The frequency of frost varies between 3 and 20 days per annum. The area has a cool-temperate pattern with a MAT ranging between 12.6 ºC and 16.7 ºC. Due to the high elevation frost is a common occurrence.

Geology and soils

Mostly on granite of the Mpuluzi Granite (Randian Erathem), Archaean gneiss giving rise to melanic soils, with intrusions of diabase. Land types are Ac, Fa and Ba.

Vegetation and landscape features

Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual Highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis Africana, Diospyros lycioides* subs *lycioides, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum*).

Swaziland Sour Bushveld (SVI 14):

The Swaziland Sour Bushveld is classified as "SVI 14" in Mucina and Rutherford (2006). This refers to the Savannah Biome as part of the Lowveld region.

Climate

Summer raifall with dry winters. MAP about 700-1 350 mm. Frost infrequent to occasional at higher altitudes.

Geology and soils

Grey soils derived mostly from Randian granites (Mpuluzi and Mswati) and Swazian granites and gneisses (Usutu Suite and Ngwane gness). The area reaches to the Onverwacht Group of the Barberton Greenstone Belt in the far north. Soils are dark, very clayey, of the Sterkspruik, Valsrivier, Swartland soil forms. Land types were unclassified in Swaziland, but elsewhere they are mainly Fa, Fb and Ae.

Vegetation and landscape features

Open to closed, medium to tall tree layer with closed well-developed grass layer. Very hilly with moderate to steep slopes, positioned at higher altitudes than the adjacent SVI 3 Granite Lowveld to the East.

Granite Lowveld (SVI 3):

The Granite Lowveld is classified as "SVI 3" in Mucina and Rutherford (2006). This refers to the Savannah Biome as part of the Lowveld region.

Climate

Summer rainfall with dry winters. MAP from about 450mm on the eastern flats to about 900mm near the escarpment in the west. In a north-south direction, MAP of the unit appears to peak in Swaziland. Generally a frost-free region. Mean monthly maximum and minimum temperatures for Skukuza 39.5ºC and -0.1ºC for January and June, respectively. Corresponding values for Hoedspruit 38.0ºC and 3.7ºC for January and July, respectively.

Geology and soils

From north to south, the Swazian Goudplaats Gneiss, Makhutswi Gneiss and Nelspruit Suite (granite gneiss and migmatite), and further south still, the younger Mpuluzi Granite (Randian) form the major basement geology of the area. Archaean granite and gneiss weather into sandy soils in the uplands and clayey soils with high sodium content in the lowlands.

Vegetation and landscape features

Tall shrubland with few trees to moderately dense low woodland on the deep sandy uplands with *Terminalia sericiea, Combretum zeyheri* and *C. apiculatum* and ground layer including *Pogonarthria squarrosa, Tricholaena monachne* and *Eragrostis rigidior.* Dense thicket to open savannah in the bottomlands with *Acacia nigrescens, Dichrostachys cinerea, Grewia bicolor* in the woody layer. The dense herbaceous layer contains the dominant *Digitaria eriantha, Panicum mazimum* and *Aristida congesta* on fine-textured soils, while brackish bottomlands support *Sporobolus nitens, Urochloa mosambicensis* and *Chloris virgata*. At seep lines, where convex topography changes to concave, a dense fringe of *Terminalia sericea* occurs, with *Eragrostis gummiflua* in the undergrowth.

Zululand Lowveld (SVl 23):

The Zululand Lowveld is classified as "SVl 23" in Mucina and Rutherford (2006). This refers to the Savannah Biome as part of the Lowveld region.

Climate

Summer rainfall with some rain in winter. MAP about 500-900mm (highest in the southeast). Generally a frost free area. Mean monthly maximum and minimum temperatures for Mpila Camp (Hluhluwe-iMfolzi Park) 38.5ºC and 7.8ºC for February and June, respectively.

Geology and soils

Black-clay soils and duplex soils derived from a distinct variety of clastic sediments of Dwyka, Ecca, Beaufort and igneous rocks of the Lebombo Groups (all of the Karoo Supergroup). Also well-drained soil forms occur especially on stony slopes. Land types Fb and Ea, with some Db and Dc.

Vegetation and landscape features

Extensive flat or only slightly undulating landscapes supporting complex of various bushveld units ranging from dense thickets of *Dichrostachys cineria* and *Acacia* species, through park-like savannah with flat-topped A. tortilis to tree-dominated woodland with broad-leaved open bushveld with *Sclerocarya birrea* subsp. *caffra* and *A. nigrescens*. Tall grassveld types with sparsely scattered solitary trees and shrubs form a mosaic with the typical savannah thornveld, bushveld and thicket patches.

5.1.2 Topography

The terrestrial topography can be described as irregular undulating plains and hills.

5.1.3 Noise and vibration

With regards to the baseline noise environment, it is important to identify existing contributors to noise in the environment as well as sensitive noise receptors which could potentially be impacted on. The activities in surrounding area ranges from commercial dryland cropping, forest plantations to cattle ranching. The most important roads that the rail route current or is proposed to traverse are the MR4, MR8, MR9 and the MR19 National and public routes.

Ground conditions may vary depending on section of rail under investigation (rural or urban). It is assumed that ground conditions could be classified as medium in terms of acoustics (slightly acoustically absorbent). This specifically relates to the way that the ground surface influence the propagation of the sound from the development as the fraction of sound that is reflected from the ground would be influenced as certain frequencies would be absorbed by the ground surface. Ground conditions will be further investigated during the Environmental Noise Impact Assessment (ENIA) phase.

Besides the mentioned roads there may be a few other significant contributors of noise in the study area of an industrial nature. Other major ambient noise contributors will be identified and quantified during the ENIA phase.

Residential dwellings (also known as noise-sensitive developments, receptors or NSD's) presented in Figure 4.

Based on the desktop study ambient sound levels could range from rural to urban in acoustical character depending on the section of rail route under investigation. Measurements conducted during the ENIA phase would ambient sound levels more accurately.

Figure 4: Aerial image indicating potential noise-sensitive developments

5.2 Biophysical environment

The present day land use around the route is characterised by rural urban development, rural informal development, subsistence agriculture (cattle), large scale commercial crop production, commercial forestry and areas containing waterbodies such as rivers as shown in Figure 5.

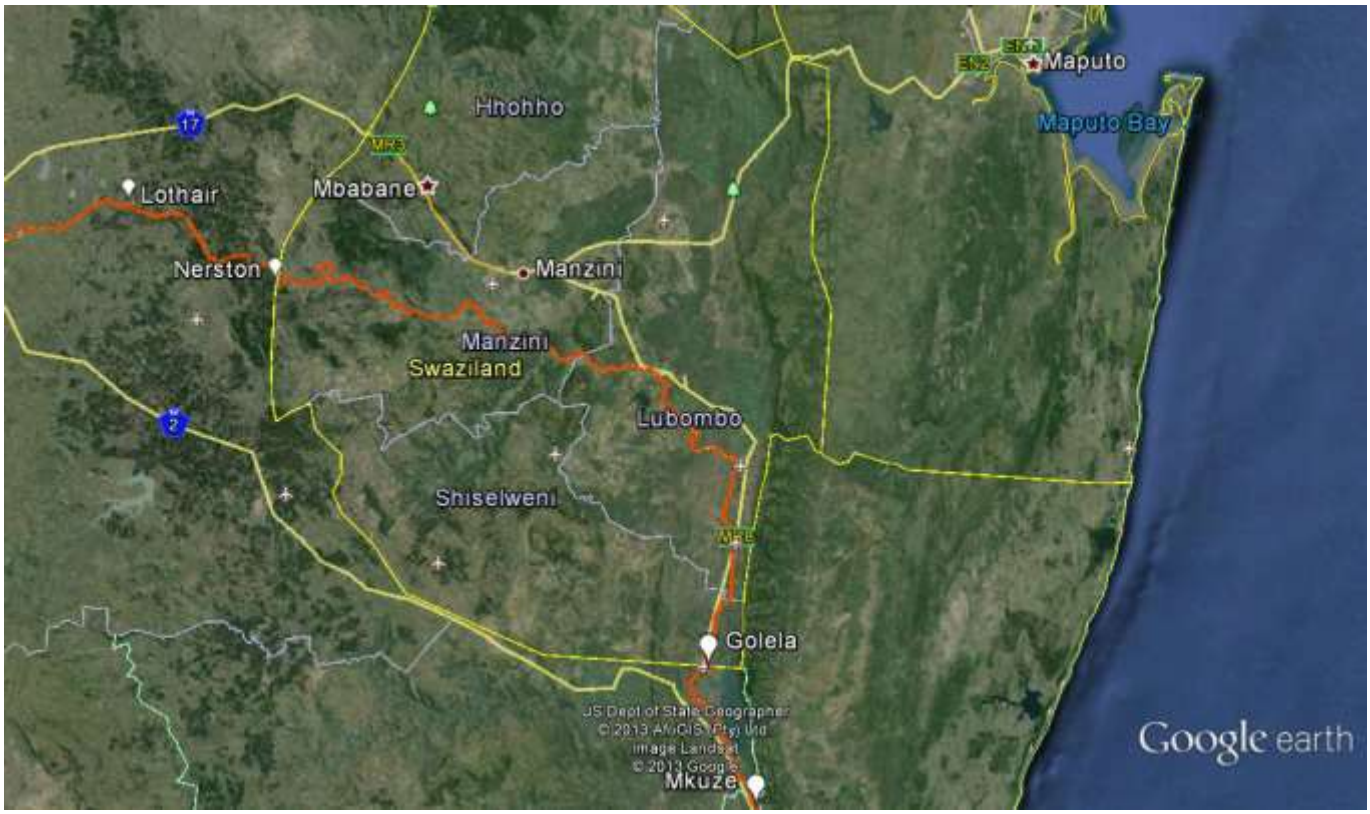


Figure 5: The Sandlane to Lavumisa proposed route

The study area is dominated by a mixture of urban and rural housing, forestry and agriculture, with the associated infrastructure such as roads, dams and the present rail network.

5.2.1 Biodiversity

Based on interactive conservation planning techniques, irreplaceability of certain sites based on the C-Plan mapping process, several Biodiversity and Tourism Corridors (BTC) were identified (Figure 6).

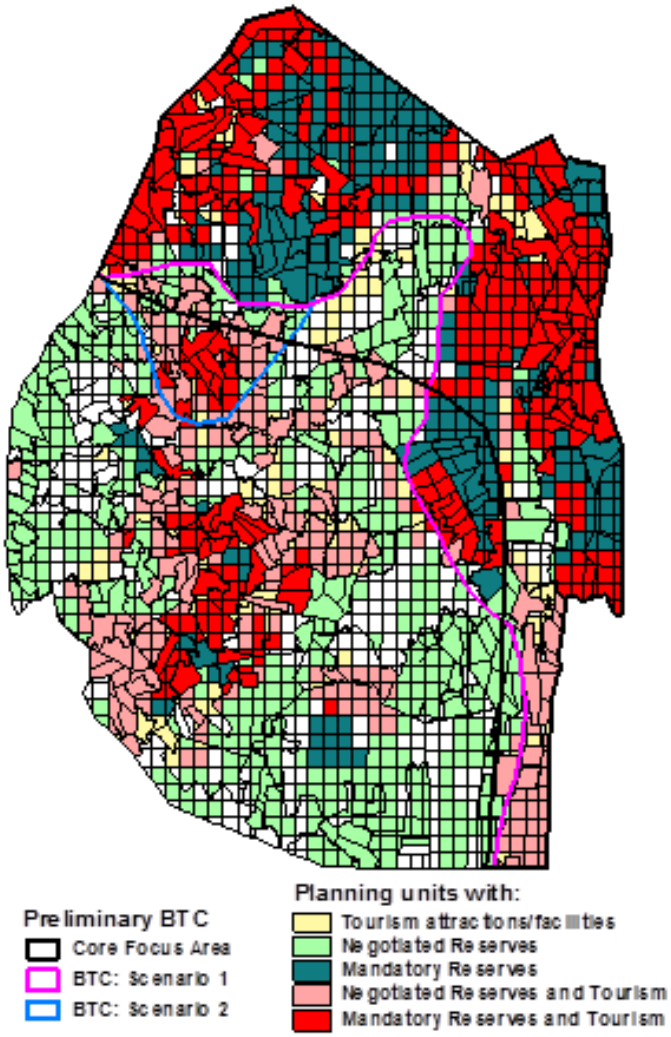


Figure 6: Preliminary Biodiversity and Tourism Corridors based on C-Plan irreplaceability scores (Emery et al., 2001) with important areas with biodiversity and tourism value shown in red.

5.2.2 Species of special concern

The Swaziland National Trust Commission (SNTC) is responsible for determining the status of various floral and faunal species within Swaziland. They have adopted the IUCN Red Data criteria with regard to assessing the conservation status of the various species found, within the country.

In this regard 24 plant species are considered Endangered, while 15 are regarded as Vulnerable. Most of these species are associated with forested area in and near river valleys (e.g. *Encephalartos spp* and *Streptocarpus spp*).

Animal Species of Special Concern within the country are limited but particular care will be focused on establishing the potential habitats of those species likely to occur listed as listed in the Ecological assessment report attached in Appendix B, Annexure A.

The potential impacts on the biophysical environment predicted for this project are:

1. Destruction of natural habitat:
    a. Loss of habitat and the removal of vegetation (terrestrial)
    b. Loss of corridors especially with regard to the proposed BTCs and Trans Frontier National Parks proposed on the south eastern borders of Swaziland
    c. Loss of ecotones
2. Loss of Species of Special Concern
    a. Loss of rare and endangered species
    b. Introduction of alien and invasive species
3. Removal of topsoils and soil erosion
    a. An increase in soil erosion
4. Introduction of alien vegetation
    a. Introduction of alien or invasive plants.

5.2.3 Aquatic environment

Swaziland is drained by five major rivers: the Mlumati, Nkomazi, Mbuluzi, Lusutfu and Ngwavuma. Three of these rivers originate in South Africa, while the remaining two (the Mbuluzi and Ngwavuma) originate within Swaziland (Frenken & Mharapara, 2001). The rivers drain from west to east. Nearly all streams in the western portion of Swaziland (Highveld) are perennial, as opposed to the Lowlands (eastern portion of the country) where most streams (except for the large rivers) flow only after large local storms. Swaziland has riverine, lacustrine, and palustrine wetland systems, with the riverine system being the most common (Frenken & Mharapara, 2001).

An estimated 20 perennial river crossings, as well as an estimated minimum of 250 drainage lines, non-perennial rivers or potential wetlands are likely to be crossed by the proposed railway and the proposed 35 m wide railway corridors. These watercourses form the basis for identifying potential wetland and riparian areas to be investigated during field surveys. No locality data is as yet available for the footprints of access roads, crew camps, borrow pits and refuelling yards. All waterbodies that lie within 500 m of the proposed development footprints will be investigated during a dedicated field survey. Functional and Integrity assessments will be conducted based on the outcomes of the field surveys.

Figure 7 illustrates the quaternary catchments delineated for the project.

Figure 7: The project locality (red line) in relation to the respective quarternary catchments

5.3 Social environment

Social impact assessment (SIA) process focuses on evaluating the impacts development has on community social and economic well-being. This analysis relies on both quantitative and qualitative measures of impacts. Assessing proposed developments in a socio-economic context will help both the developer and affected community to identify potential social equity issues, evaluate the adequacy of social services and determine whether the project may adversely affect overall social well-being.

The scoping period of the SIA previously undertaken intended to gain an initial understanding of the socio-economic environment of the proposed project area. Through scoping initial socio-economic issues that may influence project decisions, such issues were then be considered during development of the terms of reference for the impact assessment phase which ensured adequate impact assessment of the potential positive and negative impacts on the social environment.

Swaziland is divided into four main administrative regions (Figure 8), namely:

- Hhohho
- Lubombo
- Manzini
- Shiselweni

Figure 8: Regions of Swaziland and their administrative centres

Covering an area of 17,364 km² and situated between South Africa and Mozambique, Swaziland is a small landlocked country with a population of around one million people of which about 70% lives in rural areas. The political system in Swaziland is an evolving balance between modern institutions and a monarchy with constitutional powers entrusted to the King. The new Constitution that became effective in January 2006 provides for separation of powers between the executive, legislative and judicial arms of Government and stipulates various individual rights.

The study area in Swaziland relates to the areas within the railway line servitude and associated infrastructure, and affects the Manzini, Shiselweni and Lubombo regions, as indicated in Figure 3. Six Tinkhundla in the Manzini Region, four Tinkhundla in the Lubombo Region and one Inkhundla in the Shiselweni Region will be affected.

5.3.1 Socio-economic profile

Population size is regarded as one of the most important determinants of the needs of the population. These needs are expressed in the demand for infrastructural and social services as well as the potential on the extent of involvement in economic activities. It also forms the basis from which all other calculations are made.

Swaziland's population was estimated at approximately 1 020 000 people in 2007 according to the Central Statistical Office (The World Bank, 2013).

Table 4: Average population size per district

Region	Estimated population	Average Household Size
Hhohho	283 000	3.9
Lubombo	208 000	4.4
Manzini	320 000	4.3
Shiselweni	209 000	5.0
Total	**1 020 000**	**5.4**

The values indicated in the table above are however a generalisation with variation seen between urban and rural housing characteristics and conditions. In a rapid survey done by UNICEF on household demographic characteristics it was found that male-headed households had, in general higher sizes than female-headed households (5 members compared to 4.75). Similarly it was found that the households in rural areas contained on average 5.6 members, while urban households consisted of 4 members.

The effect of household size on welfare can be measured in two ways. A higher household size may result in higher welfare owing to additional income that can be generated through the additional labour that is available, but it may also have a decreasing effect on welfare since there are more people for which food, education and care need to be provided.

A population *pyramid* graphically displays a population's age and gender composition by showing numbers or proportions of males and females in each age group; the *pyramid* provides a clear picture of a population's characteristics. The sum total of all the age-gender groups in the *pyramid* equals 100 per cent of the population.

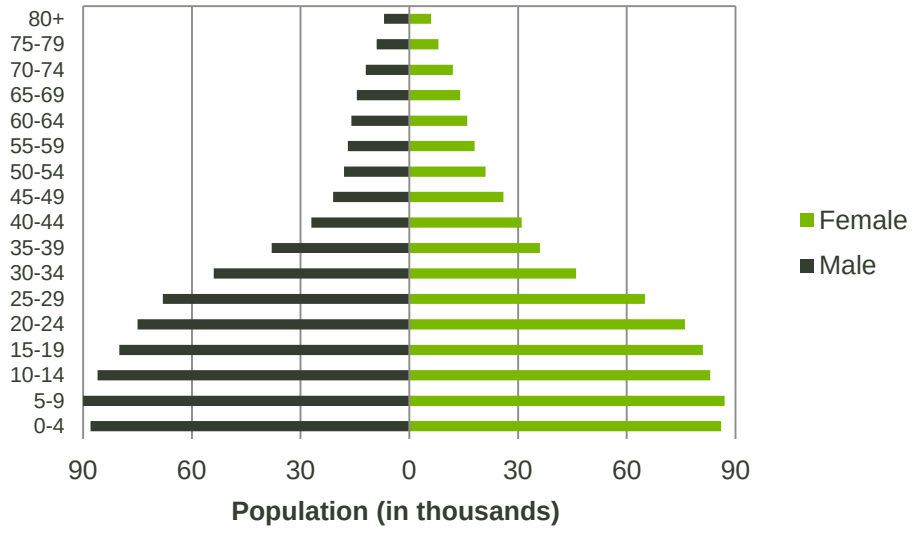


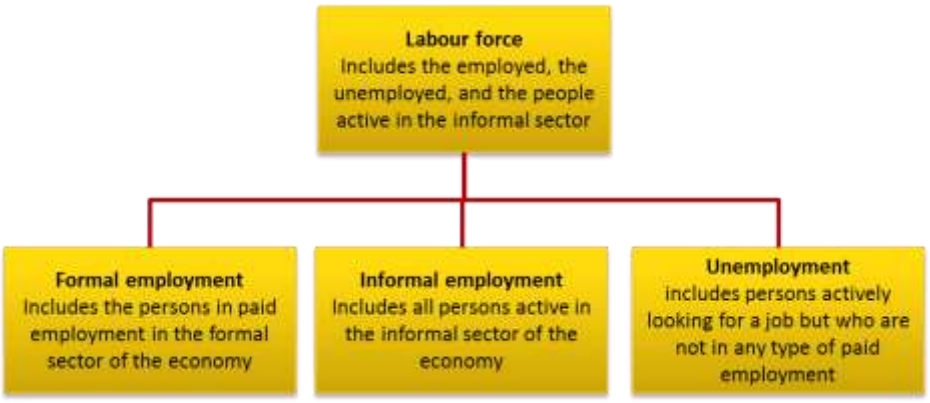
Figure 9: Population pyramid (IndexMundi, 2013)

The population pyramid shows larger numbers in the younger age groups, this indicates rapid growth. There are also a large number of people in the economically active age group (15-56 years) (Swaziland Vulnerability Assessment Committee, 2012).

5.3.1.1 Labour and Economic Analysis

In the analysis of the labour and employment situation in a defined area (such as a Tinkhundla), it is necessary to focus attention on the size and spatial distribution of the labour force. The characteristics of the labour market should be analysed.

Unemployment, and in a sense trans frontier commuting, provides an indication of the difference between supply and demand and implies that equilibrium in the labour market necessitates both expansion of economic activity and the curtailment of population growth.



Another issue that should be addressed is involvement in the peripheral (informal) sector, as not all potential workers are active in the labour market. Finally, the quality of the labour force needs to be analysed as it provides information on the employability of the workers.

The term labour force refers to those people who are available for employment.

The labour force has numerous contributors and can be extensively analysed. Within the report the data on the labour force is limited owing to the lack of labour statistics in Swaziland.

In 2011 Swaziland experienced a fiscal crisis that had a negative effect on economic and social development. Despite the country's middle-income status, Swaziland has high levels of inequality, poverty, food insecurity and unemployment.

In order to stimulate rapid and inclusive growth in Swaziland, the Cabinet approved the Economic Recovery Strategy (ERS) in 2011, aimed at raising the annual economic growth to 5% and create 30,000 jobs by 2014. The key sources identified for growth has been identified as Foreign Direct Investment (FDI), domestic investment, trade, tourism, infrastructure, Information and Communications Technology (ICT), fiscal sector, agriculture, financial sector, and human capital (African Economic Outlook, 2012).

The unemployment rate of Swaziland is high, especially among the youth. According to the 2010 labour force survey, the unemployment rate reached 29% of the labour force and considered one of the highest among Sub Sahara Africa's middle income countries. Differences emerged across subgroups: at 64% of relevant labour force, youth unemployment (ages 15 - 24) is three times higher compared with any other age groups. Unemployment is also notably higher in rural areas (51.2%) than in urban areas (23.6%), among people without education and among women.

Figure 10 indicates the high percentage of unemployment and the rise thereof from 1995 to 2010.

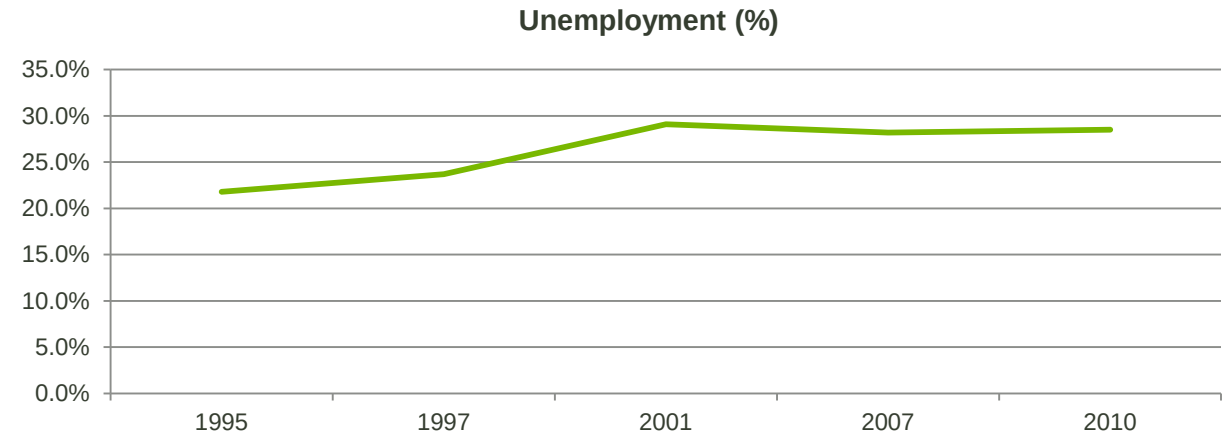


Figure 10: Unemployment rate

Unemployment is notably higher in rural areas (51.2%) than in urban areas (23.6%). The global fiscal crisis that also affected Swaziland further limited growth and job creation, causing poor prospects for new entrants into the labour market that will have a negative impact on the country's human capital and equitable economic growth (African Economic Outlook, 2012).

Job creation is an urgent priority in Swaziland. Supporting policies currently employed include removing barriers to competition and easing access to credit on the labour demand side while reforming tertiary education on the supply side. Establishing labour exchange offices to improve the flow of information between employers and workers could also help (African Economic Outlook, 2012).

5.3.2 Land use

Swaziland is a small, landlocked country of 17 364 km^2 with a population of approximately 1 020 000 people. The country has some natural mineral resources (coal, asbestos, iron-ore) but is a predominantly market economy based largely on wholesale and retail trade, agriculture and light industries.

The major land uses are for settlements, agriculture, and wildlife. Swaziland has a dual system of land tenure, namely communal – or Swazi Nation Land (SNL) and freehold or Title Deed Land (TDL). About 67% of the country is used solely for grazing; but during the dry season, an additional 14% that is normally under cultivation is also used for livestock. Arable agriculture is a major activity, especially on freehold land. Only about 4% of the land is protected – which is below the recommended level of 10% (IUCN 1989). There are several protected areas owned either by the State or privately (Keatimilwe, 2013).

The country is divided into six physiographic districts whose ecological characteristics have a profound influence on land use. The regions run almost parallel in a north-south direction.

- The Highveld, covering the western part of the country, is an upland area. Only about 3% of the region is good arable land, while a further 10% is classified as having fair potential for crop production.
- The Middleveld (both upper and lower), to the east of the Highveld, covers almost 28% of the total area. The region is warmer and drier than the Highveld. Almost 20% of the upper "Middleveld" has good to fair arable soils, while in the lower Middleveld the proportion is about 10%. The Middleveld is the most densely populated part of the country in terms of both humans and livestock.
- The Western and Eastern Lowveld is relatively flat and low-lying, with a marked drought hazard but with good soils. Most of the irrigated sugar and citrus estates are located here.

- The Lubombo plateau rises abruptly from the Lowveld. About 12% of the region has good or fair arable soils. The vegetation is mainly wooded bushvelds. (Keatimilwe, 2013)

The regions which will be directly impacted by the construction of the new rail line are the Manzini and Lubombo Districts as the Transnet-Swazi Rail link will transverse through these districts.

5.3.3 Identified risks and benefits

Any development in the study area poses a threat to the existing natural environment. Considerable care should be taken to ensure that the environment is not adversely affected.

Illegal vehicle and pedestrian movement across the line pose a safety risk. This is a result of inter-settlement movements and movements towards better economic opportunities across the line. This essentially poses a noise and air pollution risk for the inhabitants.

A section of the proposed Transnet-Swazi rail line will consist of newly constructed segments, however a large part of the alignment is already existing. Manzini district will be most directly affected by the construction of the line as the largest part of the newly constructed railway will be in this district. Caution should be taken as the new additional segment will pass through a fairly untamed natural environment.

There is a moderate prevalence of areas within close proximity to the line and its reserve across the study area that may be regarded as environmentally sensitive or conservation areas. Considerable efforts need to be taken to safeguard protection of such areas. Other areas such as subsistence farming land, which have proven pivotal for the growth of the local economies, should also be protected as far as possible.

6 ISSUES IDENTIFIED DURING THE SCOPING PHASE

The proposed construction and upgrade of the Sandlane to Lavumisa section of the Swaziland Railway Link project is anticipated to impact on a range of biophysical, social and economic aspects of the environment. One of the main purposes of the EIA process is to understand the significance of these potential impacts and to identify suitable mitigation measures, both positive and negative.

A summary of issues raised to date by both the specialists and the stakeholders are indicated below. The Plan of Study for the EIA in Appendix B, Annexure I provides a detailed indication of how these issues were addressed during the impact assessment phase.

The detail contained below has been sourced from the specialist assessment reports which can be found in Appendix B, annexures A through I.

6.1 Issues raised by the specialists

6.1.1 Ecological issues raised during the scoping phase

With regard to plant species, 24 are considered Endangered, while 15 are regarded as Vulnerable. Most of these species are associated with forested area in and near river valleys (e.g. *Encephalartos spp* and *Streptocarpus spp*). As the proposed railway alignment is closely associated with river valleys, it can be expected that a number of these species of special concern might be present in the area.

The preliminary results, based on the available information, show that the proposed Sandlane to Lavumisa line could impact on a number of sensitive and/or important terrestrial habitats. However several of the metadata sources (Emery *et al*., 2001) for the spatial data shown in this report also indicate that large areas of habitat at a broad scale are degraded or transformed. This is also supported by the observed land use character shown in the aerial images (Google Earth), thus a large proportion of time during the EIA site visit will be spent ground-truthing the potential sensitive habitats while assessing the potential for associated conservation needy species know to occur within the study region.

6.1.2 Geohydrological issues raised during the scoping phase

The potential for groundwater contamination is associated with uncontrolled spills of fuels and lubricants during the construction phase, as well as any hazardous material transported during the operational phase. The extent and impact of potential groundwater contamination is largely dependent on the nature of the subsurface soil, geological and geohydrological conditions. This will be assessed during the EIA phase.

