aurecon

The Proposed Upgrade and new Construction related to the Development of the Swaziland Rail Link Project from Sandlane to Lavumisa

Comprehensive Mitigation Plan

Reference: 109578

Prepared for: Swaziland Railway

Revision: 1

1 April 2014

Document control record

Document prepared by:

Aurecon South Africa (Pty) Ltd
4 Daventry Street
Lynnwood Bridge Office Park
Lynnwood Manor
0081

T +27 12 427 2235
F +27 86 556 0521
E Candice.Durr@aurecongroup.com
W www.aurecongroup.com

A person using Aurecon documents or data accepts the risk of:

a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
b) Using the documents or data for any purpose not agreed to in writing by Aurecon.

Document control						aurecon
Document ID		109578/SWL/CMP	**Project number**		109578	
File path		**P:\Projects\109578 EIA Process for Swaziland Rail Link\Environmental\Swaziland EIA process\CMP**				
Client		Swaziland Railway	**Client contact**		+27 11 308 3000	
Rev	**Date**	**Revision details/status**	**Prepared by**	**Author**	**Verifier**	**Approver**
0	**11 March 2014**	Draft CMP	C Durr	C Durr	Dr P Botha	B Smit
1	**1 April 2014**	CMP (Swazi comments)	C Durr	C Durr	Dr P Botha	B Smit
Current Revision		**1**				

Approval			
Author signature		Approver signature	
Name	Candice Dürr	Name	Barend Smit
Title	Environmental Scientist	Title	Technical Director

The Proposed Upgrade and new Construction related to the Development of the Swaziland Rail Link Project from Sandlane to Lavumisa

Date 1 April 2014
Reference 109578
Revision 1

Aurecon South Africa (Pty) Ltd
4 Daventry Street
Lynnwood Bridge Office Park
Lynnwood Manor
0081

T +27 12 427 2235
F +27 86 556 0521
E Candice.Durr@aurecongroup.com
W www.aurecongroup.com

Contents

Figures

Tables

1 CONTEXT AND INSTITUTIONAL MATTERS

1.1 Background to the project

AURECON South Africa (Pty) Ltd, a leading consulting engineering and environmental firm both locally and internationally, was appointed by Transnet (in collaboration with Swaziland Railway) to assist in the compilation of the required Comprehensive Mitigation Plan (CMP) and to submit the plan to the Swaziland Environmental Authority (SEA) for acceptance after which it will form part of the environmental obligations of Swaziland Railway and its appointed contractors during the construction phase of the project.

Swaziland Railway in collaboration with Transnet 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 (Figure 1). 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 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.


Hendrina
Carolina
Kriel
N11
Breyten
Chrissiesmeer
Warburton
Lochiel
Malolotja Nature Reserve
Hartebeeskop
KaDake
Mbabane
Mawula Nature Reserve
Hlane Royal National Park
SWAZILAND
N17
BETHAL
Davel
Lothair
Siteki
Milwane Game Sanctuary
Manzini
Bhunya
Proposed New Rail Line (Option 1)
Proposed New Rail Yard
Existing Rail Line
Amsterdam
Sidvokodvo
Proposed New Rail Line (Option 2)
Morgenzon
Sheepmoor
N2
Big Bend
MPUMALANGA
SWAZILAND
Ndumo Nature Reserve
Tembe Elephant Park
Ndumo
Amersfoort
PIET RETIEF
Hlathikhulu
Existing Rail Line
Mahamba
Nhlangano
Ingwavuma
Perdekop
Dirkiesdorp
VOLKSRUST
Wakkerstroom
Pongola
Vrede
Paulpietersburg
Jozini
Groenvlei
Ithala Game Reserve
Magudu
Louwsburg
Mkuze
Greater St Lucia Wetland Park
Memel
Utrecht
Hlobane
Madadeni
Ozizweni
Verkykerskop
Kingsley
Nongoma
Normandien
Dannhauser
eMondlo
Gluckstadt
Hluhluwe
KWAZULU-NATAL
Hlabisa
GLENCOE
Nqutu
Mahlabatini
Hluhluwe-iMfolozi Park
Wasbank
Ulundi
Babanango
St Lucia Estuary
Mtubatuba
River View
Helpmekaar
Geluksburg
Pomeroy
Melmoth
Qudeni
Nkandla
Kwa Mbonambi
Nseleni
Bergville
N3
Colenso
Tugela Ferry
Nkwalini
Empangeni
Winterton
Jameson's Drift
RICHARDS BAY
Weenen
Keate's Drift
Richards Bay Nature Reserve
Frere
Weenen Nature Reserve
Eshowe
Loskop
aurecon
Scale 1 : 1 600 000

1.2 Project locality

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.

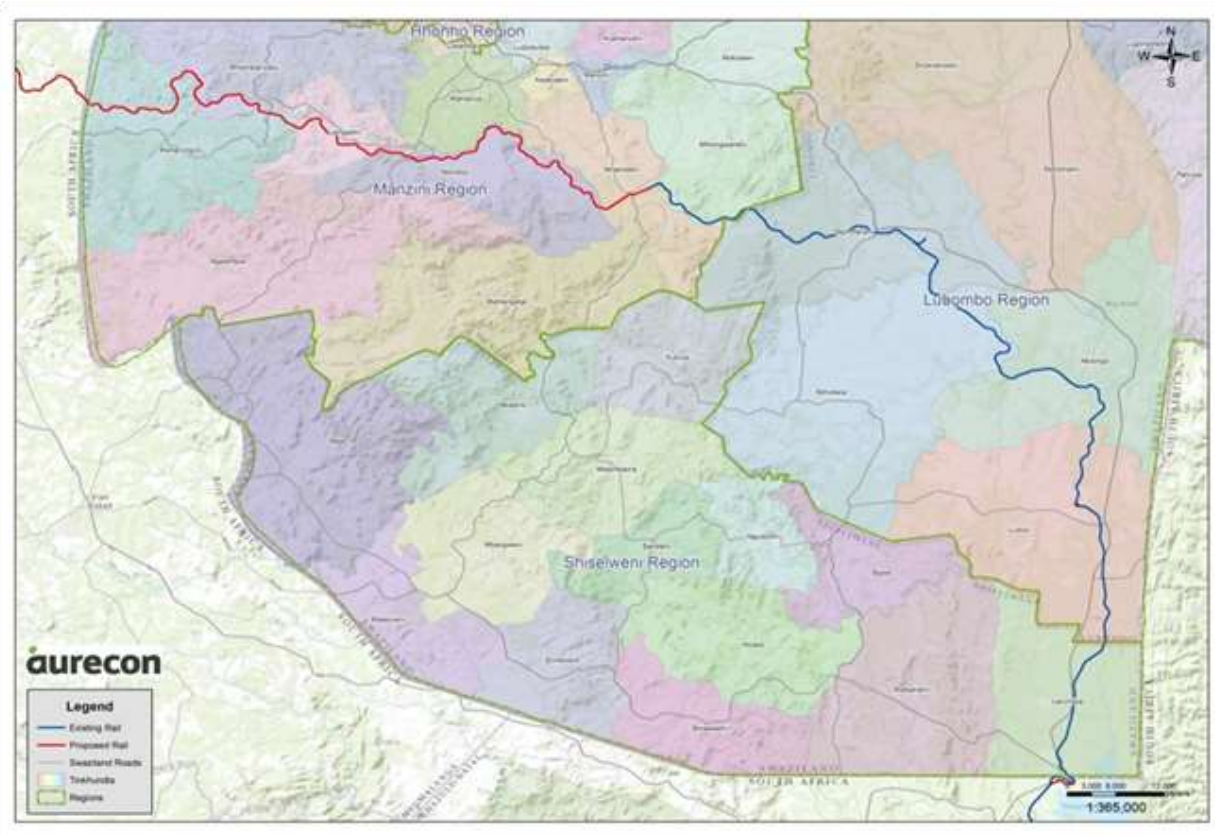

Figure 2: Regions affected by the proposed development – the red line indicates the new link line proposed to be constructed. The blue line indicates the proposed upgrading of the existing railway line.

1.3 Purpose of this document

The purpose of this document is to provide guidelines for environmental best practice to the proponent and its contractor commissioned to construct the proposed railway line. This document shall be seen as part of the contract. **The CMP will thus be part of the enquiry document to make the recommendations and constraints, as set out in this document, enforceable under the general conditions of contract.**

The CMP has a long-term objective to ensure that:

1) Environmental management considerations are implemented from the start of the project,
2) Precautions against damage and claims arising from damage are taken timeously, and

3) The completion date of the contract is not delayed due to problems with landowners arising during the course of construction.

Swaziland Railway requires a commitment from the project manager and contractor on the following issues:

1) *Take into consideration the surrounding landowners as the railway line traverses private property.*
2) *Always behave professionally on and off site.*
3) *Ensure quality in all work done, technical and environmental.*
4) *Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations.*
5) *To underwrite Swaziland Railway's Environmental Policy at all times.*
6) *To use this CMP for the benefit of all involved.*
7) *To preserve the natural environment by limiting destructive actions on site.*

Environmental input into tender drafting and adjudication:

It must be ensured that relevant environmental management specifications as contained in the CMP are incorporated into the tender and contract documentation. Relevant payment items must be incorporated into the bill of quantities. During the tender evaluations, the ability of the possible contractors to adequately manage the environmental issues must be assessed.

