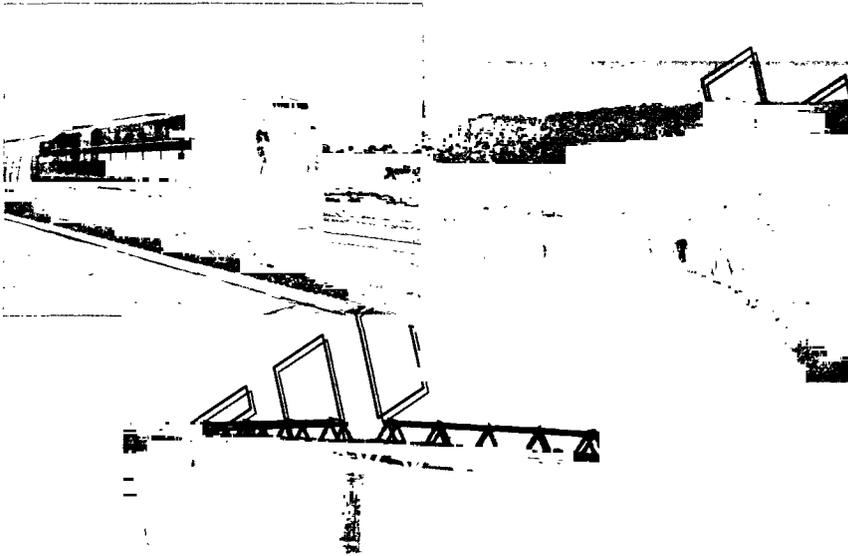


E962

BEIRA RAIL CONCESSION PROJECT



ENVIRONMENTAL AUDIT AND MANAGEMENT PLAN

Maputo, 2004



FILE COPY

INDEX

LIST OF FIGURES.....	4
LIST OF TABLES	4
LIST OF PHOTOS.....	5
LIST OF ANNEXES.....	5
CHAPTER I: INTRODUCTION AND BACKGROUND INFORMATION	7
1.1.1 Background Information	8
1.1.2 Objectives.....	9
1.1.3 Methodology	10
CHAPTER II: ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE INFORMATION	13
2.1.1 Introduction	14
2.1.2 Climate	15
2.1.3 Geology and Geomorphology	15
2.1.4 Soils.....	18
2.1.5 Hydrology.....	25
2.1.6 Flora/Fauna.....	26
2.1.7 Ecologically sensitive areas	35
2.1.8 Socio-Economic Status	37
2.1.9 Land Use Patterns.....	42
CHAPTER III: FIELDWORK RESULTS, SENA LINE	47
3.1 CONSTRAINTS	48
3.2 APPROACH	48
3.3 ENVIRONMENTAL AUDIT FINDINGS	49
3.3.1 The Concrete Sleepers Factory	49
3.3.2 The Warehouse in Dondo.....	51
3.3.4 The Sena Railway Line System	52
3.4 SOCIO-ECONOMIC AUDIT FINDINGS	61
3.4.1 Population Settlement	61
3.4.2 Population settlement along the Sena Line	62
3.5 RECOMMENDATIONS FOR REMEDIAL ACTIONS	64
3.5.1 Background Information	64
3.5.2 Concerns and Recommendations	65
3.5.3 Additional recommendations for environmental, health and safety management	70
CHAPTER IV: FIELDWORK RESULTS, MACHIPANDA LINE.....	73
4.1 APPROACH	74
4.2 ENVIRONMENTAL AUDIT FINDINGS	74
4.3 SOCIO-ECONOMIC AUDIT FINDINGS	79
4.3.1 Population Settlement	79
4.3.2 Population settlement along the Machipanda Line	79
4.4 RECOMMENDATIONS FOR REMEDIAL ACTIONS	82
4.4.1 Background Information	82
4.4.2 Concerns and Recommendations	83
4.4.3 Machipanda Line.....	83

4.4.4 Additional recommendations for environmental, health and safety management85

CHAPTER V: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT IN RELATION TO PORTS, HARBOURS AND RAILWAYS OPERATIONS87

5.1 NATIONAL POLICIES AND STRATEGIES FOR ENVIRONMENTAL MANAGEMENT88

5.1.1 Background88

5.1.2 National Environmental Management Programme (NEMP)88

5.1.3 National Strategy and Action Plan for the Conservation of Biodiversity89

5.1.4 The Land Policy90

5.1.5 Forestry and Wildlife Strategy91

5.2. LEGISLATION AND REGULATIONS92

5.2.1 Overarching Environmental Legislation92

5.2.2 The Framework Environmental Law92

5.2.3 EIA Regulations93

5.2.4 EIA Guidelines - General97

5.2.5 EIA Guidelines for Specific Sectors97

5.2.6 The New Land Law and Land Law Regulations97

5.2.7 Use of Pesticides/Herbicides for Clearing Land99

5.2.8 Forest and Wildlife Laws99

5.2.9 Employees Health and Safety101

5.3 INTERNATIONAL CONVENTIONS103

5.4 INSTITUTIONAL FRAMEWORK106

5.4.1 Environmental Management: Ministry for the Coordination of Environmental Affairs - MICOA106

5.4.2 Land Management111

5.4.3 Management of Forests and Wildlife112

5.4.4 Promotion/Identification of Development Projects in the Zambezi Valley -the Zambezi Valley Development Authority (GPZ)112

5.4.5 Caminhos de Ferro de Moçambique (CFM)114

5.4.6 Legal and Institutional Issues, Concerns and Recommendations114

CHAPTER VI: ENVIRONMENTAL MANAGEMENT PLAN116

6.1. INTRODUCTION117

6.2 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PLAN118

6.3 CFM's POLICY – AN OUTLINE118

6.4. CONTRACTUAL OBLIGATIONS OF CONCESSIONAIRES119

6.5 LEVELS OF RESPONSIBILITY FOR THE MANAGEMENT AND IMPLEMENTATION OF THE EMP119

6.6 INSTITUTIONAL ROLES IN COORDINATING IMPROVED ENVIRONMENTAL SCREENING, MONITORING, ENFORCEMENT AND CONTROL121

6.7 COMPONENTS OF THE ENVIRONMENTAL MANAGEMENT PLAN122

6.7.1 Health, Safety and Environment122

6.7.2 Health and safety of local populations123

6.7.3 Community health management123

6.7.4 Employee Safety and Health Policy for the Ports, Harbours and Railways of Mozambique124

6.7.5 Procedures for Emergency Preparedness and Response124

6.7.6 Training	125
6.7.7 Consultation with Statutory and Non-Statutory Bodies and the Public	125
6.7.8 Detailed Environmental Impact Assessment and Monitoring.....	126
6.7.9 Transport of hazardous cargos, forest products (wooden logs), bush meat, etc	127
6.7.10 Location and planning of campsites and construction material storage depots	128
6.7.11 Dismantling and rehabilitation of temporary campsites	129
6.7.12 Hazardous chemicals and substance (HCS) control.....	129
6.7.13 Waste management plan and procedures	130
6.7.14 Trespassing, poaching and protection of plants and wildlife	131
6.7.15 Fire prevention and control	131
6.7.16 Archaeological sites, graves and sacred sites.....	132
6.7.17 Appointment of an Environmental Site Officer (ESO).....	132
6.7.18 General methods for clearing vegetation in the line RoW	132
6.7.19 Construction at river crossings	133
6.7.20 Drainage lines, approaches to pans and depressions.....	133
6.7.21 Erosion control	133
6.7.22 Relocation.....	134
6.7.23 Activities and related costs to CFM.....	134
CHAPTER VII: CONCLUSIONS AND RECOMMENDATIONS	136
CHAPTER VIII: REFERENCES.....	138

LIST OF FIGURES

Figure 1. The Project's Area of Influence.....	14
Figure 2. Geology of the Project Area	17
Figure 3. The soils of the Project Area (See Table below for details)	19
Figure 4. Risk of soil erosion in the project area	24
Figure 5. Hydrographical Basins in the Project Area.....	25
Figure 6. Vegetation types in the project area.....	28
Figure 7. Sensitive areas, National Parks and Reserves in the project area	36
Figure 8. The Districts traversed by the railway lines and the respective population densities.....	39
Figure 9. a), b) and c). Land use pattern in the areas traversed by the Sena and Machipanda railway lines.....	44
Figure 10. Central level MICOA organisational structure.....	107

LIST OF TABLES

Table 1. Characteristics of the soils in the project area.....	20
Table 2. Dondo to Moatize: Vegetation Mapping Units (Source: Wild & Barbosa, 1967)	31
Table 3. Population data for large mammal species, Gorongosa National Park	32
Table 4. Population Data for large mammal Species Marromeu Complex	32
Table 5. List of large mammal species recorded for the Gorongosa National Park	34
Table 6. Endemic plant species according to family recorded for the Chimanimani Mountains.....	35
Table 7. The Population of Sofala Province	40
Table 8. Distribution of Ethnic Groups by Geographical Areas in Tete Province.....	42
Table 9. Audit Findings for the Concrete Sleepers Factory	50
Table 10. Audit Findings for the Warehouse in Dondo	52
Table 11. Population density in the Provinces and districts traversed by Sena Line.....	61
Table 12. Summary of the Audit Findings for the Sena Line	63
Table 13. Summary of the audit findings for the Warehouse in Dondo	66
Table 14. Summary of the audit findings for the Sena Line	68
Table 15. Population and population density of the Provinces and districts traversed by the Machipanda Line.....	79
Table 16. Summary of the Audit Findings for the Machipanda Line	80
Table 17. Audit Findings for the Railway Stations on the Machipanda Line.....	81
Table 18. Summary of the audit findings for the Machipanda Line	83
Table 19. Status of Mozambique's Participation in International and Regional Conventions, Agreements and Organisations Relevant to Environmental Management	103
Table 20. Summary of CFM activities and related costs during project implementation	135

LIST OF PHOTOS

Photo 1. Concrete Sleeper Factory in Dondo (Stacking Yard for Aggregates)	11
Photo 2. View of the Three Production Lines	11
Photo 3. Rehabilitated drainage channel	49
Photo 4. Ditch where liquid waste is disposed of	50
Photo 5. Storeroom, showing diesel drums, used tyres, old machines and diverse waste	51
Photo 6. Chemical (Welding) Material exposed to Rain and Sun	51
Photo 7. Aspect of an already rehabilitated line and the Dondo Railway Station	53
Photo 8. Informal market close to the line	53
Photo 9. House very close to the line (Condue, km 113).....	54
Photo 10. Open woodland with on-going track rehabilitation works	54
Photo 11. Open Miombo woodland in Savane - Miombo woodland at km 50 (Samacuesa)	54
Photo 12. The rehabilitated culvert at Km 20 with erosion on the slopes of the drainage lines	55
Photo 13. Samacuesa - Derunde.....	55
Photo 14. Km 20 temporary camp site	56
Photo 15. Destroyed bridge at River Zangue (approx. km 223)	57
Photo 16. Scrap at Caia Railway Station - Scrap at Sena Railway Station.....	57
Photo 17. Trees covering old carriages in Sena	58
Photo 18. Ponte Dona Ana	58
Photo 19. Areas showing signs of erosion (Mutarara – Vila Nova Fronteira).....	59
Photo 20. Two examples of where the soil below the line has eroded	59
Photo 21. Population settlement within 10m from the line in Marromeu.....	61
Photo 22. Erosion on the Machipanda Line (Machipanda).....	75
Photo 23. Machipanda – Vila Manica	75
Photo 24. Population settlements close to the railway line (mostly outside the 10m strip of PPZ)	76
Photo 25. Vila Manica: informal market divided by line with a warning notice and gates	76
Photo 26. Railway Station at Machipanda	77
Photo 27. Railway Station at Machipanda	78
Photo 28. Railway Station at Chimoio	78

LIST OF ANNEXES

1. List of Plant Species found in the Project Area
2. Checklist used for Interviews

LIST OF ABBREVIATIONS AND ACRONYMS

CFM	Mozambique Ports and Railways Company, E.P.
CRC	Compensation and resettlement committee
DINAGECA	National Directorate of Geography and Cadastre
DNA	Water Affairs (ground water contamination)
DNCH	National Directorate of Coal and Hydrocarbons (coal and oil pollution)
DNFFB	National Directorate of Forestry and Wildlife
DP	Displaced person
EIA	Environmental Impact Assessment
EMP	Environmental management plan
EN	National Road
ENH	National Enterprise for Hydrocarbons
ESO	Environmental Site Officer
GoM	Government of Mozambique
HCS	Hazardous chemicals and substance
HSE	Health, Safety and Environment
IA	Independent Authority
IDA	International Development Agency
IIP	Fisheries Research (fisheries)
INE	National Institute of Statistics
INIA	National Institute of Agricultural Research (soil analysis)
INNOQ	National Institute of Quality and Norms (standards)
MADER	Ministry of Agriculture Rural Development
MICOA	Ministry for the Co-ordination of Environmental Affairs
MOPH	Ministry of Public Works and Housing (sewage)
N/D	No data
NCSD	National Commission for Sustainable Development
NEMP	National Environmental Management Programme
NGO	Non-governmental organisation
OP	Operational procedures
PAP	Project affected person(s)
PPZ	Partially Protected Zone
RAP	Resettlement action plan
RoW	Right of Way
RPF	Resettlement policy framework
STD	Sexually transmitted disease
WB	World Bank

CHAPTER I
INTRODUCTION AND BACKGROUND INFORMATION

1.1 INTRODUCTION

1.1.1 Background Information

In 1989, the Mozambique Rail and Port Company (CFM) was detached from DNPCF, a Directorate of the Ministry of Transport and Communications, and became a para-statal company with increased autonomy. As of 1st January 1995, CFM was further transformed into a public company. Among other things, the law enacting this change envisages involvement of the private sector in management and operation of its activities and establishment of a contract between CFM and the Government of Mozambique (GOM) covering financial and performance targets.

Mozambique has three important transport corridors each consisting of integrated railway and port facilities and serving primarily regional transit traffic. The corridors are distinct geographical segments that have no physical links between them within Mozambique. The corridors are managed and operated by regional CFMs.

The Maputo corridor system, operated by CFM-Sul, comprises the main port of Maputo, the subsidiary port of Matola and three rail connections with the port. Maputo Port presently handles over 3.0 million tons per year while the rail network handles about 2.3 million tons of freight traffic per year.

The Beira Corridor system, operated by CFM-Centro, comprises the Port of Beira and two rail connections with the Port. Beira Port presently handles 2.2 million tons per year. The two rail connections are the Machipanda Line, 317 kilometers, linking Beira with Zimbabwe; and the Sena Line, 552 kilometers, linking Beira (Dondo) with Moatize. The latter has two important branches: Inhamitanga – Marromeu with 82 km and Dona Ana – Vila Nova da Fronteira (border with Malawi) with 44 km.

The Sena Line has been non-operational since 1984. The Machipanda Line has been operational and presently handles over 0.8 millions tons per year with a theoretical annual capacity of 2 million tons.

The Nacala Corridor system, operated by CFM-Norte, comprises the Port of Nacala and the rail link, 615 kilometers long, to Malawi. The Nacala Port presently handles about 670,000 tons per year, and the rail line carries 350,000 tons per year.