6.1.3 Noise and vibration issues raised during the scoping phase

During the public scoping meetings held (see chapter 5) the issue of a potential negative impact caused by noise and vibration from the railway line was raised by the public. It is important to note that while noise is an expected potential negative impact, actual vibration of the railway line is highly unlikely as the geology of the area is not associated with the transmission of vibration over relatively long distances. Instead, it is usually the airborne vibration resulting from the noise that can be felt when a train passes by. Therefore, actual vibration is not seen as a potential impact and only noise will be assessed during the EIA phase. This applies to both construction and operational phases of the project.

6.1.4 Social and socio-economic issues raised during the scoping phase

Negative Socio-economic Impacts

- A loss of land and assets to the railway servitude or areas to be occupied by project-related surface infrastructure;
- A population influx (due to the presence of a construction and operational workforce, as well as an influx of job-seekers into the area), with a possible concomitant increase in social pathologies and increased pressure on existing infrastructure and services;
- Disruption of access routes and daily movement patterns by the construction and/or permanent servitude;
- Impacts on sense of place. Such impacts may arise as a result of the visual intrusion of project-related infrastructure, as well as noise and traffic impacts during construction;
- Dust caused by the construction works and from movement of heavy equipment. During the construction phase, the local community and construction workers would be inconvenienced by the dust generated by the construction works;
- Noise and vibration due to the construction works and from movement of heavy equipment. Movement of heavy machinery on existing local roads may be one of the core problems for the local community during the construction phase. Vibration may also damage structures located nearby;
- Socio-cultural differences and conflicts between migrant workers and the local community. Single men predominately occupy the construction camps which could create social conflicts, usually as a result of cultural differences, alcohol abuse or being away from their wives or girlfriends for extended periods of time. A possible reason for conflict would be the perception among locals that the outsiders are taking up jobs that could have gone to unemployed members of the local community. An influx of unemployed job seekers could also add to the potential for conflict;
- Diseases associated with the arrival of temporary labour in the area. Various social pathologies, such as drug/alcohol misuse, abuse of woman and children and incidences of sexually transmitted diseases (STDs) may increase with the influx of job-seekers into the area;
- Crime. An inflow of construction workers and job seekers may also be accompanied by an increase in crime. Even if specific instances of crime are not as a result of the newcomers, they may still be ascribed to them by local communities; and
- Informal settlements. Once construction is concluded and the camp is vacated, it may be illegally occupied by unlawful tenant.

Positive Socio-economic Impacts

- Local employment and job opportunities. The construction phase of the project will have a positive impact on the local labour market. It is anticipated that the operational phase will also create permanent employment opportunities for the local affected communities though some level of technical skills and qualifications may be needed;

- Local economy opportunities and economic empowerment. The construction phase of the project will have temporary positive impacts on the local economy; and
- Establishment/ upgrading of services.

6.1.5 Cultural and heritage issues raised during the scoping phase

The cultural and heritage issues foreseen in this project include the following:

- Ignorance as to the nature and distribution of heritage resources. There is very little information available on heritage in the area. This can be overcome by a number of actions, e.g.
    - A national system whereby members of the public can record the heritage sites in their communities or on their properties should be established. This can be achieved, for example by keeping a register at the local library.
    - The authorities should make funds available for systematic surveys by which sites can be documented
- Heritage is not static. New heritage sites are continuously being created, due to events that take place, or, simplistically seen, because existing features and structures become older with the passage of time and all should be considered for their contribution to retelling the story of the past. The process of identifying and documenting heritage features would therefore, in theory, never stop.

6.1.6 Safety and security aspects

An emergency response plan should be compiled and incorporated into the CMP for both the construction and operational phases. Issues pertaining to regular inspections, monitoring mechanisms, maintenance and emergency response will be incorporated into this CMP.

Safety requirements linked to the existing development footprint of the proposed construction site will be investigated and reported in the legislative and institutional requirements of the EIA report. These aspects will further be incorporated into the design and layout of the proposed facility. Where necessary, monitoring and inspection mechanisms will be included in the construction and operational phases of the CMP.

6.2 Issues raised during the Public Participation Process

The following issues in Table 5 constitute an extract from the issues and response report (IRR) and the Minutes captured at the community liaison and public meetings for the project. The IRR containing all the issues raised by the public during the public participation meetings held can be found in Appendix C, Annexure D

.

Table 5: Extracts from the issues and response report

Issue raised	Comment
Should one need to be relocated, would one have the option of building one's own house or will it be constructed for you?	These are all issues that will be discussed during the negotiations with the land acquisition team in the future. The Relocation Action Plan (RAP) and policy framework will contain the guidelines which need to be followed to ensure all parties are treated fairly and equally.
The maps shown thus far in the process are not	More detailed maps will be available once the surveys

clear and exact, only a servitude area is indicated on aerial maps.	have been conducted.
The local SMME's requested to meet with the contractors for possible opportunities.	It was explained that at this stage no contractors have been appointed as the project is only still conducting the EIA process to identify potential impacts.
How will individuals who refuse to move or cooperate with Swaziland Railway be handled?	It was explained that due to the fact that both Swaziland and South African governments have signed an MoU in support of the project as it is a strategic initiative. Mavela Vilane explained that the project cannot easily be stopped. Affected parties will be compensated fairly and are thus motivated to cooperate.
A concern regarding graves and other structures of heritage importance was raised.	A heritage specialist has been appointed to conduct a heritage impact assessment of the project.
The issue of losing access to water, homes and resources was raised should the railway line pass by a community.	These issues will all be looked at in detail and will form part of the RAP. The ideal is to ensure all persons have access to all resources utilised before the project commences.
Will the Scoping Report be available for public review?	No, only the EIA and CMP will be made available for public review later on.

6.3 Institutional and legal aspects raised during the scoping phase

6.3.1 Project lifecycle

The project is effectively in the preliminary design phase, and no detailed design is available as such. Where applicable comment and suggestions made during the scoping phase will be incorporated into the design.

6.3.2 Alternatives to and need for the project

A detailed alternatives assessment was conducted in the EIA phase, based on alternatives identified during the Scoping Phase (Chapter 6). These alternatives included evaluation of the no-go option; alternatives to site selection; and alternatives to construction methodologies and site layout. The need for the project was also evaluated and is presented in the EIA report.

6.3.3 Availability of specialist reports and information relevant to the application

All documentation relevant to this environmental application, particularly specialist reports and background information used to compile the EIA is appended to the final reports.

7 ASSESSMENT METHODOLOGY

The purpose of this chapter is to describe the assessment methodology utilised in determining the significance of the potential impacts of the proposed activities on the biophysical, social and economic environment. The methodology was developed in 1995 and has been continually refined to date through the application of it to over 400 EIA processes.

7.1.1 Evaluation Methods in Environmental Assessments

7.1.1.1 Identification of environmental, social and economic attributes

Environmental, social and economic attributes are first identified for which impacts of the proposed activity will be assessed. This is done through initial investigations by the EAP and then through public participation.

7.1.1.2 Collection of data and description of status quo situation

Baseline information is then required to establish the *status quo* for the environmental and social attributes to be evaluated in the impact assessment. This is done through collection and collation of existing spatial information (GIS, aerial photographs, planning databases etc.) which is then verified through specialist assessments.

7.1.1.3 Identification of environmental, social and economic impacts

The impact of activities to be conducted during various phases of the proposed project on the attributes identified during scoping phase EIA is then evaluated by the EAP through input from the various specialists. The preferred methodology to evaluation is a simple Impact – Activity Checklist.

7.1.1.4 Impact – Activity Checklist

This section outlines the methodology used to assess the significance of the potential environmental impacts identified. For each impact, the EXTENT (spatial scale), INTENSITY (size or degree scale) and DURATION (time scale) are described (Table 6). These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the EIR represent the full range of plausible and pragmatic measures *but does not necessarily imply that they should or will all be implemented*. The decision as to which mitigation measures to implement lies with Swaziland Railway and ultimately with the SEA. The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Table 6: Criteria for the evaluation of environmental impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**Regional**	Beyond a 10 km radius of the proposed construction site.
	Local	Within a 10 km radius of the centre of the proposed construction site.
	Site specific	On site or within 100 m of the proposed construction site.
Intensity of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered.
	Moderate	Natural and / or social functions and/ or processes are *notably* altered.
	Low	Natural and / or social functions and/ or processes are *slightly* altered.
	Very Low	Natural and / or social functions and/ or processes are *negligibly* altered.
	Zero	Natural and / or social functions and/ or processes remain *unaltered.*
Duration of impact	**Short Term**	Up to 2 years.
	Medium Term	Up to 5 years after construction.
	Long Term	More than 5 years after construction.

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and intensity. The means of arriving at the different significance ratings is explained in the table below.

Table 7: Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	• High intensity with a regional extent and long term duration; • High intensity with either a regional extent and medium term duration or a local extent and long term duration; and • Medium intensity with a regional extent and long term duration.
Medium	• High intensity with a local extent and medium term duration; • High intensity with a regional extent and construction period or a site specific extent and long term duration; • High intensity with either a local extent and construction period duration or a site specific extent and medium term duration; • Medium intensity with any combination of extent and duration except site specific and construction period or regional and long term; and • Low intensity with a regional extent and long term duration.
Low	• High intensity with a site specific extent and construction period duration; • Medium intensity with a site specific extent and construction period duration; • Low intensity with any combination of extent and duration except site specific and construction period or regional and long term; and • Very low intensity with a regional extent and long term duration.
Very low	• Low intensity with a site specific extent and construction period duration; and • Very low intensity with any combination of extent and duration except regional and long term.
Neutral	• Zero intensity with any combination of extent and duration.

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact would be determined using the rating systems outlined in Table 8 and Table 9 respectively. It is important to note that the significance of an impact should always be considered in connection with the probability of that impact occurring. Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in Table 10.

Table 8: Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95% chance of the impact occurring.
Probable	Estimated 5 to 95% chance of the impact occurring.
Unlikely	Estimated less than 5% chance of the impact occurring.

Table 9: Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 10: Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is permanent.
Reversible	The impact is reversible, within a period of 10 years.

7.1.2 Subjectivity in Assigning Significance

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, EIA processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, EIAs must endeavour to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognising this, we have attempted to address potential subjectivity in the current EIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail in the PoSfEIA and in this EIR. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the EIR with a clear summary of how the assessor derived the assigned significance;
- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and

- Utilising a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

8 ASSESSMENT OF POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

8.1 Introduction

This chapter describes the potential impacts on the biophysical and social environments, which may occur due to the proposed activities described in Chapter 1 as well as the impacts predicted during the scoping phase as described in Chapter 6.

The potential impacts identified during the Scoping Phase of this project as assessed in detail in this report. The significance of the impact determined in the following sections of this chapter is detailed as well. The methodology used to assess the potential impacts is detailed in Chapter 7 of this report. The tems “No Mit” and “Mit” reflected in the assessment tables in this chapter refer to the impact with no mitigation and with potential mitigation respectively. **Note that this does not imply that mitigation should or would be undertaken, but merely indicates the extent to which mitigation could change the significance of the impact where it is to be implemented.**

8.2 Impacts on the Biophysical Environment

8.2.1 Ecological assessment

The following general methods were used in assessing the study area, which included the 35 m wide footprint of the proposed rail line area and 500 m zone either side of the alignment with regards to wetlands:

Flora:

- Provide a description of the general floristic species diversity and community composition;
- Evaluating the occurrence of potential Red Data taxa;
- Demarcating physiognomic units based on floristic relevès; and
- Provide an indication on the ecological condition (successional stage) of the predetermined physiognomic units.

Fauna:

- A detailed faunal assessment based on field observation;
- An avifaunal assessment with particular reference towards the occurrence species sensitive to the placement of transmission lines; and
- An evaluation of the occurrence of any of the listed conservation needy species.

Wetlands and rivers:

A large proportion of the available habitat related to sensitive or important taxa, are associated with the wetland / riverine / moist habitats. The EIA phase thus focused on critical assessment of the wetland / riverine systems in the following way:

- Delineation of any important wetland and river boundaries using the requisite techniques based upon the latest Wetland Classification systems (SANBI, 2009);
- Indicate suitable buffer zones as prescribed by the relevant provincial policies / conservation plans;
- Assess the status of the observed faunal and floral populations observed; and
- Assess the potential impacts on the functioning of these systems.

8.2.1.1 Terrestrial habitats

The study area is dominated by commercial crop production, forestry and secondary grasslands and wetlands (Figure 11, Figure 12 and Figure 13). The secondary grasslands are important in maintaining ecological links between the remaining areas the wetlands and rivers. This was highlighted by the fact the majority of the faunal, mainly birds species observed were found within the grassland / rocky outcrop areas such as those observed south of the Malkerns area.

Figure 11: Typical landscape within the western portion of the study area

Figure 12: The project near Bhunya, where the rail line will follow the southern banks Usutu River.

Figure 13: The proposed line will follow the course of the Usutu River towards Manzini with the relative alignment shown by the red arrow

As explained in Chapter 5, The Vegetation Map for South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006) was used to derive the habitats intersecting the railway through Swaziland Figure 14. All the vegetation units are Threatened habitats i.e. Critically Endangered or Vulnerable (Table 11).

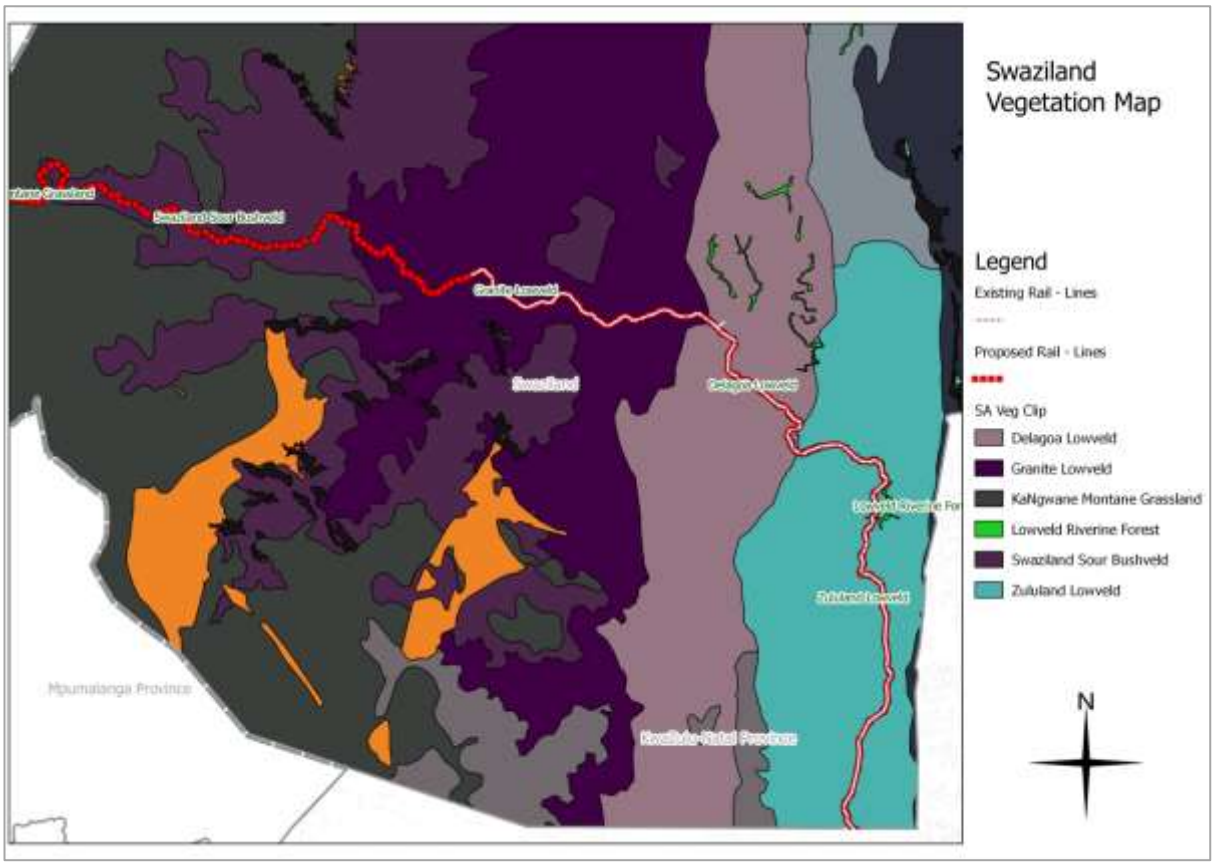


Figure 14: Vegetation Map for Swaziland (Mucina and Rutherford, 2006)

Table 11: Vegetation types intersecting the railway with associated Conservation Target, Ecosystem Status, Protection Status and Biome

Name	Conservation Target	Ecosystem Status	Protection Status	Biome
Granite Lowveld	19%	Vulnerable	Moderately protected	Savanna Biome
KaNgwane Montane Grassland	24%	Vulnerable	Hardly protected	Grassland Biome
Swaziland Sour Bushveld	19%	Vulnerable	Poorly protected	Savanna Biome
Delagoa Lowveld	19%	Vulnerable	Moderately protected	Savanna Biome
Zululand Lowveld	19%	Vulnerable	Poorly protected	Savanna Biome
Lowveld Riverine Forest	100%	Critically Endangered	Well protected	Forests

Little of the natural vegetation remains within the study area, due to the impacts already listed (grazing, farming and forestry). Thus not only has the environment been impacted upon (loss of species diversity) but a large degree of habitat fragmentation has also occurred.

The following species were observed during the survey:

Table 12: Species observed during the assessment survey.

Species	Common Name	Conservation Status
Solanum spp		-
Themeda triandra	Rooigras	-
Aristida junciformis	Ngongoni three awn	-
Oenothera tetraptera	Evening primrose	-
Plantago lanceolata	Ribwort	-
Senecio spp	-	-
Hyparrhenia hirta	Common Thatching Grass	-
Cymbopogon plurinodes	Narrow-leaved turpentine grass	-
Digitaria eriantha	Finger grass	-
Acacia mearnsii	Black wattle	-
Eucalyptus spp	Gum	-
Aloe greatheadii	Spotted Aloe	-
Cynodon dactylon	Kweek	-
Imperata cylindrica	Cottonwool grass	-
Bulbostylis schoenoides	Sedge	-
Schoenoplectus spp		
Aloe cooperi	-	-
Pteridium aquilinum	Bracken fern	-
Senna didimobtyra	Peanut-butter Bush	-
Pisdium guava	Guava	-
Strelitzia caudata	Wild banana	-
Ehrythrina lysistemons	Common Coral Tree	-
Cussonia zuluensis	Kiepersol	-
Rhoicissus tridentate	Wild grape	-

Vepris lanceolata	Ironwood	-
Searsia chirindensis	Red currant	-
Ptaeroxylon obliquum	Sneezewood	-
Euphorbia triangularis	River euphorbia	-
Hypaene coriacea	Lala palm	-
Ficus abutifolia	Large leave rock fig	-
Sclerocarya birrea	Marula	-
Birds		
Vanellus armatus	Blacksmith lapwing	-
Bostrychia hagedash	Hadeda ibis	-
Motacilla capensis	Cape Wagtail	-
Passer domesticus	House sparrow	-
Bubulcus ibis	Western cattle egret	-
Corvus capensis	Cape Crow	-
Ardea melanocephala	Black-headed heron	-
Lanius collaris	Common Fiscal Shrike	-
Scopus umbretta	Hamerkop	-

The plant and animal species observed were mostly associated with the intact riverine valleys and rocky outcrops. This was probably due to the degradation found within the remaining areas which had been converted to agricultural areas or had reverted to secondary grasslands areas. The most important habitats, with the highest diversity and largely intact were associated with the Granite outcrop areas and for this study would be rated as highly sensitive.

8.2.1.1.1 Terrestrial environment impact assessment – Loss of habitat and removal of vegetation

Nature of the impact

Due to the nature of the project, vegetation will be cleared and replaced with rail infrastructure, service roads and stormwater management systems. This will have the greatest impact in areas where no lines are in place and within the areas earmarked as biodiversity hotspots and associated with the Swaziland Lowveld and Granite vegetation types and corridors as well as the Critically Endangered Lowveld Riverine Forest found near Matata.

Significance of impacts with mitigation

The construction phase would have the greatest impact on the surrounding vegetation. This will definitely result in the disturbance of the vegetation and soils within the site especially when considering the linear aspects of the project such as the rail lines and ancillary works mentioned above. Due to the site scale of disturbance in the

construction period on the surrounding vegetation when compared to its current state, i.e. the magnitude would be Medium, the overall significance of would be rated as Medium with mitigation (Table 13).

The operational phase of the project would have limited impact on the surrounding vegetation once the plants are allowed to re-establish themselves in any remaining areas; thus the overall intensity would remain be Very Low as the species assemblages would have altered from natural. It is also anticipated that the grazing and agricultural pressure on the vegetation would also continue but would be equitable to the present state and thus similar to the No-Go option.

The table below indicates the impact description as well as mitigation measures proposed.

Table 13: Impact description for the loss of habitat and removal of vegetation in the terrestrial habitat for all the alternatives

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Loss of habitat and removal of vegetation - terrestrial</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Equal to the duration of the construction phase</td><td rowspan="3">Consequence: Slightly detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>Will result in the disturbance of the vegetation and soils within the sites</td></tr>
<tr><td>Intensity</td><td>Moderate - negative</td><td>Due to the site scale of disturbance in the construction period on the surrounding vegetation when compared to its current state, i.e. the intensity would be low as these are located mostly within commercial forestry areas.</td></tr>
<tr><td>Probability</td><td>Certain</td><td colspan="2">The activity will definitely lead to on site loss of habitat and vegetation</td></tr>
<tr><td colspan="5">MITIGATION:
• Clearing of vegetation should be kept to a minimum, keeping the width and length of the earth works to a minimum and the floodplain / wetlands habitats identified should be retained within the development footprint in its current state.
• Construction activities should not exceed the proposed construction boundaries by more than 15 m to avoid the secondary impact of construction and increasing the areas that would require clearing and rehabilitation
• A search and rescue operation for both plants and fauna (particularly reptiles) must be initiated prior to the commencement of any construction once the required permits are in place. Applications must be submitted to the applicable authority for the removal of any protected floral or faunal specie.
• Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the vegetation, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas.
• Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>As for pre-mitigation</td><td rowspan="2">Consequence: Negligible</td><td rowspan="2">Significance: Very low</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>As for pre-mitigation</td></tr>
</table>

Intensity	Very low	Mitigation will reduce the negative impact	
Probability	Certain	The activity will definitely lead to on site loss of habitat and vegetation but will be reduced through appropriate mitigation measures	

The mitigation measure in red text was found to be highly unfeasible to Transnet as 15 m either side of the centre line will not allow the contractors sufficient space to carry out construction activities. Therefore the EAP proposes the following as included in the CMP that **the width of the construction footprint must be agreed upon by the ECO and the Engineer and as far as possible must be kept to a minimum. The maximum width of the construction footprint servitude will not exceed 75 m. Should additional space be needed for the temporary storage of material, the ECO must advise on an appropriate area away from any sensitive areas**.

8.2.1.2 Aquatic habitats

As described in Chapter 5, the study area for the most part falls within the Usutu (Usuthu) and Lebombo River catchments (Figure 15). Not all of these have been classified in terms of their Present Ecological State, but in a desktop assessment of these systems in 1999, by the South African Department of Water Affairs, most of the main stem systems west of Bhunya were rated as having a Present Ecological State of C or Moderately Modified, while those systems east of Bhunya, associated with the Usutu River and below the paper mill, were then rated as E-F, i.e. largely unnatural (Nel *et al*., 2012).

Figure 15: The project locality (red line) in relation to the respective quaternary catchments (Info Source South African Department of Water Affairs & Google Earth).

This study would be in agreement with these results due to the lack of riparian habitat, lack of riparian continuity, sedimentation and erosion and general pollutants (soaps) observed in the majority of the catchments observed. Agricultural return flows in the eastern half of the study area would further reduced the PES of these systems to D (Largely Modified).

The Ecological Importance and Sensitivity (EIS) was rated as Moderate for all systems. The rationale for the higher EIS scores is due to the importance of habitat these systems provide within an environment that has largely been altered or modified for all the systems observed.

Only five wetland areas were observed within 50 m of the rail line and these would all be considered valley head seeps associated with the Usutu River. The remainder of the line would not traverse or impact on any other wetland area (Figure 16).

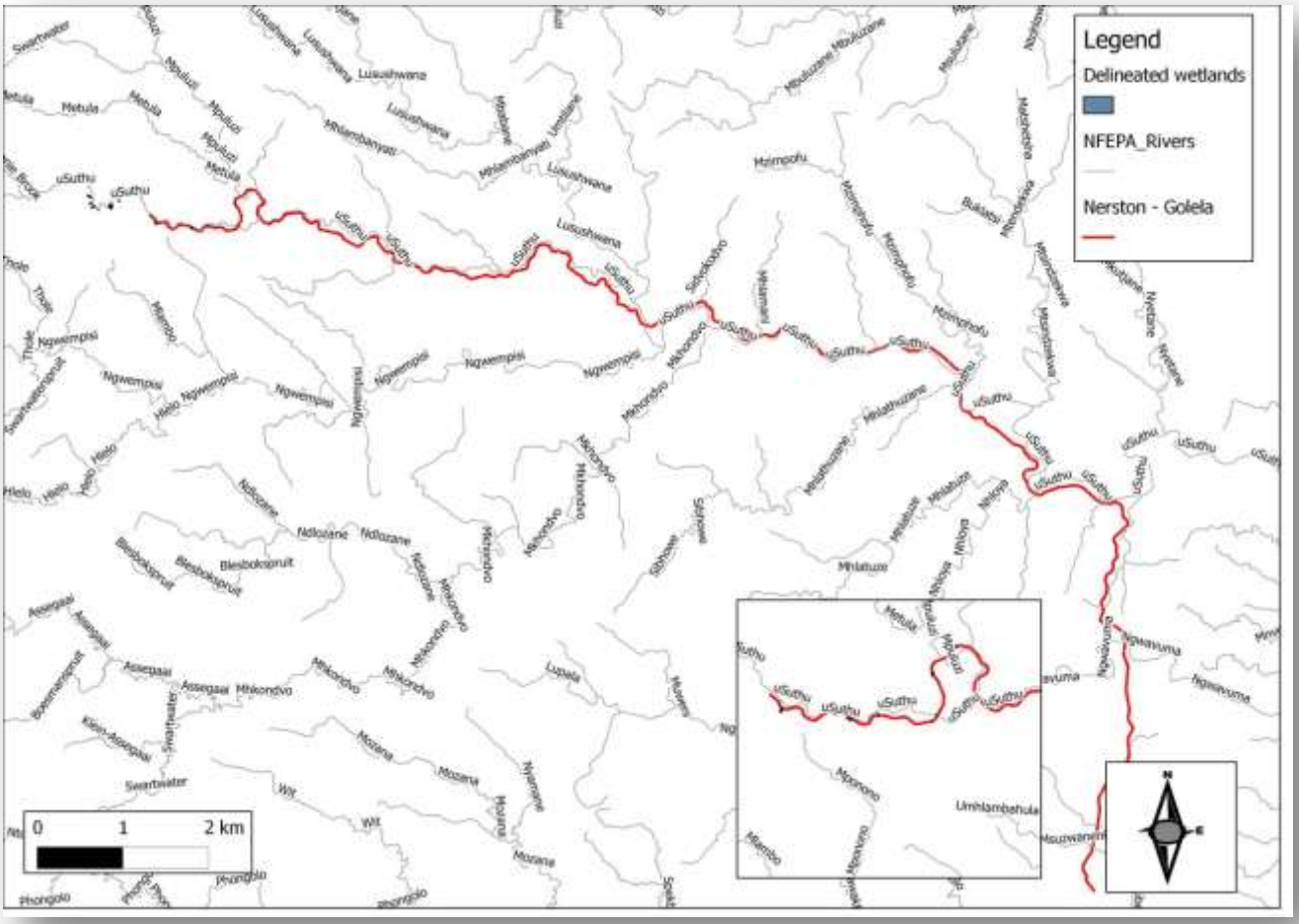


Figure 16: The main-stem rivers found along the rail line alignment, with the inset showing the seep wetland areas delineated during the study

8.2.1.2.1 Aquatic environment impact assessment – loss of habitat and removal of vegetation

Nature of the impact

Due to the nature of the project, vegetation will be cleared and replaced with rail infrastructure, service roads and stormwater management systems. The increase in rail footprint would have an impact on the valley head seeps with regard physical loss of catchment, wetland area and changes to the local hydrology. However none of the proposed areas will also impact on the proposed 50 m ecological buffer with regard the line upgrading and no loops are proposed within these areas. However several impacts already occur within and adjacent to these systems and the proposed layouts would seem to have little further impact considering the size of the footprints or the current state or lack of connectivity within the sites.

Significance of impacts with mitigation

The construction phase would have the greatest impact on the surrounding wetland and aquatic areas. This will definitely result in the disturbance of the vegetation and soils within the site. Due to the site scale of disturbance in the construction period on the surrounding vegetation when compared to its current state, i.e. the magnitude would be moderate, the overall significance of would be rated as Low, with mitigation (Table 14).

The operational phase of the project would have limited impact on the surrounding wetland areas once the plants are allowed to re-establish themselves in any remaining areas; thus the overall intensity would remain be Low as the species assemblages would have altered from natural. It is also anticipated that the grazing pressure on the vegetation would also continue but would be equitable to the present state and thus similar to the No-Go option.

The tables below indicate the impact description as well as mitigation measures proposed for the three route alternatives.

Table 14: Impact description for the loss of habitat and removal of vegetation in the aquatic habitat for the original alignment

IMPACT DESCRIPTION: Loss of habitat and removal of vegetation - wetland and waterbodies				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Equal to the duration of the construction phase	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	The increase in rail footprint would have an impact on the observed pans and valley head seeps with regard physical loss of catchment, wetland area and changes to the local hydrology		
Intensity	Moderate - negative	Several impacts already occur within and adjacent to these systems and the proposed layouts would seem to have little further impact considering the size of the footprints or the current state or lack of connectivity within the sites		
Probability	Certain	The activity will definitely lead to on site loss of habitat and vegetation		
MITIGATION:				

- All designs should include means to protect or maintain the current hydrological regime, thus maintaining and not impeding or diverting any surface water flows.
- Stormwater management systems should include energy dissipation structures to minimise the potential impact of erosion and sedimentation.
- Clearing of vegetation should be kept to a minimum, keeping the width and length of the earth works to a minimum and the floodplain / wetlands habitats identified should be retained within the development footprint in its current state.
- Construction activities should not exceed the proposed construction boundaries by more than 15 m to avoid the secondary impact of construction and increasing the areas that would require clearing and rehabilitation
- A search and rescue operation for both plants and fauna (particularly reptiles) must be initiated prior to the commencement of any construction once the required permits are in place. Applications must be submitted to the applicable department for the removal of any protected floral or faunal specie.
- Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the vegetation, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas.
- Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.