1.4 Legislative context

1.4.1 National requirements

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.

1.5 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.

1.6 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.

In section 9 the Swaziland Environment Authority is established and its functions are 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) 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 32(8) describes the information required to be included in the CMP as:

- a description of the mitigation measures that will be implemented in order to prevent, reduce or otherwise manage the environmental effects of a project;
- how these measures will be implemented; and
- any other information prescribed by the Minister.

1.6.1 Other applicable legislation

1.6.1.1 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.

1.6.1.2 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 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.

1.6.1.3 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.

1.6.1.4 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.

1.6.1.5 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.

1.6.1.6 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."

1.6.1.7 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 human settlement development plans, the revocation or modification of development plans and finance mechanisms for the supply and maintenance of improved shelter and infrastructure.

1.6.1.8 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.

1.6.1.9 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.

1.6.1.10 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.

1.6.1.11 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.

1.6.1.12 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; section11 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.

1.6.1.13 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.

1.6.2 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 3 in accordance with these regulations. The depth of study and reporting format are in accordance with the regulations.

1.6.3 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 ROLES AND RESPONSIBILITIES

2.1 Environmental Control Officer

The Environmental Control Officer (ECO) is the independent person responsible for monitoring of the implementation of the CMP. The ECO must be suitably qualified in the environmental sciences and management and have adequate construction site experience of monitoring and auditing the implementation of a CMP. The ECO may not be appointed by the Contractor, and will report to Swaziland Railway. The ECO has the authority to stop any works if, in his/her opinion, there is or may be a serious threat to or impact on the environment, caused directly by the contractor's actions or activities during the construction phase. In all such work stoppage situations the ECO is to inform the Contractor and Project Manager of the reasons for the stoppage within 24 hours. All ECO reports will be sent on a monthly basis to Swaziland Railway to keep abreast of compliance on site. The project's environmental authorisation may require that ECO reports be provided to the SEA.

Upon failure by the Contractor, or his employees, to show adequate consideration to the CMP, the ECO may recommend to the Project Manager to have the Contractor's representative or any employee(s) removed from the site, or work suspended until the matter is resolved.

2.1.1 Environmental Monitoring Committee (EMC)

Swaziland Railway is to ensure the establishment of an Environmental Monitoring Committee (EMC) for the project, with at least one meeting to be held on a six-weekly basis in Swaziland. The venue is to be agreed upon between the committee members. Interested and affected parties, directly affected neighbouring landowners and representatives from the SEA (should they wish to attend) must be invited to attend the meetings. Swaziland Railway employees and all environmental officers and managers on site must be included as committee members. The EMC meetings are to be considered formal meetings, including environmental progress presentations from the Swaziland Railway environmental manager and ECO. All stakeholders involved must be given a fair and equal opportunity to comment or raise queries and concerns regarding the environmental management status of the project.

2.2 Engineer

The Engineer responsible for the design of the railway lines and yard will be a Swaziland Railway appointment. It will be the responsibility of the engineer, together with the project manager to oversee the overall implementation of the project as well as the compliance of the CMP and incorporate any potential environmental aspects mentioned into the design.

2.3 Contractor

As part of being responsible for the construction of the proposed railway line, the contractor will also be responsible for the overall implementation of the CMP. The contractor will nominate a suitably qualified representative on site as his environmental representative, known as the Contractor's

Environmental Control Officer (CECO). The contractor must issue site instructions to rectify any environmental non-compliance, based on the CECO's findings.

2.4 Contractor's Environmental Control Officer (CECO)

The CECO will be responsible, on behalf of the contractor, to ensure that the CMP is implemented and complied with on site on a daily basis. The CECO will liaise with the ECO (see Figure 3) in all matters relating to the implementation of the CMP. The CECO needs a certain amount of environmental management experience in the field and preferably experience on large linear construction sites.

2.4.1 Environmental awareness on site

Prior to construction, all contractor teams involved in work on the project are to be briefed on their obligations towards environmental controls and methodologies in terms of this CMP. It is recommended that the briefings take the form of an on-site talk and demonstration by the CECO. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. All new employees arriving on site shall undergo this training. Environmental induction must be done and must include all aspects of the site specific CMP.

Toolbox talks are to be used as a tool for continuous training of employees and must be conducted on a weekly basis. Toolbox talks must be conducted in an interactive way as to ensure the employees understand the content and purpose of the specific CMP requirements.

As construction continues, an effort must be made by the Contractor to assess the training needs of workers on site. Cognisance must be given to the specific work to be undertaken at the time and, if necessary, additional training on environmental requirements must be conducted to ensure all workers understand the risks involved as well as how to adequately implement mitigation measures.

A signed register documenting all employees' environmental training and awareness programmes must be kept on record for verification purposes.

2.4.2 Record keeping

The CECO is responsible for maintaining all records in relation to the CMP requirements on site. Such records must be made available to the ECO on request during the monthly audits, as well as at any time as requested by the ECO, auditor or project managers. Record keeping must be done in an orderly fashion with the intent of ensuring easy reference.

2.5 Organisational and Institutional arrangements

Any changes to the CMP must be communicated in writing to the SEA within the timeframes as stipulated in the Environmental Compliance Certificate (ECC). A provisional reporting and communications structure is indicated in Figure 3 below.

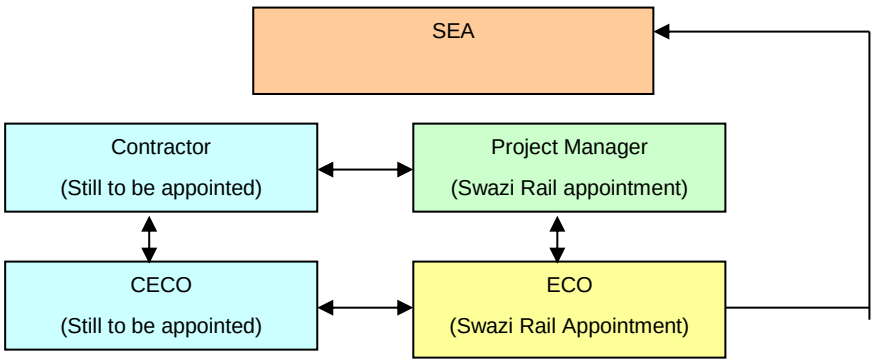

Figure 3: Proposed organisational and reporting structure

2.6 Monitoring and auditing framework

2.6.1 Monitoring programme

The purpose of the monitoring programme is to ensure that mitigation measures identified and described in the CMP are implemented. Construction activities of the railway line will be monitored and recorded by the ECO and audited against the CMP on a monthly basis. A report must be submitted at the end of each month prior to the progress meetings where they will form part of the agenda. The ultimate target is to achieve 100% compliance with the CMP.

2.6.2 Penalties

The Contractor will comply with the environmental management requirements of this CMP on an ongoing basis, any failure on their part to do so will entitle the project manager, in consultation with the ECO to certify the imposition of a non-conformance with associated defects penalty. The value of the penalty will be agreed between the PM and ECO based on the nature, extent and duration of the offence and subsequent environmental damage. Such penalties shall be payable in addition to any remediation costs for correction of environmental damage as a result of non-compliance to this CMP, that will also be for the contractor's account. Time penalties may also be awarded by the contract's manager where the contractors do not comply. These details are to be included into the contracts.

Note that the following is applicable:

- Where a contractor causes damage, Swaziland Railway can either enforce a penalty or make the contractor make good the damage, but not both.

The contractor is deemed NOT to have complied with this specification if:

- Within the boundaries of the site, site extensions and access roads there is evidence of contravention of the requirements of the CMP,
- Environmental damage ensues due to negligence,
- The requested recordkeeping as stated in the CMP is not available,
- The contractor fails to comply with corrective or other instructions issued within a specific time,

- The contractor fails to comply with a site instruction given by the project manager based on the ECO report.
- The contractor fails to respond adequately to complaints from the public,
- Legal action is instituted against the proponent in terms of environmental laws.

Payment of any fines in terms of the contract will not absolve the offender from being liable from prosecution in terms of any other law.