These corridors take advantage of the geographical position, which is the best arrival and departure gateway for the inland countries in Southern Africa without direct access to the sea.

In 1999, IMPACTO, Lda prepared an Environmental Audit and Management Plan for the Rail and Port Restructuring Project on behalf of the Caminhos de Ferro de Moçambique (CFM) and the Government of Mozambique (GOM). This study covered all the ports and rail systems under CFM control.

Presently, CFM/GOM is in the process to launch the Beira Rail Concession Project, comprising the Machipanda and Sena lines.

The Machipanda and Sena are the backbone of the socio-economic development of the Sofala, Tete and Zambézia Provinces as it plays a great influence over 14 districts and links this region with Zimbabwe and Malawi.

The Sena railway system traverses some of the richest agricultural, forestry, faunal and mineral resources areas of the country.

The GOM has granted the highest priority for the reconstruction of the Sena Railway line. It is expected that the project would serve as a catalyst for the rapid socio-economic development of the country. The development is in line with the major efforts made by the Government towards achieving the main goal of all its programs – poverty alleviation.

1.1.2 Objectives

According to the Terms of Reference (TOR) an Environmental Audit and Management Plan for the Beira Rail System has been carried out. It included an audit of the Sena Line and undertaking an inventory of people and property on railway land on the Machipanda and Sena Rail Lines.

The main objectives of the study were to:

1. Determine the environmental baseline conditions at, and in the vicinity of the Beira Rail operational sites, including the Sena Line;
2. Evaluate the current institutional and legal framework and propose new regulations, whenever considered necessary;
3. Formulate an Environmental Audit and Management Plan.

The Environment Audit and Environmental Management Plan include specific orientation for the future Environmental Impact Assessments that might take place whenever necessary in compliance with Mozambican legislation and regulations. These assessments will cover the direct and indirect impacts from the proposed activities to bring the rail lines to acceptable standards for private concessionaires to take over the operation.

1.1.3 Methodology

The methodology adopted for this study comprised the following:

Description of the railway lines according to an appropriate set of criteria, e.g. vegetation type, landscape character, topography, land use etc. The key determinants are as follows:

1. Biophysical factors

Fauna	Rare/endangered species Nesting/roosting/movement Benefit/decrement of changed habitat
Flora	Vegetation removal Conservation status Presence/threat of alien species Economic value Debris disposal Herbicide use
Physical factors	Soil erosion Terrain, soil stability/slope Wetlands/drainage lines River crossings

2. Socio-economic factors

Existing land use
Relocation

3. Technical factors

Clearances	Security/public safety
Constraints	Pollution Access Costs

Reporting on the above actions, with recommendations that emphasise specific controls and mitigatory measures for the rehabilitation and operation (including routine maintenance) phases of the project.

A field survey was carried out over October 2003, by the socio-economic and environmental specialist consultants together with a technician from CFM.

The fieldwork results and recommendations for remedial actions are presented in two distinct chapters: III) Sena Line and IV) Machipanda Line, respectively.

1.2. INFRASTRUCTURES AND SERVICES

Operated by CFM-Centro, the Beira Corridor comprises the Port of Beira, Pipeline System (oil transportation to Zimbabwe) and two rail connections with the Port. The two rail connections are the Machipanda Line, 317 kilometers, linking Beira with Zimbabwe; and the Sena Line, 552 kilometers, linking Beira (Dondo) with Moatize. The latter has two important branches: Inhamitanga – Marromeu with 82 km and Dona Ana – Vila Nova da Fronteira (border with Malawi) with 44 km. The Sena Line has not operated since 1984. The Sena rail link to Malawi is presently closed and rehabilitation works are underway. A concrete sleeper factory has been installed, with output capacity of more than 20 000 units a month.

The Port of Beira has an annual capacity of over than 3 million tonnes with a total storage capacity of 350 000 cubic metres.

However, as the Beira Rail Concession Project does not include the Port, this has not been subject to analysis in this report.

Apart from the railway lines, an important component is the concrete sleeper's factory based in Dondo (Km 0) (See photos 1 and 2). CFM has decided to use concrete ones as opposed to the wooden ones, except at the bridges. These are here produced and then carried on a wagon (150 sleepers/wagon) to the site where rehabilitation is being carried out.



Photo 2. View of the Three Production Lines



Photo 1. Concrete Sleeper Factory in Dondo (Stacking Yard for Aggregates)

Beira Corridor

The Beira Corridor consists of the Beira Port, Pipeline system (oil transportation to Zimbabwe) and two Railway Lines to Zimbabwe and Moatize (Malawi). It serves as an import/export axis for Mozambique and for the Republics of Zimbabwe, Malawi, Zambia, Botswana and Zaire.

These lines are linked to the Beira Port, which is the second port of Mozambique in terms of capacity, tonnage handled and the volume of imports and exports handled.

Current railway traffic in CFM Centro operates on the railway line connecting the Port of Beira to Machipanda on the border with Zimbabwe. 10 trains run the line on a daily basis.

The pipeline runs from Beira to Zimbabwe for a distance of more than 300 km.

Sena line has not been operational since 1984 and is now currently under rehabilitation by CFM (Brigada de Reconstrução da Linha de Sena).

Rehabilitation started at Dondo (Km 0) and involves replacement of old wooden sleepers by new concrete ones as well as replacement or mending of the rail lines and culverts and/or bridges that require rehabilitation. The sections between Derunde – Inhamitanga and Mecito – Cambulatsisse have been totally destroyed during the war and require complete rehabilitation.

Rehabilitation also involves clearing of vegetation along 10 m of each side of the line and opening of access tracks. According to CFM herbicide will not be used in the process.

According to RONCO, the company responsible for the demining operations, 10 m on each side of the Sena line, over a 600 km have already been cleared of land mines.

CHAPTER II

ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE INFORMATION (SENA & MACHIPANDA LINES)

2.1.2 Climate

Beira is situated in the tropics, featuring a warm rainy season from November to April and a cooler dry season during the rest of the year.

As for the Corridor, the climate of Central Mozambique is tropical ranging from humid at the coast to arid in Tete Province and a climate modified by the presence of mountains in Manica Province.

Annual average temperature for Sofala, Manica and Tete Provinces ranges from 18°C to 26°C. The relative humidity is around 55% - 74% and annual rainfall around 1 000 mm - 1500mm, at the exception of Tete, where it is 600 mm. In fact it varies a lot from the coast to the interior.

The study area is located in a region where two climatic regimes overlap, the East African Monsoon System in which air circulation alternates between NE during the southern summer and SW during winter, and the Indian Ocean Subtropical Anticyclone System that rules the dominant easterlies. As a consequence, the predominant wind directions recorded at Beira during the last 25 years are from ENE to SE.

Although the frequency of winds stronger than 10 m.s^{-1} is typically less than 1% from February to August and about 1-2% from September to January, the region is regularly struck by tropical storms originating in the central Indian Ocean. These devastating storms occur mostly from November to April and may feature winds of gale force (greater than 60 km/h) and large amounts of precipitation. The annual frequency of occurrence of these storms in the Mozambique Channel was 3.1 in the period between 1911 and 1960. During tropical storms, rainfall may be far above the mean values, e.g. 347.3mm of rain in 24 hours, recorded at Beira in March 1986.

According to statistics from the Instituto Nacional de Meteorologia, 23 cyclones have affected the Mozambique coast over the last thirty years. Cyclones are generated in the South Western Indian Ocean in the period between November to April, and affect Sofala Province especially in February and March. Tete and Manica Provinces are not affected by cyclones.

Fog is in general uncommon. During May until September, visibility is limited to about one kilometre during approximately 1% of the time. In the wet season, visibility can be poor during heavy rainfall.

2.1.3 Geology and Geomorphology

Whereas Beira is located on a coastal sandy plain of alluvial, colluvial and elluvial sedimentary rocks of the Quaternary, the geology of Central Mozambique provides great heterogeneity of rock structures, many of which have undergone repeated tectonic fractures and earth movements since the Precambrian.

The Rift Valley plains of recent alluvium, colluvium and eluvium separate a western Midland of Pre-Cambrian metamorphic crystalline rocks (Barue and Manica-Midlands)

from an eastern cruesta block of Cretaceous to recent sediments forming the Cheringoma Plateau.

The metamorphic crystalline sediments are formed chiefly from quartzite's of the Frontier Formation, Umkondo schist's and quartzite's, small areas of Manhica talc schist's, chlorite schist's, quartzite's, serpentines, banded ironstones and green stones. These metamorphic outcrops are interrupted by granite-gneiss of the basement complex.

The physiography of Central Mozambique comprises a steeped topography rising abruptly inland (the Midlands has rugged and precipitous scenery up to 2 000 m elevation) to the eastern Great Escarpment from a low coastline, which is fronted by a broad shallow continental shelf 120Km wide.

Geologically, the project area occurs over a variety of formations. As can be seen from Figure 2 below, the Sena Line traverses an area mostly of sedimentary rocks of the tertiary, quaternary, cretaceous and upper Karroo and Precambrian rocks of the Tete gabbro anorthosite complex.

The Machipanda Line initially traverses sedimentary formations from the quaternary and tertiary, and then formations of the precambrian metamorphic and eruptive rocks of the gneiss granite complex of the Mozambique Belt and the Zimbabwe craton.

From close to Caia the alignment enters the Rift Valley, which bisects the Zambezi River in a north-south direction and continues south to Nova Sofala. The Rift Valley is still experiencing tectonic movement causing seismic events that mainly affects central and northwestern Mozambique.

However, risk of seismic activity in the project area is unlikely to represent a fatal flaw to the present alignments.

2.1.4 Soils

The soils in the project area are diverse reflecting topographic and geologic diversity.

The soils of the region traversed by the Beira Corridor are closely related to geomorphological history and current landform. Fluviolacustrine alluvium soils in the coastal areas, sands (psammo, fersialtic, hydromorphic) at Cheringoma Plateau.

The eastern portion of Central Mozambique (Manica Platform and Barue Midlands) consists of basement rock of ferralic/fersialtic soils that run to the Rift Valley and the river valleys where fluvio, lacustric and alluvium soils occur.

The types of soils traversed by the Sena and Machipanda railway lines are shown in Figure 3 and the characteristics of the soils are given in Table 1 below.

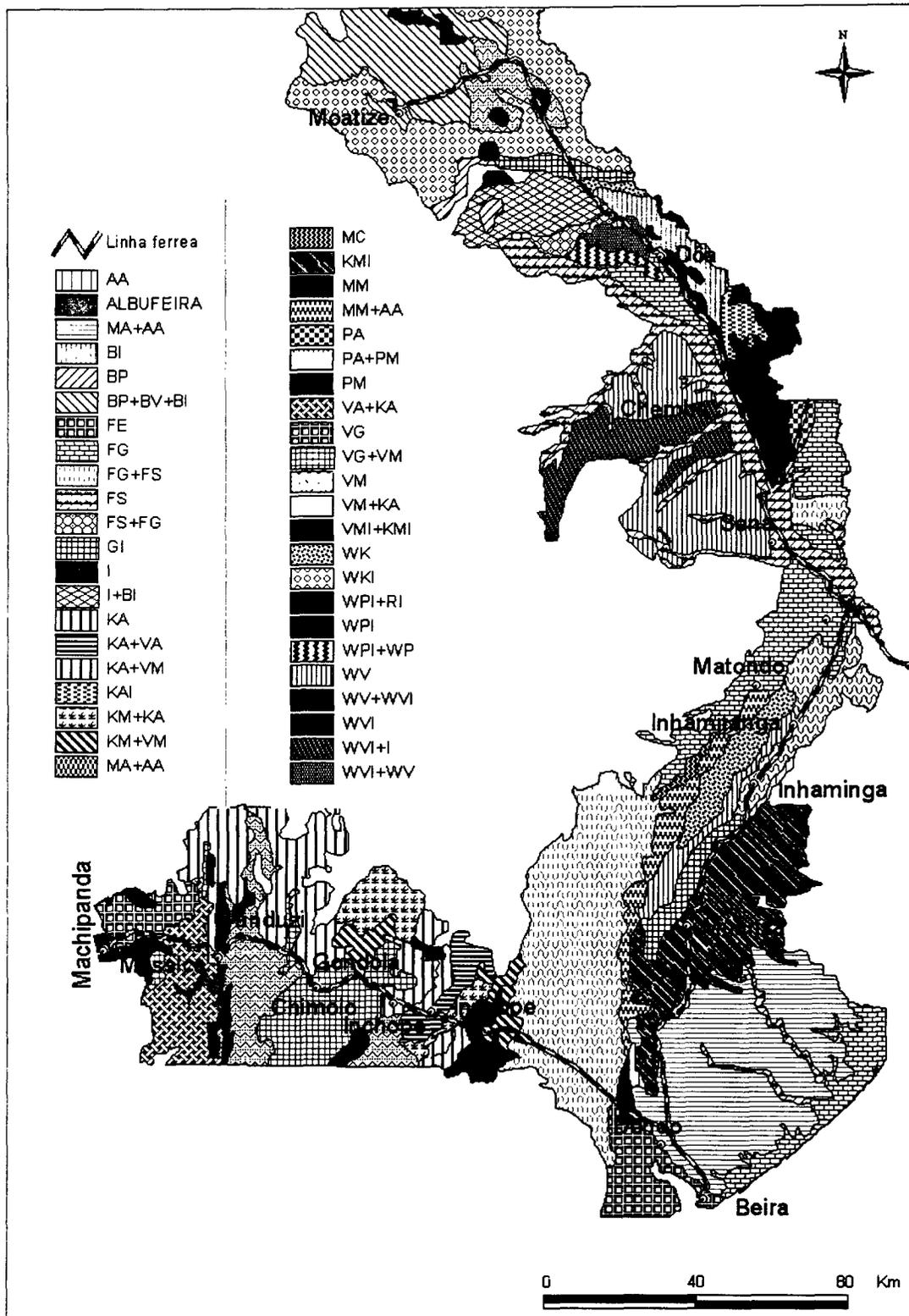


Figure 3. The soils of the Project Area (See Table below for details)