POST-MITIGATION				
Duration	Short-term	As for pre-mitigation	Consequence: Negligible	Significance: Low - negative
Extent	Site-specific	As for pre-mitigation		
Intensity	Low - negative	Mitigation will reduce the negative impact		
Probability	Certain	The activity will definitely lead to on site loss of habitat and vegetation in the aquatic environment		

The mitigation measure in red text was found to be highly unfeasible to Transnet as 15 m either side of the centre line will not allow the contractors sufficient space to carry out construction activities. Therefore the EAP proposes the following as included in the CMP that **the width of the construction footprint must be agreed upon by the ECO and the Engineer and as far as possible must be kept to a minimum. The maximum width of the construction footprint servitude will not exceed 75 m. Should additional space be needed for the temporary storage of material, the ECO must advise on an appropriate area away from any sensitive areas**.

8.2.1.2.2 Aquatic environment impact assessment – Increase in sedimentation and erosion

Nature of the impact

This impact would be also categorised as a cumulative impact, as it would impact on the region with regard potential changes to downstream habitat quality. The increase in any surface water flow velocities within the site would then increase the risk of soil erosion and later downstream sedimentation. Should sediments eventually reach the downstream systems, this could have impacts on sediments loads, but also smother benthic habitats (plants and invertebrates).

Significance of impact with mitigation

The intensity of this impact would however be Low due to the site scale of the operations in the construction phase as well as during the operational phase. Should surface water run-off be managed, by way of mitigation, using a

stormwater management plan, then overall significance would be Very Low for the construction and operations phase (Table 15).

The table below indicates the impact description as well as mitigation measures proposed, representative of all three route alternatives.

Table 15: Impact description of the increase in soil erosion

IMPACT DESCRIPTION: An increase in soil erosion				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	During construction denuded and bare areas should be monitored and managed to reduce the surface water felocity and downstream deposit of sediment	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Erosion could occur on denuded soil although it could have a downstream impact by way of sediment depositing		
Intensity	Low - negative	Due to the site scale of the operations in the construction phase as well as during the operational phase		
Probability	Fairly likely	Due to the type of activity the potential exist for erosion on denuded soil		
MITIGATION: • During construction, erosion should be monitored while areas of vegetation are being cleared. • Hard engineered surfaces that increase surface water run-off should be limited and a stormwater management plan should be created for the development for the operations phase.				
POST-MITIGATION				
Duration	Short-term	As for pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Site-specific	As for pre-mitigation		
Intensity	Very low	Mitigation measures will decrease the intensity of erosion		
Probability	Fairly likely	Mitigation will decrease probability of erosion on cleared areas		

8.2.1.2.3 Aquatic environment impact assessment – Changes to the hydrological regime within the wetland environment

Nature of the impact

Due to the nature of the proposed project this would be an operational phase impact, limited to when the rail and water course crossing features and any erosion protection structures have been constructed. These structures

could interfere with natural run-off patterns, either diverting flows or increasing the velocity of surface water flows. This has the potential to increase or decrease surface water flows into riparian areas.

Proposed mitigation

- Surface water management features such as the crossing of drainage lines, should be placed in manner that flows remain unaltered in terms of direction, velocity and volume, thus the natural base flows, i.e. hydrological regime within these systems is maintained.
- It is also important that during construction and operations that excess ballast is not allowed to enter any water course areas or culverts., which if so doing alter these systems by forming impoundments as shown in Figure 17.

Figure 17: Excess ballast falls into the culverts that creates berms, which then impedes flow.

Significance of impact with mitigation:

Although permanent changes to the local hydrological regime are probable, the intensity of the impact in the operational phase would be Moderate but on a site wide scale in the long-term, thus the overall significance of this impact would be Low with mitigation (Table 16).

The tables below indicate the impact description as well as mitigation measures proposed for each of the three alternative route alignments respectively.

Table 16: Impact description for the hydrological impacts on wetlands for the original alignment

IMPACT DESCRIPTION: Hydrological impacts on wetlands				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		

<table>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long-term</td><td>Structures could interfere with natural run-off patterns, either diverting flows or increasing the velocity of surface water flows and has the potential to increase or decrease surface water flows into wetland areas</td><td rowspan="3">Consequence: Moderately detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>Impact will generally be confined to specific areas</td></tr>
<tr><td>Intensity</td><td>Moderate - negative</td><td>Permanent changes to the local hydrological regime are probable, the intensity of the impact in the operational phase would be moderate but on a site wide scale in the long-term</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Due to the type of activity the potential exist for erosion on denuded soil</td></tr>
<tr><td colspan="5">MITIGATION:
• Surface water management features such as the crossing of drainage lines, should be placed in manner that flows remain unaltered in terms of direction, velocity and volume, thus the natural base flows, i.e. hydrological regime within these systems is maintained.
• It is also important that during construction and operations that excess ballast is not allowed to enter any water course areas, culverts etc., which if so doing alter these systems by forming impoundments.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long-term</td><td>Mitigation can reduce the risk of lasting negative effects</td><td rowspan="3">Consequence: Slightly detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>As for pre-mitigation</td></tr>
<tr><td>Intensity</td><td>Low - negative</td><td>Mitigation measures should be effective in reducing severity of impacts</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Mitigation measures would reduce probability of impacts occurring to the extent predicted</td></tr>
</table>

8.2.1.3 Biodiversity conservation

Based on interactive conservation planning techniques, irreplaceability of certain sites based on the C-Plan mapping process, several Biodiversity and Tourism Corridors (BTC) were identified (Figure 18).

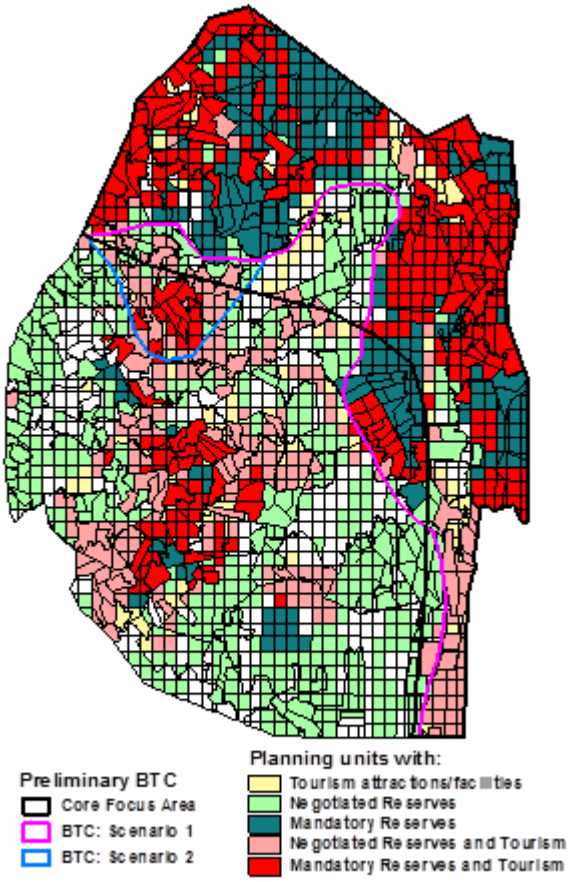


Figure 18: Preliminary Biodiversity and Tourism Corridors based on C-Plan irreplaceability scores (Emery et al., 2001) with important areas with biodiversity and tourism value shown in red.

Maputaland-Pondoland-Albany Biodiversity Hotspot Conservation Plan (2010):

The Maputaland-Pondoland-Albany Hotspot (MPAH) spans parts of South Africa, Swaziland and Mozambique. In southern Africa, it is second to the Cape Floristic Region in floristic diversity. A systematic conservation plan was implemented for the Maputaland-Pondoland-Albany Hotspot in order to identify priority areas for conservation. The biodiversity map delineates 72 key biodiversity areas (KBA) and 12 conservation corridors. Of the 72 key biodiversity areas, several fall along the railway route, three of which lie within Swaziland (Figure 19).

Three of the 12 conservation corridors are positioned across the railway route, which encompass all the key biodiversity areas. The three corridors comprise the Swaziland Lowveld Corridor, the Lebombo Transfrontier Corridor and the Zululand Corridor. Although the KwaZulu-Natal Coastal Belt Corridor does not lie adjacent to or across the railway route, the climate change resilience corridor extends between Mfolozi River to Richards Bay (Figure 19), which also represents one of the key biodiversity areas, delineated as ‘’KwaZulu Coastal Belt W1’’ (Figure 20). Both the Zululand Corridor and the KwaZulu-Natal Coastal Belt Corridor are covered by the KwaZulu-Natal (KZN) Terrestrial Conservation Plan.

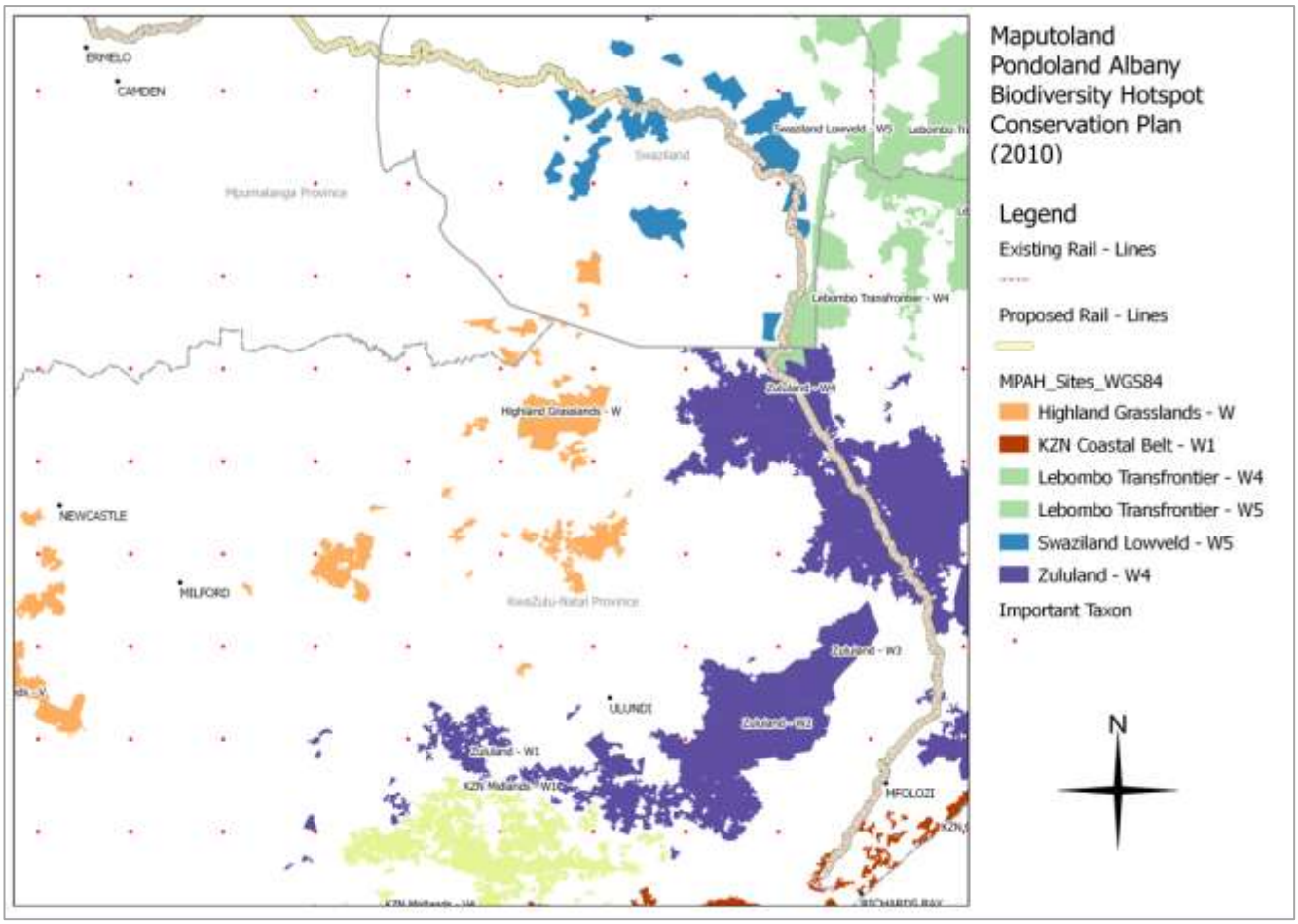


Figure 19: Key Biodiversity Areas (KBA) mapped in the Maputoland-Pondoland Albany Hotspot (MPAH) conservation plan, which intersect the railway alignment. Note that all these KBA are incorporated into the MPAH corridors, apart from the KZN Coastal Belt W1 area between Mfolozi and Richards Bay.

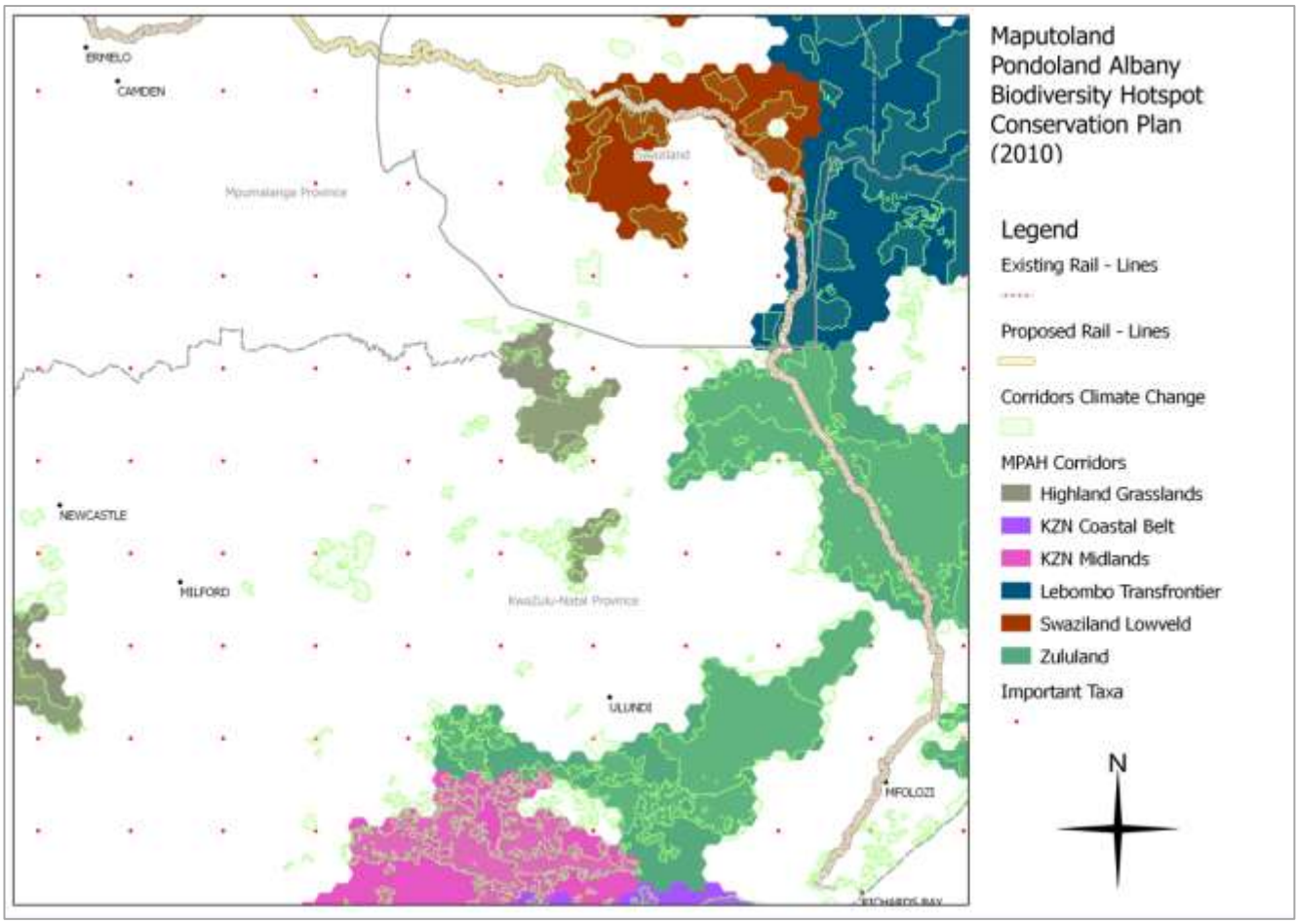


Figure 20: Important Corridors according to the Maputoland-Pondoland Albany Hotspot (MPAH) conservation plan intersecting the railway alignment. The climate change corridors indicate those areas most important for enhancing resilience to climate change impacts.

Swaziland Lowveld Corridor

The Swaziland Lowveld Corridor is situated in Swaziland and supports, for the most part, Savannah habitat (98%). A small area of Critically Endangered Lowveld Riverine Forest occurs proximate to the railway. Delagoa Lowveld, Swaziland Sour Bushveld, Zululand Lowveld and Granite Lowveld, all Vulnerable habitats, traverse the railway within this corridor.

Lebombo Transfrontier Corridor

The Lebombo Transfrontier Corridor extends across parts of Swaziland and KwaZulu-Natal, as well as Mozambique, encompassing the Lubombo Mountains and the Maputaland Centre of Endemism. It is comprised almost exclusively of Savannah. The Licuati Forests and Eastern Swazi Lebombo Protected Areas contain endemic sand forests, containing the highest diversity compared with any other temperate forest in the world. Approximately 10% of the Lubombo Transfrontier is Threatened habitat. Zululand lowveld is the only Vulnerable habitat associated with the portion of the Corridor proximate to or traversing the railway. The Vulnerable Lubombo girdled lizard (*Cordylus warreni*) and the Endangered fish, *Sihouettea sibayi*, represent Threatened species inhabiting the corridor.

Zululand Corridor

The Zululand Corridor is situated in KwaZulu-Natal extending from the Swaziland and Mozambique borders to St Lucia in the south. Most of the corridor is covered with Savannah. The Vulnerable Zululand Lowveld habitat spans the majority of this corridor along the railway line, while the Critically Endangered Lowveld Riverine Forest occurs as small patches near the southern end of the railway, as well as the Endangered Maputaland Coastal Belt. Critically Endangered species such as Black Rhino and elephant inhabit this area.

Table 17: Distribution of Threatened Species in each Conservation Corridor and Priority Ranking

Corridor	Critically Endangered	Endangered	Vulnerable	Total species	% of hotspot	Total Summary	Priority Ranking (out of the 12 corridors)
Swaziland Lowveld	11	22	36	69	11	Medium	12
Lebombo Transfrontier	9	16	32	57	9	Medium	7
Zululand	3	18	45	66	11	Medium	9

Species of conservation concern (Threatened and/or protected):

Species of Conservation Concern refer to taxa that are Threatened and Protected. Species are ''Threatened'' if classified by the IUCN (International Union for Conservation of Nature) Red List of Threatened Species as Rare, Critically Endangered, Endangered, Vulnerable or Near Threatened.

Protected species refer to those taxa that are protected by Swaziland legislation (Appendix 3 of the specialist report (Appendix B, Annexure A)).

A list of potential Species of Conservation Concern was derived from the Maputaland-Pondoland-Albany Biodiversity Hotspot conservation plan (SANBI, 2010), which incorporate Threatened species and species listed under Swaziland legislation(Table 18). Species were mapped according to their location in a Quarter Degree Square (i.e. an area of approximately 30 km by 30 km covered by one 1:50 000 topographical map). Those quarter degree squares that overlapped the railway route were selected to generate a list of potential Species of Conservation Concern along the railway alignment (Figure 21).

None of these species were observed during the site visit in areas that were accessible, however this does not preclude their presence due the lack of rainfall prior to the survey period.

Table 18: List of potential Species of Conservation Concern sited in close proximity to the railway alignment in Swaziland. (CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern)

Species (Taxa)	Common Name	Red Data Listing
Birds		
Geronticus calvus	Southern Bald Ibis	VU
Hirundo atrocaerulea	Blue Swallow	VU
Gyps coprotheres	Cape Vulture	VU
Torgos tracheliotus	Lappet-faced Vulture	VU
Falco naumanni	Lesser Kestrel	VU
Gyps africanus	White-backed Vulture	NT

Species (Taxa)	Common Name	Red Data Listing
Aegypius occipitalis	White-headed Vulture	VU
Martial Eagle	Martial Eagle	LC
Invertebrates		
Edouardia conulus		Not Listed
Ingwavuma slender spined millipede	Ingwavuma slender spined millipede	Not Listed
Maputaland cannibal snail	Maputaland cannibal snail	Not Listed
Peter's flat backed millipede	Peter's flat backed millipede	Not Listed
Zinophora laminata		Not Listed
Mammals		
Acinonyx jubatus	Cheetah	VU
Hippopotamus amphibius	Hippopotamus	VU
Ourebia ourebi	Oribi	LC
Cercopithecus mitis	Samango Monkey	LC
Cloeotis percivali	Short-Eared Trident Bat	LC
Lycaon pictus	Wild Dog	EN
Plants		
Adenium swazicum		CR
Alepidea amatymbica		VU
Allophylus chaunostachys		VU
Aloe ecklonis		VU
Aloe integra		VU
Aloe kniphofioides		VU
Asclepias eminens		VU
Celtis gomphophylla		EN
Ceropegia cimiciodora		VU
Dierama elatum		CR
Duvernoia aconitiflora		EN
Encephalartos lebomboensis		EN
Encephalartos ngoyanus		VU
Encephalartos senticosus		VU
Eulophia chlorantha		EN
Euphorbia keithii		CR
Gardenia thunbergia		CR
Haemanthus pauculifolius		VU
Heywoodia lucens		EN
Kniphofia tysonii lebomboensis		CR
Curtisia dentata		NT
Elaeodendron croceum		NT
Elaeodendron zeyheri		NT
Melanospermum swazicum		EN
Oxyanthus pyriformis pyriformis		EN

Species (Taxa)	Common Name	Red Data Listing
Pachycarpus stelliceps		CR
Protea comptonii		EN
Prunus africana		VU
Raphia australis		VU
Siphonochilus aethiopicus		CR
Streptocarpus daviesii		EN
Streptocarpus davyi		VU
Streptocarpus wilmsii		VU
Syncolostemon comptonii		CR
Olinia emarginata		NT
Pachycarpus lebomboensis		Rare
Streptocarpus occultus		VU
Teclea natalensis		NT
Reptiles		
Leptotyphlops incognitus		Not Listed
Lycophidion pygmaeum		Not Listed
Pachydactylus maculatus		Not Listed
Platysaurus lebomboensis		Not Listed
Pygmy wolf snake	Pygmy wolf snake	Not Listed
Trachylepis margaritifera		Not Listed
Trachylepis varia		Not Listed
Warren's girdled lizard	Warren's girdled lizard	Not Listed

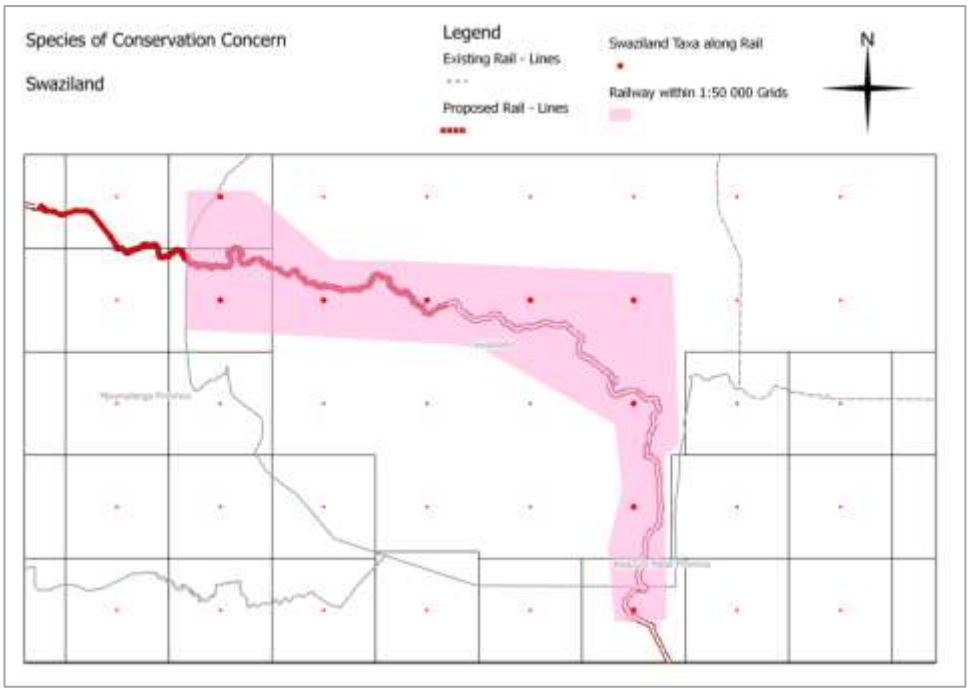


Figure 21: Important taxa (species) as point data, mapped according to species location in a Quarter Degree Square (i.e. an area of ± 30 km X 30 km covered by one 1:50 000 topographical map) by the Maputaland-Pondoland-Albany Biodiversity Hotspot conservation plan (SANBI, 2010) in Swaziland.

8.2.1.3.1 Biodiversity impact assessment – loss of corridors and habitat fragmentation

Nature of the impact

Due to the nature of the project vegetation will be cleared and replaced with rail lines and supporting infrastructure and this will result in additional habitat fragmentation both within the terrestrial and aquatic environments, i.e. the elevated embankments on which the rail lines would disrupt movement corridors. The construction phase would have the greatest impact in terms of habitat destruction, but the actual impact of fragmentation would occur in the operational phase.

Figure 22: An example of an elevated culvert that has raised the level of the riverbed resulting in a form of habitat fragmentation.

Significance of impact with mitigation

With the mitigation measures in place as listed below, the definite impact on the fragmentation would remain within the Local area, resulting in a long-term impact of Moderate intensity for the operational phase, resulting in a Moderate (with mitigation) significance (Table 19). This is assuming that the proposed infrastructure will allow for culverts in suitable areas to maintain links within the aquatic and terrestrial environment.

The table below describes the impact of the potential loss of corridors and habitat fragmentation and the proposed mitigation measures, representative of all three route alignments.

Table 19: Impact description of the loss of corridors and habitat fragmentation

IMPACT DESCRIPTION: Loss of corridors and habitat fragmentation				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	The construction phase would have the greatest impact in terms of habitat destruction, but the actual impact of fragmentation would occur in the operational phase.	Consequence: Moderately detrimental	Significance: High - negative

Extent	Local	Vegetation will be cleared and replaced with rail lines and supporting infrastructure and this will result in additional habitat fragmentation both within the terrestrial and aquatic environments		
Intensity	Moderate - negative	Several impacts already occur within and adjacent to these systems and the proposed layouts would seem to have little further impact considering the size of the footprints or the current state or lack of connectivity within the sites.		
Probability	Certain	Due to the nature of the activity it will have a definate impact on the corridors of movement resulting in fragmentation		

MITIGATION:

- Wetland and floodline areas must be excluded from development as far as possible, i.e. designs should include means to span these areas thus maintain open ecological networks.
- Where culverts are installed across drainage lines and watercourses, the proposed designs should ensure that natural ground levels are maintained, i.e. the culvert base does pose as an obstacle for the movement of aquatic organisms.
- Construction activities should not exceed the proposed construction boundaries by more than 15 m to avoid the secondary impact of construction and increasing the areas that would require clearing and rehabilitation
- Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the vegetation, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas.
- Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.

POST-MITIGATION				
Duration	Long-term	As for pre-mitigation	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	With the implementation of the proposed mitigating measures the impact on fragmentation would remain in the local sphere		
Intensity	Low - negative	The proposed mitigation will reduce impacts to some extent		
Probability	Certain	Mitigation will reduce the risk of these impacts to some extent		

The mitigation measure in red text was found to be highly unfeasible to the proponent as 15 m either side of the centre line will not allow the contractors sufficient space to carry out construction activities. Therefore the EAP proposes the following as included in the CMP that **the width of the construction footprint must be agreed upon by the ECO and the Engineer and as far as possible must be kept to a minimum. The maximum width of the construction footprint servitude will not exceed 75 m. Should additional space be needed for the temporary storage of material, the ECO must advise on an appropriate area away from any sensitive areas**.

8.2.1.3.2 Biodiversity impact assessment: Loss of species of special concern

Nature of impact

Any loss of systems could possibly result in the loss of species of special concern within the habitats as a result of their destruction during the construction phase.

However, no flora and fauna species of special concern were evident during the study within the wetland or water course areas, as well as the terrestrial habitats, possibly due to the intensity of farming, housing and rail infrastructure already found in the study area. The lack of any rainfall also seemed to precluded the early growth or appearance of species known to occur in the area (Appendix 3 of the Ecological specialist report) so as precautionary step, it is important that all riparian areas are retained and allowed to function, as a number of protected species listed (Appendix 3 of the Ecological specialist report) do occur within the region.

Significance of impact with mitigation

The impact would be rated as a regional impact due to the species under consideration and the lack of potential habitat still remaining. The impact would persist into the long-term however in view of the unlikely probability of finding such species the intensity of the impact would be Moderate (Table 20). The impact would be rated as Moderate without mitigation due to confidence in this assessment based in the reasons listed above.

The table below describes the impact of the potential loss of rare and endangered species and the proposed mitigation measures.

Table 20: Impact description for the potential loss of rare and endangered species

IMPACT DESCRIPTION: Loss of rare and endangered species				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Any loss of systems could possibly result in the loss of species of special concern within the habitats as a result of their destruction during the construction phase but could persist into the long term.	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Regional	The impact would be rated as a regional impact due to the species under consideration and the lack of potential habitat still remaining.		