3 DESCRIPTION OF ACTIVITIES

The activities that are going to be undertaken involve, but are not limited to:

3.1 Pre-construction and construction phase

3.1.1. Pre-construction

- Establishment of the contractor's camp and laydown areas;
- Survey controls;
- Preliminary geotechnical investigations;
- Protection of archaeological sites
- Vegetation/ faunal search and rescue (as applicable);
- Resettlement of affected communities/ landowners;
- Staff procurement, induction and training;
- Establish fuel storage and dispensing sites;
- Establish stores for explosives;
- Establish water supplies (abstraction, local connections, etc.);
- Fencing;
- Establish basic assess roads (to camp(s) and site)

3.1.2. Construction

- Clearing the proposed site of vegetation;
- Removal and stockpiling of topsoil;
- Fencing of the construction sites;
- Personnel conduct;
- Storage of hazardous material;
- Batching sites (if used);
- Handling and disposal of construction waste; and
- Construction of earthworks:
    - Embankments;
    - Cuttings;
    - Borrow pits;
    - Spoil heaps;
- Construction of structures and drainage:
    - Major structures: bridges and viaducts;
    - Road/ rail structure;
    - Rail/ Rail structures;
    - Access structures/ culverts;

    - Drainage structures;
    - Track (perway) construction;
- Construction of tunnels;
- Roads and fencing;
- Railway engineering – signalling and telecommunications.

3.2 Rehabilitation

The rehabilitation plan is attached to the CMP as Appendix A and deals with the following aspects:

- Removal/decommissioning of contractor's camp;
- Removal of all construction, hazardous and domestic waste;
- Rehabilitation of the disturbed areas as a result of construction works.

4 SUMMARY OF IMPACTS AND ASSOCIATED MITIGATION MEASURES

The following table covers the construction activities and associated environmental impacts that will occur during the construction of the railway line and associated connections.

The table considers the expected impacts on-site during the different phases of the project, as well as the mitigation measures and environmental management procedures required to manage the expected impacts. The following sections are dealt with in the table:

Section 5 : Pre-construction and construction site environmental management

Section 6 : Materials

Section 7 : Waste

Section 8 : Surrounding land

Section 9 : Flora & fauna

Section 10 : Air Quality

Section 11 : Water

Section 12 : Noise

Section 13 : Archaeological and Heritage sites

Section 14 : Planning and engineering

Appendix A : Rehabilitation

5 PRE-CONSTRUCTION AND CONSTRUCTION ENVIRONMENTAL MANAGEMENT

Table 1: Impacts and mitigation table

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
5.1 Engineering design	All the aspects listed in the CMP	Design incompatible with environment	**Objective:** To ensure the design of the railway line takes into account the environment. **Target:** • Assimilate requirements of the CMP in the design and construction management. • During the walk down of the approved corridors Swaziland Railway shall ensure that a suitably qualified person physically pegs out/marks all sensitive areas identified within the corridors. This information must be consolidated into a map with exclusion zones. These exclusion zones must be avoided where and the associated infrastructure and construction activities must be kept outside these areas (unless otherwise permitted/licensed).	Design meets objectives and does not degrade the environment	Engineering Design Consultant	Contract and allowance in P&G's	During Tender Design & Design Review Stage	Engineering design consultant	Design Phase
5.2 Establishment of the construction camp sites	Construction camp	Damage or loss of existing vegetation and changes to the area's water quality	**Objective:** To prevent negative influence to the surrounding surface and groundwater. **Target:** • Site establishment shall take place in an orderly manner and all amenities shall be installed at camp sites before the main workforce move onto site • A method statement is required from the contractor at appointment stage that includes the layout of the camp, management of ablution facilities and	Construction camp established in compliance with objectives.	Contractor, CECO.	Contract and allowance in P&G's	Pre-construction, Establishment of Site	ECO	Once off

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			wastewater management • The planning and design for the construction camp must ensure that there is a minimum impact on the environment. • A site plan of the construction camp must be provided indicating waste areas, storage areas and placement of ablution facilities. • The contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction. • The contractor shall supply a wastewater management system that will comply with legal requirements and be acceptable to Swaziland Railway. • Where Swaziland Railway facilities are available the contractor shall make use of such facilities where it is viable and possible. • The contractor shall inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. • The contractor shall supply waste collection bins where such is not available and all solid waste collected shall be disposed of at a registered waste dump • A certificate of safe disposal shall be obtained by the contractor and kept on file. • Where a registered waste site is not available close to the construction site, the contractor shall provide a method statement with regard to waste management. Under no circumstances may solid waste be burned on site. • The construction camp must be placed on already disturbed land as far as possible. • The construction camp should be fenced off so as to limit the removal of unnecessary vegetation. • Fences and security access must be maintained, throughout the project. • All fences removed to facilitate access will be replaced by the contractor once machinery and personnel have been removed from the site to the satisfaction of all the relevant landowners.						

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• Emergency and contact numbers of the contractors must be available and prominently displayed on a signage board that is clearly visible.						
5.3 Establishment of the construction camp site	Construction camp	Loss of soil fertility.	**Objective** The environmental objective when establishing the contractor's camp is to minimise the footprint of disturbance thereby preventing the degradation and loss of topsoil. **Target:** • Allowance for a contractor's camp site per principal contractor must be made. Care must be taken to ensure camps are located away from residential/community areas. However, where existing buildings and houses can be used as contractors camps this must be done. • Where no existing buildings/houses are available, the construction camp site shall be strictly within the project working area (i.e. 75m). • Once the site has been cleared of vegetation, the topsoil should be stripped. • Topsoil must be stored in a demarcated area which is protected from wind and rain. • The topsoil stockpiles must not exceed 2m in height. • The area must be rehabilitated once the construction camp has been decommissioned.	Established construction camp in compliance with objectives and no evidence of environmental degradation	Contractor, CECO.	Contract and allowance in P&G's	Pre-construction, Establishment of Site	ECO	Once off
5.4 Closure of the construction camp	Construction camp.	Potential impacts associated with the closure of the construction camp	**Objective(s):** To limit potential impacts on the environment for the period for which the construction camp is closed. **Target :** Should the construction camp be closed for a period of more than one week, a report on compliance will be lodged with the contractor, engineer and project manager confirming the following:- • No persons allowed on site other than project employees;	Closure of the construction camp in line with the requirements of the CMP.	Engineer, Contractor and CECO	Contract and allowance in P&G's	Closure of camp	Engineer ECO	Whenever the construction camp is closed for longer than a week.

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• Minimal materials are stored; • All waste disposal bins will be emptied periodically. • Materials are stored in leak-proof, sealable containers or packaging; • The store area is secure and locked; • Fire extinguishers are serviced and accessible; • The area is secure from accidental damage through vehicle collision, etc.; • Emergency and contact numbers of the contractor are available and prominently displayed; • All stores are secured; • Chemical toilets are empty, kept hygienically clean and secured; • 24 hour security will be on site during this period. • All trenches are barricaded with danger tape.						
5.5 Storage of topsoil	Stripping and stockpiling of topsoil.	Mixing of topsoil and subsoil. Erosion of topsoil. Contamination of top soil. Dust.	**Objective(s):** Topsoil is conserved, maintained and reused. **Target :** • The topsoil in the specific region is regarded as the top 300 mm (maximum) of the soil profile irrespective of the fertility appearance or physical depth, unless otherwise confirmed by the ECO. • Topsoil is to be stripped up to this depth when it is in as dry a condition as possible in order to prevent compaction. • The topsoil, including the existing grass cover is to be shallowly ripped (only the depth of the topsoil) before removal. This is to ensure that organic plant material, and the natural seed base is included in the stripping process. • Stockpiles shall not be allowed to become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation. • The contractor shall apply soil conservation measures to the stockpiles to	All targets are met for the storage of topsoil.	Contractor, CECO.	Contract and allowance in P&G's	Pre-construction, Establishment of site. Ongoing maintenance of topsoil stockpiles on site.	ECO	

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			prevent erosion. This could include the use of erosion control fabric or grass seeding. The use of berms must be considered to prevent the topsoil from washing away during rainy periods. • All grass and other vegetation should be left on the topsoil stockpiles so that they colonize the area after construction. • Photographic record must be kept of the topsoil stockpiles. • Topsoil stockpiles must be placed on disturbed soil. Should no such area be available, the ECO is to advise on the laydown area for the stockpiles in each section. • Dust and erosion of topsoil from runoff must be minimised through appropriate watering and the avoidance of transporting and placing of topsoil in areas exposed to high wind or excessively rainy conditions. • The contractor shall devise a soil conservation and stockpiling plan, to be approved by the ECO and engineer, which shall detail:- o Stockpile sizes, laydown areas and form; o Means of erosion (wind and water) prevention for stockpiles; o The rehabilitation measures to be taken for the area occupied by the temporary stockpile; o A generic schedule of soil replacement for areas where work has been completed. Soil replacement should preferably run in parallel (where feasible) with the construction process; o Soil erosion prevention measures for general site use. • Alien vegetation growing on stockpiles must be eradicated. • Herbicides shall not be used to remove alien vegetation unless approved by the ECO.						
5.6 Construction of site buildings	Site buildings materials	Soil pollution and permanent alteration to the natural environment.	**Objective(s):** To ensure the material for site buildings are recyclable and to minimise the impacts of the construction of the buildings on the environment.	On site buildings constructed according to the requirements of the CMP.	Contractor and CECO.	Contract and allowance in P&G's	Pre-construction, establishment of site.	ECO	Once off

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			Target : • No new permanent structures will be permitted at the contractor's camp. • Temporary structures shall be founded on a platform, either subsoil or screed slab. • Buildings should preferably be pre-fabricated or constructed of re-usable/recyclable materials. • All temporary structures must be soundly built and not pose a danger to workers. • Containers are to be used for the storage of materials which have the potential to release pollutants into the environment. • All structure footprints to be rehabilitated and re-vegetated after construction is complete.						
5.7 Fencing of the construction sites that will be affected by the proposed project	Demarcation of the site	Unnecessary removal of vegetation. Loss of topsoil. Safety	**Objective(s);** Whilst establishing the site, the footprint of disturbance must be minimised and the extent of soil erosion, loss of vegetation and the potential for the pollution of soils must be prevented. **Target:** • All excavations posing a risk to both human and animal safety must be demarcated as indicated in the CMP using danger tape with steel droppers or other methods approved by the ECO; • 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 75m. Should additional space be needed for the temporary storage of material, the ECO must advise on an appropriate area away from any sensitive areas.	The site is demarcated according to the requirements of this section of the CMP.	Contractor and CECO.	Contract and allowance in P&G's	Construction sites must be fenced off along the alignment before site clearance.	Engineer, ECO.	As construction proceeds along the alignment.