Table 1. Characteristics of the soils in the project area

Symbol	Soil Type	Characteristics	Geomorphology	Topography Slope (%)	Drainage	Salinity (ms/cm)	Classification		Limitation (agriculture)	Suitability (agriculture)
							FAO	USDA		
FG and FGh	Clayey alluvial soils (FGh – Hydromorphic)	Dark greyish brown clayey deep soils	Alluvial deposits of the Holocene	Flat 0-1	Moderately good to poor	Non-saline 0,5-3	Mollic fluvisols	Fluventic haplustolls	Drainage, sometimes salinity sodicity	Moderately to marginally suitable
FS	Coarse or medium textured stratified alluvial soils	Grayish brown sandy loam, deep soils		Almost flat 0-2	Imperfect to moderately poor	Non-saline 0-2	Eutric Fluvisols	Mollic Ustifuvents	Sometimes drainage and sodicity	Very suitable to special use
AA	Yellowish sandy soils	Yellowish brown sand, very deep soils	Sandy cover, aeolic sands, Pleistocene	Almost flat 0-2	Good to excessive	Non-saline 0-2	Ferralic Arenosols	Ustoxic Quartzipsamnets	Water retention capacity, fertility	Special use (sprinkle irrigation, rice)
G	Soils derived from red sandstone (Grés)	Coarse sand, dark reddish brown, deep soils	Sandstone (Grés) and red sands. Tertiary	Undulating 0-8	Excessive	Non-saline 0-1	Ferralic Arenosols	Ustoxic Quartzipsamnets	Water retention capacity, fertility	Not recommended, potentially suitable
MM	Soils of the Mananga having a sandy cover of varying thickness	Yellowish brown sandy clay loam, having superficial sandy layer	Mananga sediments layer of <20m Pleistocene hard sodic deposits	Almost flat 0-2	Imperfect	Non-saline 0,5-2 Non- saline- slightly saline 0,5- 9	Stagnic or Haplic Luvisols	Aquic or typic Haplustolls	Soil hardness and permeability, sodicity, sometimes salinity	Marginally suitable
MC	Clayey alluvial soils of the Mananga	Dark grayish brown clayey, deep soils	Mananga derived colluvium	Flat 0-8	Imperfect to poor	Non-saline 0,5-7,5 Non- saline- moderately saline 3-15	Mollic Solonchak s	Salorthidic Haplustolls	Salinity, sodicity, drainage, inundations	Marginally suitable
PA	Post-Mananga coarse textured soils	Reddish brown, sandy loam, moderately deep and deep soils	Red Pleistocene Post-Mananga deposits 80,5-10m) Upper slope of valleys Platforms of rolling pebbles/stones of Mananga origin	Gently undulating 0-5	Good	Non-saline 0,5-1	Chromic Cambisols	Typic ustochrepts	Fertility, water retention capacity	Very to moderately suitable

WV	Red clayey soils derived from calcareous rocks	Very dark gray clayey moderately deep soils over rolling pebbles/stones Reddish brown clayey, moderately deep soils	Outcrops of sedimentary rocks of Karoo, Cretaceous or Tertiary origin Outcrops of sedimentary rocks of Karoo Cretaceous or Tertiary origin	Gently undulating 0-5	Imperfect to moderately good Good Imperfect to moderately good Imperfect to good	Non-saline 0-1,5 Non-saline 0-0,5	Luvic Chemeze ms Chromic, Luvisol or Haplic Lixisols	Calciustolls Typic Haplustalfs or Kanhaplic Haplustalfs	Sometimes soil depth (<1m), erosion (slopes)	Marginally suitable, Special use (sprinkle irrigation, rice) Moderately suitable
WP	Shallow soils over non-calcareous rocks	Brown clayey, moderate depth Brown sandy clay loam, moderate depth, calcareous	Basaltic mantle along the pre-cambrian socle and Libombos volcanic chain, Karoo basalt Pre-cambrian socle, acid rocks, granite, gneiss	Undulating 0-8		Non-saline 0-3 Slightly saline-5 Non-saline 0,1-1 Mod saline 0-5-15	Eutric Cambisols Calcaric Cambisols or Eutric Cambisols	Typic Ustochrepts Typic Calciusterts	Soil depth, drainage, soil fertility Soil depth, sodicity, sometimes salinity Sodicity, sometime soil depth, land preparation	Marginally suitable, Special use (sprinkle irrigation, rice) Moderately to marginally suitable Very to marginally suitable
WK	Shallow soils over calcareous rocks			Flat 0-1		Moderately good	Non-saline 0-1 Non-saline 0-3 Slightly saline 0-5 Non-saline 0-1			
BP	Black basaltic soils	Black clayey, heavy textured with cracks, varying depth		Almost flat 0-2	Good	Non-saline 0-1 Non-saline 0-3 Slightly saline 0-5 Non-saline 0-1	Ferric Lixosols	Kanhaplic Rhodustalfs	Sometimes soil depth	
BV	Red basaltic soils	Dark reddish brown clayey, varying depth		Gently undulating 0-4	Moderately good to imperfect Moderately good	Non-saline 0-1	Albic and Cambic arenosols Haplic Acrisols	Ustic quartzipsamments Paleustults	Water retention capacity, fertility Erosion risk, germination conditions	Marginally suitable, special use (e.g. rice) Moderately to marginally suitable
Kag	Mottled-brown sandy soils	Grayish brown sandy, deep soils Brown sandy clay loam, deep soils		Undulating 0-5						
KM	Brown medium textured soils									
I	Lithic soils	Brown sandy loam, shallow soils over altered rock	Pre-Cambrian socle, acid rocks: granite, gneiss	Mountainous >30%	Excessively	Non saline (0-1)	Eutric Leptosols	Lithic Ustorthents	Soil depth, erosion risk	Forests, Natural reserves
VM	Medium textured red soils	Reddish brown sandy clay loam, deep soils	Pre-Cambrian socle, acid rocks: granite, gneiss	Undulating 0-8	Somewhat excessive	Non saline (0-1)	Ferric Lixisols	Rhodustalfs Kanhaplic	Erosion risk, germination conditions	Moderate to marginally suitable
VG	Red, clayey soils	Reddish brown clayey, deep soils	Pre-Cambrian socle, acid rocks, granite, gneiss	Undulating (0-8)	Good		Ferric Lixisols	Paleustults	Fertility, topography	Very to marginally suitable
MA	Soils of the Mananga having a sandy cover of varying thickness	Yellowish brown sandy clay loam, having moderately thick sandy layer	Mananga sediments Layer of < 20m Pleistocene hard solid deposits	Almost flat 0-2	Moderately well	Non-saline (0,5-1)	Ferralic Arenosols	Thapto-Camborthidic Quartzipsamments	Water retention capacity, fertility	Moderate

FE	Soils of marine estuary sediments	Grey clayey Deep soils Often saturated	Marine estuary sediments of the Holocene	Flat 0-1	Poorly to very poorly	Non-saline 0-4	Salic Fluvisols	Mollic Fluvaquents	Salinity, sodicity, drainage, inundations	Good to marginally suitable for pastures
VA	Reddish sandy soils	Reddish brown, sandy, deep soils	Pre-cambrian socle, acid rocks, granite, gneiss	Ondulating 0-8	Somewhat excessively	Non-saline 0-1	Ferralic Arenosols	Ustic Quartzipsamments	Water retention capacity, fertility	Moderate to marginally suitable
BI	Lithic basaltic soils	Dark brown, sandy clay loam, topsoil over altered rock	Basaltic mantle along the Pre-cambrian socle and Libombos volcanic chain, Karroo basalt	Ondulating 1-8	Well	Non-saline 0-2	Eutric Leptosols	Lithic Ustorthents	Soil depth and erosion	Forests, natural reserve
PM	Post-Mananga, medium textures soils	Reddish brown sandy clay loam, moderately deep and deep soils	Red Pleistocene Post-Mananga deposits (0,5-10m) Upper slope valleys	Gently undulating 0-5	Well	Non-saline 0-1,5	Haplic Lixisols or Chromic Luvisols	Kanhaplic Haplustalfs or Typic Haplustalfs	Sometimes soil depth (< 1 m), erosion (slopes), salinity, sodicity	Good (moderately good)
RI	Lithic rhyolitic soils	Yellowish brown sandy clay loam, topsoil over altered rock	Libombos volcanic chain Karroo rhyolite	Steeply dissected >8	Moderately well	Non-saline 0-1	Eutric Leptosols	Typic e Lithic Ustorthents	Soil depth	Forests, natural reserve

Risk of erosion

Erosion hazard is determined from a combination of soil type, topography, rainfall and construction activity. If not appropriately managed, erosion can lead to the transport of sediment into downstream areas, either land or waterways. The effects of seismic activity may also play a role here with a potential for landslides in hilly terrain.

The dynamic interplay of several key factors dictates the degree of susceptibility to mainly water-driven soil erosion processes. These are:

- Seasonality and intensity of rainfall in relation to water run-off,
- Landscape topography in relation to slope ingredients,
- Soil profile parameters, notably depth and binding properties,
- Degree of vegetation cover, and
- Magnitude and frequency of seismic events.

Sedimentation is a secondary process of erosion and can be exacerbated by railway line construction, due to:

- Deliberate and unanticipated modifications to surface and ground water hydrology,
- Incomplete rehabilitation of access roads and RoW
- Inadequate rehabilitation through naturally hilly terrain.

High, medium, and low erosion risk zones have been mapped for Mozambique at a scale of 1 : 2.000,000 (Soil and Water Conservation and Land Utilization Coordination Unit 1986).

Figure 4 below presents the areas susceptible to erosion in the project area. From the figure it is possible to see the major part of the railway lines is on areas with low risk of erosion. However, the Machipanda line, from Inchope to Machipanda, traverses areas with very high risk of erosion.

With regards to the Sena Line, it traverses mostly areas with a low risk of erosion. However, in Inhaminga, Mecito and Caia, it traverses an area of moderate risk of erosion and in the area of Doa – Cambulatsisse it traverses an area of very high risk of erosion. In Moatize, the erosion risk is also high in certain areas.

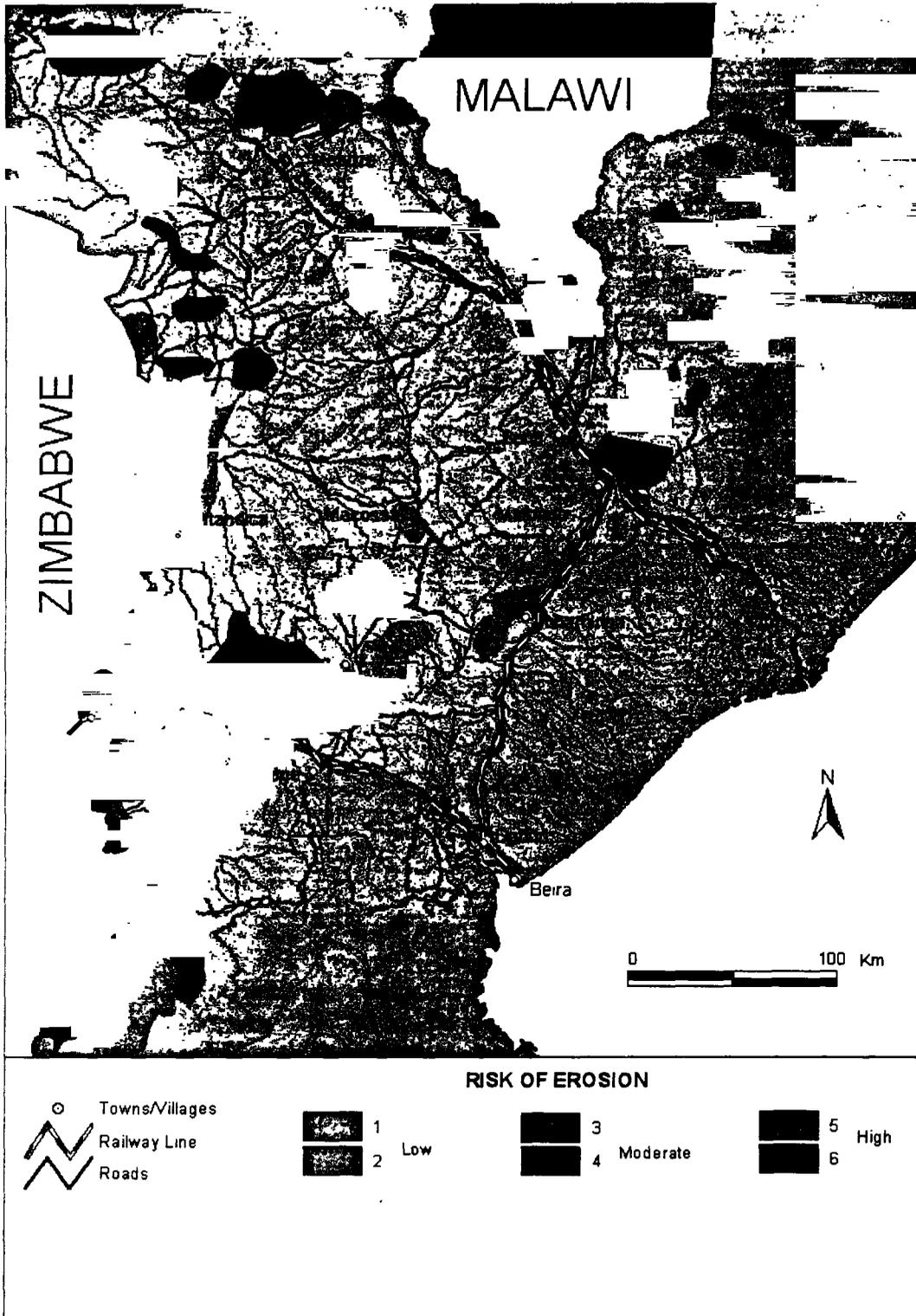


Figure 4. Risk of soil erosion in the project area

2.1.5 Hydrology

A major part of the project's area, namely most of the Sena Line is in the hydrographical basin of the Zambezi River. Other important basins traversed by the railway lines are the Púngue and Buzi Rivers, and other smaller ones as shown in Figure 5 below.

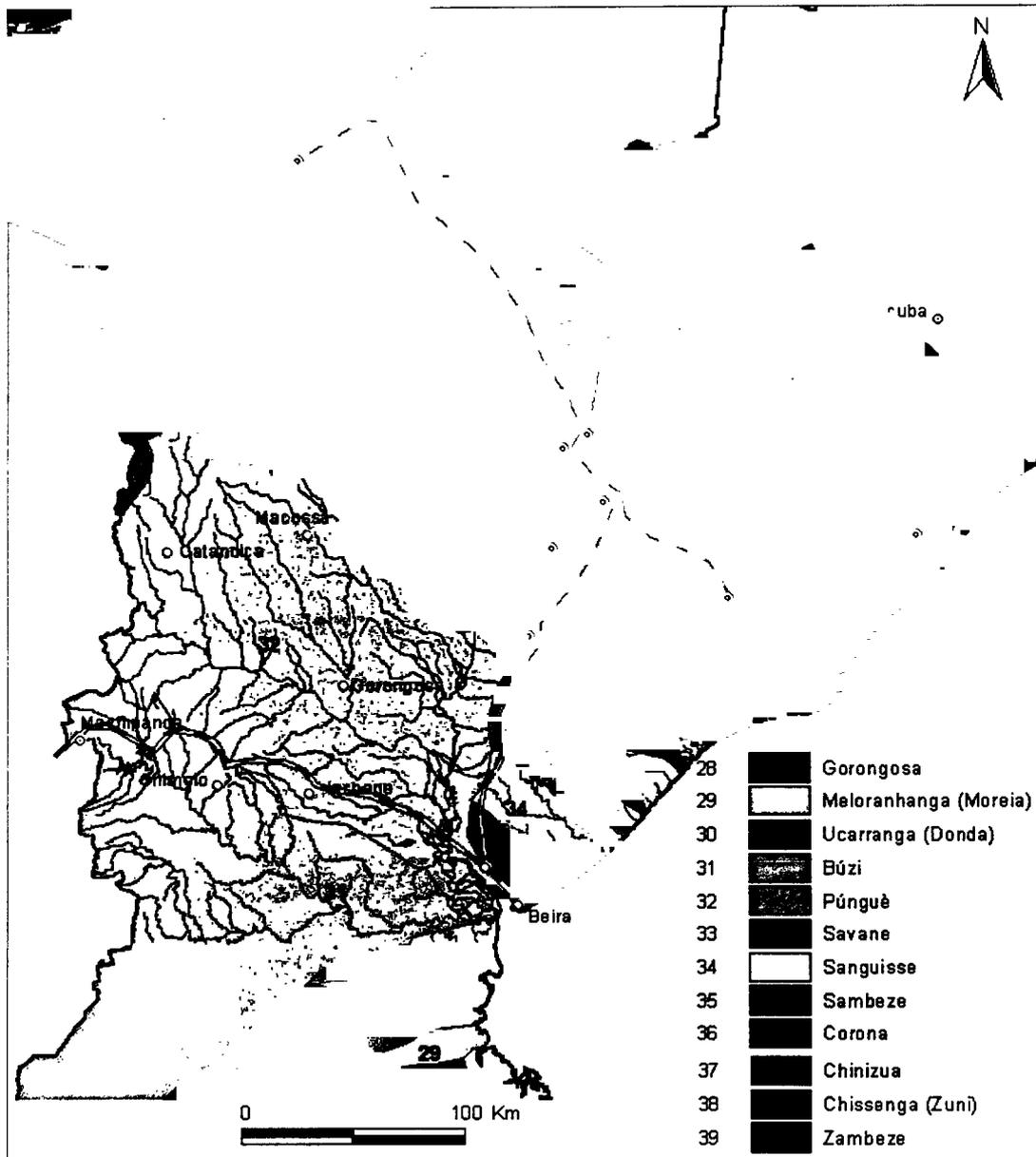


Figure 5. Hydrographical Basins in the Project Area

The Zambezi is the largest of the rivers and is crossed by the Sena Line at Sena through the Dona Ana Bridge. In its lower reaches, the Zambezi River can be several kilometres wide as it meanders across the broad floodplain.