Intensity	Moderate - negative	No flora and fauna species of special concern were evident during the study within the wetland or water course areas, as well as the terrestrial habitats, In view of the unlikely probability of finding such species the intensity of the impact would be low		
Probability	Fairly likely	No flora and fauna species of special concern were evident during the study within the wetland or water course areas, as well as the terrestrial habitats, possibly due to the intensity of farming, housing and rail infrastructure already found in the study area.		

MITIGATION:

- All designs should include means to protect or maintain the current hydrological regime, thus maintaining and not impeding or diverting any surface water flows.
- Stormwater management systems should include energy dissipation structures to minimise the potential impact of erosion and sedimentation.
- Clearing of vegetation should be kept to a minimum, keeping the width and length of the earth works to a minimum and the floodplain / wetlands habitats identified should be retained within the development footprint in its current state.
- Construction activities should not exceed the proposed construction boundaries by more than 15 m to avoid the secondary impact of construction and increasing the areas that would require clearing and rehabilitation
- A search and rescue operation for both plants and fauna (particularly reptiles) must be initiated prior to the commencement of any construction once the required permits are in place. Applications must be submitted to the applicable department for the removal of any protected floral and faunal specie.
- Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the vegetation, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas.
- Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.

POST-MITIGATION				
Duration	Long-term	As per pre-mitigation	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Regional	As per pre-mitigation		
Intensity	Low - negative	As per pre-mitigation		
Probability	Unlikely	As per pre-mitigation		

The mitigation measure in red text was found to be highly unfeasible to the proponent as 15 m either side of the centre line will not allow the contractors sufficient space to carry out construction activities. Therefore the EAP proposes the following as included in the CMP that **the width of the construction footprint must be agreed upon by the ECO and the Engineer and as far as possible must be kept to a minimum. The maximum width of the construction footprint servitude will not exceed 75 m. Should additional space be needed for the temporary storage of material, the ECO must advise on an appropriate area away from any sensitive areas**.

8.2.1.3.3 Biodiversity impact assessment – The potential spread of alien vegetation

Nature of the impact

Large areas contain alien plants, and these are mostly limited to disturbed areas or example.

Significance of impact with mitigation

With the above mitigation measures in place, the impact on the vegetation would remain within the site, with natural re-vegetation happening within a short time period, resulting in a Very Low impact significance with mitigation (Table 21). This is also based on the fact that during the operational phase on-going clearing and maintenance practices will be employed by Swaziland Railway.

The table below describes the potential impact of the introduction of alien vegetation and the proposed mitigation measures.

Table 21: Impact description for the introduction of alien and invasive species

IMPACT DESCRIPTION: Introduction of alien and invasive species				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Will be limited to construction phase.	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Potential for spread of alien species in newly cleared areas		
Intensity	Low - negative	A large area of the project is already disturbed and planted with alien species.		
Probability	Fairly likely	The disturbance of vegetation can easily lead to the establishment of new colonies of alien and invasive species		
MITIGATION: • Clearing of vegetation should be kept to a minimum, keeping the width and length of the earth works to a minimum. • Re-vegetation as part of a rehabilitation plan is always advocated, however to the low annual rainfall (normal conditions), this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas. • Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.				
POST-MITIGATION				
Duration	Long-term	As for pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Site-specific	As for pre-mitigation		
Intensity	Very low	Mitigation measures will reduce the potential spread of alien species and natural re-vegetation can take place		
Probability	Fairly likely	Mitigation measures will reduce likelihood of spread of alien species and clearing of the sites during operational phase will further reduce the possible negative impacts.		

8.2.1.4 Conclusions and recommendations of the ecological assessment undertaken

The results, based on the available information and the site investigations, show that the proposed line could impact on a number of sensitive and/or important terrestrial and aquatic habitats. However several of the metadata

sources for the spatial data shown in this report also indicate that large areas of habitat at a broad scale are degraded or transformed. This is also supported by the observed land use character shown in the aerial images (Google Earth). This was confirmed during the site visit.

It would therefore seem that, based on the site visit and the type of habitats observed, the proposed extension of rail lines and yard would have a limited impact on both the terrestrial aquatic environment if the mitigations and recommendations are upheld:

Compilation and implementation of a Comprehensive Mitigation Plan (CMP), that provides specifications with regards to:

- Rehabilitation with indigenous plants species. (i.e. a Rehabilitation Plan).
- Plant removal within the construction footprint only.
- Alien vegetation clearing and management within the development footprint / construction area.
- Detailed storm-water management and erosion control plan.
- Waste management:
  - (i) to prevent accidental leakage of pollutants e.g. oil, fuel, cement,
  - (ii) to identify procedures for solid waste disposal (e.g. bins, no littering or burning policy and the maintenance of ablution facilities, including the disposal of liquid and hazardous waste at a licensed waste disposal site,
  - (iii) to ensure that no re-fuelling of construction vehicles or maintenance activities occur proximate to the non-perennial stream (drainage area) to the west of the sites; and
  - (iv) to designate an area for the construction camp (which includes ablution facilities, storage of hazardous wastes, maintenance stations etc.) at least 100 m away from the non-perennial stream (drainage area) to the west of the sites
- Other generic mitigation measures associated with construction.
- Employment of an Environmental Control Officer to oversee the implementation of the CMP and the conditions contained in the Environmental Approval.

8.2.2 Hydrology assessment

This section of the project (Sandlane to Lavumisa) is located in part on the watershed of the Olifants and the Vaal catchments which limits the river crossings. The section crosses the Vaal River once and is close to a series of pans.

The Usuthu River flows eastwards through Swaziland to Mozambique and then on to Indian Ocean. The new rail alignment for the most part runs close to Usuthu River crossing it five times along with several of its tributaries. The catchments in the study area are situated in a mid-summer rainfall region. During the Tropical Storm Demonia a flood peak of 13500 m^3/s was recorded in January 1984 on the Usuthu River close to Big Bend (Kovacs, 1988). The mean annual precipitation (MAP) is within a range of 400 to 1200 mm (Figure 23) and catchment runoff is between 20 and 300 mm. The higher altitudes and higher MAP occurs in the west and the lower altitudes and lower MAP in the east.

The main soil types are sandy loam, sand clay loam and sandy clay (Figure 25) with the predominate geology being basalt, shale, granite, dolerite and ultramafic formations Figure 26). The main land uses include commercial irrigated sugarcane, game farms, subsistence agriculture, natural veld and pine plantations (Figure 27).

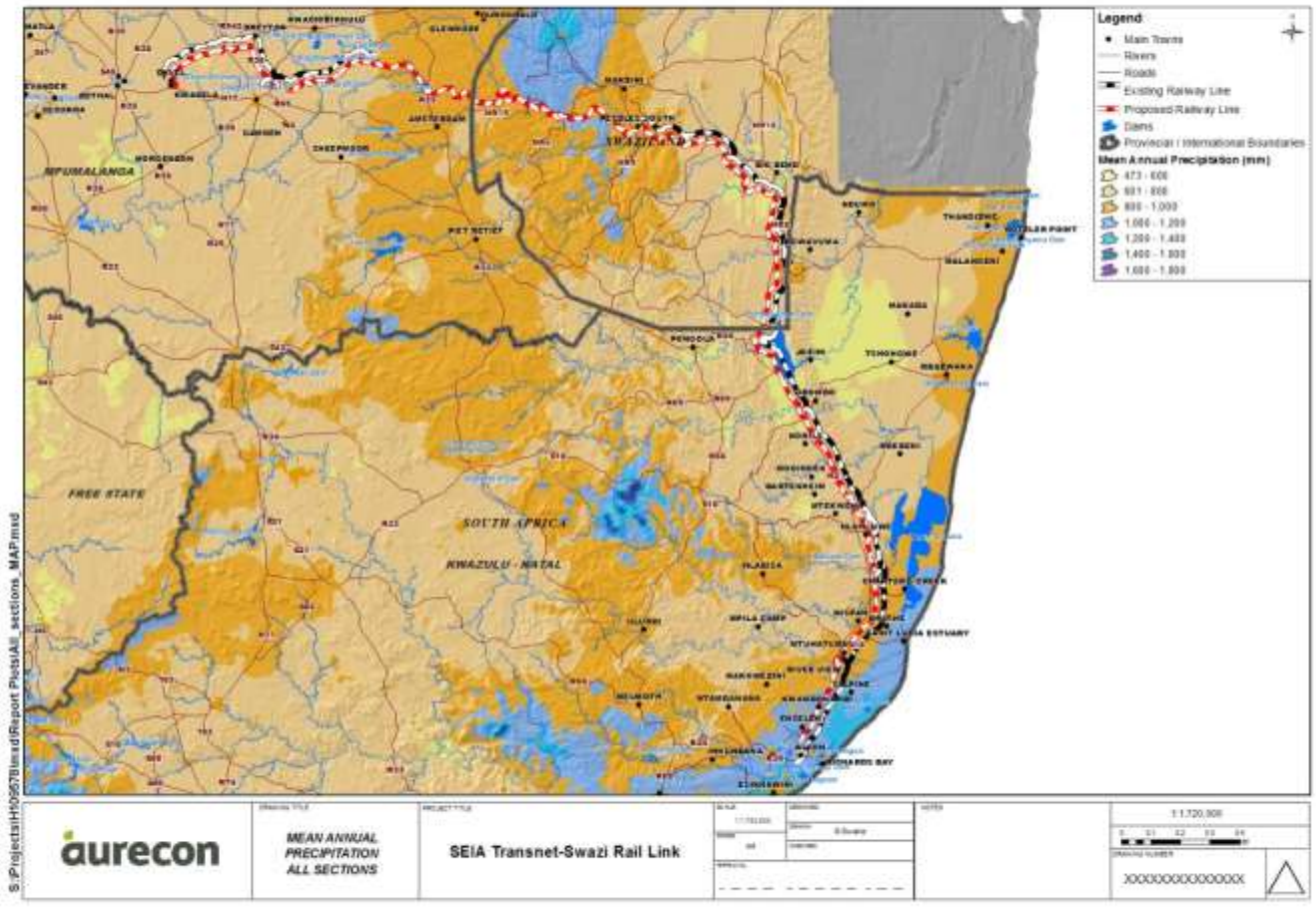


Figure 23: Mean Annual Precipitation (mm) for all sections of the Swazi Rail Link

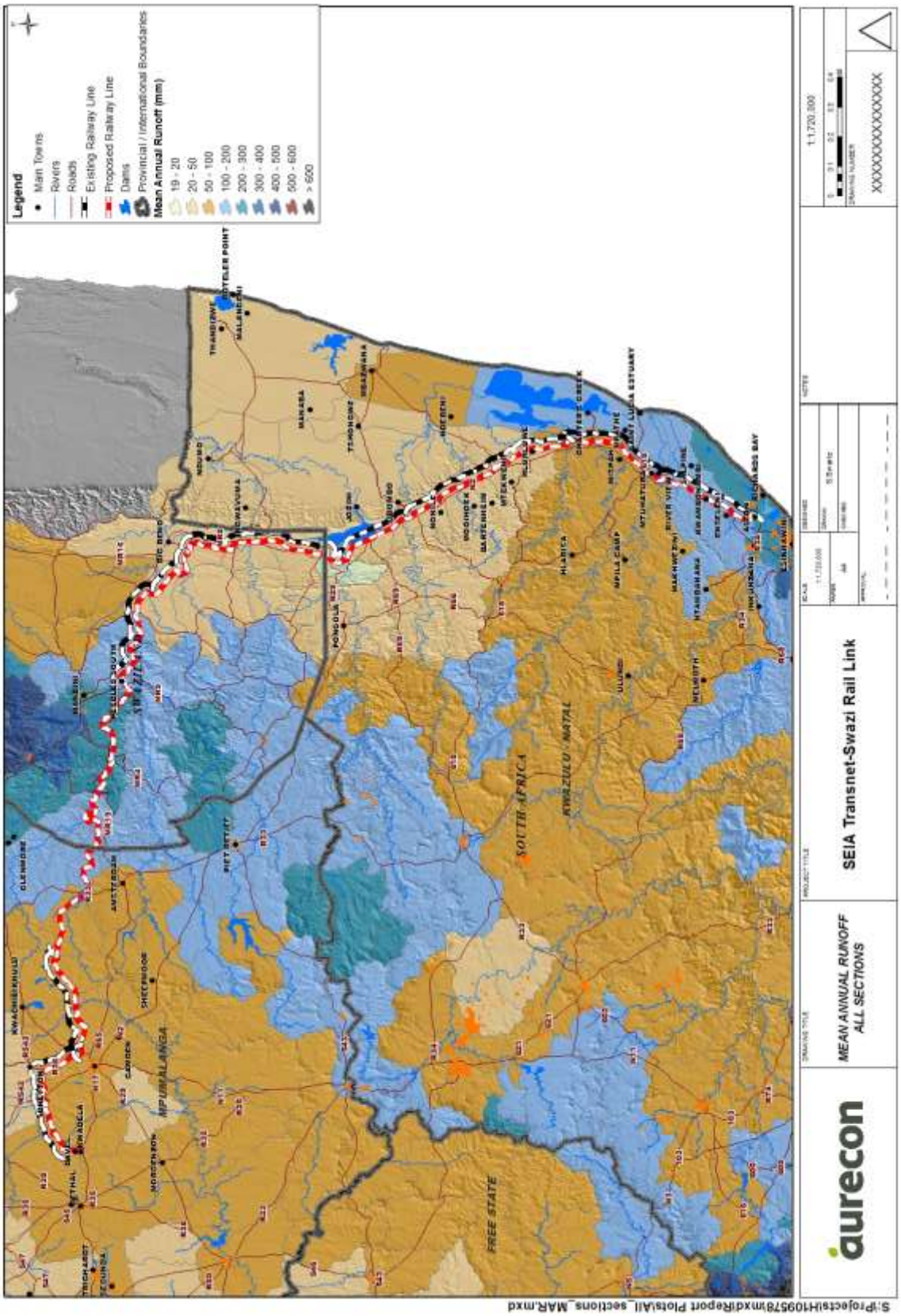


Figure 24: Runoff (mm) for all sections of the Swazi Rail Link

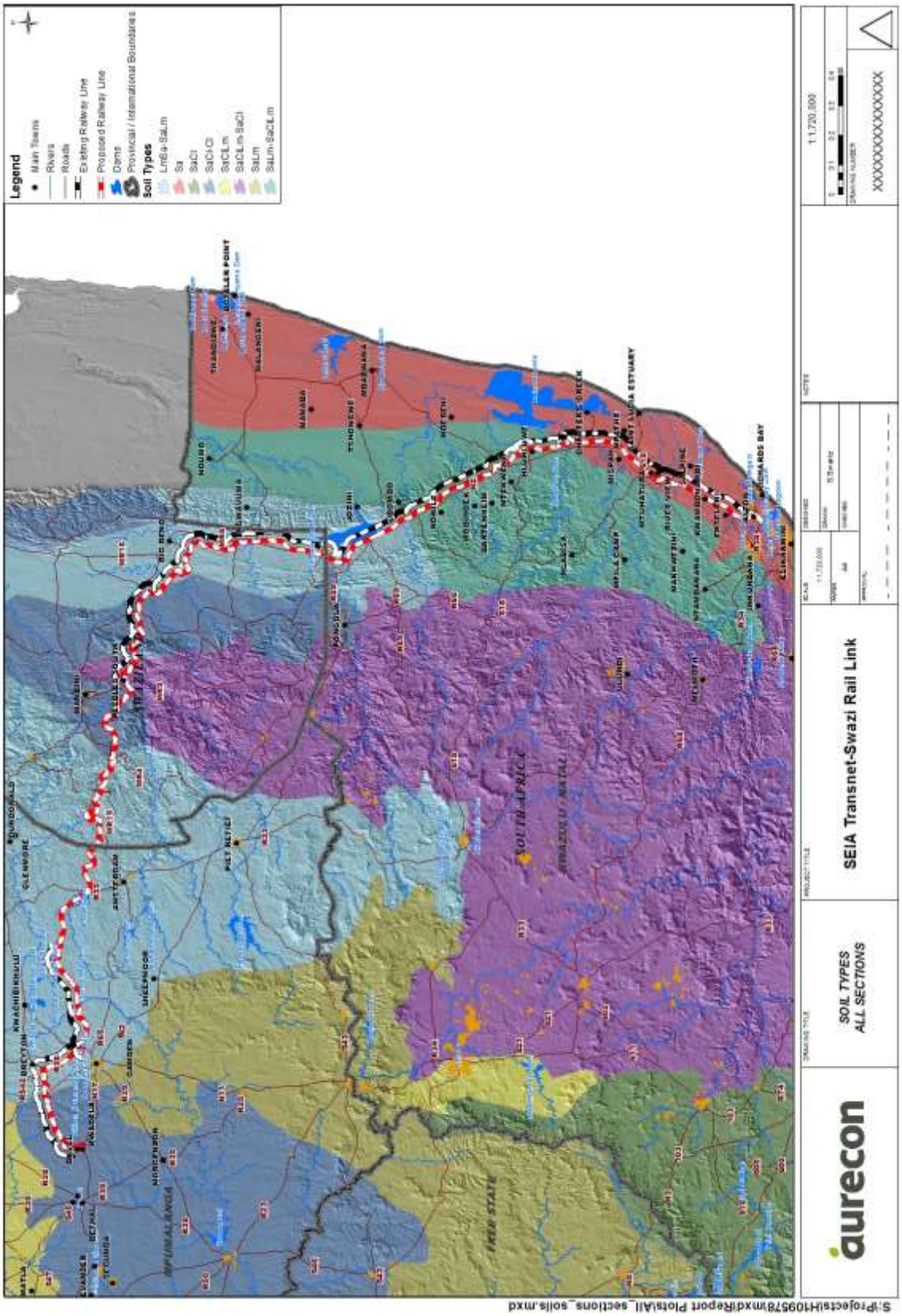


Figure 25: Soil types for all sections of the Swazi Rail Link

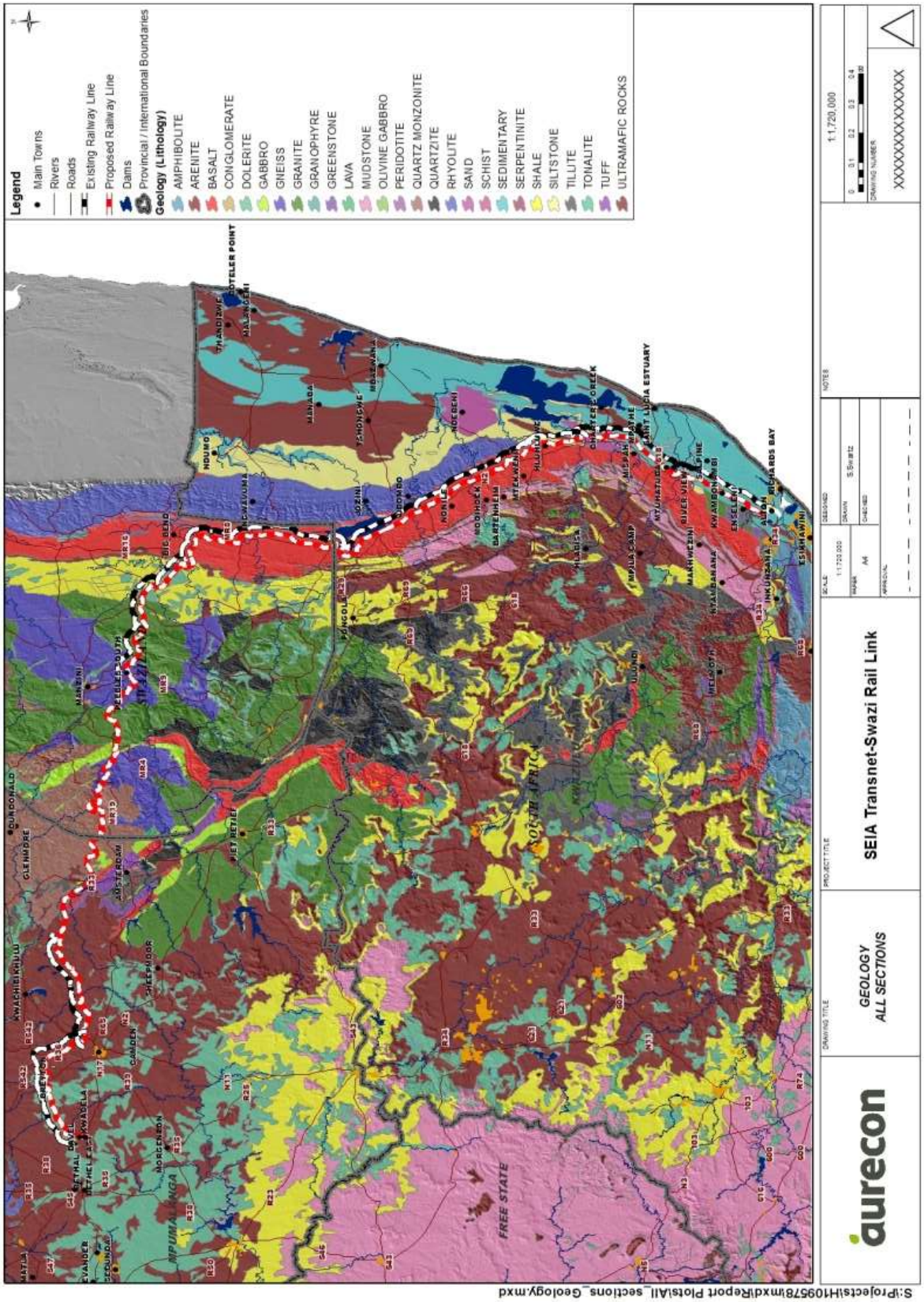


Figure 26: Geology for all sections of the Swazi Rail Link

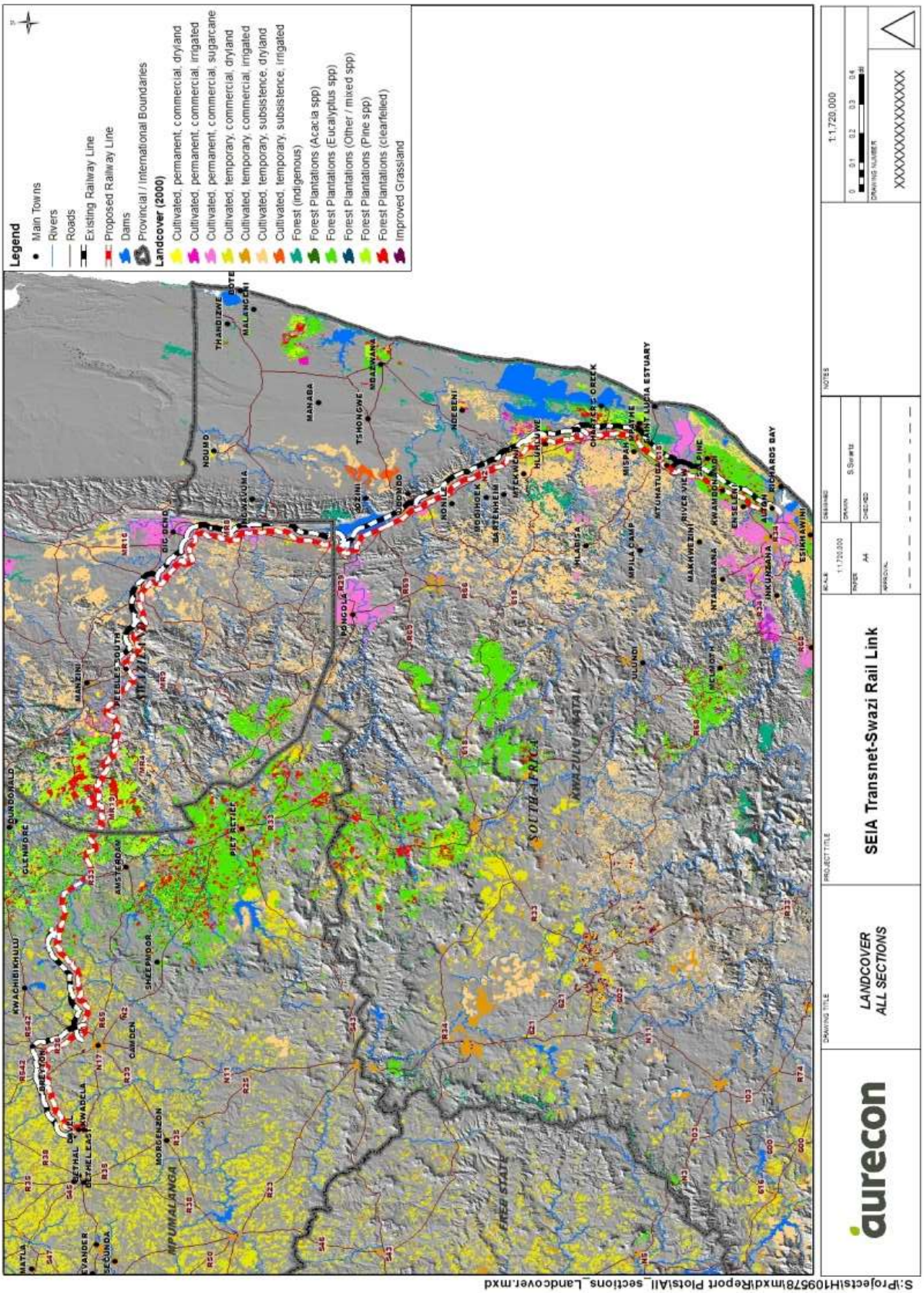


Figure 27: Land cover for all sections of the Swazi Rail Link

8.2.2.1 Water quality impact assessment

In terms of water quality impacts of the railway line, there are three concerns. The impact descriptions can be found at the end of Chapter 8.2.2:

1. The first is the accumulation of coal dust along the railway line and the impacts this may have on water quality in local streams and rivers. The water quality impacts may include an increase in the amount of dissolved salts in wash-off from the affected area, and a possible change in the pH of the water. However, it is estimated that these impacts would probably be minor and would only be manifested during the rainy season and rainfall events that generate runoff. There might be first flush effect at the onset of the rainfall season but there would probably be sufficient dilution during that time to minimise any water quality impacts. Coal dust in small quantities is relatively innocuous when mixed in water. Impurities in the coal such as sulphides may become mobilised when mixed with water and chemical reactions may create sulphates that are readily soluble in water. Particularly high volumes of sulphates need to enter the rivers to raise sulphate concentrations to levels where it can be harmful to humans, livestock and aquatic life. Golder Associates undertook an environmental impact assessment of transporting coal by rail to a power station in South Africa (Golder Associates, 2004). As part of the study they investigated the water quality impacts of the Richards Bay Coal Transport Line that transports coal from the Highveld coalfields to the coal export harbour at Richards Bay, South Africa. This line has been in operation since 1976. On this line coal is transported using both sealed wagons and bottom dumping wagons. Golder found no obvious signs of coal dust pollution, land owners confirmed that there did not appear to be any detrimental impacts as a result of coal dust, and an examination of soil and vegetation samples near the railway line did not show signs of coal dust pollution. Golder also investigated the impacts of coal falling from wagons and found minor evidence of coal falling on the area adjacent to the ballast. It was concluded that this coal fell from side-dumping wagons that did not seal well resulting in small pieces of coal falling through the small openings between the flaps. A comparison of water quality in farm dams upstream and downstream of the railway line found no difference in water quality and it was concluded that the railway line had a negligible effect on water quality (Golder Associates, 2004).

2. The second concern is seepage of rain water from uncovered wagons during the rainfall season. The limited contact time between the rainwater and the coal could lead to a minor increase in dissolved salts in the seepage water. However, there would probably be sufficient rainfall runoff and dilution in the surrounding area during such events to minimise any water quality impacts. It is also a linear impact, that is, the impact is distributed linearly along the length of the railway line.

3. The third concern is smothering of in-stream aquatic habitats with coal dust. In this case aquatic habitat refers to the substrate where aquatic biota occurs and it includes the mosaic of bedrock, cobbles, vegetation, sand, gravel and mud that make up a stream habitat. Large volumes of coal dust have the potential of smothering aquatic habitats, impacting negatively on the biota. However, no evidence of habitat smothering was found along the Richards Bay coal transport line.

8.2.2.2 Hydrological impact assessment and mitigation

8.2.2.2.1 Watercourse crossings

The major crossing that were identified as potential sites of concern and requiring a field assessment are presented Figure 28 and listed in Table 22 along with information relating to the Quaternary Catchment in which the crossing

is located. This section includes the field assessment and impact rating for the watercourse crossings and for Phuzumoya Yard.

Figure 28: Major river crossings for Sandlane to Lavumisa

Table 22: Major watercourse crossings and quarternary catchment information

Crossing No	Lat	Long	River Name	Quat number	Quat MAP (mm)	Quat Runoff (mm)
15	27°16'06.24" S	31°53'43.35" E	Msuzwaneni	W44E	581	15
16	27°14'29.78" S	31°54'07.46" E	Mhlofunga	W44E	581	15
17	27°01'36.89" S	31°55'59.94" E	Ngwavuma	W43E	588	6
18	26°59'14.71" S	31°54'29.35" E		W57J	628	16
19	26°51'51.17" S	31°54'33.64" E		W57J	628	16
20	26°51'14.38" S	31°49'50.41" E	Mhlatuze	W57E	701	19

21	26°44'06.34" S	31°44'33.62" E	Mhlathuzane	W57E	701	19
22	26°42'48.89" S	31°44'50.70" E	Usuthu	W57E	701	19
23	26°41'02.25" S	31°38'48.76" E	Mzimmeni	W57A	824	106
24	26°40'05.37" S	31°30'38.45" E	Usuthu	W57A	824	106
25	26°37'43.27" S	31°26'27.91" E	Sidvokodvo	W57A	824	106
26	26°39'24.76" S	31°22'33.26" E	Usuthu	W54G	947	64
27	26°34'58.31" S	31°04'56.11" E	Umhlambahula	W54F	998	71
28	26°31'44.63" S	30°55'20.12" E	Usuthu	W54E	963	26
29	26°31'09.25" S	30°55'18.01" E	Mpuluzi	W55E	933	20
30	26°29'57.48" S	30°55'05.39" E	Malangeni	W55E	933	20
31	26°30'21.13" S	30°54'04.48" E	Mpuluzi	W55E	933	20
32	26°32'30.62" S	30°53'49.41" E	Usuthu	W54E	963	26

Impacts on surface waters will occur during rail construction. Pollution from mobilised suspended solids is the major concern particularly where there are water abstractions close to the watercourse crossing as well at those crossings that are upstream of nature reserves or dams. Sediment mobilisation can be prevented in the most part in the construction phase by the use of silt traps. These silt traps would need to be cleaned regularly. If best practice is followed in bridge and culvert design then erosion and sediment mobilisation in the long term will have a limited impact. Good practice would include upstream downstream and downstream erosion protection.