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
5.8 Cooking of food	Cooking facilities	Type and placement of cooking facilities used, and how they will be used.	**Objective(s):** To ensure that the cooking facilities used on site do not pose risks to the environment. **Target:** • The contractor must supply gas and /or electricity cooking facilities for the labourers at the construction camp. • If gas cooking facilities are not available fires (for the purposes of cooking) will be allowed in a demarcated area that has been cleared of any combustible materials. This area must be carefully controlled. A fire extinguisher must be kept in close proximity to the cooking area. • Firewood, or other suitable fuels, must be supplied by the contractor. • No vegetative matter may be removed from the area for firewood. • After use, all cooking fires must be extinguished. • An emergency first aid kit must be present on site. All workers are to know the location and contact details of the appointed first aider.	Evidence of presence of gas and /or electricity cooking facilities and/or demarcated area for cooking with fire.	Contractor.	Contract and allowance in P&G's	Pre-construction, Establishment of site.	ECO	Once off.

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
5.9 Operation of the sanitation system(s)	Sanitation systems	Unpleasant odours on site. Inadequate number of latrines on site. Position of latrines and shower systems. Poor management of waste water.	**Objective(s):** To ensure good sanitation system and management throughout the construction period. **Targets:** • Adequate chemical toilets must be provided for all staff. Alternatively, existing ablution facilities on site can be utilised if available. • Chemical toilets must be emptied / serviced on a regular basis to prevent them overflowing. Proof of this must be provided to the ECO. • A minimum of one toilet must be provided per 11 persons at each working area within 100m from worker activity. • Where shower facilities are provided for use by staff the following must be imposed:- o Positioning of the showers, specifically the discharge point , must be placed in a way to ensure that erosion and build-up of detergents does not occur; o All discharge from the shower and other washing facilities must pass through a suitable filter to reduce the load of detergents to the environment; o Use of the shower facilities must be limited to staff or authorised persons only.	Adequate toilets and showers will be positioned at the right places as per the CMP and ECO. Absence of odours, erosion and build-up of detergents.	Contractor	Contract and allowance in P&G's	Pre-construction, establishment of site.	ECO	Once off

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
5.10 Vehicle parking area. Storage of equipment	Vehicle parking and parking area(s). Storage of equipment.	Pollution of soils. Disturbance of soils due to parking of vehicles outside of designated areas.	**Objective(s):** To ensure vehicles are parked according to the specifications in the CMP and that equipment is handled appropriately. **Target:** • No storage of vehicles or equipment will be allowed outside of the designated area. • Drip trays or any form of oil absorbent material must be placed underneath vehicles and equipment when not in use for periods longer than 3 days and/or for those vehicles and plant showing evidence of leaking hydrocarbons.	Drip trays must be provided and placed under vehicles and equipment which are not being utilised on site.	Contractor and CECO.	Contract and allowance in P&G's	Throughout the construction period.	ECO	As per specified target.
5.11 Servicing and washing of vehicles and machinery	Workshop and equipment storage areas	Water contamination. Soil contamination. Noise pollution.	**Objective(s):** To ensure that the environment is not polluted by ensuring that service areas and wash bays for vehicles and machinery are made available and utilised. **Target:** • Where possible and practical, all maintenance of vehicles and equipment shall take place in a workshop area. • During servicing of vehicles or equipment, a suitable drip tray shall be used to prevent spills onto the soil, especially where emergency repairs are conducted outside the workshop area. • Leaking equipment shall be repaired immediately or be removed from site to facilitate repair. • All potentially hazardous and non-degradable waste, including used ballast or the waste water effluent from washing the contaminated ballast, shall be collected and removed to a registered waste site. • Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and re-mediated to the satisfaction of the ECO. • A method statement is required from the contractor for dealing with possible	Evidence of prescribed servicing and washing services.	Contractor, CECO.	Contract and allowance in P&G's	During construction.	ECO	As per specified target.

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			emergencies that can occur, such as fire and accidental leaks and spillage. • The contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site. • Should emergency repairs be necessary, drip trays or tarpaulins must be utilised to ensure the collection of the oil. The area for emergency repairs should be identified by the ECO. • Only emergency repairs shall be allowed on site and a drip tray shall be used to prevent oil spills. • The contractor must ensure that delivery drivers and plant operators are informed of all relevant procedures and restrictions required ensuring compliance with this document. • All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages. • The following shall apply: o All contaminated soil / yard stone shall be removed and be placed in containers for further disposal; o Hazardous waste may only be stored on site for a maximum period of 90 days before it must be disposed of at a registered hazardous waste site. o Contaminated material can be taken to one central point where bio-remediation can be done; o Smaller spills can be treated on site; o A specialist contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site; and o All spills of hazardous substances must be reported to the ECO and relevant authorities.						
5.12 Personnel conduct	Personnel	Infringement of the CMP requirements by personnel	**Objective(s):** To ensure that personnel are adhering to the CMP requirements. **Target:**	Personnel wearing proper safety uniform. Absence of trespassers on site.	Contractor and labourers.	Contract and allowance in P&G's	Approved PPE must be issued to all employees pre-construction but must be used for the	ECO	Throughout construction period.

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• All personnel to undergo Environmental Awareness Training. Such training must include the requirements of the CMP as well as the location of sensitive areas of which the workers must be aware. A signed register of attendance must be kept for proof. • Swaziland Railway induction must be attended by all parties involved in the construction. • Tool box talks to include aspects of the CMP. • Labourers associated with the contractor must be easily recognizable (i.e. company issued overalls with company name/logo etc.), and other persons will not be allowed within the construction camp at any time without prior permission from the project manager. • The contractor shall take all necessary precautions against trespassing on private properties. • Warning signs must be placed on and around the site as per the Occupational, Health and Safety requirements. • Adequate first aid services must be provided by the contractor at the contractor's camp. • The contractor will be responsible for his own security arrangements and shall comply will all site security instructions. • Basic firefighting equipment must be available on site. • PPE to be provided and well maintained at contractor's camp. • All environmental incidents should be reported to ECO, investigated, documented and kept on file.				duration of the construction period.		

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
5.13 Construction activities	Safety of the Public / surrounding landowners	Injuries to Public / landowners Health of Public / landowners	**Objective(s):** To ensure that the public at large is not injured or affected negatively in any way. **Target:** • The contractor shall recognise that the site is situated close to inhabited and agricultural areas and shall therefore take all reasonable measures to ensure the safety of people in the surrounding communities. • Where the public could be exposed to danger by any of the works or site activities, the contractor shall as appropriate provide suitable flagmen, barriers and/ or warning signs in English and SiSwati, all to the approval of the project manager. • All unattended open excavations shall be adequately demarcated (fencing shall consist of a minimum of three strands of wire and made clearly visible). Adequate protective measures must be implemented to prevent unauthorised access to and climbing of partly constructed structures and protective scaffolding.	No injuries or health consequences to neighbouring people. No complaints from neighbouring people.	Contractor and CECO.	Contract and allowance in P&G's	Throughout the construction period.	ECO	Whenever there are stationary vehicles or equipment present on site.