The River Pungué is the second largest river in the project area. It discharges into the centre of a major coastal retrogression, which is not followed by the continental shelf. An extensive shallow area, known as the Sofala Bank and traversed by numerous tidal channels, separates the port from the deep water of the Mozambique Channel.

The coastal region bordering Beira City is swampy and crossed by several small rivers from South to north: Buzi, Pungué, Macuti, Rio Maria, Rio Ladrão, Nhamaroja, and Savane. The latter is actually a larger river that runs from West to East, providing a main drainage from the Cheringoma hills, and then curves South, at the limit of the study area. Numerous creeks that allow the tidal flood of this system cross the extensive mangrove forests that cover most of the coastal area in this region.

2.1.6 Flora/Fauna

Vegetation

Beira lies within a coastal mosaic comprising different vegetation types including dune forest, woodland, grassland and mangroves (Figure 6). The natural pattern of vegetation is markedly influenced by urbanisation.

The vegetation of the area crossed by the Beira Corridor comprises a stepped sequence of dry and moist formations related to the physiography and climate of the area.

From Beira eastward to the Zimbabwe border the railway line crosses physiographic areas with distinct broad vegetation types: A seasonally-inundated lowland formation (the Gorongosa "tandos") links the Zambezi Valley with the Pungue system in the South via the Urema trough (Rift Valley). Tree species include *Acacia* spp. and *Hyphaene* sp. Moist (Lowland) formations of *Pteleopsis myrtifolia* and *Newtonia*. Going West of the rift Valley a narrow strip of *Julbernardia globiflora* in the south and *Brachystegia boehmii*, *Brachystegia allenii* in the north forms a curtain that separates an extension of *Julbernardia globiflora* with *Ostryoderris-Sclerocarya* that extends close to the border with Zimbabwe.

A Moist Semi-Deciduous-Mesoplana and Lowland-*Pteleopsis myrtifolia* or *Newtonia-Erythrophleum* runs in the southern part of the Pungué River in parallel to a tail strip of the *Julbernardia globiflora* with *Ostryoderris-Sclerocarya* extension. Along the eastern border with Zimbabwe and Malawi where the Mozambique plains rises up sharply to the western rim of the great southern African plateau, Afromontane elements are common and occur in small "island" habitats.

Moist forest formations occur on foothills, on slopes and in valleys between 500 and 1500 m where mean annual rainfall is between 1700 mm and 2000 mm. Species of *Parinari curatellifolia* and the Moist evergreen - *Maranthes polyandra-Aphloia macaranga* are the most abundant tree species.

From Beira northward to Malawi and Moatize the major vegetation types are fringing Mangroves around the coast and estuaries as well as species of *Hyphaena*, *Phoenix* or *Borassus* along the sand coast separated from the lower Gorongosa.

Dry Mixed – lowland – *Adansonia-Cordila-Brachystegia-Pteleopsis* separated, the Rift Valley vegetation from the moist lowland *Pteleopsis murifolia* or *Newtonia-Erythrophleum* and the coastal vegetation type of *Hyphaena*, *Phoenix* and *Borassus*. Along the eastern bank of Zambezi River in the north of Sofala a strip of *Acacia* spp., *Hyphaena*, as well as *Adansonia-Sterculia-Cordyla* extends South until the border with Zimbabwe and continues with a narrow stripe of *Colophospermum*). Along the northwestern side of the Rift Valley a large formation of saline soils extends up to the *Adansonia-Sterculia-Cordyla*.

At a broad level, 8 vegetation types can be mapped¹, as shown in Figure 6 below. The Mapping Units are based mainly on Wild & Barbosa (1967). These are:

¹ There are many other vegetation types or habitats that occur within the overall broad vegetation types; these cannot be mapped at this scale but where relevant are highlighted in the text.

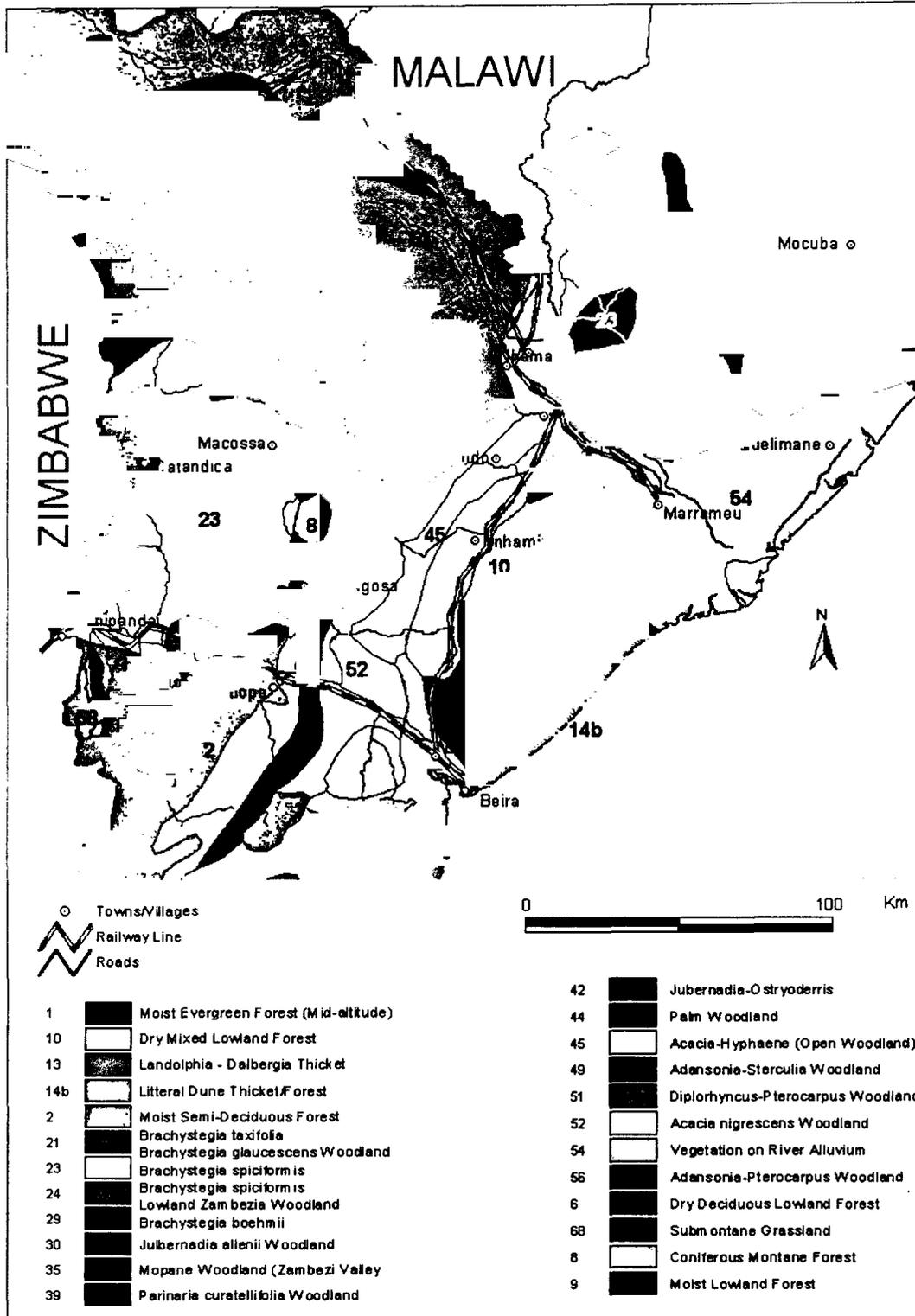


Figure 6. Vegetation types in the project area

1. Discontinuous Dry Savanna Woodland-Tree Savanna and “Tandos” Grassland (Gorongosa Lowland): *Acacia – Hyphaene* Open Woodland (Equivalent to Mapping Unit 45, Wild & Barbosa, 1967)

This type of vegetation is characterised by a discontinuous dry deciduous savanna woodland and thicket (with dry forest patches here and there) with a tree or shrub savanna of *Acacia-Hyphaene* and, in depressions, extensive grasslands (tandos) with a large number of pools. This type is characteristic of an area in the Gorongosa National Park.

On small elevations of conglomerates, sandstones and calcareous soils sloping down to the R. Urema is savanna woodland with deciduous *Adansonia digitata*, *Sterculia appendiculata*, *S. africana*, *Cordyla africana*, *Lonchocarpus capassa*, *Azelia quanzensis*, etc. Here and there this formation thickens into dry forest patches. In reddish brown clayey, compact soils is a tall shrub savanna with *Combretum ghasalense*, *Pterocarpus brenanii*, *Terminalia sericea*, *Ostryderris stuhlmannii*, *Dalbergia melanoxylon* and *Diospyros kirkii*. The grass layer is Andropogoneae, Paniceae, etc.

In the dark grey or black clayey soils with a high water table there is a tree savanna with thorny thickets of *Acacia nigrescens* (sometimes dominant) associated with *Albizia harveyi*, *Ziziphus mucronata*, etc., or a tree savanna with *Acacia xanthophloea*, *Hyphaene crinita* and *Combretum imberbe*, *C. ghasalense* or *Polycantha subsp. Campylacantha*.

2. Mosaic of Moist Semi-Deciduous Forest with Miombo Woodland (Equivalent to Mapping Unit 9, Wild & Barbosa, 1967)

Mixed formations of dense semi-deciduous tall forest, at low altitudes, of *Pteleopsis myrtifolia – Erythrophleum suaveolens* with *Hirtelia zanguebarica*; forming a mosaic with the catena facies of *Brachystegia spiciformis-Julbernardia globiflora*.

It occupies the area of Cheringoma to Inhaminga and Marromeu. This type develops in these areas because of the relatively abundant littoral rains and also because of the accumulation of ground water. It is therefore partially edaphically controlled.

3. Deciduous Miombo Tree Savanna with Gregarious Dense Dry Woodland with *Julbernardia globiflora – Androstachys johnsonii* (Equivalent to Mapping Unit 36, Wild & Barbosa, 1967)

A belt of this type of woodland occurs between Inhaminga and the Urema River lowland that intrudes into the eastern Pungwe basin. It consists of species such as *Julbernardia globiflora*, *Pterocarpus angolensis*, *Burkea africana*, *Albizia versicolor* and *Azelia quanzensis*. Gregarious patches of *Androstachys johnsonii* forest form a further element of the mosaic.

Between the Inhaminga region and the valley of the R. Urema (Gorongosa National Park), in calcareous soils derived from the Cretaceous there is also a tree savanna of

Acacia nigrescens, *A. spp.*, *Dalbergia melanoxylon*, *Ziziphus mucronata*, *Spirostachys africana*, etc. or *Ostryoderris*, *Lonchocarpus*, *Terminalia*, *Sclerocarya*, etc.
Scattered in the *Julbernardia* savanna are gregarious patches of *Androstachys johnsonii* forming the second element of the mosaic.

4. Open Deciduous Tree Savana of *Acacia nigrescens* (Equivalent to Mapping Unit 52, Wild & Barbosa, 1967)

In Mozambique there are several communities of scattered trees and shrubs where *Acacia nigrescens* is the dominant in the tree/shrub layer. An important patch extends some way up the R. Buzi valley to its confluence with the R. Revuè and thence northwards on the slopes adjacent to the lowland "tandos" of the R. Urema (Gorongosa). On the Gorongosa tandos, there is a tree/shrub savanna with *Acacia nigrescens* (dominant), *A. karroo*, *Ostryoderris stuuhlmannii*, *Sclerocarya caffra*, *Combretum ghasalense*, *Dalbergia melanoxylon*, *Ziziphus mucronata*, *Combretum imberbe*, etc., whilst in low lying areas bordering the tandos there is *Acacia xanthophloea* and *A. nilotica subsp. Kraussiana*.

5. Dry Early Deciduous Shrub Savanna (Lowland) with *Diplorhynchus* – *Pterocarpus brenanii* – *Combretum spp.*, *Diospyros* (Equivalent to Mapping Unit 51, Wild & Barbosa, 1967)

This type occurs in a significant area of the Zambezi valley between the Chicôa and Sena regions. The most common species are *Pterocarpus brenanii*, *Diplorhynchus condylocarpon*, *Combretum ghasalense*, *Diospyros kirkii*, *Terminalia sericea*, *Sclerocarya caffra*, *Acacia nigrescens*, *Colophospermum mopane* (shrubby), *Julbernardia globiflora*, *Combretum imberbe*, *Dalbergia melanoxylon*, *Bauhinia tomentosa*, *Cordyla africana*, *Sterculia quinqueloba*, etc.

6. Deciduous Dry Miombo (Lowland) Savanna Woodland with *Julbernardia globiflora* (Equivalent to Mapping Unit 30, Wild & Barbosa, 1967)

This type of vegetation is well developed in the Zambezi Valley region. It occurs in the Districts of Manica, Sofala, Tete and Zambezia Provinces. The following species occur where *J. globiflora* is dominant: *Diplorhynchus condylocarpon*, *Terminalia sericea*, *Brachystegia boehmii*, *Diosphyrus kirkii*, *Oxytenanthera abyssinica*, *Colophospermum mopane*, *Pterocarpus brenanii*, *Combretum ghasalense*, *Burkea africana*, , etc.