It is not anticipated that there would be major hydraulic related impacts during high flows at the crossings of the major water courses. This assumption is based on Swaziland Rail Link FEl-2 (Mott MacDonald, 2013) study, where the drawings of major drainage structures show the height of the structure openings to be well above the 1:100 year flood level. For the minor crossing where culverts maybe constructed, the flow velocity downstream of the culvert should not be greater than pre-construction velocity. In order to mitigate an increase in flow velocity, a structure to dissipate the energy maybe required.

The alignment runs for long sections in the Usuthu river valley, the alignment will however be placed outside of the 1:100 year floodline (Mott MacDonald 2013). In addition to this cross drainage structures will need to be constructed at appropriate locations.

Another impact during the construction phase is the accidental spillage of fuels and hydraulic fluids from construction plant. Therefore, storage of fuel, oils and chemicals should be on an impermeable base, away from drains and watercourses.

The **longer term impacts** for **crossings 15 to 25** (the upgrade sections) will be similar to those of the existing bridges. Impacts during the construction phase include the introduction of sediment and erosion of banks.

Accumulation of coal dust along the railway line and seepage of rain water from uncovered wagons during the rainfall season may have impacts on water quality in local streams and rivers.

Impacts associated with **crossings 26 to 32** (the new link) will mainly result from disturbance and changes in the flow regime. Impacts during the construction phase include the mobilisation of sediment and erosion of banks. Accumulation of coal dust along the railway line and seepage of rain water from uncovered wagons during the rainfall season may have impacts on water quality in local streams and rivers.

The crossings listed in Table 22 will be discussed in more detail below.

Crossing 15: Msuzwaneni River, Lavumisa:

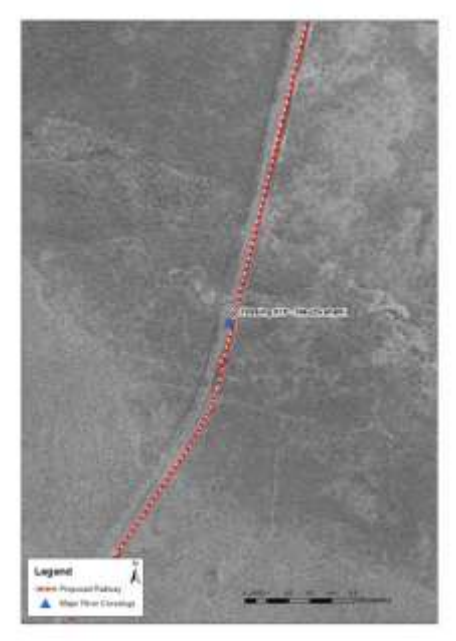


Figure 29: Aerial view Msuzwaneni River crossing

Figure 30 | 2000 m upstream the river crossing

The Msuzwaneni crossing is 6 km north of Golela border, the railway line crosses a region with land use being a mixture of agriculture and game farm. The Msuzwaneni River is an ephemeral watercourse and ultimately it flows into the Pongola Dam. Flow channel and banks ill-defined, obstructed with vegetation and eroded by floods (see Figure 30). There are signs of erosion caused by high flows.

Crossing 16: Mhlofunga River, Lavumisa:

Figure 31: Aerial view Mhlofunga River crossing

Figure 32: Site view

Figure 33: View of Mhlofunga River crossing

Figure 34: Looking upstream Mhlofunga crossing

Figure 35: Looking downstream Mhlofunga crossing

The Mhlofunga crossing is 9 km north of Golela border, the railway line crosses a region with land use being a mixture of agriculture and game farms. The existing crossing is a series of large culverts. The Mhlofunga River is

an ephemeral watercourse and ultimately it flows into the Pongola Dam. Flow channel and banks ill-defined, obstructed with vegetation and eroded by floods (see Figure 34 and Figure 35).

Crossing 17: Ngwavuma River, Nsoko:

The Ngwavuma River crossing is close to the Nsoko settlement (Figure 36). The new crossing is 250 m upstream of the existing rail bridge with the major land use in the area being irrigated sugarcane (Figure 37).

Figure 36: Aerial view Ngwavuma River crossing

Figure 37: Site view

Figure 38: View of Ngwavuma River crossing

Figure 39: Looking upstream Ngwavuma crossing

Figure 40: Looking downstream Ngwavuma crossing

Flow channel and banks are well defined but eroded by cattle activity and sand mining. There are also signs of flooding where the existing railway line intercepts the river. There are a number of abstractions from the river both upstream and downstream of the crossing and farm dam spillways discharging into the river along with cattle drinking from the river (see Figure 39 and Figure 40).

Crossing 18: - Near Nsoko

The Crossing 18 (unnamed watercourse) is close to the Nsoko settlement (Figure 41). The major land use in the area is cattle grazing.

Flow channel and banks are ill-defined and obstructed with vegetation (see Figure 43 and Figure 44).

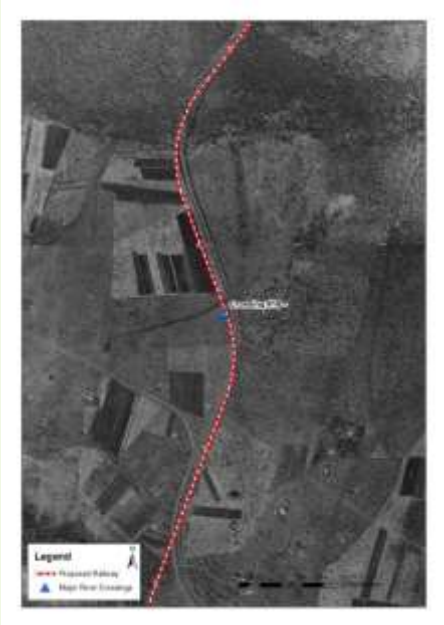


Figure 41: Aerial view crossing 18

Figure 42: View of River crossing

Figure 43: Looking upstream

Figure 44: Looking downstream

Crossing 19 – Usuthu tributary near to Matata

Crossing 19 is over a tributary of the Usuthu River and is close to the Matata settlement (Figure 45). The land use is a mixture of subsistence agriculture and commercial irrigated agriculture.

Figure 45: Aerial view crossing 19

Figure 46: View of river crossing

Figure 47: Looking upstream

Figure 48: Looking downstream

The tributary is an ephemeral river with a clear channel and eroded unstable banks. (see Figure 47 and Figure 48).

Crossing 20: Mhlatuze River, Matata

The Mhlatuze River crossing is close to the Matata settlement (Figure 49). The land use is a mixture of subsistence agriculture and commercial irrigated agriculture.

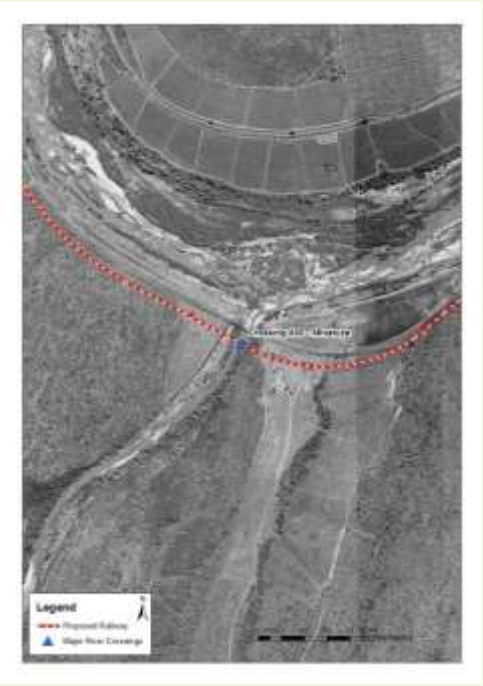


Figure 49: Aerial view Mhlatuze crossing

Figure 50: Rocky outcrop river bed 3000m downstream crossing

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The Mhlatuze River crossing is close to the Matata settlement (Figure 49). The land use is a mixture of subsistence agriculture and commercial irrigated agriculture.

The Mhlatuze is a perennial river with high flows in summer months. At the crossing the banks appear relatively stable due to bedrock presence along sections of the reach (Figure 50) and there are existing instream pools and riffles.

Crossing 22: Usuthu River, Siphofaneni

The Usuthu River crossing is close to the Siphofaneni settlement (Figure 51). The land use is a mixture of subsistence agriculture and commercial irrigated agriculture.

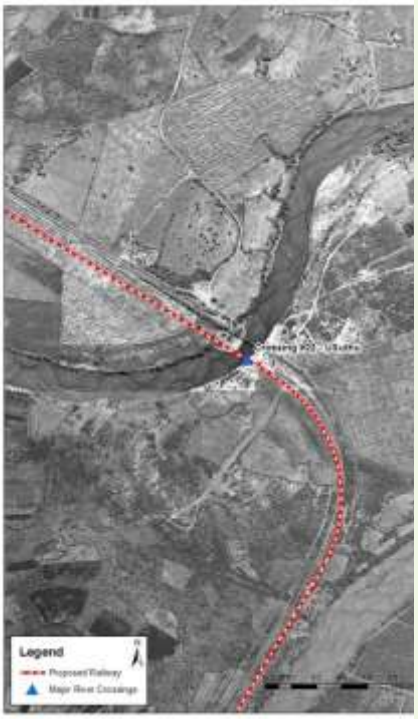

Figure 51: Aerial view Usuthu River crossing

Figure 52: Irrigation water abstraction

Figure 53: View of Usuthu river crossing

Figure 54: Looking upstream of Usuthu crossing

Figure 55: Looking downstream of Usuthu crossing

The Usuthu is a perennial river with high flows in summer months. Flow channel and banks are well defined despite eroded by cattle activity (Figure 54 and Figure 55). There are also signs of flooding during high flows where the railway line intercepts the river. During the Tropical Storm Demonia a flood peak of 13500 m^3/s was recorded in January 1984 on the Usuthu River close to Big Bend (Kovacs, 1988). There are several irrigation abstractions downstream (see Figure 51).

Crossing 23: Mzimneni River, Siphofaneni

The Mzimneni River crossing is close to the Siphofaneni settlement (Figure 56) and it is a tributary of the Usuthu River. The land use is a mixture of subsistence agriculture and commercial irrigated agriculture. The Mzimneni is an ephemeral river with high flows in summer months. The flow channel and banks have been eroded by cattle activity and high velocity flows in rainy season (Figure 58 and Figure 59). There are also high levels of sedimentation due to confluence with Usuthu River downstream (Figure 60).

Figure 56: Aerial view Mzimneni River crossing

Figure 57: View of Mzimneni river crossing

Figure 58: Signs of erosion from fast flows and floods during rainy season

Figure 59: Looking upstream of Mzimneni crossing

Figure 60: Looking downstream of Mzimneni crossing

Crossing 24: Mhlamani River, Sidvokodvo

The Mzimneni River crossing is 8 km from the Sidvokodvo settlement (Figure 61) and it is a tributary of the Usuthu River. The land use is a mixture of subsistence agriculture and commercial irrigated agriculture. The Mzimneni is an ephemeral river with high flows in summer months. The flow channel and banks have been eroded by cattle activity and high velocity flows in rainy season. There are also high levels of sedimentation due to confluence with Usuthu River downstream.

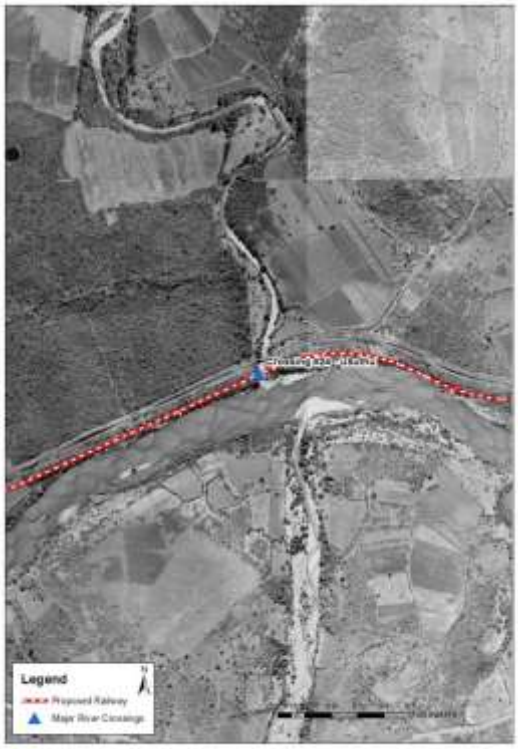

Figure 61: Ariel view of Mhlamani crossing

Crossing 25: Sidvokodvo River, Sidvokodvo

The Sidvokodvo River crossing is near to the the Sidvokodvo settlement (Figure 62) and it is a tributary of the Usuthu River. The land use is a mixture of subsistence agriculture and commercial irrigated agriculture. The Mzimneni is an ephemeral river with high flows in summer months. . The river channel and banks have been eroded by cattle activity and floods (Figure 64). There are high levels of deposited sediment in river bed (Figure 65).

Figure 62: Aerial view Sidvokodvo crossing

Figure 63: View of Sidvokodvo river crossing

Figure 64: Looking upstream of Sidvokodvo crossing

Figure 65: Looking downstream of Sidvokodvo crossing

Crossing 26: Usuthu River, Sidvokodvo

The Usuthu River crossing is close to the Siphofaneni settlement (Figure 66). The land use is a mixture of subsistence agriculture and commercial irrigated agriculture. The Usuthu is a perennial river with high flows in

summer months. The river banks are relatively stable due to bedrock outcrop in the river bed. There is a rock weir for irrigation water abstraction just 100 m downstream crossing section (see Figure 67).

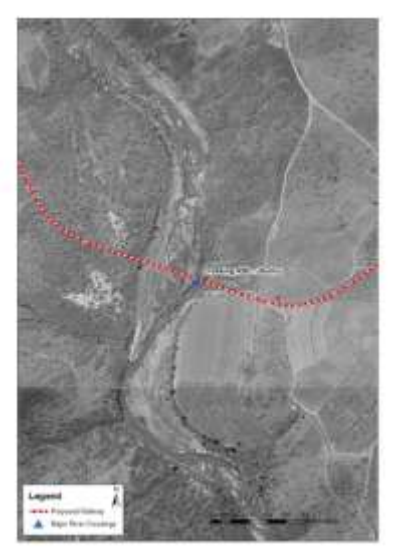

Figure 66: Aerial view Usuthu crossing

Figure 67: Irrigation water abstraction

Crossing 27: Umhlambahula River, Bhunya

The Umhlambahula River crossing is close to the Bhunya settlement (Figure 68) and is a tributary of the Usuthu River. The crossing occurs just before a major meander. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Umhlambahula is a perennial river with high flows in summer months. The river banks are relatively stable due to bedrock outcrop in the river bed with significant loads of settled sedimentation (Figure 70 and Figure 71).

Figure 68: Aerial view Umhlambahula crossing

Figure 69: Cross-section of Umhlambahula crossing

Figure 70: Looking upstream of Umhlambahula crossing

Figure 71: Looking downstream of Umhlambahula crossing

Crossing 28: Usuthu River, Bhunya

The Usuthu River crossing is close to the Bhunya settlement (Figure 72) and is just above the confluence with the Mpuluzi River. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Usuthu is

a perennial river with high flows in summer months. The channel has a sinuous pattern with a bedrock pavement (Figure 74 and Figure 75).

Figure 72: Aerial view Usuthu crossing

Figure 73: Cross-section of Usuthu crossing

Figure 74: Looking upstream of Usuthu crossing

Figure 75: Looking downstream of Usuthu crossing

Crossing 29: Mpuluzi River, Bhunya

The Mpuluzi River crossing is close to the Bhunya settlement (Figure 76) and is a tributary of the Usuthu River. The crossing occurs just after a meander. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Mpuluzi is a perennial river with high flows in summer months. The river banks are relatively stable due to bedrock outcrop in the river bed (Figure 79) and there a number of bedrock pools in the low flow months.

Figure 76: Aerial view Mpuluzi crossing

Figure 77: Cross-section of Mpuluzi crossing

Figure 78: Looking upstream of Mpuluzi crossing

Figure 79: Looking downstream of Mpuluzi crossing

Crossing 30: Malangeni River, Bhunya

The Malangeni River crossing is close to the Bhunya settlement (Figure 80) and is a tributary of the Mpuluzi River. The crossing occurs just above the confluence with Mpuluzi River. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Malangeni is a perennial river with high flows in summer months. The river banks are relatively stable due to bedrock outcrop in the river bed and there a number of bedrock pools in the low flow months.

Figure 80: Ariel view of river crossing

Crossing 31: Mpuluzi River, Bhunya

The Mpuluzi River crossing is close to the Bhunya settlement (Figure 81) and is a tributary of the Usuthu River. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Mpuluzi is a perennial river with high flows in summer months. The channel is well-defined and has significant loads of settled sediment (Figure 82, Figure 83 and Figure 84) in the form of lateral bars and mid-channel bars.

Figure 81: Aerial view Mpuluzi crossing

Figure 82: Cross-section of Mpuluzi crossing

Figure 83: Looking upstream of Mpuluzi crossing

Figure 84: Looking downstream of Mpuluzi crossing

Crossing 32: Usuthu River, Bhunya

The Usuthu River crossing is close to the Bhunya settlement (Figure 85) and is just aboue the confluence with the Mpuluzi River. The land use is a mixture of subsistence agriculture and semi-commercial agriculture. The Usuthu is a perennial river with high flows in summer months. The channel has a sinuous pattern with a bedrock pavement

Figure 85: Ariel view of Usuthu crossing

Upgrade of Phuzumoya Yard

Figure 86: Phuzumoya Yard

Figure 87: Watercourse 300m from Phuzumoya Yard

Potential sources of surface water pollution at the rail yard include:

- wastewater from kitchen and ablution facilities
- wash bays and workshops
- fuelling facilities
- coal dust and rainfall seepage from the wagons.

It is recommended that monitoring be undertaken of any effluent that is discharged from the Phuzumoya Yard into a surface watercourse such as shown in Figure 87. Any effluent must comply with the Water Pollution Control Regulations of 2010 issued under section 37 of the Swaziland Environment Manangement Act of 2002. In Schedule 2 of the regulations effluent standards are specified. The regulations do not prescribe a sampling frequency and it is therefore recommended that sampling be undertaken at a monthly frequency. The regulations require the Yard Operator to report the monitoring results to the SEA within two weeks of the results being released by the water testing laboratory. The regulations also specify that exceedence of the effluent standards be reported and that the discharger has an obligation to mitigate any harm done to the receiving water bodies and to take remedial action to ensure that the effluent standards are met.

The following tables describe the potential impacts as predicted by the Hydrology specialist.

Table 23: Impact description for the potential disturbance, introduction of sediments and the erosion of banks or channels

IMPACT DESCRIPTION: Disturbance, introduction of sediments or erosion of banks or channel				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				

Duration	Medium-term	Mobilised suspended solids released as a result of the construction activities will settle once construction is finalised. Erosion to banks is possible during construction and will naturally stabilise with time	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Local	Impact on water quality where there water abstractions close to the watercourse crossing as well at those crossings that are upstream of nature reserves or dams		
Intensity	Low – negative	As the existing conditions show signs of high erosion and sedimentation the additional impact significance associated with the construction of bridges and culverts are predicted to be low without mitigation.		
Probability	Fairly likely	Due to the construction activity the probabilty of this impact is fairly likely		
MITIGATION: • Sediment mobilisation can be prevented in the most part in the construction phase by the use of silt traps. Regular cleaning of the silt traps. • Best practice culvert and bridge design practices to be followed to provide good drainage and prevent erosion and sediment mobilisation. • Upstream downstream and downstream erosion protection • In order to mitigate an increase in flow velocity, a structure to dissipate the energy maybe required. • Attention needs to be given to the prevention of bank erosion and sediment input into the stream both during construction and as a result of storm water during the operational phase.				
POST-MITIGATION				
Duration	Short-term	The implementation of the proposed mitigation measures will result in the decrease of suspended solids and erosion of stream banks	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Will be contained through the implementation of the proposed mitigation measures		
Intensity	Very low	Improved housing will constitute a significant benefit		
Probability	Fairly likely	Due to the construction activity the probability of this impact is fairly likely, however, the potential impact will be reduced by the mitigation measures		

Table 24: Impact description for the potential change in flow regime

IMPACT DESCRIPTION: Change in flow regime				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		

PRE-MITIGATION				
Duration	Long-term	As permanent structures will be placed in watercourses, the duration is seen as long term.	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Local	The structures are immobile and will not likely change once they have been installed, thus the extent is local.		
Intensity	Low – negative	Once the construction activities have been completed, the flow regime will settle around the bridge and culvert structures resulting in a low intensity.		
Probability	Fairly likely			
MITIGATION: • In order to mitigate an increase in flow velocity, a structure to dissipate the energy maybe required. • Best practice culvert and bridge design practices to be followed to provide good drainage and prevent erosion and sediment mobilisation. • Natural weirs and small lakes must be preserved.				
POST-MITIGATION				
Duration	Long-term	As for pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Site-specific	With the suggested mitigation measures the extent of the impact will be reduced to site specific.		
Intensity	Very low	With the suggested mitigation measures the probability of the intensity of the impact will be reduced.		
Probability	Unlikely	With the suggested mitigation measures the probability of impact on the flow regime will be unlikely.		

Table 25: Impact description for predicted water abstractions, effluent discharges and animal drinking

IMPACT DESCRIPTION: Water abstractions, effluent discharges, animal drinking.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Suspended solids in the water might cause reduction in water quality during construction	Consequence: Slightly detrimental	Significance: Low - negative

Extent	Local	Water abstraction points downstream of construction will be affected		
Intensity	Moderate – negative	Concentration of suspended solids may impact on water quality for man and beast		
Probability	Fairly likely	Due to the construction activity the probability of this impact is fairly likely		
MITIGATION: • Best practice culvert and bridge design practices to be followed to provide good drainage and prevent erosion and sediment mobilisation. • Upstream downstream and downstream erosion protection				
POST-MITIGATION				
Duration	Short-term	As for pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Site-specific	As for pre-mitigation		
Intensity	Low – negative	Concentration of suspended solids will be reduced as a result of the mitigation measures		
Probability	Fairly likely	Due to the construction activity the probabilty of this impact is fairly likely, however, the potential impact will be reduced by the mitigation measures		

Table 26: Impact description for the potential coal dust and rainfall seepage water from the coal wagons

IMPACT DESCRIPTION: Coal dust and rainfall seepage water from the coal wagons.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Accumulation of coal dust along the railway line and seepage of rain water from uncovered wagons will occur throughout the lifecycle of the project	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Local	Accumulation of coal dust along the railway line and seepage of rain water from uncovered wagons during the rainfall season may have impacts on water quality in local streams and rivers		
Intensity	Low – negative	Through natural dilution the impact of such contamination will be low		
Probability	Fairly likely	Due to the nature of the project coal dust will be produced and will be washed into streams		

MITIGATION: • Coal should be transported using both sealed wagons and bottom dumping wagons				
POST-MITIGATION				
Duration	Long-term	As for pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Site-specific	The accumulation of coal dust will be reduced through the implementation of the proposed mitigation measures		
Intensity	Very low	As for pre-mitigation, but at a reduced level		
Probability	Fairly likely	The implementation of the proposed mitigation measures will contribute towards reducing the potential intensity of the impact		

The mitigation measure in red text was found to be highly unfeasible to Transnet. This would require major operational variations to their current operational system. The time and cost required to implement this requirement would lead to a major delay in turnaround times of trains together with the subsequent economic impacts which would follow. It is the EAP's view that as the significance of the impact is determined by the specialist to be low, **the implementation of such an extravagant mitigation measure is unjustifiable. Therefore, no mitigation measures are proposed for this impact. The significance of this impact will thus remain low**.

8.2.3 Air quality assessment

The objectives of the air quality impact assessment (AQIA) are to:

- Assess qualitatively the potential air quality impacts of emissions during the construction phase of the railway line and associated infrastructure.
- Assess quantitatively the potential air quality impacts of pollutants from the combustion of diesel fuel from locomotives.
- Propose mitigation measure for each phase to prevent or reduce any adverse air quality impacts on the receiving environment.

The complete air quality impact assessment report can be found in Appendix B, Annexure E.

8.2.3.1 Emissions characterisation

Emission estimates are typically the biggest uncertainty in an AQIA. Since the overall objective of any AQIA is to protect human and environmental health, it is important to understand that conservative estimates will be made at every step of emissions estimation. Two operational scenarios are considered. First the construction phase of the proposed project, thereafter the operational phase.

8.2.3.1.1 Construction phase of the project

The construction phase will mainly result in nuisance impacts in the form of dust. Large uncertainties are associated with emission estimates for these types of activities, resulting mostly in fugitive emissions. These factors

therefore do not justify a full modelling assessment for the construction phase of this project. However, the nuisance and other possible impacts should still be managed. Best practise and possible mitigation strategies are therefore recommended for the construction activities.

It will include emissions from on-site heavy-duty off-road vehicles, other light-duty vehicles and dust emissions as a result of the construction activities. The most important emissions will be NOx from the vehicles and dust from the earthworks. It will also result in mainly nuisance impacts in the form of dust.

8.2.3.1.2 Operational phase of the project

Combustion of diesel results in the following emissions:

- volatile organic compounds (VOCs) and other hydrocarbons (HC);
- carbon monoxide (CO);
- nitrogen oxides (NO_x);
- particulate matter with an aerodynamic diameter smaller than 10 μg (PM_{10});
- particulate matter with an aerodynamic diameter smaller than 2.5 μg ($PM_{2.5}$); and
- sulphur dioxide (SO_2).

The pollutants of most concern and for which there exist ambient standards in South Africa include CO, nitrogen dioxide (NO_2), PM_{10} and benzene (C_6H_6) (one of the HCs). Although SO_2 is a pollutant of concern, the emission factors strongly depend of the fuel characteristics, which is not known, and furthermore, the contribution is likely not significant. Emissions for diesel locomotives have been quantified by the USEPA (1989). Emissions factors for different duty cycle diesel locomotives are shown in Table 27. The different duty cycles correspond to the age of the technology (as shown in brackets). Separate emissions standards are given for line-haul and switch mode of operation.

Table 27: USEPA Locomotive emission standards (g/bhp.hr)

Duty Cycle	HC	CO	NOx	PM_{10}
Tier 0 (1973-1992)				
Line-haul	1.00	5.0	8.0	0.22
Switch	2.10	8.0	11.8	0.26
Tier 1 (1993-2004)				
Line-haul	0.55	2.2	7.4	0.22
Switch	1.20	2.5	11.0	0.26
Tier 2 (2005 – 2011)				
Line-haul	0.30	1.5	5.5	0.10
Switch	0.60	2.4	8.1	0.13
Tier 3 (2012-2014)				
Line-haul	0.30	1.5	5.5	0.10
Switch	0.60	2.4	5.0	0.10
Tier 4 (2015 or later)				
Line-haul	0.14	1.5	1.3	0.03
Switch	0.14	2.4	1.3	0.03

To calculate the total annual emissions from the diesel locomotives, the information on the number of locomotives, the annual fuel consumption rates of diesel for each train types and line types, and the mode of the locomotives operation (line-haul or switch modes) is required. The speed of operation (throttle notch), as well as the idle characteristics also have an impact on emissions.

A detailed analysis of the proposed design capacity was done in the pre-feasibility stage. The track design allows for a train length of 2562 m, or 200 wagons for coal and 160 wagons for general freight. Class 43 (or equivalent) type diesel electric locomotives have been assumed for the entire train service. Traction is provided by up to 6 Class 43 equivalent diesel locomotives positioned at the front, the centre and the rear of the train in Distributed Power (DP) mode.

Three terminals will be used for operations. These include Davel, Nsezi and Phuzamoya. Nsezi in Richards Bay will be the base of operations. Activities at Nsezi will include traction changes, load consolidation/distributions and fuelling. Davel will be the secondary terminal. Activities at Davel include traction changes, load consolidation/distributions and secondary fuelling. A junction terminal will be located in Phuzamoya in Swaziland. Activities at Phuzamoya will include junction and secondary fuelling.

Table 28: Throttle notch weighting factors for diesel locomotives (UNESPA, 2008)

Throttle notch	Line-haul	Switch
Idle	38.0	59.8
Dynamic brake	12.5	0.0
Notch 1	6.5	12.4
Notch 2	6.5	12.3
Notch 3	5.2	5.8
Notch 4	4.4	3.6
Notch 5	3.8	3.6
Notch 6	3.9	1.5
Notch 7	3.0	0.2
Notch 8	16.2	0.8

Trains start off in 50 wagon lengths at 20 ton axle loads during 2017. By 2020 almost all possible combinations with current wagon types are performed and 25% of coal trains run at 26 ton axle loads. By 2030 approximately 50% of all wagons are high capacity wagons running at 20 ton axle loads whilst some coal runs at 26 tons. At 2040 the majority of bulk trains run in 200 wagon lengths at 26 ton axle loads. All general freight trains then run at maximum lengths.

Coal from other areas will probably be transported in light-loaded jumbo wagons and 100 wagon blocks initially. The train axle loading and length will evolve to the maximum permissible axle loading and length over time.