6 MATERIALS

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
6.1 Transport-ation of material	Material transport	Traffic congestion. Dust during transportation. Excessive noise.	**Objective(s)** To ensure that whilst material is transported, it cannot be of negative influence to the surrounding environment. **Target:** The following targets must be adhered to: • Existing access roads must be utilised as far as possible, with only the minimum new access roads being constructed where absolutely necessary. • Access to privately owned land will be arranged with the various landowners along the alignment by the contractor. • Adequate and appropriate traffic warning signage must be erected where applicable, along transport routes and access roads. • The contractor shall take preventative measures e.g. screening, muffling, timing, pre-notification of affected parties to minimise complaints regarding noise and vibration nuisance from sources. • Vehicle speed on site shall be restricted to 30km/h for construction vehicles and 40km/h for motor vehicles. • Fine materials (such as sand) must be covered during transportation when travelling on public roads. Covering of loads will not be necessary where the vehicles transporting such fine materials abide by the construction speed limit of 30km/h. • Appropriate response plans must be prepared by contractors to ensure the fastest possible reaction to spills or accidents. This response plan must be included in the awareness training and a flow chart indicating the procedures to be followed must be erected onto signage boards for easy reference. • Deliveries must be scheduled for off-peak hour traffic times.	Mufflers and silencers fitted to construction vehicles and equipment. Covering of material during transportation. Emergency reaction plan (for spills/accidents) must always be readily available on site.	Contractor and CECO	Contract and allowance in P&G's	Prior to construction start.	ECO	Throughout construction period or as required by the ECO.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• All trucks and vehicles removing spoil from the site via a public road must have load areas and must be covered by a tarpaulin (plastic/synthetic sheets (covers) to prevent rocks and spoil falling onto the road surfaces. Should the covering of vehicles not be possible, vehicles are only to be loaded to a capacity of 80% of the maximum capacity of the vehicle. • All drivers and operators are to have licences for driving and moving of plant on site. • All road vehicles to be road worthy.						
6.2 Storage and use of hazardous material	Hazardous material storage and usage areas	Contamination of soil by hazardous material. Inadequate remediation measures for spills.	**Objective(s):** To ensure adequate protection of soil and soil remediation measures in case of spills. **Target:** • Hazardous materials – such as paint, cement, fuels, bitumen, fuel, oil, herbicides, battery acid or detergents – must be stored in sealed, lockable containers when not in use • A register shall be kept on all substances and be available for inspection at all times. Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately • No decantation into unmarked containers or containers with irrelevant labeling. • 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 stormwater run-off be diverted through an oil/water separator before leaving the site. • To avoid fire risks, no decanted fuel to be left unattended in the sun to avoid fire. • When handling hazardous materials, manufacturer's specifications must be complied with. The 16 point Material Safety Data Sheet is available on site.	Storage of hazardous materials in sealed and lockable containers. No evidence of spills on site. Absorbent and clean-up material readily available on site.	Contractor and CECO.	Contract and allowance in P&G's	Construction period	ECO	For the duration of the construction period dependent on the presence of hazardous material on site.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• All reasonable care must be taken to prevent spills of any hazardous material when in use. • Emergency spill response and clean-up procedures must be in place with capable people listed as responsible parties. These parties must have the necessary training to adequately handle major accidents and/or accidental spillages, including where such spillages might occur within a watercourse. • All spills (minor and major) must be cleaned and remediated to the satisfaction of the ECO and CECO within 24 hours of occurrence. • Should contamination of the soil/groundwater be suspected, a detailed site and consequent risk assessment must be conducted in order to establish the risk that the contaminated soils and groundwater pose to the receiving environment using the Risk Based Corrective Action approach. Appropriate remedial measures must be designed and implemented at the site. • The contractor must ensure that there is a supply of absorbent material (e.g. Drizit) and clean-up materials readily available to absorb, breakdown and, where possible, encapsulate minor hazardous material spillages. • All products are to be stored with compatibility in mind. • Storage areas shall display the required safety signs depicting "No smoking", "No naked lights" and "Danger". Containers shall be clearly marked to indicate contents as well as safety requirements. • The contractor shall supply a method statement to the engineer for approval for the storage of hazardous materials prior to site preparation works.						
6.3 Storage of Fuel	Storage areas	Contamination of soil by fuel. Inadequate remediation measures for spills.	**Objective(s):** To ensure that there is optimum environmental protection (especially soil) from fuel spills. **Target:** • Fuel must be stored in above ground storage tanks or sealed containers, contained within a bunded area with sump drainage.	Established fuel storage areas in compliance with the objectives of the CMP.	Contractor and CECO.	Contract and allowance in P&G's	Pre-construction, establishment of site.	ECO	Once off

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• All bunds must be designed to contain at least 110% of the tank or drum storage capacity (this shall apply to above ground storage, and include fuels, welding equipment and oxy-acetylene cutting equipment). • No drainage from fuel storage areas shall be permitted. • Any other hazardous substances stored in bulk will require bunding.						
6.4 Use of cement	Cement	Contamination of soil and surrounding environment by cement. Decrease in ambient air quality.	**Objective(s):** To ensure that the environment is protected from cement that will be used on site. **Target:** • Cement must be delivered in sound and properly secured bags or in approved bulk containers. • Cement products in bags must be stored in storage containers to be provided at the construction camp and should only be opened when needed. • The storage facility and surrounding area must be swept and cleaned regularly as required to ensure that cement products do not the pollute the surrounding environment. • Empty cement bags are to be collected in larger hessian or material bags which, once full, can be disposed of at a registered landfill site. • Cement bags are not to be burnt on site. • No concrete batching on bare soil. • Batch plants shall be located within the designated working area on an impermeable surface to prevent cement spillages from contaminating bare soil. • Care must be taken to prevent concrete spills.	Cement delivery, storage and use will be in line with the CMP requirements.	Contractor and CECO.	Contract and allowance in P&G's	Construction period.	ECO	As long as cement is in use on site.

7 WASTE

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
7.1 Storage, removal and disposal of construction waste	Construction waste	Land pollution. Compaction of soil by rubble. Decreased aesthetic integrity of the site.	**Objective(s):** To ensure that waste is correctly stored and disposed of, decreasing the visual and environmental impacts during the construction and post construction period. To keep the servitude neat and clean. Disposal of rubble and refuse in an appropriate manner. Minimise litigation. Minimise landowner complaints. **Targets:** • The Waste Management Plan must be adhered to at all times. • No material shall be left on site that could be of harm to humans and animals. • Surplus concrete may not be dumped indiscriminately on site, but shall be removed from site when nearing completion of the different stages of work. • Concrete trucks shall not be washed on site unless adequate washing and concrete collection facilities are introduced to site. • Bins and containers must be made available by the contractor for the storage of construction waste. • All construction waste shall be stored in waste skips located strategically on site. A licensed waste contractor shall collect these skips for removal to a licensed landfill site. No construction waste may be stored on site for longer than 30 days; • The Contractor will be responsible to remove and transport all construction waste material off site to a registered waste disposal facility (proof of this as well as a copy of the site's Registration Permit, must be provided by the contractor to the ECO) • No burning of waste permitted on site.	Construction waste stored, collected and disposed of as per the requirements of this CMP.	Contractor and CECO	Contract and allowance in P&G's	Waste bins/ skips must be available prior to construction. Removal of waste throughout the construction period.	ECO	The ECO will determine the frequency of waste removed from site.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
7.2 Storage, removal and disposal of domestic waste	Domestic waste	Land pollution. Unpleasant odours. Decreased aesthetic integrity of the site.	**Objective(s)** To ensure that waste is correctly stored and disposed of, decreasing the visual and possible environmental impact during the construction and post construction period. **Target:** • All requirements contained in the Waste Management Plan must be adhered to and shall be audited by the ECO as part of the CMP audits. • The contractor must supply sealable waste bins at the construction camp for the storage of domestic waste. • Clearly marked waste bins are to be provided for the separation of waste. • Recyclable waste, including glass, paper and plastic must be separated at the construction camp, stored and recycled, where economically feasible. • Personnel must be informed about the necessity of using the waste drums. • The contractor must do site clean-ups of litter other than construction waste on a daily basis, and dispose of it in the designated refuse bins provided at the contractor's camp. It is recommended that one designated cleaner per section of construction is appointed to collect and sort the litter on site. • The contractor must ensure that general site-wide litter clean-up will occur at least once a week. • The contractor must dispose of all domestic refuse generated by his staff and sub-contractors on a weekly basis at a registered waste disposal facility. The contractor must provide proof of this to the ECO in the form of a safe disposal certificate unless the domestic waste is collected by the local municipality. • Sealable waste drums should be provided at least every 100m along the active working servitude of the railway line. • Grey water must be stored in sealable marked containers and disposed of with other waste water from the construction works.	Evidence of domestic waste stored, removed and disposed of according to the requirements indicated in this CMP.	Contractor and CECO	Contract and allowance in P&G's	The waste bins/ skips must be available prior to construction. Removal of waste throughout the construction period.	ECO	The ECO will determine the frequency of waste removal from site.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
7.3 Storage, removal and disposal of hazardous waste.	Hazardous waste.	Soil pollution. Goundwater contamination	**Objective(s):** To ensure that soil and the rest of the surrounding environment on site is protected from hazardous waste. **Target:** • All hazardous waste must be stored in sealed and suitably marked containers for removal to a registered hazardous waste disposal facility. • Hazardous waste may only be stored on site for a period of 90 days, where after it must be disposed of at a registered hazardous waste disposal site. • Used ballast from railway lines proposed to be upgraded shall be treated as hazardous waste. Should the contaminated ballast be washed for re-use, the dirty water effluent from the washing process will constitute the hazardous waste. • Any oil spillage on site will be excavated to a depth determined between the CECO and ECO and disposed of for removal to a registered hazardous waste disposal site. Excavated areas are to be refilled with suitable replacement material. Alternative *in-situ* remediation techniques could be used, if approved by the ECO.	All mitigation measures with regards to Hazardous waste mentioned in the CMP are implemented.	Contractor and CECO	Contract and allowance in P&G's	Hazardous Wastes must be collected in sealable, safe containers. Removal of hazardous waste throughout the construction process.	ECO	During whole construction period.