7. Dry Early Deciduous Savanna Woodland with *Colophospermum Mopane* (Equivalent to Mapping Unit 35, Wild & Barbosa, 1967)

This type of vegetation covers large areas in the Zambezi valley, where the *Colophospermum mopane* savanna woodland is usually medium or tall (10-15 m), almost pure but with some *Adansonia digitata*.

Mopane savanna woodland often grades into *Julbernardia globiflora* savanna woodland (MP 30) in drier areas with poorer well drained soils and into the *Adansonia*, *Sterculia* savanna domain (MU 49). On the banks of the Zambezi River, the mopane is often replaced by *Ziziphus mauririana*, *Diospyrus mespiliformis* and sometimes *Berchemia discolor*.

8. Vegetation on River Alluviums (Equivalent to Mapping Unit 54, Wild & Barbosa, 1967)

This type of vegetation is an important coastal formation in Mozambique. The areas with this type of vegetation are mainly periodically flooded, badly drained plains with extensive grasslands, interspersed with some slightly higher, well-drained areas. On these latter occurs a dry savanna with scattered trees and shrubs.

This is mapped as a single unit although two main sub-units can be distinguished viz., (a) the seasonally inundated Gorongosa Tandos that links the Zambezi valley with the Pungwe System in the south via the Rift Valley, and (b) the seasonally inundated grasslands of the lower Pungwe/Buzi floodplains and estuary.

Table 2 below summarises on a chainage kilometre basis the vegetation mapping units (Wild & Barbosa, 1967) the Sena Line traverses. Please refer to section above for details.

Table 2. Dondo to Moatize: Vegetation Mapping Units (Source: Wild & Barbosa, 1967)

Section	Mapping Unit (MU)
Dondo – Inhaminga	45 (Acacia – Hyphaene Open Woodland) 9 (Moist Lowland Forest) 36 (Julbernardia globiflora with Androstachys (patches) woodland) 52 (Acacia nigrescens woodland) 54 (Vegetation on River Alluviums)
Inhaminga – Sena	52 (Acacia nigrescens woodland) 45 (Acacia – Hyphaene Open Woodland) 51 (Diplorhynchus – Pterocarpus woodland)
Dona Ana – Vila Nova Fronteira	51 (Diplorhynchus – Pterocarpus woodland) 54 (Vegetation on River Alluviums)
Dona Ana – Moatize	51 (Diplorhynchus – Pterocarpus woodland) 30 (Julbernardia globiflora woodland) 35 (Mopane woodland, Zambezi Valley)
Inhamitanga – Marromeu	52 (Acacia nigrescens woodland) 36 (Julbernardia globiflora with Androstachys (patches) woodland) 45 (Acacia – Hyphaene Open Woodland) 54 (Vegetation on River Alluviums)

Fauna

Central Mozambique was traditionally a species rich area with a large diversity and abundance of big game and was frequently visited by tourists.

Prior to the armed conflict (c. 1982 – 1992) large mammal populations were reported to be healthy and increasing in most of the protected areas network. During the long period of conflict it was not possible to carry out surveys in any of the protected areas.

During this period there was much speculation regarding the status of large mammals in the protected and rural areas. After the end of civil unrest period primary data gathered

showed a massive decline in large mammal populations, especially of the three largest animals (elephant, buffalo and Hippo). In Gorongosa National Park the number of elephant prior to the conflict was in the order of 3000 whilst in 1994 only 108 elephants were recorded. Similar massive declines were recorded for buffalo (from 14,000 in 1979 to zero in 1994), hippo (from 4800 in 1979 to zero in 1994), wildebeest (from 5500 in 1968 to zero in 1994) and waterbuck (3500 in 1988 to 129 in 1994).

A similar devastating trend was recorded for Marromeu Buffalo Reserve. The Reserve, famous for its large herds of buffalo, boasted 20,000 buffalo in 1968 – in 1994 the estimate was 2346 animals. Other large mammal species showed similar declines.

Changes in large mammal populations for Gorongosa National Park and Marromeu Buffalo Reserve are given in Tables 3 and 4. Note: these data are based on aerial transect surveys and larger populations may still occur in densely wooded areas. Recent information indicates the large mammal populations are recovering in the Gorongosa National Park and Marromeu Reserve (Chande, B. pers. comm).

Table 3. Population data for large mammal species, Gorongosa National Park

(n/d = no data)

	1968	1970	1979	1993	1994
Elephant	2200	1900	3000	4	108
Buffalo	14000	11900	18000	0	0
Hippo	3000	3200	4800	0	0
Wildebeest	5500	4900	1900	7	0
Waterbuck	3500	2500	800	200	129
Zebra	3000	N/D	N/D	7	65
Eland	500	N/D	N/D	0	0
Sable	N7D	N/D	N/D	700	12
Hartebeest	300	N/D	N/D	0	156

Table 4. Population Data for large mammal Species Marromeu Complex

(N/D = No Data)

	1968	1977	1978	1979	1988	1990	1994
Elephant	257	331	361	373	?	326	0
Buffalo	20 000	45 000	43 992	30 394	11 575	3696	2346
Hippo	250	2820	1010	1770	N/D	260	0
Waterbuck	40 300	36 380	47 227	45 653	6455	4480	142
Zebra	673	1340	2120	2720	N/D	1205	0
Sable	N/D	N/D	N/D	250	N/D	N/D	0
Hartebeest	N/D	N/D	N/D	100	N/D	520	0
Reedbuck	N/D	N/D	N/D	250	N/D	N/D	20

During the field visit few animals were seen along the railway corridor. There were seen along the Mwanza – Inhamitanga – Marromeu and Marromeu – Caia parts and were mainly suni, klipspringer, blue duiker and baboons.

Other animals

The exact number of species of amphibia in Mozambique is unclear, due to taxonomic uncertainty. About 28 species, mostly located in the highlands, are believed to be endemic. Thirty-five amphibian species were recorded for the Chimanimani Massif of which two are endemic: *Bufo vertebralis grindleyi* (Grindleys toad) and *Arthroleptis troglodytes* (the cave squeaker).

Bird life was abundant and varied. About 200 species are known to occur, including pelicans, cranes, egrets, cormorants, herons, storks, darters, eagles, raptors, guinea fowls, hornbills, barbets, etc. Of special interest is the Wattled Crane, a globally endangered resident of sub-saharan Africa. The vast majority of the population (more than 95% of an estimated global population of 15,000 birds) occurs in south-central Africa, in the floodplains and dambos of the Zambezi, Pungwe, Lower Zaire, and Okavango River basins.

Within the project area, the wattled cranes are believed to migrate between the lower Pungwe floodplains and the GNP (Gorongosa National Park) as well as the Zembezi delta floodplains.

Termites and termitaria, although small in size are abundant in number. Termites have visible impacts upon landscapes and ecosystems, especially the hill-building species which are numerous on the Gorongosa ecosystem. The most common genera recorded by Tinley (1977) is the *Macrotermes mossambicus*, one of the three hill-builders.

Protected Areas

National Parks, Reserves, Controlled Areas and Vigilance Areas comprise the protected areas of this central part of Mozambique. Gorongosa National Park, Marromeu Reserve, Inhamitanga Forest, Nhapacue Forest and four controlled hunting areas are shown in Figure 7. The railway line from Beira to Zimbabwe crosses Vigilance Areas and Controlled Hunting Areas in Sofala and Manica Provinces.

The railway line to Malawi runs in between the Gorongosa National Park and Marromeu Reserve before crossing a controlled hunting area in the North near the eastern bank of the Zambezi River. Information concerning the wildlife species composition of those areas is listed below (Table 5).

Table 5. List of large mammal species recorded for the Gorongosa National Park

Scientific Name	English Name
<i>Loxodonta africana</i>	Elephant
<i>Syncerus caffer</i>	Buffalo
<i>Connochaets taurinus</i>	Wildebeest
<i>Equus burchelli</i>	Zebra
<i>Aepyceros melampus</i>	Impala
<i>Kobus ellipsiprymnus</i>	Waterbuck
<i>Hipopotamus amphibius</i>	Hippo
<i>Tragelaphus strepsiceros</i>	Kudu
<i>Hipotragus niger</i>	Sable
<i>Tragelapus angasii</i>	Nyala
<i>Taurotragus oryx</i>	Eland
<i>Alcelaphus lichtensteini</i>	Hartebeest
<i>Tragelaphus scriptus</i>	Bushbuck
<i>Redunca arundinum</i>	Reedbuck
<i>Phacochoerus aethiopicus</i>	Warthog
<i>Potamochoerus a porcus</i>	Bush pig
<i>Silvicapra grimmia</i>	Grey duiker
<i>Nesotragus moschatus mitis</i>	Suni
<i>Cephalophus natalensis</i>	Red duiker
<i>Panthera leo</i>	Lion
<i>Panthera pardus</i>	Leopard
<i>Acinonyx jubatus</i>	Cheetah
<i>Canis spp.</i>	Jackal
<i>Viverra civeta</i>	Civet
<i>Girafa camelopardis</i>	Giraffe

Source: Hatton & Munguambe, 1998

The Gorongosa Mountain-Rift Valley-Marromeu Complex in the East and the Afromontane habitats (including Chimanimani Mountains) are known as “Biological Hotspots” of Central Mozambique.

The Chimanimani Afromontane areas are well known for their high levels of biodiversity and endemism. Nearly 1000 vascular plant species have been recorded, of which 45 are endemic including five *Aloe* species, three species of *Erica* and two species of *Protea*.

However, none of these species were observed along the railway system during the field visit.

Table 6. Endemic plant species according to family recorded for the Chimanimani Mountains

Family	Species	Family	Species
ASTERACEAE	<i>Anisopappus paucidentatus</i> <i>Erlangea westii</i> <i>Helichrysum buchananii</i> <i>H. maestum</i> <i>H. rhodellum</i> <i>Humea africana</i> <i>Vernonia gracilipes</i>	FABACEAE	<i>Aeschynomene aphylla</i> <i>Crotalaria phylicoides</i> <i>Crotalaria</i> sp.
		LABIATAE	<i>Hemizygia critrephes</i> <i>H. flabellifolia</i> <i>Plectranthus caudatus</i>
		LILIACEAE	<i>Aloe munchii</i> <i>A. hazeliana</i> <i>A. howmanii</i> <i>A. plowsii</i> <i>A. wildii</i>
ASCLEPIADACEAE	<i>Pachycarpus graminifolius</i> <i>Raphionacme</i> sp.		
BALSAMINACEAE	<i>Impatiensis salpinx</i>		
CARYOPHYLLACEAE	<i>Dianthus chimanimaniensis</i>	LOBELIACEAE	<i>Lobelia cobaltica</i>
ERICACEAE	<i>Erica lanceolifera</i> <i>E. pleiotricha</i> <i>E. wildii</i>	MELASTOMATACEAE	<i>Pseudosbeckia swynnertonii</i>
		POLYGALACEAE	<i>Polygala rehmannii</i>
		PROTEACEAE	<i>Protea crinita</i> <i>P. enervis</i>
ERIOCAULACEAE	<i>Mesanthemum africanum</i>		
EUPHORBIACEAE	<i>Antidesma vogelianum</i> <i>Clutia</i> sp. <i>Phyllanthus</i> sp.	RUBIACEAE	<i>Oldenlandia canum</i>
		SANTALACEAE	<i>Thesium dolichomeres</i> <i>T. chimanimaniensis</i>
VELLOZIACEAE	<i>Vellozia argentea</i> <i>Crotalaria</i> sp.	UMBELLIFERAE	<i>Centella obtringularis</i>

Source: Hatton & Mungambe, 1998

2.1.7 Ecologically sensitive areas

All river courses, streams and drainage lines must be considered ecologically sensitive areas.

Other ecologically sensitive areas due to its outstanding biological value that occur in the project area are (also refer above):

- The Gorongosa Mountain – Rift Valley Complex (Sofala), supporting several endemic and near-endemic plants and animals within the mountain's habitats;
- the Cheringoma Plateau (Sofala), comprising several important hardwood species;
- the Zambezi Delta grasslands and swamps (Sofala and Zambezia), representing an important wetland for resident and migratory bird species (It has been

recently qualified as a Wetland of International Importance under the Ramsar Convention), and

- the Chimanimani Massif (Manica) – which, although relatively small in area is characterized by an exceptionally high diversity of habitats and species and a rich endemic flora.

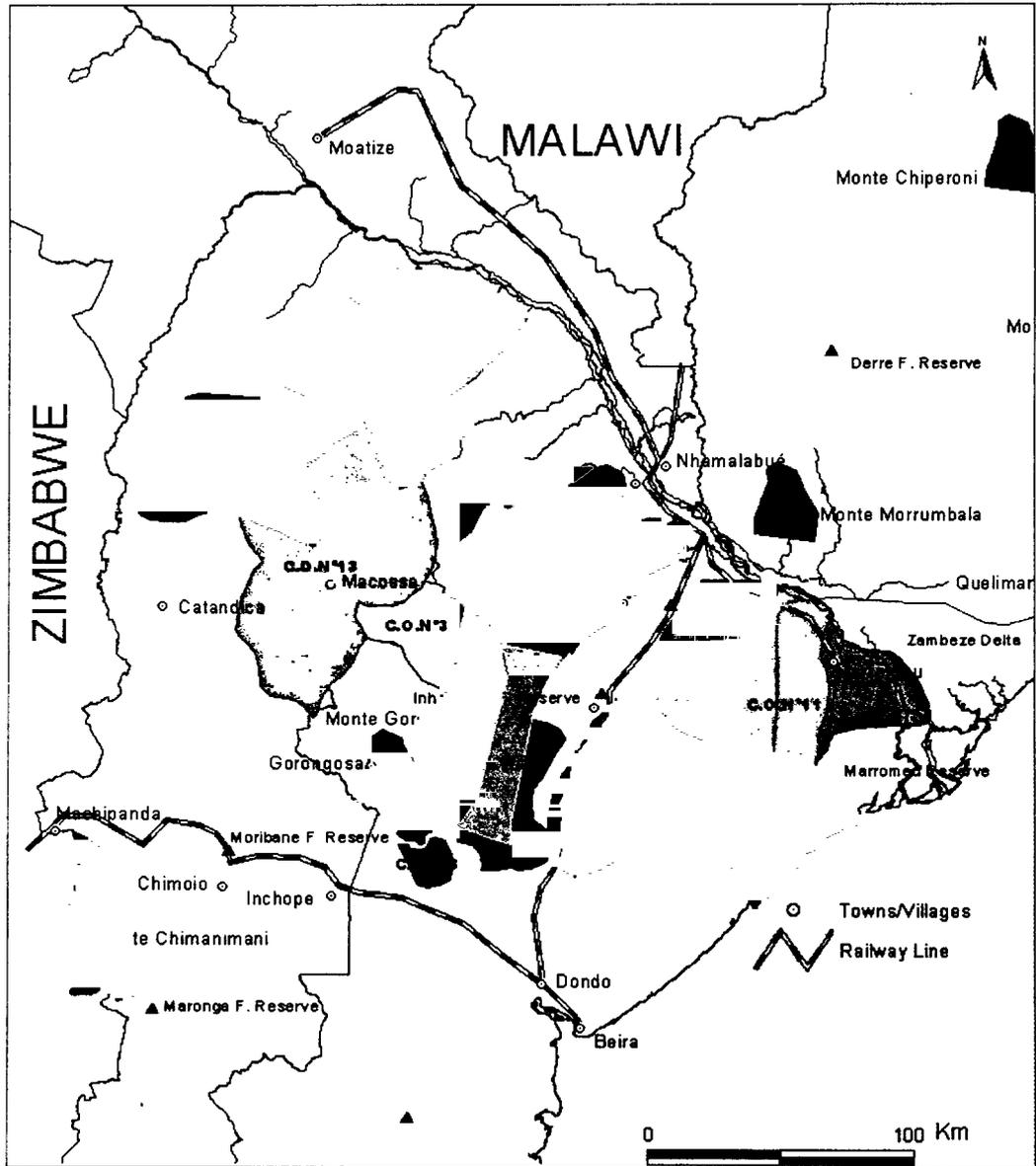


Figure 7. Sensitive areas, National Parks and Reserves in the project area

2.1.8 Socio-Economic Status

The Sena Line, that extends from Dondo, in the proximities of the City of Beira, up to Moatize, in the Province of Tete, is a decisive factor for the development of the central area of Mozambique in general and of the valley of Zambezi in particular. The Zambezi River valley comprehends an area of about 225 thousand square kilometers, covering the whole Tete Province and the Districts of Morrumbala, Mopeia, Chinde, Milange, Mocuba, Maganja of Costa, Namacurra, Nicuadala, Inhassunge and Quelimane (in the Zambezia Province), Gorongosa, Maringuè, Chemba, Caia, Marromeu, Cheringoma, and Muanza (Sofala Province), Bárúé, Guro, Tambara and Macossa (Manica Province). In this vast area of the valley of Zambezi, live about 4 million inhabitants, in other words, the equivalent to a quarter of the population of Mozambique.