A worst case scenario at full capacity is assumed for the purpose of an AQIA. The maximum particle design capacity estimated scenario is shown in Table 29. Slight differences in train frequencies exist between the Davel to

Phuzamoya and the Phuzamoya to Nsezi sections. For this AQIA, the maximum of the two are used. A conservative estimate of 150 Ml of diesel per annum is assumed. This includes haul-line and switch mode operations.

Table 29: Maximum annual estimated fuel consumption during the operational phase

Train composition	Trains/direction/day	Litre diesel/train	Litre diesel/day	Mega litre diesel/annum
100w/20 tal	1	15 010	15 010	150
160w/20 tal	7	24 141	144 846	
200w/26 tal	8	35 089	280 712	

8.2.3.2 Proposed emissions included in the assessment

The locomotive fleet is likely older and the maintenance might not be to the same standard as those used in for testing. It is also not certain what the exact specification of the locomotives used on this rail line will be. For the purpose of the AQIA, conservative estimates of operations, as well as emission factors should account for these uncertainties. The AQIA therefore models two scenarios: scenario A assumes old, badly maintained tier 0 locomotives and scenario B assumes new locomotives with the best available emission control technology, or tier 4. This approach provides the absolute worst possible impact as well as the benefits obtainable from using best available technology. The final set of emission factors used for modelling the two scenarios are shown in Table 30. It is further assumed that 15% of fuel is spent on switch mode operations an 85% for line haul. Combining the emission factors in Table 30 with the fuel estimates in Table 29 leads to total estimated annual emissions for the peak of operations (Table 31). Annual contributions of 13307 T/annum NO_x, 336 T/annum PM_{10}, 673 T/annum hydro carbons and 4394 T/annum CO makes up a significant portion of the national budget for the worst case scenario.

Table 30: Locomotive emission estimates used in this analysis (g/l)

Duty Cycle	NO_x	PM_{10}	HC	CO
Scenario A (worst case)				
Line-haul	83.5	2.1	4.1	27.5
Switch	95.6	2.4	5.5	32.1
Scenario B (mitigated)				
Line-haul	0.14	1.5	1.3	0.03
Switch	0.14	2.4	1.3	0.03

Table 31: Total estimated annual emissions for the peak operations of the Swazi Rail Link (T/annum)

Scenario	NO_x	PM_{10}	HC	CO
A: Worst-case	13 307	336	673	4394
B: Mitigated	1 070	24	116	1318

8.2.3.3 Baseline air quality assessment

This section aims to present baseline ambient concentrations for pollutants using available monitoring data. Very few datasets exist in South Africa that is suitable for this objective. The rail line runs through rural Swaziland. No air quality data is available for this area. Data from Kwadela (near Davel in Mpumalanga, South Africa) was therefore used in order to ensure adequate representation as these measurements are representative of the air quality around low income households. It therefore provides a perfect baseline for the current impact assessment.

Domestic burning is the most common source of air pollution in rural areas. As the railway line passes by many settlements and homesteads, an estimate of air quality in these areas are needed. Several monitoring sites are found in the area. However, very few datasets are available that characterize air quality in settlements where domestic burning of coal is prevalent. A recent study were conducted in Davel/Kwadela during the 2013 months with the worst dispersion potential as presented by Piketh et al. (2013)). These measurements can be seen as representative of the air quality around low income households. It therefore provides a good baseline for the current AIA.

Typical diurnal patterns driven by domestic cooking and heating are visible in the diurnal distribution. Isolated high peaks in CO and SO_2 suggest an impact for industry and biomass burning in the area. CO values are relatively low and below the national guidelines. Particulate matter (PM) (PM_{10} and $PM_{2.5}$), NO_x and SO_2 are especially high during times of domestic burning.

It is evident that the ambient concentrations of pollutants in low income areas are poor. Even isolated villages are expected to have high PM values. Any contribution to ambient PM and NO_x would therefore be significant.

The following tables indicate the impact description together with the proposed mitigation measures for the impacts relative to air quality for the railway line.

Table 32: Impact description for the release of dust from earthworks

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Dust releases from earthworks</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Particulate matter will be produced during the construction phase</td><td rowspan="3">Consequence: Moderately detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Local</td><td>Be restricted to the immediate vicinity of the site</td></tr>
<tr><td>Intensity</td><td>High - negative</td><td>Dust emissions as a result of the construction activities which will mainly be as nuisance impacts</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Due to the activities associated with construction dust will be generated</td></tr>
<tr><td colspan="5">MITIGATION:</td></tr>
</table>

Standard mitigation measures are recommended for the construction phase. These include: • Use of enclosures, screens and sheeting to contain dust • Use of paved / surfaced and cleaned haul routes • Use of water suppression and wheel washing • Choice of location and facilities for site storage where required • Location of dust generating activities • Transport route selection and location • No burning on site and close to settlements • Conduct any slash burning (glossary term) in compliance with open burning permit requirements • Minimize the amount of disturbance and areas cleared of vegetation • Re-vegetate disturbed areas as soon as possible after disturbance • Use dust abatement techniques on unpaved, un-vegetated surfaces • Enact fugitive dust and vehicle emission controls • Establish and enforce speed limits to reduce airborne fugitive dust • When feasible, shut down idling construction equipment • Keep soil moist while loading into dump trucks to minimize fugitive dust • Keep soil loads below the freeboard of the truck to minimize fugitive dust • Minimize drop heights when loaders dump soil into trucks • Tighten gate seals on dump trucks • Cover dump trucks before traveling on public roads • When possible, schedule construction activities during periods of low winds to reduce fugitive dust				
POST-MITIGATION				
Duration	Short-term	As per pre-mitigation	Consequence: Slightly detrimental	Significance: Very low
Extent	Local	As per pre-mitigation		
Intensity	Low - negative	Mitigation measures will reduce the intensity		
Probability	Unlikely	The implementation of the proposed mitigation measures will reduce the probability of the impact		

Table 33: Impact description of vehicle exhaust during construction

IMPACT DESCRIPTION: Construction vehicle exhaust				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Emissions of mainly NO_2 from on-site heavy-duty off-road vehicles and other light-duty vehicles will occur during the construction phase	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Local	Emissions will be restricted to the immediate vicinity of the construction activities		
Intensity	High - negative	The emissions will have a nuisance value		
Probability	Fairly likely	Due to the activities associated with construction exhaust emissions will be generated		
MITIGATION: Standard mitigation measures are recommended for the construction phase. These include: • Use of enclosures, screens and sheeting to contain dust • Use of paved / surfaced and cleaned haul routes • Use of water suppression and wheel washing • Choice of location and facilities for site storage where required • Location of dust generating activities • Transport route selection and location • No burning on site and close to settlements				

- Conduct any slash burning (glossary term) in compliance with open burning permit requirements
- Minimize the amount of disturbance and areas cleared of vegetation
- Re-vegetate disturbed areas as soon as possible after disturbance
- Use dust abatement techniques on unpaved, un-vegetated surfaces
- Enact fugitive dust and vehicle emission controls
- Establish and enforce speed limits to reduce airborne fugitive dust
- When feasible, shut down idling construction equipment
- Keep soil moist while loading into dump trucks to minimize fugitive dust
- Keep soil loads below the freeboard of the truck to minimize fugitive dust
- Minimize drop heights when loaders dump soil into trucks
- Tighten gate seals on dump trucks
- Cover dump trucks before traveling on public roads
- When possible, schedule construction activities during periods of low winds to reduce fugitive dust

POST-MITIGATION				
Duration	Short-term	As per pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Local	As per pre-mitigation		
Intensity	Very low	Mitigation will reduce the intensity of the impact		
Probability	Fairly likely	Due to the activities associated with construction exhaust emissions will be generated		

Table 34: Impact description for the contribution of the proposed project to the ambient CO

IMPACT DESCRIPTION: Contribution to ambient CO				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Combustion of diesel will result in release of carbon monoxide	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	Impact will be localised		
Intensity	Moderate - negative	Calculated release is well below ambient standard		
Probability	Very likely	Combustion of diesel will result in release of carbon monoxide		
MITIGATION:				
• Huge reduction in emissions from diesel locomotives can be achieved by upgrading the engines • Maintenance of the locomotives				
POST-MITIGATION				
Duration	Medium-term	As per pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Local	As per pre-mitigation		
Intensity	Very low	Implementation of the mitigation measures will reduce the release of carbon monoxide		
Probability	Very unlikely	Implementation of mitigation measures will greatly reduce the probability of the impact		

Table 35: Impact description for the contribution to ambient PM10

IMPACT DESCRIPTION: Contribution to ambient PM10

Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Combustion of diesel will result in release of particulate matter	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	Impact will be localised		
Intensity	High - negative	Ambient concentration of PM in low income areas are poor and even isolated villages will have a high PM. Release of particulate matter will contribute to this will have a significant impact at local level		
Probability	Very likely	Combustion of diesel will result in release of particulate matter		
MITIGATION: • Huge reduction in emissions from diesel locomotives can be achieved by upgrading the engines • Maintenance of the locomotives				
POST-MITIGATION				
Duration	Short-term	Mitigation will reduce the duration of the impact	Consequence: Negligible	Significance: Very low
Extent	Local	As per pre-mitigation		
Intensity	Very low	Release of particulate matter will be reduced to almost zero through the implementation of appropriate mitigation measures		
Probability	Unlikely	Release of particulate matter will be reduced		

Table 36: Impact description for the contribution to ambient NO2

IMPACT DESCRIPTION: Contribution to ambient NO2				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Combustion of diesel will result in release of nitrogen oxides	Consequence: Highly detrimental	Significance: High - negative
Extent	Regional	Distribution of the plume could result in a regional impact		
Intensity	High - negative	Nitrogen oxide pollution have an impact on human health		
Probability	Very likely	Combustion of diesel results in the release of nitrogen oxides		
MITIGATION: • Huge reduction in emissions from diesel locomotives can be achieved by upgrading the engines • Maintenance of the locomotives				
POST-MITIGATION				
Duration	Short-term	Combustion of diesel will result in release of nitrogen oxides	Consequence: Negligible	Significance: Very low

Extent	Local	Distribution of the plume could result in a regional impact		
Intensity	Very low	Implementation of appropriate mitigation measures will reduce the level of nitrogen oxides		
Probability	Unlikely	Combustion of diesel results in the release of nitrogen oxides albeit at a much reduced level		

Table 37: Impact description for the contribution to ambient C6H6

IMPACT DESCRIPTION: Contribution to ambient C6H6				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Combustion of diesel will result in release of hydro carbons	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	Impact will be localised		
Intensity	Moderate - negative	Hydro carbon pollution could have an impact on human health		
Probability	Very likely	Combustion of diesel will result in release of hydro carbons		
MITIGATION: • Huge reduction in emissions from diesel locomotives can be achieved by upgrading the engines • Maintenance of the locomotives				
POST-MITIGATION				
Duration	Short-term	Combustion of diesel will result in release of hydro carbons	Consequence: Negligible	Significance: Very low
Extent	Local	Impact will be localised		
Intensity	Very low	The release of hydro carbons will be reduced to below the ambient standard		
Probability	Unlikely	Combustion of diesel will result in release of hydro carbons		

8.2.4 Geohydrological assessment

As part of the project, the existing Sidvokodvo to Lavumisa Rail Line will be upgraded which will include amongst other, the construction of the “Phuzumoya West Yard”.

Only a geohydrological desk study for this portion was required. This document outlines the approach and methodology to describe the baseline conditions in order to quantify potential impacts, and ultimately develop a groundwater management framework to mitigate identified potential impacts.

The tasks consisted of the following:

1. Reconnaissance Trip & Desk study,
2. Reporting.

For the purpose of this study, the Sandlane to Lavumisa section of the Transnet Swazi Rail Link is divided into eleven sections according to the geohydrological boundaries as described in the 1: 250 000 Hydrogeological Map (Swaziland) underlying the route. The physical attributes hereof are described in Table 38 below according to this arrangement.

Table 38: Description of the Hydrogeological units underlying the Lavumisa – Sandlane section.

Chainage (km)	Hydrogeological Unit	Geological Description
160 – 186; 197.5 - 199 (Portion 1)	G3	Lochiel Granite (AG3)
186 – 197.5; 199 – 209; 232 – 262 (Portion 2)	GW	Ngwane Gneiss
209 – 215; 267 – 277 (Portion 3)	G5	Maswati Granite (AG5)
215 – 232; 277 – 287 (Portion 4)	GD	Granodiorite (Usutu Suite)
262 – 264; 270 – 270.5 (Portion 5)	MY	Mylonite
287 – 290; 297 - 306 (Portion 6)	DO	Diabase/Dolerite
292 – 297 (Portion 7)	KN	Nkondola Group Karoo Sediments
306 – 314 (Portion 8)	KD	Dwyka Group Sediments
314 – 324 (Portion 9)	BA/WE	Weathered Basalt
340 – 371 (Portion 10)	BA	Massive Basalt
324 - 340; 371 - Lavumisa (Portion 11)	BD	Dyke Swarm Basalt

The site locations, topography, drainage, climate, geohydrology and water use are described in detail in the specialist report. Please refer to Appendix B, Annexure B for more information regarding each chainage portion assessed.

The summary of the impact assessment findings are discussed below.

From the outcome of the specialist assessment it can be seen that the construction and operational phases of the Sandlane to Lavumisa section will have a “very low” impact on the investigated geohydrological environment, given that sound environmental infrastructure and management procedures are put in place. All of the identified impacts could be countered by appropriate mitigation. The impact description and accompanying mitigation measures can be found in the following tables:

Table 39: Impact description for the potential hydrocarbon spillages.

IMPACT DESCRIPTION: Potential hydrocarbon spillages from equipment, machinery and vehicle storage may lead to contamination of groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				

Duration	Long-term	Contamination of groundwater resources as a result of hydrocarbon runoff from contaminated poses a long term threat	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Local	Plumes migrate off-site		
Intensity	Very high - negative	Hydrocarbon contamination poses a serious health risk		
Probability	Fairly likely	Hydrocarbon spills on ballast stones is fairly likely resulting in a contamination of groundwater		
MITIGATION: • Ballasts should be cleaned every 3 to 4 years by the use of a ballast cleaner • Ballast cleaning should involve the removal of worn ballasts with the replacement of new ballasts • The construction of the workshops, cleaning bays and fuel dispensing areas of the construction camps should be in such a way that no accidental spillages leave the site and surface and storm water run-off be diverted through an oil/water separator before leaving the site. • Emergency Spill Response Procedures should be in place with capable people with the necessary training available at strategic locations to follow these procedures in the case of major accidents and/or accidental spillages.				
POST-MITIGATION				
Duration	Short-term	Hydrocarbon contamination of water resources will be contained thereby reducing the impact on the water resources	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Reduction of hydrocarbon contamination will restrict impact to specific sites		
Intensity	Very low	No contamination of aquifers		
Probability	Unlikely	Contamination will be contained and restricted		

The mitigation measure highlighted in red above is as proposed by the specialist. However, after consultation with the proponent, the EAP is of the opinion, based on current operations for the Sishen-Saldanha Ore line in South Africa that **a cleaning cycle of at least once every 16 years be implemented during the operational phase**. This is due to the fact that while at rail yards and fuelling stations hydrocarbon spillages are likely to occur, the same happening on a running railway line is unlikely. Undergoing costs of cleaning ballast every 3-4 years is an unwarranted cost and this mitigation measure is thus not included as part of the impact assessment, i.e. **the significance of the impact post mitigation remains very low**.

Table 40: Impact description for the potential of waste leakages / spillages in the construction camps

IMPACT DESCRIPTION: Potential waste leakages / spillages in construction camp may lead to contamination of groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Contamination of aquifers poses a long term threat	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Local	Plumes migrate off-site		
Intensity	Very high - negative	Poses serious health risks		
Probability	Fairly likely	Accidents and contamination is fairly likely due to human nature		
MITIGATION: • The construction of the workshops, cleaning bays and fuel dispensing areas should be in such a way that no accidental spillages leave the site and surface and storm water run-off be diverted through an oil/water				

separator before leaving the site. • Emergency spill kits should always be present at strategic locations with capable people with the necessary training available to use it in the case of accidental spillages.				
POST-MITIGATION				
Duration	Short-term	Spillages are contained and threat will be short term	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Spillages will be contained		
Intensity	Very low	No contamination of aquifers		
Probability	Unlikely	Spillages will be contained and contamination restricted		

Table 41: Impact description for the incorrect disposal of hazardous and non-hazardous materials or waste

IMPACT DESCRIPTION: Incorrect disposal of hazardous and non-hazardous materials or waste could contaminate groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Contamination of aquifers poses a long term threat	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Local	Local water resources may be contaminated resulting in contamination of aquifers		
Intensity	Very high - negative	Contamination of water resources with hazardous material could lead to health risks		
Probability	Fairly likely	Contamination of water resources by the incorrect disposal of materials is fairly likely due to the nature of the material being transported		
MITIGATION: • An adequate waste management plan should be implemented to prevent incorrect disposal of materials.				
POST-MITIGATION				
Duration	Short-term	Contamination of water resources will be prevented therefore restricting the potential impact of contamination	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Potential impacts will be contained at will only have an impact at site level		
Intensity	Very low	Contamination of water resources will be contained therefore restricting the potential impact of contamination		
Probability	Unlikely	Implementation of appropriate mitigating measures will severely reduce the potential of contamination of water resources		

Table 42: Impact description for the potential contamination of groundwater by contaminated ballast stone

IMPACT DESCRIPTION: Contaminated ballast stone may lead to contamination of groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Contamination of water resources could pose a long term health risk	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Long-term	Plumes migrate off-site		
Intensity	Long-term	Poses a serious health risk		
Probability	Long-term	Contamination is fairly likely due to human error		
MITIGATION: • Ballasts should be cleaned every 3 to 4 years by the use of a ballast cleaner • Ballast cleaning should involve the removal of worn ballasts with the replacement of new ballasts				
POST-MITIGATION				
Duration	Short-term	Aquifers will not be contaminated	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Spillages will be contained		
Intensity	Very low	No contamination of aquifers		
Probability	Unlikely	Mitigation will reduce the potential for spillages and contamination		

The mitigation measure highlighted in red above is as proposed by the specialist. However, after consultation with the proponent, the EAP is of the opinion, based on current operations for the Sishen-Saldanha Ore line in South Africa that **a cleaning cycle of at least once every 16 years be implemented during the operational phase**. This is due to the fact that while at rail yards and fuelling stations hydrocarbon spillages are likely to occur, the same happening on a running railway line is unlikely. Undergoing costs of cleaning ballast every 3-4 years is an unwarranted cost and this mitigation measure is thus not included as part of the impact assessment, i.e. **the significance of the impact post mitigation remains very low**.

Table 43: Impact description for potential spillages of hazardous materials resulting from accidents or collisions

IMPACT DESCRIPTION: Spillages of hazardous materials resulting from accidents or collisions may result in contamination of groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Contamination of surface water resources could have a long term impact on groundwater	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Medium-term	Will be restricted to local impact		

Intensity	Medium-term	Contaminated groundwater could pose a serious health risk		
Probability	Medium-term	Contamination is likely due to human error		
MITIGATION: • Emergency spill response procedures should be in place with capable people with the necessary training available at strategic locations to follow these procedures in the case of major accidents and/or accidental spillages.				
POST-MITIGATION				
Duration	Short-term	Contamination of water resources will be contained before aquifers are affected	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Contamination will be contained		
Intensity	Very low	Contamination will be contained resulting in low impact		
Probability	Unlikely	Mitigation will greatly reduce the impact of waste and spillage contamination of water resources		

Table 44: Impact description for potential wind-blown material emanating from uncovered rail trucks

IMPACT DESCRIPTION: Wind-blown material emanating from uncovered rail trucks may result in contamination of groundwater.				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Contamination of surface water resources could have a long term impact on groundwater	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Local	Will be restricted to local impact		
Intensity	Moderate - negative	Contaminated groundwater could pose a serious health risk		
Probability	Fairly likely	Contamination of water resources by material emanating from uncovered wagons is fairly likely due to the nature of the material being transported		
MITIGATION: • Transnet should consider covering rail trucks when transporting hazardous materials.				
POST-MITIGATION				
Duration	Short-term	Contamination of water resources will be contained before aquifers are affected	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Contamination will be contained		
Intensity	Very low	Contamination will be contained resulting in low impact		
Probability	Unlikely	Mitigation will greatly reduce the impact of waste and spillage contamination of water resources		

8.3 Impacts on the Physical Environment

8.3.1 Noise and vibration assessment

Measurements and site investigation were conducted from the 10th September till the 13th September 2013. Potentially sensitive receptors, also known as noise-sensitive developments (NSDs) were identified up to 200 m from the railway line. Receptors locations were identified using tools such as Google Earth® and other available internet resources and information. Potential receptors around the development were classified between NSD04 to NSD121. The following rating levels are proposed for receptors in the study area:

- The noise guidelines as prepared by the International Finance Corporation (IFC) in its Environmental, Health and Safety Guidelines (EHS) – General EHS Guidelines: Environmental Noise Management (2007) with a 55 and 45 dBA day/night time rating level for receptors.

Four operational scenarios were assessed as the project functions, namely:

- The projected *daytime* initial peak hour assessment (worst case) when the railway initially starts operations;
- The projected *night-time* initial peak hour assessment (worst case) when the railway initially starts operations;
- The projected *daytime* future peak hour assessment (worst case) when the railway operates at maximum capacity; and
- The projected *night-time* future peak hour assessment (worst case) when the railway operates at maximum capacity.

There is no standard or guideline in Swaziland or South Africa stipulating the requirements to calculate or model the potential noise impacts from a railway operation. Various International propagation models do exist. The European Transportation Research Laboratory (TRL) has recommended the British model “Calculation of Railway Noise, 1995” as the most technical sound of the available models. For this reason assessment calculations were done in accordance with the sound propagation model described by British CRN (Railway Noise) model.

Assessment indicated a potential sound environment where the IFC guidelines would be exceeded by the initial and future day and night-time operation sound levels during peak traffic periods at houses directly adjacent or bordering the train line. This is mostly due to the proximity of the proposed railway line in relation to certain receptors.

The two tables below describe the impacts of the Initial day and night scenario and the future day and night scenario respectively as well as their proposed mitigation measures.

Table 45: Impact description of the initial day and night scenario

IMPACT DESCRIPTION: Initial day and night scenario				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				

Duration	Long-term	Will continue after construction is complete	Consequence: Extremely detrimental	Significance: Very high - negative
Extent	Regional	Will affect surrounding communities		
Intensity	Very high - negative	Equivalent noise levels will exceed the IFC guidelines during day and night-time hours		
Probability	Certain	The nature of the project will result in noise and vibration becoming a nuisance		

MITIGATION:

- Programmes to manage rail and wheel roughness
- Lowering of speed limits near sensitive areas
- Screening of line of sight from receptors
- Relocate receptors
- Continuous public participation
- Establishment of a help line and noise complaint logging
- Environmental acoustical programme
- Identifying of special receptors such as religious, health and educational facilities

POST-MITIGATION				
Duration	Long-term	Will continue after construction is complete	Consequence: Highly detrimental	Significance: High - negative
Extent	Regional	Will affect surrounding communities		
Intensity	Moderate - negative	Equivalent noise levels will exceed the IFC guidelines during day and night-time hours		
Probability	Certain	The implementation of the proposed mitigation measures will reduce the potential negative impact and the potential positive economic impacts of the project might create a positive attitude towards the project		

Table 46: Impact description of the future day and night scenario

IMPACT DESCRIPTION: Future day and night scenario				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Will continue after construction is complete	Consequence: Extremely detrimental	Significance: Very high - negative
Extent	Regional	Will affect surrounding communities		
Intensity	Very high - negative	Equivalent noise levels will exceed the IFC guidelines during day and night-time hours		
Probability	Certain	The nature of the project will result in noise and vibration becoming a nuisance		
MITIGATION:				

- Programmes to manage rail and wheel roughness
- Lowering of speed limits near sensitive areas
- Screening of line of sight from receptors
- Relocate receptors
- Continuous public participation
- Establishment of a help line and noise complaint logging
- Environmental acoustical programme
- Identifying of special receptors such as religious, health and educational facilities

POST-MITIGATION				
Duration	Long-term	Will continue after construction is complete	Consequence: Highly detrimental	Significance: High - negative
Extent	Regional	Will affect surrounding communities		
Intensity	Moderate - negative	Equivalent noise levels will exceed the IFC guidelines during day and night-time hours		
Probability	Certain	The implementation of the proposed mitigation measures will reduce the potential negative impact and the potential positive economic impacts of the project might create a positive attitude towards the project		

It must be noted that commercial railway line activities are exempted from certain requirements of Government Notice R154 of 1992 (Noise Control Regulations) – Regulation 2.(c) - *"Provided that the provisions of this paragraph* (in reference to noise emanating from a development) *shall not apply in respect of a disturbing noise or noise nuisance caused by rail vehicles or aircraft which are not used as recreational vehicles"*. Furthermore the locomotive horns is exempted from the Government Notice R154 of 1992 (Noise Control Regulations) – Clause 7.(1) – *"the emission of sound is for the purposes of warning people of a dangerous situation".*

With a risk of a noise impact developing during the night-time hours being of a potential high significance, mitigation options could be considered by the proponent. The mitigation of noise from railway lines is difficult and potentially expensive to implement. Mitigation discussed below is optional and not mandatory for the developer due to the exemptions mentioned above. Mitigation options should be considered at receptors where a medium to high potential for a noise impact has been identified (refer to Appendices in document) receptors that are near where trains have to brake and/or receptors that border or are adjacent to the railway line. Mitigation options should also be considered at potential sensitive areas such as places of worship (religious), at educational and health care facilities and at business that cater for hospitality (game lodges).

Mitigation Options: Mitigation of Noise Source – Railway Line

Possibly the best mitigation options when considering acoustics is the design and specifications of railway lines and operations. These include:

1. *Minimise train operations during the night-times (22:00 – 06:00, SANS 10103:2008)* - The potential important times for a noise annoyance to occur would be during the night-time hours when a quiet environment is desired (at night for sleeping etc.). It is highly likely that maximum noise levels due to single noise events outdoor at houses (directly adjacent to the train) could exceed 80 dBA. This would be also relevant during religious worship, at educational and health care facilities and at business that cater for hospitality (e.g. pray times at the Mosque or Sunday church services and at game lodges).The developer should consider identifying such sensitive areas as mentioned above and discussing the findings of this report with them. **However, as the railway line is a 24 hour operation, this mitigation measure is**

considered impractical and unfeasible and will therefore not be implemented by Swaziland Railway and Transnet. ;

2. *Programmes to manage rail and wheel roughness* – The developer can consider the implementation of composite material (or similar) brake shoes ("K or LL Blocks") as cast-iron brakes cause wheel roughness (and more friction and noise). These wheel dampers will produce the lowest peak noise levels, but may not prevent tyre squeal fully. The LL brake block system has the potential to reduce rolling and braking noises over cast iron brakes as well as K blocks. LL block systems does not require the adaption of cast-iron brake systems and also damage the train wheels far less than a conventional cast-iron brake. The developer should consider ensuring that rail head grinding and rail head maintenance is conducted regularly to ensure that the correct rail head profile is maintained. The developer could consider rail dampers on the rail line at sections of rail near receptors dwellings;
3. *Consideration of 40 km/h train speeds near sensitive areas* – If the developer operates at slower speeds (not maximum) near sensitive areas, this would minimise a potential noise annoyance near places of religious worship, at educational and health care facilities and at business that cater for hospitality (game lodges);
4. *Screen the line of sight from receptors to the rail loops and railway lines* – The developer can consider berms, barriers and design of the rail loop infrastructure (placement of buildings at rail loops) in order to screen the railway line operations to a receptors dwellings. From a technical perspective it would seem easiest to consider a berm or single/double brick wall. A less feasible option (from a technical perspective) is to design the railway loops and railway line to be at a lower elevation than a receptors dwelling (sufficient height difference to obscure line of sight). Advancement in barriers designed specifically for sound insulation has improved drastically over the years. Although a more expensive option than single/double brick/concrete wall or an aggregate berm, acoustic barriers are specifically designed as a buffer for noises. Such barriers could be implemented along the railway line where there is a potential for a high noise impact or at sensitive areas. If the developer decides to implement a double brick wall or berm, the following factors should be implemented to ensure an effective noise boundary wall/barrier:
    - It is recommended that the barrier be built as close as possible to the footprint of the railway line (noise source) or residents (receptor) as is feasible as possible. The barrier design needs to consider diffraction, and should have no aperture or gaps;
    - It is recommended that the height of the berms/barriers be at least 1 m higher than the line of sight to the highest noise source from the railway line to a receptors dwelling. Barriers must also be sufficiently dense (at least 20 kilograms/square meter surface density) and sufficient in thickness. A brick wall provides a surface density of 244 kilograms/square m at thickness of 150 mm[1]and is considered as a typically good acoustical barrier. Certain metrological conditions (particularly during night-times) can see refraction of noise over the barrier due to the various temperature inversion layers. This means that noise levels from a railway line may propagate back down to the ground at a receptors dwelling due to the curvature of sound in the warmer upper night-time atmosphere. Barrier height cannot effect this propagation; and
    - The barrier should be sufficiently long.

<u>Mitigation Options: Mitigation at Receptors</u>

The following optional possibility can be considered by the developer:

1. *Relocate receptor* – An option for the developer to consider relocating receptors directly adjacent to the proposed railway line.

<u>Mitigation Options: Management Mitigation</u>

Public relations are important throughout the entire planning, construction and development of the project. The developer could consider the following:

1. *Public participation* – A developer representative could discuss the calculated noise levels in this document with receptors. The developer representative should indicate other positive aspects of the project (job and infrastructure enhancement in the area);
2. *Help line and noise complaint logging* - The developer could consider a line of communication (e.g. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers. Sporadic and legitimate noise complaints could develop. For example, sudden and sharp increases in sound levels could result from poorly maintained tracks. Noise complaints can be logged and supplied to railway maintenance staff to further investigate (rail roughness);
3. *Environmental Acoustical Measurement Programme* – The developer could implement a noise measurements programme and reporting conducted on an annual basis and preferably linked to a noise propagation model to illustrate the extent of the noise impact from the railway. This may enable the developer to identify and potential problems relating to noise from the development at that stage of the project operations; and
4. *Religious, health, educational buildings and hospitality facilities* – The developer could consider identifying these facilities near the railway line and co-ordinating any operational times that may be sensitive to these receptors.