8 SURROUNDING LAND

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
8.1 Entering different properties	Access roads	Damage to access roads. Damage to environment. Loss of topsoil. Erosion.	**Objective(s):** To minimise damage to existing access roads. To minimise damage to the environment due to construction of new access roads. To minimise loss of topsoil and erosion. **Targets:** • Existing maintenance and access roads along the servitude shall be used for construction activities as far as possible. • Planning and construction of any additional access routes must be done in conjunction between the contractor, ECO, engineer and applicable landowners or communities. • All agreements reached should be documented and no verbal agreements should be made. • The contractor shall properly mark all access roads. Markers shall show the direction of travel. Roads not to be used shall be marked with a "NO ENTRY" sign and adequately barricaded to prevent construction vehicles from utilizing such roads. • Water diversion berms shall be installed from the start of the contract. These berms shall be maintained at all times and be repaired at the end of the contract. • Where berms are introduced on steep slopes the outflow shall be suitably stone pitched to prevent erosion from starting at the berms. • Roads may not be constructed on steep slopes prone to result in excessive erosion unless such roads follow contours. • The introduction of concrete pipes and drifts, to facilitate access, shall be at	No claims from Landowners due to further damage on existing access roads. No erosion visible on access roads three months after completion of construction. No loss of topsoil due to run-off water on access roads.	Contractor and CECO.	Contract and allowance in P&G's	During the establishment of the construction site.	ECO	Once off

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			the discretion of ECO on site. Any dangerous crossings shall be marked as such and where necessary, speed limits shall be enforced. • Where necessary, a suitable mixture of grass seed shall be used to re-seed damaged areas. • Deteriorated areas shall be fenced-in to enhance rehabilitation.						

9 FLORA AND FAUNA

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
9.1 Construction activities (Physical issues and their control)	Terrain	Scarring of soil surface, disturbance/loss of topsoil	**Objective(s):** Minimise scarring of the soil surface and land features. Minimise disturbance and loss of topsoil. Rehabilitate all disturbed areas along the servitude. **Target:** • Topsoil to be stripped to 300 mm where required by ECO • Topsoil only to be stripped where absolutely necessary • Rehabilitation of disturbed area is required	No visible erosion scars once construction is completed. Minimum loss of topsoil at any one site. No barren areas visible three months after construction is completed. All damaged areas successfully rehabilitated.	Contractor and CECO.	Contract and allowance in P&G's	During the establishment of the construction sites along the alignment.	ECO	Topsoil will be removed and stockpiled as construction proceeds along the alignment.
	Vegetation	Damage to vegetation. Erosion due to removal of vegetation.	**Objective(s):** Minimise damage to vegetation. Minimise possibility of erosion due to removal of vegetation. Minimise removal of plant material on river and stream embankments. Eradication of alien invader species. **Target:** • The objective of vegetation clearing is to trim, cut or clear the minimum number of trees and vegetation necessary for the safe mechanical construction of the railway line • No scalping shall be allowed on any part of the servitude road unless	No trees and vegetation removed unnecessarily. No vegetation interfering with structures and statutory distances upon completion of the contract.	Contractor and CECO.	Contract and allowance in P&G's	During the establishment of the construction sites along the alignment.	ECO	Vegetation will be cleared as construction proceeds along the alignment.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			absolutely necessary. • Permits from the relevant authorities will be attained and the removal of all economically valuable trees or vegetation shall be negotiated with the landowner before such vegetation is removed. • No vegetation shall be pushed into heaps or left lying all over the veld. • Vegetation clearing on railway line servitudes must be kept to a minimum. • Stumps shall be treated with herbicide in conjunction with the approval of the ECO. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. • Any vegetation cleared on the servitude shall be removed or flattened and not be pushed to form an embankment. • No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river- and stream banks. • Protected or endangered species of plants and animals shall not be removed unless they are interfering with a structure. Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained. • All protected species not to be removed must be clearly marked and such areas fenced off if required. • The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. • Swaziland Railway's approval for the use of herbicides is mandatory. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications.	No visible erosion scars three months after completion of the contract due to vegetation removal. No visible damage to the vegetation along the servitude one year after completion of the contract due to herbicide use. No litigation due to unauthorised removal of vegetation. All alien invaders eradicated from the servitude					
	Gate installation and control	Damage to existing fences, security	**Objective(s):** Properly install gates to allow access to the servitude. To minimise damage to	No transgressions of	Contractor and CECO.	Contract and allowance	During the establishment of the	ECO	During construction

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			fences, limit access to Swaziland Railway and contractor personnel with gate keys. To minimise the extent of removal of vegetation. **Target:** • Gate installation shall be according to Swaziland Railway standards. • All gates installed in electrified fencing shall be electrified as well • All gates shall be fitted with locks and be kept locked at all times during the construction phase. Gates shall only be left open on request of the landowner if he accepts partial responsibility for such gates in writing, once the contractor have left site and the gates are fitted with Swaziland Railway locks. Such gates shall be clearly marked by painting the posts green • All claims arising from gates left open shall be investigated and settled in full by the contractor. • If any fencing interferes with the construction process, such fencing shall be deviated until construction is completed.	the Fencing Act. No damage to fences and subsequent complaints from landowners. All gates equipped with locks and kept locked at all times to limit access to key holders. All fences properly tied off to the gate posts. All gates properly and neatly installed according to specifications. No complaints about open gates.		in P&G's	construction sites along the alignment.		
9.2 Vegetation clearing	Conservation and protection of flora	Unnecessary removal of flora. Removal of vegetative matter for firewood.	**Objective(s):** To minimise the extent of removal of vegetation. **Target:** • Prior to construction commencing, a thorough search and rescue operation for both plants and fauna (particularly reptiles) must be initiated once the required permits are in place. • Plants outside of the construction area are not to be disturbed, destroyed or removed.	No unnecessary loss of vegetation.	Contractor and CECO.	Contract and allowance in P&G's	During the establishment of the construction sites along the alignment.	ECO	During construction

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• A nursery must be maintained to protect plants removed during the search and rescue operation. These plants are then to be used during the rehabilitation phase. • Should construction activities have to occur outside the maximum disturbance boundary of 75m, this will only be allowed with the prior approval of the ECO so as to ensure that sensitive areas are avoided. • The contractor will be held liable for the replacement of any plant or feature under the protection of these specifications that is removed or damaged by the contractor's negligence or mismanagement. • No open fires are permitted. • No material storage or lay down is permitted under trees. • All woody material not donated to local villages is to be chipped and used back on site for rehabilitation.						
9.3 Conser-vation of Flora	Alien vegetation	Introduction of alien plants/seeds on site.	**Objective(s):** To prevent alien plants/ seeds from being introduced on site. To remove alien plants where possible, from site. **Targets:** • All sites disturbed by construction activities must be monitored for exotic or invasive plant species and weeds. • Chemical removal shall be used in accordance with manufacturer's specification for weeds. • The type of chemical to be utilised must be approved by the ECO in consultation with a qualified pest control operator • Any eradicated exotic/invasive plant or weed vegetation must be removed from site and disposed of at an approved waste disposal facility. • A maintenance schedule is to be provided after reinstatement. • Swaziland Railway will be responsible for the implementation of the maintenance schedule.	Decrease of alien plants on site.	Contractor, Labourers, CECO.	Contract and allowance in P&G's	For the duration of the construction period.	ECO	During construction

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
9.4 Conser-vation of Fauna	Protection of Fauna	Intentional or unintentional killing of fauna on site. Loss of fauna due to habitat disturbance.	**Objective(s):** To ensure that fauna found on site are protected and not interfered with. **Target:** • The contractor must ensure that the site is kept clean and free of litter that could potentially attract animal pests, and that refuse bins are scavenger proof. • The contractor must report problem animals or vermin to the ECO. A high probability exists that domestic animals from the neighbouring communities will scavenge the site. • Ensure that domesticated and livestock animals belonging to the local community are kept away from the construction works. • The contractor may under no circumstances make use of pesticide or poison to control unwanted animals. • Workers should be educated so as not to kill any fauna found onsite. • The footprint of disturbance should be kept to a minimum. • Hunting or trapping is strictly prohibited. Anyone found guilty of such an act will be removed from the project. • Access roads should be planned so that only minimum linear distances are developed. • Excavations must be checked on a daily basis for any signs of fauna which may have fallen in.	No evidence of domestic animals on site. The site is kept clean and does not attract fauna.	Contractor, CECO.	Contract and allowance in P&G's	Throughout the construction and post construction period.	ECO	Ongoing

10 AIR QUALITY

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
10.1 Trenching and transport or soils.	Dust, smoke and emission control	Air pollution	**Objective(s):** To reduce the generation of dust and emissions on the construction site. **Target:** • Dust suppression is to be conducted during construction. • The use of enclosures, screens and sheeting should be considered to contain dust at defined locations, e.g. batching plants, etc. • The contractor is to take appropriate measures to minimise the generation of dust as a result of excavation works. Such measures include frequent spraying during low rainfall periods or by using chemical dust binding agents approved by the ECO. • Paved or surfaced roads should be used where possible. Where none are available, haul roads should be cleaned of loose material to prevent dust. • Speed limits must be enforced in all areas to reduce the generation of dust. • Cover dump trucks before traveling on public roads. • Keep soil loads below the freeboard of the truck to minimise fugitive dust. • Minimise drop heights when loaders dump soil into trucks. • Re-vegetate disturbed areas as soon as possible after disturbance. • When feasible, shut down idling construction machinery. • Tighten gate seals on dump trucks. • No burning on site and close to settlements.	Dust is kept at its lowest level on site.	Contractor and CECO.	Contract and allowance in P&G's	Throughout construction period.	ECO	During periods of low rainfall or as required by the ECO.