In the Zambezi Valley there is an immensity of natural resources, distributed according to the characteristics of the different geographic sub-areas. The plateau sub-area of the Valley (constituted by the districts of Angónia, Tsangano, Chifunde, Macanga and parts of Chiúta and Moatize, Zóbué), due to their excellent agriculture-climatic characteristics, has enormous agriculture and cattle breeding potentialities. Traditionally, the agricultural production of the plateau was transported through the Sena Line, starting from Cambulatsisse, before its paralysation in 1984.

The main potentialities of the Medium-Zambezi, including the Districts of Zumbo, Marávia, Mágoè, Cahora-Bassa, Chiúta, Changara, City of Tete, Moatize (Tete Province) and Guro in Manica, consist of: hydro-electric power, agriculture, cattle breeding, forests, wildlife, mineral, fishing and tourism resources. With the majority of the rural population living of agriculture, cattle breeding and fishing, this sub-area presents a low population density, living in small-dispersed communities, with the exception of some urban centers.

The main wealth of the so called Shire-Zambezi (composed by the Districts of Mutarara, in Tete, Morrumbala/Zambézia, Tambara/Manica and Chemba/Sofala) are cotton, corn, millet, beans, cassava, sweet potato, peanut, sesame and horticultural. Besides the agriculture, the population is renowned for livestock (goats, cattle, pigs) and fishing, although on a smaller scale. It is a poorly populated area.

The most populated sub-area of the Basin of Zambezi is the one of the Zambezi delta that has about 1.8 million of inhabitants, which represents about a half of the population of the whole Zambezi Basin in Moçambique. Belonging to this sub-area are the districts of Milanje, Mocuba, Maganja da Costa, Namacurra, Nicoadala, Quelimane, Mopeia and Chinde in the Zambézia Province, and Marromeu and Caia in Sofala. The economy of this sub-area is based in agriculture, cattle breeding, fishing, trade, mines and transports. There are potentialities in the industry and tourism sectors, still not recovered from the effects of the war. In the past, this sub-area gave a great contribution to the national economy, through the production of the main alimentary and export cultures, such as: rice, copra, tea, cashew nut, cotton, sugar, corn, bean, sorghum and peanut.

Finally it is important to refer the potentialities of the Low-Zambezi, which includes the Districts of Muanza, Cheringoma, Gorongosa and Maringuè (in Sofala), Bárúé and Macossa in Manica Province. Besides the agriculture and cattle breeding, this sub-area is rich in forest, fauna and tourism resources.

The Beira Railway System has a very important role in the international trade of the neighbouring countries, especially Malawi and Zimbabwe, through the Port of Beira, as well as in the export of the numerous goods produced in Mozambique. These goods include coal from Moatize, granites from Tete, sugar from Marromeu, Luabo and Mafambisse, timber from Sofala and Zambézia, cotton from Murrumbala, Manica and Sofala and citrus from Manica, as well as various other products from central Mozambique.

Summarizing, in the valley of Zambezi there are enormous potentialities for development. However, these are conditioned to the reconstruction of the Sena Line, the construction of the bridge on the Zambezi river and the rehabilitation of secondary and tertiary roads, linking the railway line to the productive areas of the interior. In fact, the inoperativeness of the Sena Line constitutes a great constraint, at this time, for the accomplishment of many projects in the Zambezi valley. The projects for restarting the production of sugar, cotton, tobacco, rice, and wood are in course, but they go very slowly due to a fundamental reason: the stoppage of the railway line and the degradation of access roads to the interior of the Basin of Zambezi. The largest mining activity of Mozambique is in the Zambezi Basin river, waiting for the rehabilitation of the Sena Line for its mobilization. All these confer the strategic importance of the operation of the Sena Line within the context of economic reanimation of the central area of Mozambique and on the improvement of the local population living conditions.

Figure 8 below shows the districts traversed by the railway lines of Machipanda and Sena as well as the respective population densities, according the 1997 Population Census (INE, 1999).

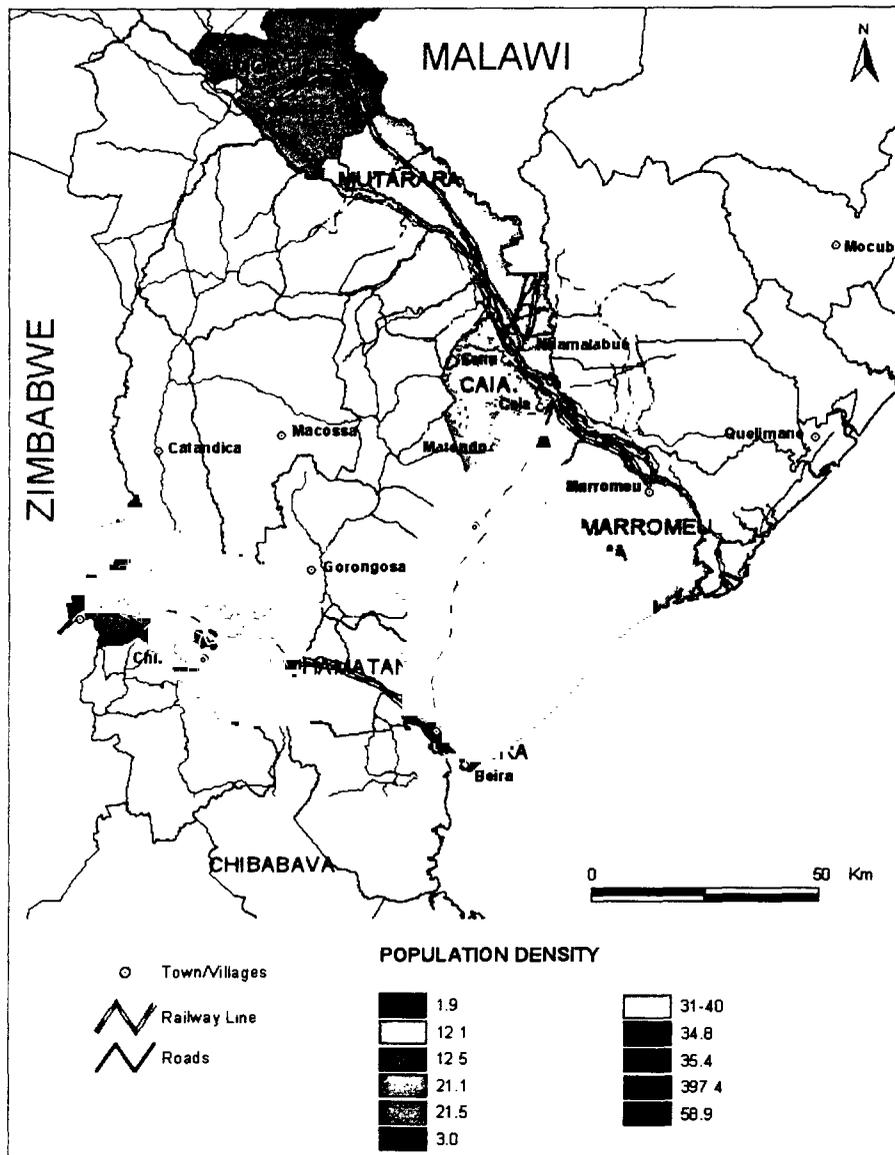


Figure 8. The Districts traversed by the railway lines and the respective population densities

Beira is the capital of Sofala Province and the second largest town in Mozambique. This town accommodates the Port of Beira, which is of crucial importance in handling and transportation of goods along the Beira Corridor.

Beira City, the capital of Sofala Province, concentrates almost one third of the province's total population (30.8%). The other most populated districts are Buzi (11.1%), Nhamatanda (10.7%) and Dondo (9.1%). The current population of Sofala Province and its distribution is presented in Table 7. The Beira Corridor traverses the Districts of Nhamatanda, Dondo, Muanza, Cheringoma, Caia and Marromeu.

Table 7. The Population of Sofala Province

Population of Sofala Province	Number
Total Population	1 289,390
Urban	41%
Rural	59%
Economically active	35%

Populations of the three Provinces crossed by the Beira Corridor were estimated at 1 289,390 for Sofala Province, 974,208 for Manica Province and 1 144,604 for Tete Province (INE, 1997).

A brief socio-economic description of the three provinces covered by the Beira Corridor is given below. More detailed and site-specific socio-economic data obtained during fieldwork is presented in Chapters III (Sena Line) and IV (Machipanda Line) below.

Sofala Province

Two population groups dominate the area, namely, the Ndau, from Beira to the South and also northwards into the Manica Province. This group is part of the Shona Tribe. The other group is the Sena, dominating the area from Beira to the North. Neither of the above population groups dominates in the Beira area. They coexist and interact socially.

The majority of the population in Sofala Province speaks cisená, followed by cindau and Portuguese.

Half of the population in the Sofala Province is non-religious. The most practiced religions are Sião/Zione and catholic. In the rural areas, non-religious people represent over 50% of the population compared to the urban areas where only 35.3% do not practice any religion.

In the urban areas, the most common religion is Catholic (27.2%), followed by Protestant/Evangelic (13.7%). In the rural areas, the most common religions are Sião/Zione, followed by catholic.

The economy of Sofala Province is characterised by a subsistence sector, with extremely low levels of productivity and dependent on climatic factors. The industrial sector is weak, with poor internal economic integration and relations, a relatively large component of services to neighbouring countries, notably in the use of migrant labour in ports and railways.

The main economic activities of the local inhabitants presently located within the Beira Corridor are: household/subsistence agriculture, charcoal production, wood collection and selling, fishing, informal commerce and hunting.

Subsistence farming is the mainstay of about 600 000 families. Production of surplus is low, linked with poor availability of infrastructure for delivery of produce. The most important agricultural products for the farmers are maize, rice, sunflower, sorghum and cashew, which they both consume and sell. Peasant and commercial livestock production is relatively important in Sofala. It includes cattle, pigs and other smaller species.

Tourism is poorly developed in Sofala. Hotel capacity is currently about 1 700 beds in various establishments of different grades. The poor state of repair of infrastructure and the scarcity of properly trained staff are the main constraints faced by this sector.

The reopening of the Gorongosa National Park and several Game reserves, and the rehabilitation of their accommodation facilities, represent a major opportunity for investors.

Manica Province

Manica Province has a population of 974,208 inhabitants, of which 28.2% live in the urban areas and 71.8% in the rural areas (INE, 1999).

The population is distributed in a relatively uniform way in the various districts. For example, the most populated district, Gondola, has 19.0% of the population, Chimoio, the capital has (17.6%) and Manica District (16.0%). The Machipanda Line crosses the Districts of Gondola and Manica.

The most spoken language in the Manica Province is cindau (28.6%), followed by chitwe (21.6%) and cimanika (15.4%). Other important languages in the region are cisena (10.7%) and cinyungwe (5.3%).

Non-religious people represent over 50% of the population (54.0%). The most important religion is Sião/Zione (26.4%), followed by Catholic (11.5%) and Protestant/Evangelic (3.3%).

In the urban areas, the percentage of non-religious people is less than in the rural areas (40.2% and 59.5%, respectively). The percentage of the people that practice the Sião/Zione religion in both areas is similar (27.6% and 26.0%). However, the percentage of people that practice the Catholic and Protestant/Evangelic religions is higher in the urban areas compared to the rural areas (20.5% against 7.9% and 4.4% against 2.8%, respectively).

The main economic activities in this Province are agriculture, fisheries and forestry.

Tete Province

Tete Province is centrally located in what resembles a peninsula extending itself westwards and is almost totally surrounded by foreign countries (Malawi, Zambia and Zimbabwe). The province has strong economic, cultural and family ties with these countries. There is even a history of migration of people from Tete to Zimbabwe and the other way around (especially now with the political problems in Zimbabwe).

Tete Province has a population number of 1 144,604 inhabitants, of which 14.7% live in the urban areas and 85.3% live in the rural areas.

The most populated districts in Tete Province are Angónia (21.7%), Mutarara (11.4%) and Changara (10.4%). Tete City, the capital of the province, concentrates 8.9% of the total population. Moatize concentrates 9.5% of the Province's total population. The Sena Line crosses Mutarara and Moatize Districts.

Nyanja, Nyungwe and Sena, representing 88% of the total population of Tete Province, are the dominant groups. From a geographical point of view, these predominant ethnic and langua groups are concentrated in a number of areas in the province (Table 8).

The most important languages spoken in Tete Province are therefore cinyanja (48.4%), followed by cinyungwe (27.9%) and cisena (11.7%).

Table 8. Distribution of Ethnic Groups by Geographical Areas in Tete Province

Ethnic Group/ Mother tongue	Geographical distribution (districts)
Nyanja	North of the Zambezi River, districts of Zumbo, Maravia, Chifunde, Chiuta, Angonia, Tsangano and Mutarara
Nyungwe	South of the Zambezi River, districts of Magoe, Cahora Bassa and Changara
Sena	Changara and Mutarara Districts

In terms of religion, non-religious people represent almost half of the population (43.9%). Catholic religion is the most important one, practiced by 22.7% of the population, followed by Sião/Zione (17.5%) and Protestant/Evangelic (4.3%).

The percentage of non-religious people in the urban and rural areas is similar (42.3% and 44.2%, respectively). The percentage of the people that practice the catholic religion is also similar, with 27.6% in the urban areas and 26.0% in the rural areas. However, the percentage of the people that practice the Sião/Zione is higher in the rural areas.