As it is unsure of which (if any) mitigation options the developer may implement, identifying the potential impacts with mitigation options implemented cannot be assessed.

The findings of this report should be made available to all identified potentially noise-sensitive developments in the area with the contents explained to them to ensure that they understand all the potential risks that the development may have on them their families or their business.

It must also be noted that it is unfair to expect the noises from the development to be inaudible under all circumstances (even mitigated noise) as this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source. Care must be taken to ensure that the sound produced by the proposed development is at a reasonable level in relation to the existing ambient sound levels.

8.3.2 Cultural and heritage resources assessment

In Swaziland heritage protection falls under the Swaziland National Trust Commission (SNTC). This body is empowered by the SNTC Act of 1972 which was amended in 1973. Forty years ago, when the act was written heritage, cultural and archaeological surveys were not envisaged, nor was there any attempt at a systematic national assessment of assets, therefore there is no heritage ranking system in Swaziland.

Instead nature conservation was prioritised within the act. The act does allow for the creation of national monuments, however in forty years three national monuments have been declared, none of these in the past thirty five years. A list of twelve proposed new national monuments submitted by the SNTC has never been gazetted.

Comprehensive new legislation has been drafted to update the legal framework of the SNTC, however when it was presented to parliament it was sent back for revision and awaits resubmission.

In the absence of existing legal guidelines in Swaziland the South African triple tier heritage grading system has been used in this scoping survey. It is compatible with the South African component of the Davel to Richards Bay rail ink heritage survey.

The South African National Heritage Resources Act No 25 of 1999 (NHRA) has been relied upon for the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act (known as the triple tier heritage grading system):

- **Grade I**: Heritage resources with qualities so exceptional that they are of special national significance;
- **Grade II**: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III**: Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable of mitigation measures would allow the development activities to continue.

Sites regarded as having low significance is viewed as recorded in full after identification and would require no further mitigation. Impact from the development would be judged to be low. Sites with a medium to high significance would require mitigation. Mitigation, in most cases the excavation of a site, is in essence destructive and therefore the impact can be viewed as high and as permanent.

8.3.2.1 ARCHAEOLOGICAL, CUTURAL AND HISTORICAL ASSETS ON THE SURVEY ROUTE

Grade 1:

No heritage assets were recorded.

Grade 2:

Two heritage assets were recorded, namely:

1. A refuge cave at 260 35’ 51.183” S and 310 09’ 20.27 E. The rail line passes within a hundred meters of the site, care should be taken not to enter or disturb the caves, no further action is required.

2. A reed collection site for the Umhlanga ceremony, 260 38' 27.42" S and 310 25' 13.52 E. This is between the Sidvokodvo siding and the Usutu River, mostly on the river banks. The reeds are an essential component for the Umhlanga or Reed Dance ceremony, one of two major national ceremonies - along with the Incwala - in Swaziland. Reed areas are threatened countrywide by changing land use. The reed growth area should be avoided if the siding is enlarged, no further action is needed.

Grade 3:

No heritage assets were recorded.

The light scatters of MSA stone tools and isolated hand axes found are unlikely to provide further information and are not sites. Excavation is not needed.

Graves:

Numerous graves were recorded on the route, in all cases these are associated with occupied homesteads. Projects like Maguga Dam and LUSIP exhumed the graves and reburied them under the supervision of the project sociologist. It is assumed that this project will be similar.

Further action

The route from the border to Sidvokodvo should be periodically monitored when the rail line is constructed and earthworks occur. By its very nature many archaeological remains are buried and are only uncovered when the surface is disturbed. The line from Sidvokodvo to Lavumisa will follow the existing route, little disturbance is expected and no further monitoring of this section is recommended. However where sidings are enlarged this will cause soil disturbance and these operations should be monitored.

Stone hand axes were found on the lowvelt rail sidings, these indicate that there may well be further material. In addition some of the sidings, like Matata, lie below Border Cave in South Africa which is clearly visible from it. Construction and extension of these sidings should be monitored as Border Cave is of Grade 1 significance and there may be associated material uncovered during line construction or from other periods.

8.3.2.2 Impact assessment

Impact analysis of cultural heritage resources under threat of the proposed development, are based on the present understanding of the development.

The table below describes the impact predicted by the heritage impact assessment, as well as the proposed mitigation measures.

Table 47: Impact description of the possible disturbance of cultural and heritage resources

IMPACT DESCRIPTION: Disturbance of cultural and heritage resources				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				

Duration	Long-term	Displacement of graves/ spiritual sites will be permanent	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Regional	Will affect graves/ spiritual sites in right-of-way		
Intensity	High - negative	Loss of graves/ spiritual sites will constitute a negative social impact and may precipitate opposition to the project		
Probability	Fairly likely	Presence of cultural resources in right-of-way was not established as part of this assignment		
MITIGATION: • Where possible, narrow the right-of-way to avoid graves/ spiritual site. • Relocation of graves/ spiritual sites to be executed in culturally appropriate manner • Accidental discovery of graves/ archaeological sites to be reported and dealt with according to relevant legislation and cultural norms				
POST-MITIGATION				
Duration	Long-term	As for pre-mitigation	Consequence: Highly detrimental	Significance: Moderate - negative
Extent	Regional	As for pre-mitigation		
Intensity	Moderate - negative	Number of affected graves/ spiritual sites may be reduced by narrowing parts of the right-of-way		
Probability	Fairly likely	Culturally appropriate relocation will reduce the likelihood of this constituting a negative social impact		

8.4 Impacts on the Social and Socio-economic Environment

8.4.1 Social impact assessment

The SIA formed an important component of the EIA and was aimed at assessing and estimating, in advance, the social consequences that are likely to follow the implementation of the proposed project.

The SIA sought to provide a framework for prioritising, gathering, analysing, and incorporating social information and participation into the design and delivery of the project. Furthermore, the SIA ensured that the proposed project is informed and took into account the key relevant social issues.

The methodology took into account the distinction between social change processes and social impacts. A change process refers to a change that takes place within the receiving environment as a result of a direct or indirect intervention. An impact follows as a result of the change process. Impacts are those changes that are physically felt and emotionally experienced, positively and negatively. However, a change process can only result in an impact once it is experienced as such by individual persons, by groups of people and households, a community or society as a whole, social organisations and institutions individual/community on a physical and/or cognitive level.

The social impacts identified during the specialist assessments can be classified into the following broad categories:

8.4.1.1 Objective social impacts

These are impacts that can be quantified and verified by independent observers, such as changes in population size or composition, in employment patterns, in standard of living or in health and safety.

8.4.1.2 Subjective social impacts

These are impacts that occur “in the imagination” or emotions of people, such as negative public attitudes, psychological stress or reduced quality of life. This kind of impact is much more difficult to identify and describe, as one cannot readily quantify perceptions or emotions.

For the purpose of this SIA the following categories were investigated:

- Social well-being;
- Quality of the living environment;
- Economic impacts and material well-being;
- Family and community impacts;
- Institutional impacts, and
- Gender impacts.

The general criteria for selecting significant social impacts included the following:

- Probability of the event occurring;
- Number of people that will be affected;
- Duration of the impact;
- Value of benefits or costs to the impacted group;
- Extent to which identified social impacts are reversible or can be mitigated;
- Likelihood that an identified impact will lead to secondary or cumulative impacts; and
- Uncertainty over possible effects.

Positive impacts associated with the project include:

- The creation of temporary employment opportunities and social benefits;
- Opportunities for local sourcing of goods and services;
- Improved road infrastructure associated with development project;
- Local and regional economic benefits; and
- Increased development aid/investment from government and/or project investors.

Negative impacts that may be associated with this phase include:

- Social and cultural disruption and conflict due to population influx;
- Creation of spontaneous and informal settlements;
- Possible social pathologies arising from the population influx (such as crime, HIV/AIDS, prostitution etc);
- The need to secure accommodation for construction staff;
- Disturbance impacts related to physical intrusion (i.e. the impacts of dust, noise, traffic and pollution on sense of place);
- Land use impacts and impacts on common property resources;
- Displacement; and
- Community perceptions and responses.

The following impact descriptions represent the potential positive impacts which may occur due to the proposed development:

8.4.1.3 Impact assessment: Creation of temporary employment opportunities and social benefits

The results of the socio-economic survey indicate that the surrounding environment of the project are characterised by poverty and underdevelopment. Notable socio-economic statistics include:

- A *very high unemployment rate* – 24 percent of the surveyed population is unemployed;
- There is a significant *dependency ratio* in these areas, with 1 or 2 employed household members often having to provide for households with an average of 8 household members; and

From these figures, it is clear that the households in the project area face significant socio-economic challenges. The creation of employment opportunities can therefore be seen as a significant positive impact on the surrounding communities, even if these opportunities are only of a temporary nature.

During the household survey, the issue regarding creation of employment opportunities was most frequently mentioned in the area. There is a widespread high expectation that Swaziland Railway and Transnet should provide employment opportunities to the residents in the local area. With increased income-earning capacity the individuals and communities will be empowered.

Construction activities on the proposed railway project will create a number of permanent and temporary employment opportunities. The magnitude of this impact is related to the number of construction workers to be employed, either by Swaziland Railway itself or by contractors. It is recommended that local labour must be used as much as possible.

Sourcing of construction workers from the local labour pool is likely to be limited to unskilled and semi-skilled workers. This could have some economic benefits for surrounding communities, although mostly of a temporary

nature. It is recommended that recruitment for new positions be undertaken through the *Employment Forum* (or any other relevant Forum) that would have been established by the local community /chief or Inkhundla.

Marginalised and vulnerable groups are particularly sensitive to social and economic changes in their local area, special care should be taken to incorporate these vulnerable groups and in so doing minimising the potential negative impacts of the project on them and create positive economic opportunities for them.

In addition to creating job opportunities for construction workers, the project may also lead to indirect employment creation in the informal sector, for instance in terms of food stalls for the convenience of construction workers. Additionally, more informal employment opportunities may be created through a multiplier effect from the project's activities.

The table below describes the impact associated with the creation of employment opportunities.

Table 48: Impact description for the creation of employment opportunities

IMPACT DESCRIPTION: Creation of employment opportunities				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Construction activities will create a number of temporary jobs	Consequence: Moderately beneficial	Significance: Low - positive
Extent	Local	Sourcing of construction workers from the local labour pool is likely to be limited to unskilled and semi-skilled workers		
Intensity	High - positive	In addition to creating job opportunities for construction workers, the project may also lead to indirect employment creation in the informal sector		
Probability	Fairly likely	Semi-skilled and unskilled jobs will be created		
MITIGATION: • Make use of local labour as far as possible. • Liaise with local community structures to identify local labour pool.				
POST-MITIGATION				
Duration	Medium-term	As for pre-mitigation	Consequence: Moderately beneficial	Significance: High - positive
Extent	Local	As for pre-mitigation		
Intensity	High - positive	By implementing the mitigation measures the local labour pool will benefit		
Probability	Certain	The use of the local labour force will be enhanced		

8.4.1.4 Impact assessment: Opportunities for local sourcing of goods and services

Local communities often have high expectations about participating in new opportunities in their area. Local procurement of goods and services are a manner that these communities can successfully partake in the

development project. Local procurement can provide a fundamental linkage between the project implementers and the local communities.

Community contracting describes a number of different methods to implement infrastructure projects at a community level. These range from what is effectively direct implementation by project developers and contractors using community labour to structures where independent community-based organisations act as contractors on a similar basis to a private sector contractor.

Creating a platform where Local suppliers development (LSD) can take place would not only benefit the local micro, small and medium enterprises as they would be in a better position to win contracts, but the project implementer as well as they would have a bigger and more experienced pool of enterprises to choose from.

The table below describes the impact for the opportunities for local sourcing of goods and services as well as recommended mitigation (or maximisation) measures.

Table 49: Impact description for opportunities for local sourcing of goods and services

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Local sourcing of goods and services</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><th>Dimension</th><th>Rating</th><th colspan="3">Motivation</th></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Procurement of goods and services required for the construction phase of the project from companies owned by historically disadvantaged South Africans</td><td rowspan="3">Consequence: Slightly beneficial</td><td rowspan="4">Significance: Low - positive</td></tr>
<tr><td>Extent</td><td>Local</td><td>Will benefit the local economy</td></tr>
<tr><td>Intensity</td><td>Moderate – positive</td><td>Depends on the implementation of the Transnet procurement policy</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Depends on the implementation of the Transnet procurement policy towards achieving their procurement targets</td></tr>
<tr><td colspan="5">MITIGATION:
• Include conditions in construction contract to involve and train emerging entrepreneurs.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>By implementing the mitigation measures the duration of the impact could continue during the operational phase, albeit at a lower intensity</td><td rowspan="2">Consequence: Moderately beneficial</td><td rowspan="2">Significance: Moderate - positive</td></tr>
<tr><td>Extent</td><td>Regional</td><td>As for pre-mitigation</td></tr>
</table>

Intensity	Moderate – positive	Implementation of the mitigation measures will enhance the use of local service providers and goods		
Probability	Certain	Mitigation will increase the use of appropriate service providers and goods		

8.4.1.5 Impact assessment: Improved road infrastructure associated with development project

As mentioned earlier the needs analysis revealed that respondents felt that bad roads and associated transport problems has a negative impact on the quality of their life. Projects like construction of new railway lines cannot take place without creating access points and routes to the areas where the project is to take place, and this infrastructure can have countless positive consequences for the local communities. The current road infrastructure that has been classified by the local residents as bad will have to be upgraded, making it easier for the local communities to travel on and transport goods from and to places previously unreachable. Better road infrastructure and transport linkages can provide opportunities for catalysing local economic opportunities.

The table below describes the impact rating for the improvement of road infrastructure.

Table 50: Impact description for the improvement of road infrastructure

IMPACT DESCRIPTION: Improved road infrastructure				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Trained workers would become more marketable elsewhere after the completion of this project thereby adding to the migrant labour force	Consequence: Moderately beneficial	Significance: Low – positive
Extent	Local	Will affect local communities		
Intensity	Moderate - positive	Outflow of trained workers could have a negative impact but would also create opportunities for other workers and will potentially increase the economic inflow to the community.		
Probability	Fairly likely	Job opportunities for trained workers outside the study area is likely to happen		
MITIGATION: • Construction of road infrastructure. • Upgrading current road infrastructure. • Maintain newly constructed and upgraded road infrastructure.				
POST-MITIGATION				
Duration	Long-term	Implementation of mitigation measures could alleviate the need for trained workers to leave the area	Consequence: Highly beneficial	Significance: Moderate - positive

Extent	Regional	As for pre-mitigation		
Intensity	Moderate - positive	Mitigation will reduce the need for trained workers to leave the area		
Probability	Fairly likely	Mitigation could reduce the outflow of trained workers from the area		

8.4.1.6 Impact assessment: Local and regional economic benefits

In addition to the economic benefits derived from employment, the proposed development will also contribute to the local and regional economy in other ways. For instance, local expenditure by employees will have multiplier effects in various sectors of the economy, thereby stimulating business activity and further employment creation.

Changes in the local economy structure such as opening of new markets for products and services, increased demand for consumer goods and inflation of local prices can all have some positive outcomes on the local and regional economy for example profits that will be injected into the local and regional markets.

The project could also have fiscal impacts – in other words, an impact on government revenues and expenditures. In particular, payment of business and personal tax could contribute to government revenue at a national level, while rates and payment for services could strengthen the income base of the area.

The table below describes the impact for the local and regional economic benefits as well as recommended mitigation (or maximisation) measures.

Table 51: Impact description for local and regional economic benefits

IMPACT DESCRIPTION: Local and regional economic benefits (operational phase)				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Creating employment will increase the spending regime in the area. Long term jobs will persist for the life span of the project	Consequence: Moderately beneficial	Significance: High - positive
Extent	Local	The project could also have fiscal impacts. Payment of business and personal tax could contribute to government revenue at a national level, while rates and payment for services could strengthen the income base of the district and local municipalities		

Intensity	Moderate - positive	Local expenditure by employees will have multiplier effects in various sectors of the economy, thereby stimulating business activity and further employment creation		
Probability	Certain	Increased employment levels will contribute to the economy		
MITIGATION: • Maximise local employment opportunities through training and capacity building.				
POST-MITIGATION				
Duration	Long-term	increased levels of employment will persist for the duration of the project	Consequence: Moderately beneficial	Significance: High - positive
Extent	Local	As per pre-mitigation		
Intensity	Moderate - positive	As per pre-mitigation		
Probability	Certain	As per pre-mitigation		

8.4.1.7 Impact assessment: Increased support from government and/or project implementers

In many cases the project will be located in remote rural areas where the population is engaged in subsistence production that provide limited opportunities for development and economic growth. Low levels of skills and literacy can restrict communities in their ability to realise opportunities associated with the project.

Human Capital Development investments have both short and long term returns. In the short term, training and skills development can provide a basis for new augmented sources of income for the local population. In the long term, some projects may provide human development in the area through support for education, training and skills development.

The table below describes the impact for the potential increased support from government and/or project implementers as well as recommended mitigation (or maximisation) measures.

Table 52: Impact description for the increased support from government and/or project implementers

IMPACT DESCRIPTION: Increased support from government and/or project implementers				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long-term	Influx of workers and job seekers could result in an increase in crime	Consequence: Moderately beneficial	Significance: Low - positive
Extent	Local	Local communities will be affected		
Intensity	Moderate - positive			

Probability	Fairly likely	Increase in population numbers and low levels of employment in confined areas could potentially lead to an increase in crime		
MITIGATION: • Capacity building and skills development projects and initiatives should be implemented.				
POST-MITIGATION				
Duration	Long-term	Mitigation could reduce the time span of potential impact	Consequence: Highly beneficial	Significance: Moderate - positive
Extent	Regional	Impact will be contained at local level		
Intensity	Moderate - positive	Mitigation will lower the crime levels		
Probability	Fairly likely	Mitigation will have a positive impact on the lowering of the crime levels		

The following impact descriptions represent the potential negative impacts which may occur due to the proposed development:

8.4.1.8 Impact assessment: Social and cultural disruption and conflict and social pathologies arising due to population influx

As news regarding the proposed project spreads, expectations regarding possible employment opportunities may also take root. Consequently, the area surrounding the site / construction areas may experience an influx of job seekers.

The magnitude of this impact depends on the severity of unemployment in surrounding areas. It could be expected that migrant labours will flock to the area. Furthermore, poverty is believed to be a widespread problem in Swaziland, with an unemployment rate of more than 40 percent. Given these figures, it is likely that a large enough number of job seekers will flock into the area to have fairly significant population impact on the immediate social environment. This population increase may impact on the area in terms of additional demand for services and infrastructure.

An influx of newcomers seeking opportunities associated with the project could also create various social problems. Tension or conflict can be created as a result of religious or ethnic rivalries.

It is assumed that the biggest percentage of the construction workforce for the Swaziland Railway Link will be locals, while the remainder will have to be housed reasonably close to the construction site. It is possible that *conflict* might arise between the newcomers and local residents. One possible reason for such conflict would be the perception among locals that the outsiders are taking up jobs that could have gone to unemployed members of the local community. An influx of unemployed job seekers (which was discussed in the preceding sections) could add to the potential for conflict.

One of the potential social pathologies that may arise from a rapid increase in population numbers in an existing underdeveloped area is an increase in *crime levels*. The extra strain that the influx of job seekers will place on limited employment opportunities in the area will potentially increase the unemployment rate, which will increase

the crime rate. Even if particular instances of crime are not as a result of the newcomers, they may still be attributed to them by local communities.

Another possibility is that a population influx will contribute to *alcoholism*, *drug abuse*, *prostitution* and the spread of *sexually transmitted diseases* in the local population. An influx of newcomers can overburden the health services and infrastructure, inadequate sewage and waste management and can increase some health risks.

The table below describes the impact which could arise due to possible social and cultural disruption and conflict due to population influx as well as recommended mitigation (or maximisation) measures.

Table 53: Impact description for possible social pathologies arising from population influx

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Social pathologies arising from population influx</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Influx of job seekers during the construction phase could lead to conflict between locals and newcomers</td><td rowspan="3">Consequence: Slightly detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>Will affect local communities</td></tr>
<tr><td>Intensity</td><td>Moderate - negative</td><td>Conflict between locals and newcomers could occur.</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Local communities frequently, rightly or wrongly, associate newcomers with social problems</td></tr>
<tr><td colspan="5">MITIGATION:
Additional security must be provided during this period by the contractors, which should be integrated with existing farm /community security systems
Implement HIV/AIDS and alcohol abuse campaigns in the communities
Align awareness campaigns with those of other organisations in the area (i.e. the Local Municipality, Farmers etc.)
As far as possible, make use of local labour.
Liaise with local community structures / chiefs to identify mutually acceptable means of controlling the influx of job seekers or, if this is not possible, to mitigate the negative effects of such an influx
Recruitment is to be conducted via the Employment Forum / appropriate forum and not within the project area itself</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>Management of the issue could reduce the impact to a short term impact</td><td rowspan="3">Consequence: Negligible</td><td rowspan="4">Significance: Very low</td></tr>
<tr><td>Extent</td><td>Site-specific</td><td>Impact could be reduced</td></tr>
<tr><td>Intensity</td><td>Very low</td><td>Occurrence of the impact could be reduced by mitigation process</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Even with mitigation potential still exists, albeit at a lower intensity</td></tr>
</table>

8.4.1.9 Impact assessment: Creation of spontaneous and informal settlements

One of the contributors to the development and expansion of informal settlements is the influx of job seekers into the area, as these job seekers tend to settle in the informal settlements. However, many other factors are also responsible for the growth of informal settlements, which cannot all be attributed to the proposed railway line project. Therefore, this establishment of informal settlements is the result of many cumulative impacts, such as influences of other projects and factories in the area, current socio-economic conditions in the country and region and so forth.

Many impacts also arise from the expansion of informal settlements, especially an increase in associated social pathologies. The informal settlements are highly underdeveloped in terms of infrastructure. Most houses have no electricity supply, no safe drinking water and have no refuse disposal systems. These informal settlers are also mostly unemployed as they are job seekers who migrate to the area.

In most instances the local communities would claim that the informal settlements are contributing directly to a number of problems. In particular, the community believes that these settlements lead to a higher crime rate in the area.

It is therefore clear that there is a cumulative impact of various preceding factors that influence the extent of this impact. It is possible that an influx of job-seekers moving into the area because of the project will cause informal settlements to expand even more, and thereby exacerbate the social problems mentioned above.

Measures to mitigate or control the expansion of informal settlements will have to be implemented with considerable sensitivity so as not to infringe on people's constitutionally guaranteed right to freedom of movement. To this end, it is recommended that Swaziland Railway facilitate the establishment of a "Community Safety Committee" with the aim of monitoring and controlling illegal squatting. The suggested membership of such a committee would include:

- The Community Relations / Stakeholder Engagement Departments of Swaziland Railway;
- Respective local Chief;
- Respective Inkhundla;
- Local landowners; and
- Representatives of local community.

The functions of this committee would include:

- Frequent monitoring of the area to detect the establishment of new informal settlements. (It is foreseen that this function could be carried out by Community Relations / Stakeholder Engagement Departments of Swaziland Railway in cooperation with the local Chiefs, as well as other stakeholders in the area);
- The establishment of a "hotline" at a local police station or at the local authority / chieftainship for reporting of illegal squatting. The number of this hotline should be widely disseminated among local communities and landowners to ensure that the erection of new informal settlements is reported as soon as possible, thereby allowing for timeous response ; and
- The formulation, in consultation with all relevant stakeholders, of an appropriate plan for responding to illegal squatting.

The table below describes the impact which could arise due to possible creation of informal settlements as well as recommended mitigation (or maximisation) measures.

Table 54: Impact description for the creation of informal settlements

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Creation of informal settlements</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>The establishment of informal settlements by caused by the influx of workers could occur during the construction phase</td><td rowspan="3">Consequence: Slightly detrimental</td><td rowspan="4">Significance: Low - negative</td></tr>
<tr><td>Extent</td><td>Local</td><td>Informal settlements are usually associated with an increase in social pathologies which could manifest itself on a wider regional scale</td></tr>
<tr><td>Intensity</td><td>Low - negative</td><td>Informal settlements are often associated with negative social problems</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">The expected influx of job seekers, the high unemployment rate and lack of sufficient housing will in all probability lead to the establishment of informal settlements</td></tr>
<tr><td colspan="5">MITIGATION:
• Facilitate the establishment of a “Community Safety Committee” to monitor and control illegal squatting. Committee to consist of:
- The Community Relations / Stakeholder Engagement Departments of Swaziland Railway;
- Its counterparts at other projects in the area
- The local Chiefs;
- The Local Inkhundla;
- Local landowners;
- Representatives of local community structures; and
- Local police.
• Align social investment strategies with local development
• Include a requirement in the Conditions of Service of construction contractors that construction workers must be vacated from the area once construction is completed.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Short-term</td><td>The implementation of the mitigation measures will reduce and manage the establishment of informal settlements</td><td rowspan="3">Consequence: Negligible</td><td rowspan="4">Significance: Very low</td></tr>
<tr><td>Extent</td><td>Local</td><td>Mitigation could contain the impact to the local level</td></tr>
<tr><td>Intensity</td><td>Very low</td><td>Mitigation could reduce severity of impact</td></tr>
<tr><td>Probability</td><td>Fairly likely</td><td colspan="2">Mitigation could reduce likelihood of impact occurring to the intensity predicted</td></tr>
</table>

8.4.1.10 Impact assessment: Accommodation for construction staff

It may be necessary to find accommodation for a number of construction workers in the vicinity of the proposed developments. One option would be to house them in a construction village. The other option will be to house them in nearby settlements. This may require that Swaziland Railway invest in the construction of additional housing units.

A major concern for communities in the area relates to the management of housing for the construction workers who are employed by the contractors. Construction contractors also reportedly do not construct adequate housing facilities for their workers, resulting in the expansion of informal settlements and other social pathologies, such as increased crime levels.

The construction of additional housing units for construction workers will increase the pressure on the service infrastructure. In addition, there is an existing perception among community members that construction workers from contractors move into the area and stay there even after construction activities have completed. The construction of additional housing units for construction workers might reinforce this perception and cause resentment.

Therefore, it is recommended that a construction village be used as housing for the construction workers. It is recommended that one construction village be used to house construction workers of the project components to minimise the extent of pressure the additional housing will exert on social and municipal infrastructure. Since the construction timeline of the proposed project components is sequential with some overlapping time periods, it is necessary to ensure that the construction village is large enough to accommodate the maximum number of construction workers that will be employed at any given time.

Furthermore, it would be preferable if sufficient entertainment facilities could be included in the construction camp. Entertainment facilities could comprise a lounge with pool table, television, vending machines for soft drinks, etc. By providing entertainment facilities, the workers' motivational levels may increase and the risk to social pathologies will decrease. If entertainment facilities cannot be included in the camp layout, attendance of alternative entertainment facilities must be encouraged.

Once construction of the project components is completed, the construction camp should be demolished completely to avoid settling of informal residents. As an alternative, the construction contractor may negotiate with the Inkhundla about possibly selling or donating the construction camp to them for use as formal housing in the area.

The table below describes the impact which could arise due to the need to accommodate construction staff as well as recommended mitigation (or maximisation) measures.

Table 55: Impact description for the accommodation of construction staff

IMPACT DESCRIPTION: Accommodation for construction staff				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Negative impacts associated with the accomodation of construction staff will be limited to the construction period	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Local	Impacts will affect local communities		

Intensity	Low - negative	Providing accomodation for construction workers will have very little impact on the local communities		
Probability	Very likely	Additional housing will increase the pressure on local infrastructure		
MITIGATION: • Housing of construction workers in a construction village site • Maximisation of the proportion of job opportunities allocated to locals, thus reducing the need for outsiders • Provision of sufficient entertainment facilities (e.g. lounge with TV, pool table, etc.) • Demolishing construction village after construction activities have finished, or donating the construction camp to the local municipality for formal housing, or alternatively convert the construction camp to permanent housing for labourers during the operational phase.				
POST-MITIGATION				
Duration	Short-term	As per pre-mitigation	Consequence: Negligible	Significance: Very low
Extent	Local	As per pre-mitigation		
Intensity	Very low	Mitigation will alleviate the pressure on local housing		
Probability	Fairly likely	Mitigation will reduce the intensity of the impact		

8.4.1.11 Impact assessment: Physical intrusion

Impacts related to noise, visual aspects, air quality and the like are discussed under this heading, as all these impacts are related to the physical presence of project-related infrastructure and the intrusion this imposes on surrounding communities. Such intrusion could impinge on the lives of surrounding communities by affecting the area's *sense of place*.

Several factors have to be borne in mind when assessing the potential magnitude of such an impacts. One of these factors is the *current state of the landscape* in which the development is situated. The landscape for the upgrade section already bears the marks of development and as such sense of place will not be such a major issue. However, for the new link, visual impact assessment may be needed to provide professional opinion and recommendation.

Another factor to take into account when assessing the impact on sense of place is the *meanings* that people who live or work in an area attach to the anticipated changes. If a development promises to offer tangible *benefits* to surrounding communities (in terms of, amongst others, job creation.), it is unlikely that its impact on the character of the landscape will be perceived in a negative light – even if that impact is substantial from an aesthetic point of view.

Dust generated by construction activities, and by vehicles moving on access roads during construction could affect air quality in the area. The air quality specialist study reports on the potential impacts on air quality in the area. Construction activities may also increase *noise pollution* in the area.

As indicated above, the impact of a development on the character of the landscape may not be experienced as negative if that development offers tangible benefits. To the extent that the project benefits local communities, it is therefore *unlikely* that they will experience it as a significant negative impact on the area's sense of place.

The two tables below describe the impact due to the physical intrusion as well as recommended mitigation (or maximisation) measures for both the construction as well as operational phases of the project.