11 WATER

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
11.1 Construction activities in or around watercourses.	Wet areas	Unnecessary removal of aquatic flora.	**Objective(s):** Avoid and/ or mitigate activities in or around watercourses (including wetlands, rivers, etc.) to prevent negative impacts. **Target:** • All designs should include means to protect or maintain the current hydrological regime. • Stormwater management systems should include energy dissipation structures to minimize the potential impact or erosion and sedimentation • Surface water management features such as the crossing of drainage lines should be placed in a manner to ensure flows remain unaltered in terms of direction, velocity and volume, thus the natural base flows, i.e. hydrological regime within these systems is maintained. • Excess ballast during construction and operation is not allowed to enter any watercourse areas, culverts etc. to prevent alterations of these systems by forming impoundments. • Clearing of vegetation should be kept to a minimum • No vehicular traffic shall be allowed outside the construction servitude/ path in wet areas and along the boundaries of pans. No equipment shall be used outside the construction path. • The wet areas outside the immediate railway servitude must be marked as “no-go zones” to prevent unauthorised access to these sensitive areas by construction activities. • The conditions contained in the water use license must be adhered to.	No damage to wet areas.	Contractor and CECO.	Contract and allowance in P&G’s	During the establishment of the construction sites along the alignment.	ECO	During whole construction period.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• 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 not pose an obstacle to the movement of aquatic organisms						

12 NOISE

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
12.1 Construction activities	Construction vehicles, plant and machinery.	Noise and vibration.	**Objective(s):** Reduction in the amount of noise on site. **Target:** • Should construction have to continue after hours, all residents affected must be notified no less than two days before the planned after-hours working will commence. Such a notice must also indicate the duration of the nuisance. • Working hours shall be limited to 6:00 – 18:00 on weekdays and 07:00-15:00 on Saturdays. No construction works are to take place on Sundays. In instances where work cannot be kept within the working hours, two days' notification of such work to affected landowners and communities, together with an adequate motivation for working after hours must be made. • All machinery and equipment must be maintained in good working order, and fitted with approved and specified muffler systems. • Continuous welded rails and ballast are to be implemented which will result in a noise reduction factor. Cracked, corrugated or damaged rails should be mended or replaced immediately to reduce noise and vibrations. • Train speeds must be limited to 40 km/h in populated and sensitive areas such as places of worship, educational and health care facilities and at hospitality venues such as game lodges or hotels.	Construction vehicles and machinery fitted with mufflers silencers. Working hours are adhered to.	Contractor and CECO.	Contract and allowance in P&G's	The vehicles and machinery must be fitted with mufflers prior to the commencement of construction. Work hours, unless otherwise permitted, must be adhered to through the construction period.	ECO	Ongoing

13 ARCHAEOLOGICAL AND HERITAGE SITES

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
13.1 Protection of archaeological sites	Heritage & Archaeology	Destruction of graves and other sites of archaeological and heritage value.	**Objective(s):** To ensure that sites of archaeological interest are preserved. To prevent cultural alienation and emotional distress. To prevent financial loss to family resulting from costs of relocating graves. To prevent non-compliance to applicable legislation on the relocation of graves. **Target:** • 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. • A reed collection site for the Umhlanga ceremony, 260 38' 27.42" S and 310 25' 13.52 E. The reed growth area should be avoided if the siding is enlarged. • All graves within a 100m buffer zone from the centre of the railway line, but outside the servitude must be located via the coordinates contained in the HIA and temporarily fenced off with danger tape during the construction period in the specific area. • The affected family is to be consulted in order to positively identify graves and relocate graves to alternative sites identified by the family and approved by the Chiefdom. • The costs of relocating graves, including all costs incidental to such relocations must be covered by the proponent. • Relevant authorities, i.e. Municipalities, Royal Swaziland Police and	No places of archaeological value are being disturbed or affected due to the construction of the railway line. No destruction of or damage to known archaeological sites. Management of existing sites and new discoveries in accordance with the recommendations of the Archaeologist	Contractor, CECO.	Contract and allowance in P&G's	For the duration of the construction period.	ECO	Ongoing

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			Chiefdom on discovery of graves and relocate graves in accordance with Regulation 4 of the Cemetery Regulations, 1971 and section 14 of the Conveyance and Burial of Dead Bodies Act, 1970. • Artefacts may not be removed under any circumstances unless permitted to do so. • Any destruction of a site will only be allowed once a permit is obtained and the site has been mapped and documented. • Should any archaeological sites be uncovered during construction, their existence shall be reported to the engineer immediately. • An archaeologist will then take the necessary action so that construction can continue. • Construction must be immediately stopped, should any elements of cultural or heritage significance be found.						
	Monuments & historical sites	Damage or loss of monuments or historical sites. Vandalism, theft of such sites	**Objective(s):** To protect sites and land considered to be of cultural value. To protect sites against vandalism, destruction and theft. **Target:** • All monuments, heritage sites and historical sites shall be treated with the utmost respect. • All graves shall be clearly marked and treated as no go areas as covered above. • Destruction of such sites is strictly not allowed. Should it be necessary to remove any sites, the necessary procedures shall be followed and permits obtained.	No destruction of or damage to known sites. Management of existing sites and new discoveries in accordance with legislation. No litigation due to destruction of sites.	Contractor, CECO.	Contract and allowance in P&G's	Ongoing	ECO	During construction
	Farmhouses & buildings	Damage or loss of farmhouses or buildings of heritage value	**Objective(s):** To have control over actions and activities in close proximity to inhabited areas	No complaints from landowners. No damage to	Contractor, CECO.	Contract and allowance in P&G's	Ongoing	ECO	During construction

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			Target: • If and where the lines cross any inhabited area, the necessary precautions shall be taken by the contractor to safeguard the lives and property of the inhabitants. • The contractor shall under no circumstances interfere with the property of landowners. • If water is required, the contractor shall negotiate with the relevant landowner and a written agreement shall be drawn up.	private property of heritage value.					

14 PLANNING AND ENGINEERING

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
14.1 Construction activities	Existing infrastructure	Disruption of services, damage to installations, damage or loss of plant	**Objective(s):** • To have control over and prevent temporary or permanent damage to plant and installations; • To prevent interference with the normal operation of plant and installations; and • Securing the safe use of infrastructure, plant and installations have control over actions and activities in close proximity to inhabited areas. **Target:** • Where construction vehicles need to pass under electrical power lines or cables, sufficient access will be ensured to prevent vehicles from coming into contact with electricity. • Where pipe lines are found along the route, the depth of the pipes under the surface shall be determined to ensure that proper protection is afforded to such structures. • Any damage to pipe lines shall be repaired immediately. • All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties. • Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect. • Upon completion of the project all roads directly damaged by construction activities shall be repaired to their original state. • Interruptions of existing services must be carefully planned. If possible, disruptions must be kept to a minimum and should be well advertised and	No unplanned disruptions of services. No damage to any plant or installations. No complaints from authorities or landowners regarding disruption of services. No litigation due to losses of plant, installations and crops.	Contractor, CECO.	Contract and allowance in P&G's	Ongoing	ECO	During construction