The main economic activities in this Province are agriculture, fisheries and forestry.

The main crops are maize, sorghum and millets, particularly close to the riverbanks.

Apart from crop and livestock production people living in the rural areas of the province are involved in a diverse range of other food and income generating activities. Some of these activities are fishing, exploitation of forest resources, hunting, informal trading and retailing.

2.1.9 Land Use Patterns

There are a number of factors that influence how the land is used, these including the fertility of soils (for crop production), the terrain, the presence of Tsetse fly in some

areas, accessibility (limited in most areas), the availability of water for domestic purposes and livestock and the availability of household labour. Low and erratic rainfall, coupled with high temperatures, is a generally limiting factor throughout most of the project area.

Most land in the project area is used for agriculture by the family sector. Most of this land is used to provide grazing and browsing for livestock, followed by cultivation.

Over the years the family sector farmers have developed livelihood strategies oriented towards minimizing through crop diversification, which takes place in a variety of ways including:

- Growing several crops and the dominance of mixed intercropping with crops which are tolerant to drought conditions, e.g. millet, sorghum, groundnut and pumpkin,
- Preferring to grow two or more consecutive crops rather than a single one of longer cycle, even if the potential total yield is higher for the latter, to obtain advantage of moisture availability during the short rainy period,
- Growing crops in as many diverse environments (topography/relief/soil) as possible, e.g. in sandy flat areas, in medium textured colluvial deposits of slopes (transition zones), in the fine textured dark coloured soils of the lowlands and in the open valleys and alluvial fans.

This results in a combination of plots on different soil types and in different crop preferences, each with different fallow and cropping patterns.

The land use pattern in the areas traversed by the Sena and Machipanda railway lines is shown in Figures 9a), b) and c).

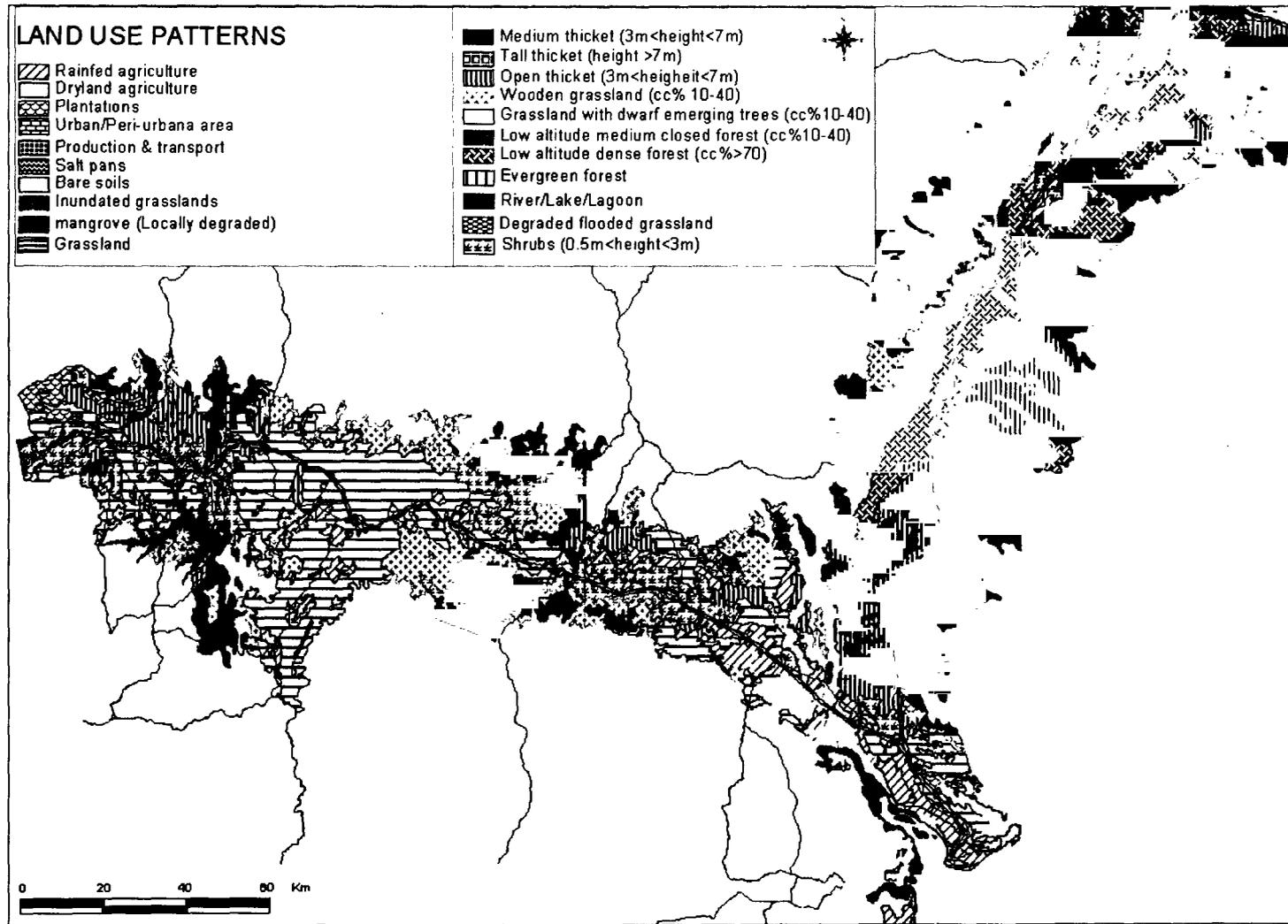
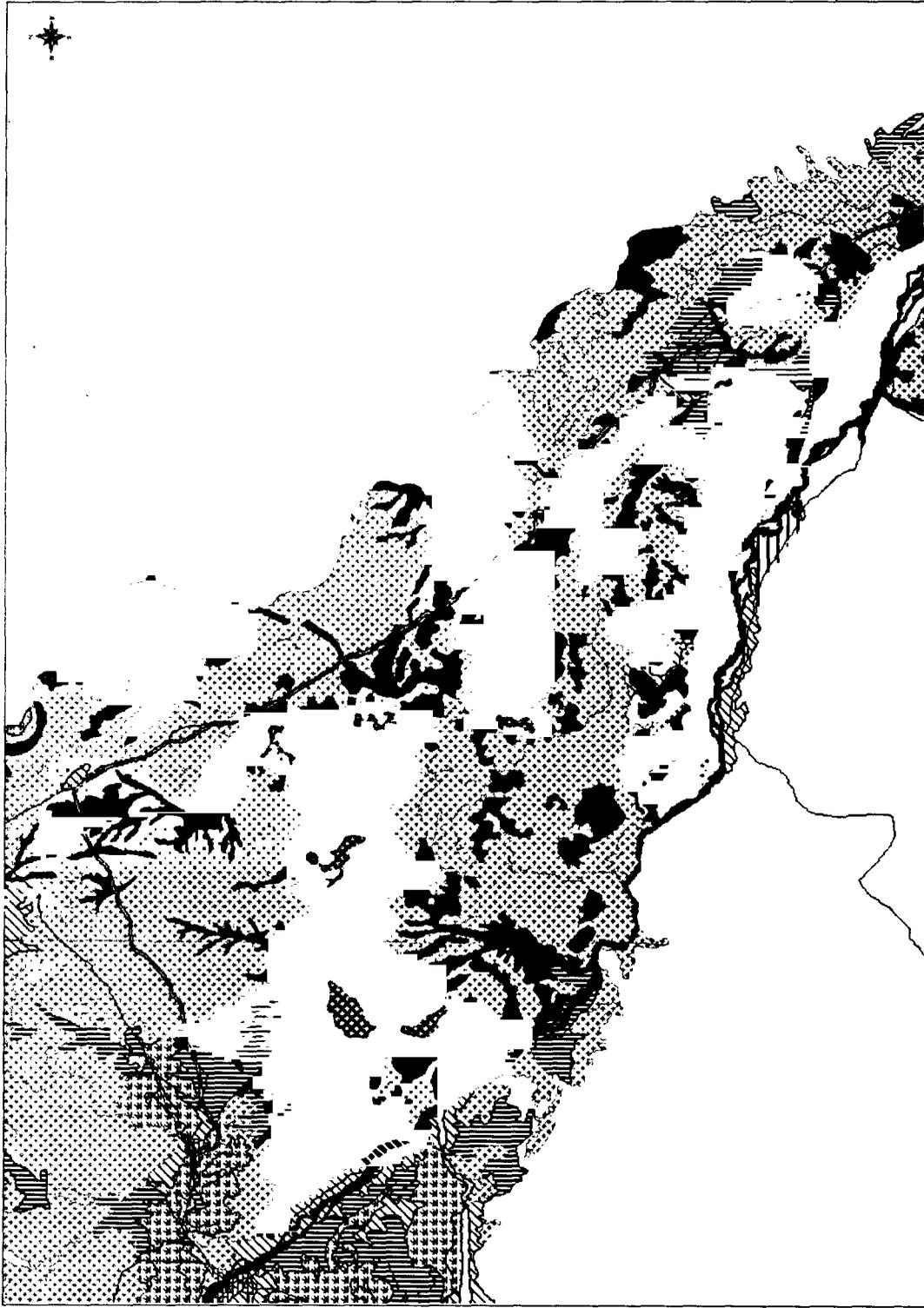


Figure 9. a), b) and c). Land use pattern in the areas traversed by the Sena and Machipanda railway lines





CHAPTER III
FIELDWORK RESULTS
SENA LINE

3. INTRODUCTION

It is important to highlight that this is not an Environmental Impact Assessment Report and that most of the impacts occurred during construction of the railway lines. Examples of these are permanent loss of habitats, including wetland habitats; destruction or damage of threatened plants; construction-induced erosion; reduction of biodiversity as a consequence of habitat fragmentation; increased unsustainable hunting and poaching as a consequence of improved accessibility, accelerated transformation of natural habitats from harvesting of natural resources such as timber, fuel wood, charcoal production, etc).

At this stage, very few negative impacts will result from the rehabilitation of the lines.

3.1 CONSTRAINTS

A major constraint was the impossibility of ground truthing the entire line due to lack of access and existence of land mines. However, although it was not possible to ground truth the entire railway corridor on a chainage kilometre basis, part of the environmental assessment will be at a screening level and based on best available information (mapping, assessment of similar habitats, etc).

3.2 APPROACH

Fieldwork was conducted over a 6-day period from 6 -11 October 2003. During this period most of the railway lines (Sena and Machipanda) were ground truthed on a chainage kilometre basis. The Concrete Sleepers Factory and a warehouse at the offices of "Brigada de Reconstrução da Linha de Sena" in Dondo were also visited.

The socio-economic study was based on the following:

- Semi-structured interviews. The interviews were made with the support of a check-list (Annex 2) and the target groups were the owners of properties close to the line, district and municipal authorities, community leaders, CFM railway station workers and local residents in general.
- Direct observation. The team that carried out the study visited the whole alignment of the Sena and Machipanda Lines observing carefully the aspects of interest for the study.
- Documentary and bibliographical analysis. A group of documents and bibliographical sources (to see bibliographical reference) was consulted for the data information on direct observation and of the interviews.

For the sake of brevity only the key environmental and socio-economic features of each of the lines are described here.

With reference to chainage kilometre, km 0 refers to Dondo (the origin of the line).

Rehabilitation works started in Dondo and at this stage only the line and the bridges/culverts will be rehabilitated. As part of it, the existing drainage channel will also be repaired and/or cleaned and a new one built in order to have one drainage channel on each side of the railway line.

Rehabilitation also entailed demining activities on 10m of each side of the line and clearing of vegetation on 10 m on each side.

It is also important to highlight that according to the Land Law (Decree 66/98 of the 19/97 Land Law) the Partially Protected Zone for Railway Lines is 50 m on each side of the line. However, CFM has decided to reduce the Partially Protected Zone inside the villages to a width of 10 m on each side.

The Railway stations and halts will be rehabilitated later by the same team that is repairing the bridges and culverts. At the time of the field visit, less than 20 km had been rehabilitated.



Photo 3. Rehabilitated drainage channel

This chapter presents the findings of the audit and is separated into three main sub-sections:

- a) Concrete Sleepers Factory
- b) Warehouse
- c) Sena Line

3.3 ENVIRONMENTAL AUDIT FINDINGS

3.3.1 The Concrete Sleepers Factory

Concrete sleepers are produced from cement, crushed stone, sand, water, steel wire and shoulders in a process that results in liquid and solid wastes. Sludge from the concrete production process and waste water is discharged into a ditch outside the factory (Photo 4 below) whereas the solid one is accumulated onsite and then taken to a waste pit. It can also be used for construction purposes and is frequently sold out to local people.

The ditch where the liquid effluent is discharged forms part of Dondo's sewage system.

Rejected sleepers are not recycled but can be used in secondary and/or tertiary lines.



Photo 4. Ditch where liquid waste is disposed of

This Factory includes a laboratory where the test cubes are moulded and tested for superficial humidity, as well as corrected before usage. The concrete sleepers are then produced in the production lines.

The only raw materials used here are concrete, sand and water. Wastes are taken to a waste pit. Small quantities of CaCO_3 (Calcium Carbonate) may be used (presently not) in the process to determine the superficial humidity of sand (inert material). Calcium Carbonate has a low hazard risk for accidental ingestion, skin and eyes.

Paper wastes from the offices are burnt in a waste pit.

The details of the audit findings are presented in the following table.

Table 9. Audit Findings for the Concrete Sleepers Factory

Audit Finding	Positive/Negative
All forms of waste have been identified but the exact quantity of each is not known	Positive
It is known where each waste originates	Positive
Waste is not recycled but rejected sleepers are used in secondary and tertiary lines	Positive
Arrangements to dispose of waste are adequate	Positive
There is a clear procedure to deal with such incidents as chemical spills and accidental releases	Positive
Employees have been trained to deal with foreseeable emergencies	Positive
Use of protective gear (overalls, helmet, goggles, ear plugs, respirators) is generally adequate.	Positive
Working site is kept clean	Positive

Table 9 above shows that all the audit findings are positive.

Although the use of protective gear is generally adequate, its use should be enforced at all times.

Management guidelines for the potential use of CaCO_3 in the laboratory are presented in Section 3.5.

3.3.2 The Warehouse in Dondo

Material is stored in an adequate form in storerooms according to type. It is adequately labelled and registered.

Some storerooms contain chemicals such as ammonia and battery acid, but these are kept well closed, on the ground and are easily identifiable.

Various types of materials are also stored in open air by type. Waste (mainly scrap metal) is also kept there.