Table 56: Impact description for physical intrusion (construction phase)

IMPACT DESCRIPTION: Physical intrusion (Construction phase)				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Impacts related to noise, visual aspects, air quality and the like are related to the physical presence of project-related infrastructure and the intrusion this imposes on surrounding communities.	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Localised impact		
Intensity	Moderate - negative	Such intrusion could impinge on the lives of surrounding communities by affecting the area's sense of place		
Probability	Certain	Due to the type of project it will result in an impact on the community		
MITIGATION: • Implement mitigation measures recommended in separate specialist reports on noise impacts and air quality. • Do not engage in construction activities during church gatherings or at night. • Liaise with local communities as to activities scheduled and avoid construction during these times, if possible. • Continuous communication with the affected communities				
POST-MITIGATION				
Duration	Short-term	Will be limited to the construction phase	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Localised impact		
Intensity	Moderate - negative	Mitigation will reduce the impact		
Probability	Certain	Although the impact will persist mitigation will reduce the intensity of the impact on the local communities		

Table 57: Impact description for physical intrusion (operational phase)

IMPACT DESCRIPTION: Physical intrusion (operational phase)				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				

Duration	Long-term	Impacts related to noise, visual aspects, air quality and the like are related to the physical presence of project-related infrastructure and the intrusion this imposes on surrounding communities will continue for the life span of the project.	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Site-specific	Localised impact		
Intensity	Moderate - negative	Such intrusion could impinge on the lives of surrounding communities by affecting the area's sense of place		
Probability	Certain	Due to the type of project it will result in an impact on the community		
MITIGATION: • Implement mitigation measures recommended in separate specialist reports on noise impacts and air quality. • Do not engage in construction activities during church gatherings or at night. • Liaise with local communities as to activities scheduled and avoid construction during these times, if possible. • Continuous communication with the affected communities.				
POST-MITIGATION				
Duration	Long-term	The impact will continue throughout the life span of the project	Consequence: Slightly detrimental	Significance: Moderate - negative
Extent	Site-specific	Localised impact		
Intensity	Low - negative	Mitigation will reduce the impact on the local communities		
Probability	Certain	Although the impact will persist mitigation will reduce the intensity of the impact on the local communities		

8.4.1.12 Impact assessment: Displacement

Historically d*evelopment induced displacement* in Swaziland has been negatively perceived by the population as previous projects relocated project affected persons without proper consultation and compensation. This left the people affected scared and others wary of development projects and the consequences they have. There should be proper mechanisms for addressing the relocated person's grievances to restore their livelihoods and prevent them from feeling helpless or powerless.

There will be a permanent loss of life-long social and emotional investment as well as livelihood resources for the households that need to be relocated. Special care should be taken, as far as possible, to relocate the affected households back into their own communities through using the infill method.

The table below describes the impact due to the possible displacement of people as well as recommended mitigation (or maximisation) measures.

Table 58: Impact description for the displacement of people / households

IMPACT DESCRIPTION: Displacement of people/households

Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium-term	Relocations and displacement will only occur during the construction phase.	Consequence: Moderately detrimental	Significance: High - negative
Extent	Local	Displacement will only occur where the railway line impacts on dwellings.		
Intensity	High - negative	There will be a permanent loss of life-long social and emotional investment as well as livelihood resources for the households that need to be relocated.		
Probability	Certain	It has been established that the proposed routes will require displacement should the project be authorised.		
MITIGATION: • Adequate compensation • Proper grievances measures • Suitable Relocation Action Plan				
POST-MITIGATION				
Duration	Medium-term	As per pre-mitigation	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	As per pre-mitigation		
Intensity	Moderate - negative	The implementation of the mitigation measures will lessen the impact.		
Probability	Very likely	As per pre-mitigation		

8.4.1.13 Impact assessment: Community / farmer perceptions and responses

The communities in the area generally have no major problems with the proposed railway line, as they expect it will create employment opportunities and other social benefits in the area. However, significant concerns have also been raised about the possible negative impacts of the project. In particular, influx of construction workers and job seekers and concomitant social effects associated with the two.

While the potential impacts related to these effects were discussed earlier, they are mentioned here due to the fact that *community perceptions and concerns* regarding these effects may in themselves constitute a significant social impact. If community members believe that the project will have a negative effect on their lives – regardless of whether or not this perception is justified – they are likely to be extremely resistant to the proposed developments. This constitutes a source of social risk to the project, which should be addressed by allaying unjustified community fears regarding the project, and instituting appropriate mitigation measures to address realistic concerns.

The table below describes the impact regarding community / farmer perceptions and responses as well as recommended mitigation (or maximisation) measures.

Table 59: Impact description for the predicted community perceptions and responses

IMPACT DESCRIPTION: Community perceptions and responses				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Negative perceptions of the impacts of the project by the local communities will develop prior to and during the construction phase	Consequence: Slightly detrimental	Significance: Moderate - negative
Extent	Local	Localised impact		
Intensity	Moderate - negative	• Generally no major problems with the proposed upgrade, as communities expect it will create employment opportunities in the area • Concerns have been raised about the possible negative impacts of the project, in particular, influx of construction workers and job seekers and concomitant social effects, including air quality due to dust during construction		
Probability	Certain	If community members and farmers believe that the project will have a negative effect on their lives – regardless of whether or not this perception is justified – they are likely to be resistant to the proposed developments		
MITIGATION: • Involve communities and farmers continuously in the construction process • Continued communication • Implement mitigation measures that have been promised • Maintain a transparent approach to the EIA process • Provide for local employment				
POST-MITIGATION				
Duration	Short-term	Mitigation measures will allay the fears of the communities	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Local	Localised impact		
Intensity	Low - negative	Allaying unjustified community / farmer fears regarding the project will reduce the potential resistance to the project		
Probability	Fairly likely	Effective implementation of the mitigation measures will contribute to the change in attitude of the communities towards the project		

8.4.1.14 Impact assessment: Land use impacts and impacts on common property resources

There is a probability that the project will result in impacts on traditional land rights, occupations and production systems, it can as well result in increased and unsustainable utilisation of local natural resources. There may be a loss or reduction in existing land use, potential land use, access to or quality of natural resources on which communities / land owners depend now or in the future.

In the above sections it was indicated that 28 percent of households' main source of water is the rivers, and with a linear project like this it is bound to happen that some of the households will lose access to their primary water source. Furthermore it was earlier established that 95 percent of households had land under cultivation and when rural subsistence farmers are cut off from their livelihood it poses a big and complicated problem. Special investigations should be done to identify affected land owners, create access points and compensate affected parties appropriately.

Access to common property resources may be at risk with a linear project like this, access to water, grazing, hunting and fishing areas, timber and fuel wood, medicinal and herbal plants, craft materials and seasonal uses may be at threat. It is not just access to and availability of these communal resources that could be threatened but the construction phase may further pose an imminent risk to the quality of these resources especially water resources.

The table below describes the impact on land use and common property resources as well as recommended mitigation (or maximisation) measures.

Table 60: Impact description for the creation and sustainment of employment opportunities

<table>
<tr><th colspan="5">IMPACT DESCRIPTION: Land use impacts and impacts on common property resources</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long-term</td><td>Generation and sustaining of employment opportunities is the main concern for the communities surrounding the project area which will have long term downstream impacts on the economic activity of the area.</td><td rowspan="3">Consequence: Moderately detrimental</td><td rowspan="4">Significance: Moderate - negative</td></tr>
<tr><td>Extent</td><td>Local</td><td>Localised impact</td></tr>
<tr><td>Intensity</td><td>Low - negative</td><td>Salary and wages earned will mostly be spent in the vicinity of the affected area</td></tr>
<tr><td>Probability</td><td>Certain</td><td colspan="2">The project will generate jobs which will persit after the construction phase</td></tr>
<tr><td colspan="5">MITIGATION:
• See that the consumption of natural resources in construction phase is minimised.
• Construct enough access points
• Appropriately compensate of affected land owners.
• Put necessary measures in place to minimise or eliminate any pollution by project.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Medium-term</td><td>Using local employment for permanent jobs will contribute to the local economy</td><td>Consequence: Slightly detrimental</td><td>Significance: Low - negative</td></tr>
</table>

Extent	Local	Localised impact		
Intensity	Low - negative	Increased employment levels will increase local economy		
Probability	Very likely	Mitigation will further enhance the positive impacts of the project		

8.4.1.15 Summary of the predicted SIA impacts and recommendations

Based on the discussion presented in the previous sections, it can be concluded that many of the significant socio-economic impacts of the proposed Swaziland Railway Link project will occur during their *construction phase*.

Positive impacts include temporary and permanent creation of *employment opportunities* as well as associated economic benefits and possible creation of opportunities for local communities, sourcing of goods and services as well as anticipated positive impacts on local micro, small and medium enterprises.

Negative impacts include the potential influx of job seekers, creation of informal settlements, possible social pathologies arising from the influx of construction workers and job seekers, as well as increased traffic, damage to roads and impacts related to physical intrusion (dust, noise and vibration). Loss of access to communal resources such as water, grazing and fuel wood and displacement are other negative impacts related to the project.

The proposed Swaziland Railway Link project poses a number of potential positive and negative social impacts. The preceding tables show that a total of 13 socio-economic impacts were identified for the project, of these 5 are positive and 8 likely negative. With appropriate measures, the negative impacts can be reduced to acceptable levels or eliminated while the positive impacts can be maximised to provide significant benefits to the local communities, land owners and region. It will therefore be very important that all the mitigation measures are implemented according to the recommendations given, and to this end, it is anticipated that the probability of most negative impacts will be reduced. This is particularly relevant where construction activities phase could affect the quality of life of adjacent households in terms of access, noise, dust, safety and security.

In conclusion, procedures must also be put in place to monitor and evaluate implementation of these mitigation measures and to take corrective action where necessary.

8.4.2 Socio-economic assessment

Due to the nature of assessing the socio-economic impact the project might have on the environment, it is necessary to view the impact holistically. Therefore, the findings presented in this chapter are representative of the entire Swaziland Railway Link project, and not only for that of the Sandlane to Lavumisa railway line section. The complete specialist report can be found in Appendix B, Annexure H.

The capital investment in rail infrastructure for this project will boost the transport and export sectors in the respective economies. However, it will also have an immediate direct and indirect positive impact on the growth and development of South Africa and Swaziland. The economic impact analysis reveals a positive impact on major macro-economic variables such as Output, Gross Value Added (GVA), income and employment on the provinces of Mpumalanga and KwaZulu-Natal as well as Swaziland.

The impact evaluation uses economic multipliers from Social Accounting Matrices (SAMs). A SAM is a widely used tool to assess the macro-economic impact of changes in final demand induced by events such as large scale developments or shifts in policy.

In addition to the short-run implications of a large scale capital investment injection, the on-going operational expenditure effect on the provincial economies and Swaziland is estimated.

The static framework of the SAM will not be able to capture the structural changes occurring in subsequent years due to the construction of the rail link. The model only takes into account one particular shock to the system, while everything else is assumed to remain constant. Therefore the magnitude and direction of the response variables could have been cushioned or increased by other changes in the economy.

The CAPEX or investment is estimated at approximately ZAR19 billion. The terms CAPEX and investment are used interchangeably in this report but are identical. In order to understand how this shock will affect and filter through the respective economies it is important to understand how investments are recorded in the system of national accounts (SNA).

8.4.2.1 Capital investment expenditure

Investment in capital goods is the same as the concept of gross capital formation (GCF) in the SNA which includes produced capital goods (machinery, buildings, roads etc.). Gross capital formation measures the additions to the capital stock or the capacity to produce more goods and income in the future and is subdivided into gross fixed capital formation (GFCF) and changes in inventories.

GFCF includes all goods and services that can be used repeatedly for more than one year to produce other goods and services while changes in inventories include materials and supplies, work-in-progress, finished goods and goods for resale. Gross capital formation or capital investment is financed through savings by households, firms, government and foreign investment.

8.4.2.2 Gross domestic product

An economic impact is typically measured in terms of changes in labour income; employment; gross domestic product (GDP) or gross value added (GVA). Both GDP and GVA are measurements of final goods and services (output) produced within a region in a given period of time, serving as a measure of the size of a region's economy. GVA equals GDP plus taxes on products minus subsidies on products and is typically used for measuring gross *regional* domestic product of entities smaller than a whole economy.

GDP can be determined in three ways, all of which should, in principle, give the same result. They are the production approach, the income approach, and the expenditure approach. This study will use the production approach which calculates GDP as follows:

$$Total\ output\ by\ industries\ -intermediary\ inputs = GVA\ at\ market\ prices$$

$$GVA\ at\ market\ prices + taxes - subsidies = GDP\ at\ market\ prices$$

Capital projects create additional demands for labour, materials, technology etc. and increase production, both during construction phase as well as the operations. A macro-economic impact analysis evaluates and quantifies the effect of a capital project on the economy of a given area.

Imports of capital goods are excluded from the CAPEX estimates used in this study in order to isolate the effects on the local economy.

Economic multipliers from SAMs were used to estimate the effects of the capital project. Economic effects in terms of output, GVA, employment and income are calculated annually for the duration of the project period based on preliminary cash flow estimates. These annual estimates are then aggregated to give a lump-sum economic effect of the capital expansion for the duration of the project's construction phase as well as effects due to annual OPEX.

The estimated effects are based on the CAPEX and OPEX numbers, estimated at current 2013 prices, as reported in the FEL-2 study.

OPEX estimates used are the average cost of repairs and maintenance over the 24 analysis period for both rail and rolling stock.

8.4.2.3 Results of the assessment undertaken

The following sub-sections present and expand upon the applications and results of the analysis conducted. A separate analysis was done for each province, Mpumalanga and KwaZulu-Natal and for Swaziland. The CAPEX values were assigned to Mpumalanga, KwaZulu-Natal and Swaziland according to the three sections of the Swaziland Railway Link project, namely Mpumalanga, Swaziland and KwaZulu-Natal. Table 61 presents the CAPEX breakdown by work packages and regions.

Table 61 and Table 62 reflect the changes in final demand and were used as inputs for determining the macro-economic impact of CAPEX and OPEX.

CAPEX was apportioned to the respective provinces and Swaziland according to the cost breakdown per work package. Railway repair and maintenance (OPEX) were apportioned to the ratio of the rail track distances in the respective regions. Repairs and maintenance to rolling stock, locomotives and wagons, were apportioned to Mpumalanga and KwaZulu-Natal as no such activities are currently being performed in or planned for Swaziland.

Table 61: CAPEX of work packages assigned to Mpumalanga, Swaziland and KwaZulu-Natal

Location	Work Package	Description/ Start Location	Description/End Location	Primary Purpose
Mpumalanga	WP1A	Lothair	Nerston	New Link line
	WP2	Davel Yard and Connections		New Terminal, network links
	WP3	Davel Yard	Lothair	Line upgrade
Swaziland	WP1B	Nerston	Sidvokodvo	New Link line
	WP4	Sidvokodvo	Phuzamoya	Line upgrade (new line)
	WP5	Phuzamoya	Golela	Line upgrade (new line)
KwaZulu-Natal	WP6	Golela	Nsezi	Line upgrade (new line)

Table 62: Estimated capital expenditure (CAPEX) project values and imports (Current 2013 prices, Rand Million)

	Mpumalanga	Swaziland	KwaZulu-Natal	Total
Estimated Total Project Value	**4,965**	**7,850**	**6,344**	**19,159**

Domestic	**4,491**	**1,453**	**5,824**	**11,767**
Building & Construction	2,850	1,008	3,956	7,813
Mining & Quarrying	250	66	298	614
Manufactured goods	541	111	493	1,146
Wholesale & Retail Trade	9	1	-	10
Real Estate	71	43	183	297
Business Services	769	223	894	1,886
Imported Goods & Services	**474**	**6,397**	**520**	**7,392**

The loss of biological assets, forestry plantations and natural vegetation, due to expropriation and reclamation of land as well as the loss of production from such assets could be included in the CAPEX and OPEX changes in final demand, respectively. Such effects would reflect in negative changes in final demand due to reduced economic output.

Due to the lack of sufficient information regarding the quantum and value of the likely loss of biological assets, the effect was omitted from the analysis. Such reductions in final demand would lead to a marginal reduction in economic output and other metrics. It is possible to estimate the effects using the SAM multipliers.

8.4.2.3.1 Macro-economic impact results

The effects on total output associated with the total CAPEX as well as the annual effect of OPEX are summarised in and Table 63.

The output multiplier combines all direct, indirect and induced effects and shows the final increase in gross output of all the production activities. The output CAPEX ratio falls between 2.1 and 2.7 for both the provinces and Swaziland. Thus, for every one ZAR increase in CAPEX, output increases between 2.1 and 2.7 ZAR.

Table 63 represents the changes in GVA, in response to the projected capital expenditures. Similar to total output, KwaZulu-Natal experiences a greater effect on GVA than Mpumalanga and Swaziland. The gross value added is significantly lower than total output as it does not include all the intermediate consumption, inputs which are used in the production of final goods and services.

In addition, the gross value added portion in the form of factor payments to labour can be disaggregated by skills level. Representing the estimated effects as follow gives a sense of which skill groups are most likely to benefit from this capital project.

Table 63: Annual estimated total operational expenditure and capitalised operational expenditure (Current 2013 prices, Rand Million)

	Mpumalanga	Swaziland	KwaZulu-Natal	Total
Estimated total OPEX	**174**	**47**	**190**	**411**

Table 64: Macro-economic impact of CAPEX (Current 2013 prices, Rand Millions)

	Mpumalanga	Swaziland	KwaZulu-Natal	Total
Domestic CAPEX	**4,491**	**1,453**	**5,824**	**11,767**
Output	**9,443**	**3,938**	**15,622**	**29,003**
Gross Value Added	**2,199**	**1,024**	**4,064**	**7,287**

Labour	1,015	466	1,847	3,328
Skilled	300	187	740	1,227
Semi-Skilled	319	171	676	1,166
Unskilled	396	109	431	936
Capital	1,185	558	2,217	3,959
Income	**1,395**	**771**	**3,059**	**5,226**
Enterprises	450	225	894	1,569
Households	945	546	2,166	3,657
Low income	192	40	159	391
Middle income	232	120	477	829
High income	279	386	1,530	2,194
Employment creation	**14,910**	**9,415**	**16,513**	**40,838**

Unskilled and semi-skilled workers in all the regions will receive more than half of the increase in factor payments in the form of wages, to the equivalent of ZAR715 million in Mpumalanga, ZAR279 million in Swaziland and ZAR1.1 billion in KwaZulu-Natal. Factor payments to skilled workers will increase by ZAR300 million in the Mpumalanga, ZAR187 million in Swaziland and ZAR740 million in KwaZulu-Natal.

Annual employment effects during the construction period were estimated by using the assumed cash flows adjusted for imports. Retention of labour in subsequent years is incorporated. As labour demand increases with increased capital expenditure, it is assumed that 80 per cent of the previous year's labour would be retained. Employment created during a period is the difference between the total demand for labour and the retained labour from the previous period. More than 40 000 jobs could be created across all three regions during the construction phase of the project. This is not a reflection of permanent employment changes for the permanent residents but merely reflects the increases employment needed for the rail component construction located in each region. In addition, labour demand does not solely pertain to the unemployed but also includes people moving from one sector to the next. Employment at all levels is an increasing function of the total project value. KwaZulu-Natal experiences the greatest effects on employment.

The income effect focuses on the factor payments that are destined for Mpumalanga, Swaziland and KwaZulu-Natal households and enterprises, permanently based in the respective provinces. The income multiplier measures the additional income generated by households and institutions due to additional direct and indirect production activity. The size of the multiplier effect will depend on the structural features of the economy such as the component of domestically produced goods and the share of tradable and non-tradable goods in the consumption basket as well as the share of factor income actually received by households. The greater the import component of domestic consumption the greater the sum of funds not spent in the local economy. This is referred to as an import leakage which will decrease the multiplier effect

The income effect is much smaller than the gross valued added effect as a large portion of the wages and capital payments are accrued by enterprises and individuals residing outside of the provinces reflecting there leakages towards other provinces and abroad. Potential import leakages for the regions can be quite significant as the factors of production namely labour may not reside or spend their income in the province of interest. In addition, taxes and savings will decrease household disposable income and ability to purchase locally produced goods.

Income can be disaggregated by income group which gives a sense of which income groups are most likely to benefit from this capital project. High income earners in KwaZulu-Natal stand to gain much more relative to the other income groups. In Mpumalanga and Swaziland the income effect seems to be more balanced.

Table 65 represents the effects from the annual OPEX. Output increases substantially for all three regions whilst the change in GVA is relatively small, especially in Mpumalanga and KwaZulu-Natal. The annual labour demand for the on-going operations and maintenance amounts to 935 jobs.

Table 65: Macro-economic impact of annual OPEX (Current 2013 prices, Rand Millions)

	Mpumalanga	Swaziland	KwaZulu-Natal	Total
Annual OPEX	**174**	**47**	**190**	**411**
Output	**245.6**	**146.8**	**473.3**	**865.6**
Gross Value Added	**27.4**	**35.7**	**88.6**	**151.7**
Labour	13.1	17.1	40.6	70.7
Skilled	3.8	6.6	15.8	26.2
Semi-Skilled	4.1	6.3	15.0	25.4
Unskilled	5.2	4.2	9.8	19.2
Capital	14.3	18.6	48.0	80.9
Income	**17.5**	**27.0**	**65.1**	**109.6**
Enterprises	5.4	7.5	18.4	31.3
Households	12.0	19.5	46.8	78.3
Low income	2.4	1.5	3.5	7.4
Middle income	2.9	4.5	10.5	17.9
High income	3.7	8.0	19.0	30.7
Employment creation	**247**	**324**	**364**	**935**

The tables below describe the impact for macro-economic CAPEX and OPEX as well as proposed mitigation measures.

Table 66: Impact description for the regional macro-economic CAPEX

IMPACT DESCRIPTION: Macro-economic CAPEX Regional				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Generation and sustaining of employment opportunities is the main concern for the communities surrounding the project area which will have long term downstream impacts on the economic activity of the area.	Consequence: Moderately beneficial	Significance: Moderate - positive
Extent	Regional	Localised impact		
Intensity	High - positive	Salary and wages earned will mostly be spent in the vicinity of the affected area		
Probability	Very likely	The project will generate jobs which will persist after the construction phase		

MITIGATION: Maximise local employment opportunities through training and capacity building.				
POST-MITIGATION				
Duration	Short-term	Using local employment for permanent jobs will contribute to the local economy	Consequence: Negligible	Significance: N/A
Extent	Site-specific	Localised impact		
Intensity	Very low	Increased employment levels will increase local economy		
Probability	Very unlikely	Mitigation will further enhance the positive impacts of the project		

Table 67: Impact description for the local macro-economic CAPEX

IMPACT DESCRIPTION: Macro-economic CAPEX Local				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Short-term	Creating employment will increase the spending regime in the area. Long term jobs will persist for the life span of the project	Consequence: Moderately beneficial	Significance: Moderate - positive
Extent	Local	The project could also have fiscal impacts. Payment of business and personal tax could contribute to government revenue at a national level, while rates and payment for services could strengthen the income base of the district and local municipalities		
Intensity	High - positive	Local expenditure by employees will have multiplier effects in various sectors of the economy, thereby stimulating business activity and further employment creation		
Probability	Very likely	Increased employment levels will contribute to the economy		
MITIGATION: N/A				
POST-MITIGATION				
Duration	Short-term	Increased levels of employment will persist for the duration of the project	Consequence: Negligible	Significance: N/A
Extent	Site-specific	As per pre-mitigation		
Intensity	Very low	As per pre-mitigation		
Probability	Very unlikely	As per pre-mitigation		

Table 68: Impact description for the regional macro-economic OPEX

IMPACT DESCRIPTION: Macro-economic OPEX Regional				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		

PRE-MITIGATION				
Duration	Long-term	Creating employment will increase the spending regime in the area. Long term jobs will persist for the life span of the project	Consequence: Moderately beneficial	Significance: Moderate - positive
Extent	Regional	The project could also have fiscal impacts. Payment of business and personal tax could contribute to government revenue at a national level, while rates and payment for services could strengthen the income base of the district and local municipalities		
Intensity	Low - positive	Local expenditure by employees will have multiplier effects in various sectors of the economy, thereby stimulating business activity and further employment creation		
Probability	Very likely	Increased employment levels will contribute to the economy		
MITIGATION: N/A				
POST-MITIGATION				
Duration	Short-term	increased levels of employment will persist for the duration of the project	Consequence: Negligible	Significance: N/A
Extent	Site-specific	As per pre-mitigation		
Intensity	Very low	As per pre-mitigation		
Probability	Very unlikely	As per pre-mitigation		

9 CONCLUSIONS AND RECOMMENDATIONS

The project is currently fast-tracked to an aggressive completion programme. By virtue of its international nature, cohesive and wide-ranging inter-governmental co-operation remains one of the key pillars to success. The creation of a strategic link between South Africa and the export Ports of Richards Bay and Maputo, through Swaziland, has been found to be technically feasible, with certain risks attached.

Two possible corridors are proposed and the potential impact of the construction of the railway line on the environment needs to be assessed in terms of the process prescribed by the Environmental Management Act, 5 of 2002.

Network upgrades

The additional demand on parts of the network brought about by increase in traffic volume from sources other than Mpumalanga and central Gauteng in South Africa make upgrades of the network a critical planning driver. Expected Limpopo (RSA) traffic is a major contributor to demand capacity on the southern section of the corridor. This refers particularly to the Phuzumoya-Nsezi section which has the addition of growing North-South line traffic to deal with. This fact should not be permitted to cloud or delay the original strategic intent, namely, to create a new rail link between Swaziland and South Africa.

In summary:

- The project is an international venture and therefore includes activities within both Swaziland and South Africa.
- The upgrade of the existing rail network from Davel to Lothair and from Sidvokodvo to Nsezi is key to the project feasibility, reflected in the viability of the new link section;
- Certain network upgrade activities equal or even surpass the new link in length and scope of civil works required. This is particularly true in respect of the section Sidvokodvo-Phuzumoya to Nsezi;
- Critical infrastructural elements are introduced under route upgrades, including:
    - Davel Yard. Penultimate Work Package, due to long term nature of load consolidation, but will be required for 200 wagon functionality;
    - New line between Breyten and Buhrmanskop, including links for existing and future traffic access and major level crossing elimination benefit;
    - New junctions at Lothair and Phuzumoya; and
    - New line between Sidvokodvo and Nsezi, (excluding Pongola River bridge and Mtubatuba tunnel) creating bypass lines at the towns of Golela, Mtubatuba and Hluhluwe.
- Public level crossings will be eliminated where possible;
- Upgrades can be achieved with minimum disruption to current operations; and
- The line between Buhrmanskop and Lothair will need to be closed for the commodities originating from Lothair will need to be transported by road to Buhrmanskop.

The above, notwithstanding that there are many planning and construction aspects (activities) and many areas of environmental concern attached to the project.

These arise by virtue of:

- The topography of the area, linked to stringent route geometry factors required to meet the design criteria for heavy haul operations as planned.
- The magnitude of earthworks required (high banks and deep cuttings) as well as the number and size of structures involved.
- The rural nature of large sections of the route, environmentally sensitive land use (forestry, subsistence farming) and long linear impact on riverine / floodplain farming and land use.
- Point-type areas of impact.
- The impact on human settlement, particularly the rural settlement patterns prevailing in the Swaziland section of the new link line.
- The successful conclusion of the EIA process, culminating in Authorisations valid in each of the Partner States is critical to the viability of the Project, timeous commencement of the Works and commencement of train operations according to the agreed programme in the 2nd Quarter of 2017.
- The EIA process will be complex from management and technical perspectives and exhaustive in extent by virtue of:
    - The multinational nature of the project;
    - Complexities inherent in differing legal and governance requirements per Partner State; and
    - The sensitive bio-physical and social setting of the project.

Other permitting processes must not be overlooked in the need to obtain environmental approval under the respective country regulations. Factors such as the need for water use or borrow pit licences need to be clarified as soon as possible, since these processes can be extensive.

At this stage the direct labour force could reach 2 180 units, with a potential value of ZAR 2 080 million. This comprises labour components of both construction activities as well as material supply. The Swaziland / RSA split is estimated at approximately 45% / 54%. Viewed as an on-going project, the estimated annual labour budget to operate the corridor amounts to ZAR 115 million. This comprises direct personnel in the fields of Movement, Train Control and Yard functions, as well as Rolling Stock and Infrastructure maintenance.

The “Equator Principles” established by the Equator Principles Financial Institutions are described for applicability to the project. Visible compliance to this set of voluntary guidelines for the financing industry in assessing environmental and social risks is a prerequisite for funding and investment purposes.

9.1 Recommendations

Taking into account the mitigation measures proposed by the specialist as well as those contained in the CMP, the EAP is of the opinion that the potential impacts posed by the proposed development can be adequately mitigated to alleviate possible detrimental impacts to the environment. The Authority is reminded that, as described in Chapter 8, **many of the mitigation measures proposed by the specialists in their various reports were found to be totally unfeasible** to implement and were therefore out-motivated in Chapter 8. **The feasible mitigation measures as well as alternative mitigation measures are captured in the CMP.**

It is therefore recommended that the SEA considers the Environmental Assessment Report and issues an Environmental Certificate to Swaziland Railway to proceed with the construction of the railway line and associated infrastructure.

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Appendix A

Curriculum Vitae of the Environmental Assessment Practitioners

Addendum A: Dr Pieter Botha

Addendum B: Candice Dürr

Addendum C: Steve Mitchell

Appendix B
Specialist input reports

Annexure A: Ecological report

Annexure B: Geohydrological report

Annexure C: Hydrological report

Annexure D: Social Impact Assessment

Annexure E: Air Quality report

Annexure F: Noise and vibration report

Annexure G: Cultural / Archaeological report

Annexure H: Socio-economic assessment

Annexure I: Plan of Study for EIA

Appendix C
Public Participation documents

Annexure A: Scoping meeting Bhunya

Annexure B: Scoping meeting Luyengu

Annexure C: Scoping meetings Siphofaneni & Nkilongo

Annexure D: Issues and Response Report

Appendix D
Communication with SEA

Annexure A: SEA approval of the Scoping Report

Appendix E
Comprehensive Mitigation Plan

Appendix F
Waste Management Plan