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			communicated to the landowners should they be affected by such service interruptions. • Care must be taken not to damage irrigation equipment, lines, channels and crops. • The position of all pipelines and irrigation lines must be obtained from the landowners and be shown on the physical access plan.						
14.2 Batching concrete	Batching plants (if applicable)	Damage to vegetation. Damage to topsoil. Surface water contamination. Disturbance to area.	**Objective(s):** To ensure all agreements with Landowners are adhered to. To prevent complaints arising from batching plant/ activities from Landowners. Successful rehabilitation of disturbed areas **Target:** • The siting of batching plants shall be done in conjunction with the engineer and ECO. • Swaziland Railway specifications regarding batching plants must be adhered to. • The batching plant area shall be operated in such a way as to prevent contaminated water to run-off the site and polluting the nearby streams or water bodies. • Swaziland Railway PM shall ensure that all agreements reached with the landowner are fulfilled, and that such areas be rehabilitated once construction is completed	No complaints from landowners. All disturbed areas successfully rehabilitated three months after completion of the Contract.	Contractor, CECO.	Contract and allowance in P&G's			During construction
14.3 Construction activities on private land	Interaction with landowners	Damage to structures and crops. Disruption of services.	**Objective(s):** To create sound and sustainable relationships with Landowners **Target:** • The success of the project depends a lot on the good relations with the	No delays in the project due to landowner interference.	Contractor, CECO.	Contract and allowance in P&G's	Ongoing throughout the project.	ECO	During construction

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			landowners. It is required that the contractor will supply one person to be the liaison officer (CLO) for the entire contract, and that this person shall be available to investigate all problems arising on the work sites concerning the landowners. • All negotiations for any reason shall be between Swaziland Railway, the landowner and the contractor. • No verbal agreements shall be made. All agreements shall be recorded properly and all parties shall co-sign the documentation. • The contractor shall keep a photographic record of access roads. This will then be available should any claims be instituted by any landowners. • All claims instituted by the landowners shall be investigated and treated promptly. • Unnecessary delays should be avoided at all costs. • The landowners shall always be kept informed about any changes to the construction program should they be affected. • If the ECO is not on site the contractor's liaison officer should keep the landowners informed. • The contact numbers of the contractor's liaison officer and the Swaziland Railway's ECO shall be made available to the landowners. This will ensure open channels of communication and prompt response to queries and claims. • All contact with the landowners shall be courteous at all times. • The rights of the landowners shall be respected at all times and all staff shall be sensitised to this.						
14.4 Actions by site staff	Littering on site	Untidy and polluted site and surrounding land	**Objective(s):** To maintain a neat and tidy workplace **Target:**	No visible sign of littering. No complaints from Landowners	Contractor, CECO.	Contract and allowance in P&G's	Ongoing throughout Construction phase	ECO	During construction

Activity	Aspect	Potential Impact	Mitigatory Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• Littering by the employees of the contractor shall not be allowed. • The ECO shall monitor the neatness of the work sites as well as the campsite.						

Appendices

Appendix A
Rehabilitation Plan

REHABILITATION PLAN

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
Rehabilitation of construction site	Rehabilitation	Fauna and flora.	**Objective(s):** To minimise damage to topsoil and environment at construction areas. Successful rehabilitation of all damaged areas. Prevention of erosion **Target:** • All areas earmarked for construction shall have the topsoil removed separately and stored for later use during rehabilitation of such areas as described in section 5.5 of the CMP. • All backfill should be reinstated in the layers in which they were encountered. • Re-seeding shall be done on disturbed areas as directed by the ECO. • Other methods of rehabilitation may also be used at the discretion of the ECO, e.g. stone pitching and logging. • The disturbed land is to be landscaped so that slope gradients are reduced to at least 1:3 but preferably 1:5. • Geotechnical stability will be the key criterion influencing the slope gradients. Where geotechnical stability allows, slope gradients should be at least 1:3 to facilitate the establishment of vegetation. Where slope gradients are 1:1.5 or greater and are not protected by natural scour-protection measures, the slopes will be established by vegetation. • On slopes with a gradient of 1:2 or greater, the layer of topsoil spread over the landscaped surface to be at least 200 mm and preferably 500 mm • Topsoil should be spread manually on slopes with a gradient of less than 1:4. • Topsoil to be loosely spread with as little compaction as possible.	No loss of topsoil due to construction activities. All disturbed areas successfully rehabilitated within three months of completion of the Contract. No visible erosion scars three months after completion of the contract.	Contractor, CECO.	Contract and allowance in P&G's	As construction ends in separate sections and post-construction.	ECO	During construction and one year post construction.

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• For rehabilitation of cultivated land, the layer of topsoil spread over the landscaped surface is to be at least 500 mm. • For rehabilitation of grazing land and wilderness, the layer of topsoil spread over the landscaped surface will is to be at least 200 mm and preferably 500 mm. • Topsoil should to be spread manually on slopes with gradient of less than 1:4. A mixture of grass seed can be used provided the mixture is carefully selected to ensure the following: • Annual and perennial grasses are chosen; • Pioneer species are included; • Species chosen will grow in the area without many problems; • Root systems must have a binding effect on the soil; and • The final product should not cause an ecological imbalance in the area Grass runners and mulch - preferred manual option for steep slopes (gradients of less than 1:3) • Runners of grass with a stoloniferous and rhizomatous growth form will be hand planted into drills on the slopes to facilitate rapid stabilization of the slopes. • Trenches or the runners will be cut approximately 10 cm deep along the contour at a spacing of approximately 300 mm. • A mulch of grass cut from the surrounding veld, when the grass is in seed. will also be used - the mulch application rate should be 2 tons/ha. • The mulch may need to be secured on slopes with a gradient of less than 1:2, particularly during the rainy season (October to March), with pegged netting (temporary plastic bird netting or permanent biodegradable geonetting). • Seeds can be added to the mulch if deemed necessary by the rehabilitation specialist.						

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• The success of this method is strongly dependant on the techniques used and the supervision of planting - detailed guidelines will be prepared by the rehabilitation specialist. Hydroseeding - alternative mechanical option for steep slopes (gradients of less than 1:3) • The grass and fertilizer slurry will include a mulch of grass cut from the surrounding veld, when the grass is in seed - the mulch application rate should be 2 tons/ha. • An adhesive will be included in the moisture to prevent the seed and fertilizer from blowing, washing or slipping. Hand sowing - preferred manual option for more gentle slopes (gradients of more than 1:3) • Trenches for the seeds will be cut approximately 10 cm deep along the contour at a spacing of approximately 300 mm. • The seeds and fertilizer will be broadcast into the trenches by hand and the trenches filled with topsoil. The soil should be gently compacted using a garden rake or similar implement. • A mulch of grass cut from the surrounding veld, when the grass is in seed, will also be used - the mulch application rate should be 1 ton/ha. Mechanical sowing - alternative mechanical option for more gentle slopes (gradients of more than 1:3) • Fertilizer to be spread over the surface and then ploughed or disked in. • The surface is then to be harrowed until a fine seed bed has been prepared. • The seed to be broadcast and then rolled with an agricultural roller. • A mulch of grass cut from the surrounding veld, when the grass is in seed, is also be used at an application rate of 1 ton/ha. • Runners of *Cynodon dactylon* (kweek/star grass) should be used in grassland areas (areas which have not been disturbed by cultivation).						

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• Runners of *Pennisetum clandestinum* (kikuyu) can be used in areas surrounded by cultivated land. They are not be used in grassland areas, and in relatively undisturbed areas. • The seed mix should contain a rapidly germinating annual commercial species which will act as a "nurse crop" - this will stabilise the soil rapidly and will then die out allowing for colonization of the vegetated area by indigenous species. *Eragrotis teff* (teff) is ideal for this purpose and should be applied at a rate of 0.5 kg/ha. • The seed mix should also contain perennial commercial species with a high seed viability. These species should not be invasive. The following species are recommended, each at an application rate of 1 kg/ha: *Cynodon dactylon* (star grass): *Chloris gayana* (Rhodes grass); *Cenchrus ciliaris* (Cenchrus); and *Digitaria eriantha* (Smuts grass). • Maintenance of the re-seeded areas shall be conducted until an acceptable cover has been established, meaning 75% ground cover with no gaps exceeding 500mm. Maintenance includes watering, mowing and weeding as well as preventing the development of erosion channels. • Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the ECO, unless specifically requested by a landowner. • Microspray irrigation should be used and the irrigation system could be linked to a water cart. • After planting (sowing of seeds and/or planting of runners) the planted areas will be irrigated on a daily basis until the seedling and/or runners have established. • Irrigation of established vegetation will only be required if rainfall is poor (less than 300 mm/yr) and/or there is dieback of vegetation. • The removal of all construction facilities and materials from the construction camp will be required, and rehabilitation carried out. This includes the removal of concrete and compacted earth platforms, fuel storage tanks and chemical toilets.						

Activity	Aspect	Potential Impact	Mitigation Measure (Objective and Target)	Performance Indicator	Implementation Responsibility	Resources	Time Schedule	Verification Responsibility	Frequency
			• All access roads not required for operational purposes shall be rehabilitated. • Any contaminated material or soil must be removed to a registered hazardous waste disposal facility and the prescribed re-vegetation process must then be followed thereafter. • Rehabilitation must be carried out as soon as possible after the construction is completed. All rehabilitation is to be done with approval of Swaziland Railway environmental management department. • The required frequency of monitoring of plant development in re-vegetated areas varies according to the phase of plant establishment. Monitoring will be conducted on a weekly basis during the initial phase and can be done on a monthly basis and then a seasonal basis as the plants become established. • Vegetation will be re-established in areas where the rehabilitated vegetation cover has died back.						