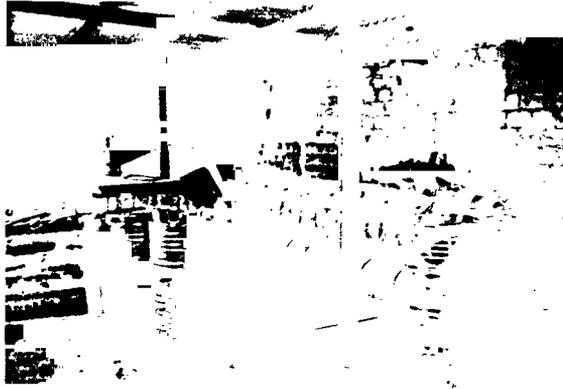


Photo 5. Storeroom, showing diesel drums, used tyres, old machines and diverse waste

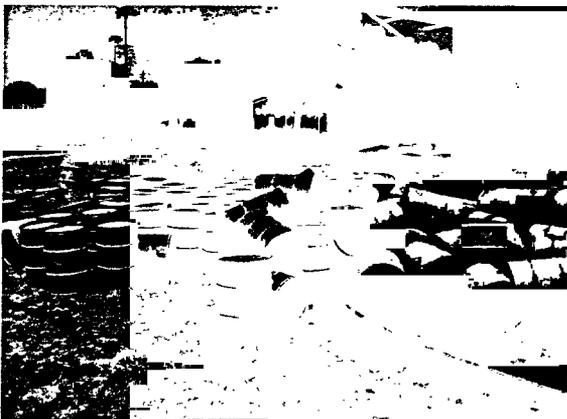


Photo 6. Chemical (Welding) Material

Some waste material is also contained in a storeroom (e.g. used tyres, old machines, diesel drums, etc). These areas are mostly clean and organized. However, in one of them there was some diesel spill on the floor and diverse rubbish (e.g. paper, sawdust). Used diesel/oil drums are not collected by Petromoc and are used for various purposes on-site.

Approximately 100 drums of a reactive powder (from P.C. Wagner, in Vienna) used for rail welding purposes were in open air, exposed to the sun and rain (Photo 6 above). However, these are usually kept in a storeroom that was being repaired at the time of the

visit. According to CFM, this was a short term measure and the drums have been returned to the storeroom.

The details of the audit findings are presented in the following table.

Table 10. Audit Findings for the Warehouse in Dondo

Audit Finding	Positive/Negative	Major/Minor
Chemical (welding) material temporarily exposed to rain and sun. No MSD (Material Safety Data) sheet available to determine handling, storage and disposal conditions.	Negative	Minor
Material/equipment is generally stored in an adequate way.	Positive	
There is a clear procedure to deal with such incidents as chemical spills and accidental releases	Positive	
There are oil/diesel spills on-site (including inside a storeroom)	Negative	Minor
There is a significant quantity of scrap metal onsite but this is in the process of being removed. Part of it will be re-used.	Negative	Minor
Various wastes on-site	Negative	Minor
Fuel tanks are on concrete pavement, but not bermed and/or bunded	Negative	Major

3.3.4 The Sena Railway Line System

The Sena Railway line system was divided into sections according to the maps provided by CFM. It comprises the following sections:

1. **Dondo – Inhaminga**
2. **Inhaminga – Sena**
3. **Dona Ana – Vila Nova Fronteira**
4. **Dona Ana – Moatize**
5. **Ramal Inhamitanga – Marromeu**

Defining environmental and socio-economic features for each of these line sections are presented below.

1. Dondo – Inhaminga

Along this section the line follows the existing road alignment.

Dondo has been considered km 0 for the purposes of rehabilitation. Photos below show the aspect of the line and station after rehabilitation.



Photo 7. Aspect of an already rehabilitated line and the Dondo Railway Station

In Dondo, the vegetation has already been cleared and drainage channels built. There are few population settlements along the line, although a few machambas have been seen next to the line in a natural drainage channel.

Local communities have been informed by the Governmental Authorities regarding the need to relocate and not to continue farming for new crops in the next season within CFM's Partially Protected Zone (Refer to Section 3.4.2 below).

Most of the line in this sub-section is characterized by very low population densities, with the exception of the main centers (e.g. Savane, Semacuesa, Derunde, Muanza, Condue, Mazamba and Inhaminga), where some informal markets have been built close to the line. Muanza and Inhaminga are the main urban centers.

Photos below show sites where informal markets or population settlements occur very close to the line. Very few of these occur within the 10 m/50 m partially protected zone of CFM, but are a common feature in the main population centers.

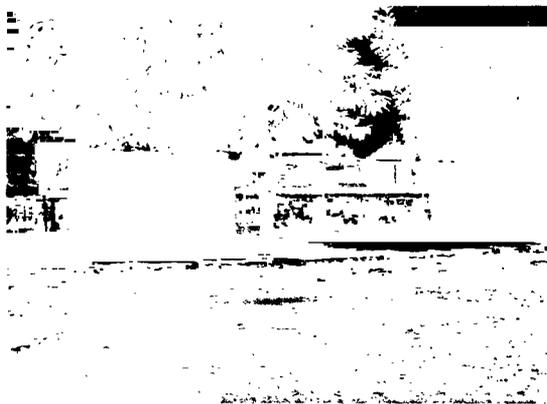


Photo 8. Informal market close to the line



Photo 9. House very close to the line (Condue, km 113)

The vegetation is naturally open woodland that turns into open Miombo woodland in Derunde. There are also a few patches of tree and shrub savanna from Muanza. From here until Inhaminga, the vegetation is open Miombo woodland again. The main plant species found along the lines are given in Annex 1. Close to the population settlements, the natural vegetation has been converted into machambas with cassava, maize, cabbage, banana, mango and pawpaw trees, sometimes on the line.



Photo 10. Open woodland with on-going track rehabilitation works



Photo 11. Open Miombo woodland in Savane - Miombo woodland at km 50 (Samacuesa)

Important commercially valuable hardwood species include *Azelia quanzensis* (Chanfuta), *Millettia stuhlmannii* (Panga-Panga) and *Androstachys jonsonnii* (Sinbirre).

With regards to the condition of the line, rehabilitation has gone as far as chainage km 17. From here, the railway line is in poor condition. Derunde to Inhamitanga (km 70 – 184) is one of the two sections of the entire Sena Line (the other section is between Mecito and Cambulatsisse) where the line has been completely destroyed.

The slopes of some drainage lines adjacent to culverts are showing signs of erosion due to the steepness of the slopes and lack of binding vegetation.

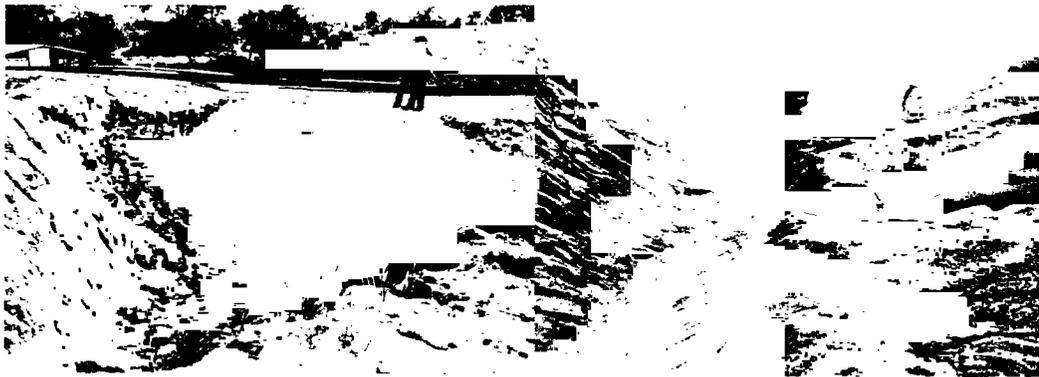


Photo 12. The rehabilitated culvert at Km 20 with erosion on the slopes of the drainage lines.

Burnt and/or old and abandoned carriages are seen along the whole alignment. Removal of scrap by a private company (Reclam) is progressing well and has been carried out until Savane (chainage km 26).



Photo 13. Samacuesa - Derunde

At chainage km 20 the Construction's brigade has a workers temporary campsite (Photo below).



Photo 14. Km 20 temporary camp site

The area is kept clean. Water is brought in by tractor.

A mobile diesel tank with a 1600 litre capacity was on-site and a few diesel spills were seen on the ground.

2. Inhaminga – Sena

Along this section the line follows the existing road alignment from Inhaminga to Inhamitanga (km 158 - 184) and from Caia to Sena (km 223 – 287).

The vegetation is basically a dense forest with Baobab (*Adansonia digitata*), *Pterocarpus angolensis* and *Brachystegia spiciformis* as the main plan species. As the Line crosses EN 1 (newly rehabilitated Gorongosa – Caia Road), the vegetation becomes open woodland mainly characterized by shrubs such as *Markhamia obtusifolia*, *Combretum paniculatum*, *Xylothea tettensis*, *Senna petersiana*, etc.

From Caia the vegetation is open woodland with *Albizia adianthifolia*, *Combretum molle*, *Combretum imberbe*, *Millettia stuhlmanii*, *Sterculia rogersii* and *Kigelia africana* as the main tree species.

Between Caia and Murraça, the line crosses wetlands that are part of the Zambezi floodplain. However, the line passes over an elevated area.

There are a few houses and machambas close to the partially protected zone. In this area people have been informed of the need to relocate from this zone.

With regards to the condition of the line, most of the rail line and sleepers are in good condition. In the Caia, Murraça and Magagade areas, the railway line is in good condition, but the wooden sleepers must be replaced. The line requires clearing of

vegetation, opening access tracks, rehabilitation of railway stations and halts and removal of scrap. The major operation would be the reconstruction of the bridge at Zangue River. There is a team already clearing vegetation and cleaning the station at Caia.

The bridge on Zangue River was destroyed by a bomb during the war. This bridge, including the railway line, requires total rehabilitation (Photos below).



Photo 15. Destroyed bridge at River Zangue (approx. km 223)

As in the rest of the alignment, there is a lot of scrap (mainly carriages), especially at the Caia, Magagade and Sena Railway Stations.

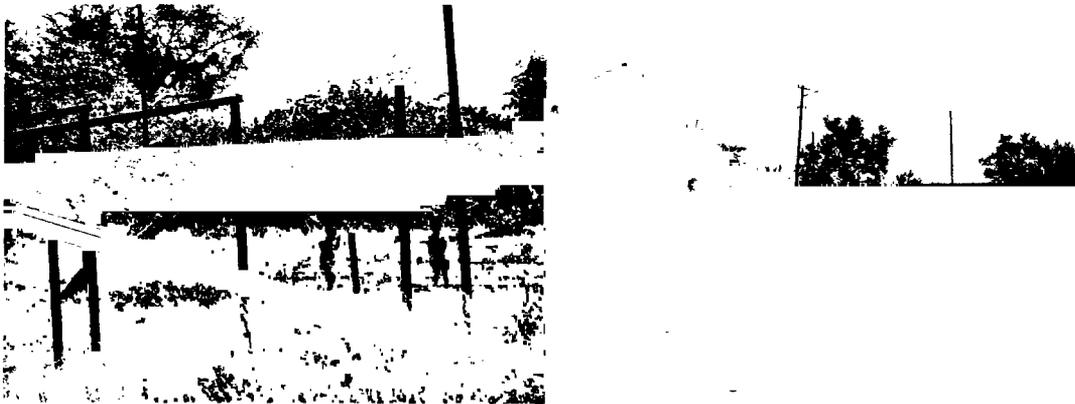


Photo 16. Scrap at Caia Railway Station - Scrap at Sena Railway Station



Photo 17. Trees covering old carriages in Sena

Sena is where Ponte Dona Ana, the 4.2 km bridge, crosses the Zambezi River to Mutarara (Tete Province). The bridge was formerly used only for trains but has since the war been adapted for vehicles. The railway line and sleepers need to be totally replaced and the idea is to rehabilitate it for both train and vehicle use.



Photo 18. Ponte Dona Ana

3. Ponte Dona Ana – Vila Nova Fronteira

This is the shortest section (44km), along which the line follows the existing road alignment in only a few areas.

The vegetation is shrub grassland with the following main plant species: *Combretum sp.*, *Albizia sp.*, *Adansonia digitata* (trees), *Ziziphus mucronata*, *Salvadora persica*, *Sesbania sesban*, *Vernonia sp.*, and *Trichodesma sp* (shrubs). The most common grass is *Panicum maximum*. As the line approaches Vila Nova Fronteira, the grassland is interspersed by miombo woodland with *Brachystegia sp.* and *Acacia nigrescens*.

The area presents significant signs of erosion.



Photo 19. Areas showing signs of erosion (Mutarara – Vila Nova Fronteira)

Most of the line in this sub-section is characterized by very low population densities, with no needs to relocate people.

The railway line is in good condition.

Some scrap can be seen at Vila Nova Fronteira Railway Station.

4. Ponte Dona Ana - Moatize

Along this section the line follows the existing road alignment all the way until Cambulatsisse. From here to Moatize it is not possible to see the line from the road.

From Ponte Dona Ana (Mutarara) to Moatize, the line traverses the following main types of vegetation: shrub grassland and open woodland. The main plant species are given in Annex 1).

This is one of the most critical areas with regards to erosion. From Mutarara to Doa, and from Doa to Cambulatsisse, the risk of erosion is significantly high. In certain areas the soil below the railway line eroded, appearing to be a bridge (only the rails are left).



Photo 20. Two examples of where the soil below the line has eroded

Areas showing minor signs of erosion occur along the whole alignment.

Most of the line in this sub-section is characterized by very low population densities, with the exception of the main centers (e.g. Mutarara, Chavundira, Sinjal, Mapangali, Doa, Chueza, Mecito, Necungas and Cambulatsisse), where informal markets close to the road and/or railway line are an important feature. In the main centres, some houses, machambas and a corral for cattle occur within 50m from the line. However, taking into account that within villages the partially protected zone has a width of 10m on each side of the line, none will be affected by this project.

The line is in rather good conditions from Mutarara to Mecito, where most of the railway is re-usable, at the exception of the wooden sleepers that require replacement. In certain areas though, the line is out of place and in others it has been folded and will require replacement.

The section of the line between Mecito and Cambulatsisse has been totally destroyed and requires replacement of railway line and sleepers, as well as rehabilitation of all the train stations and halts. The Moatize train station is the only one in good conditions and operational at the moment.

It is important to highlight that in Doa a drain-pipe has been placed next to a culvert. The area shows signs of erosion, probably due to the compaction between the two.

Scrap (remains of carriages, etc) are also found along this section. Old carriages are also still standing at all the train stations, including in Moatize, where according to the manager, there are no other types of waste.

5. Inhamitanga - Marromeu

It was not possible to ground truth the entire section of the line, as most of the alignment does not follow the road.

Here, the vegetation is characterized by open woodland to dense forests where the dominant tree species are *Pterocarpus angolensis*, *Strychnos sp.*, *Albizia adiantifolia*, *Millettia stuhlmanii*, *Sterculia africana*, *Sterculia appendiculata*, *Combretum imberbe*, *Acacia nigrescens* and *Lonchocarpus sp.* The only important commercially valuable hardwood specie in this section of the line is *Millettia stuhlmanii* (Panga-Panga).

Approaching Marromeu, the line enters the wetlands of the Zambezi floodplain and the vegetation is basically grassland with scattered palm trees. In Marromeu the natural vegetation has been transformed by the population and has been replaced by machambas.

The line traverses the Zambezi Delta floodplains and this could be an issue of concern in case of extreme floods. However, Marromeu is surrounded by dykes to protect the village against floods.

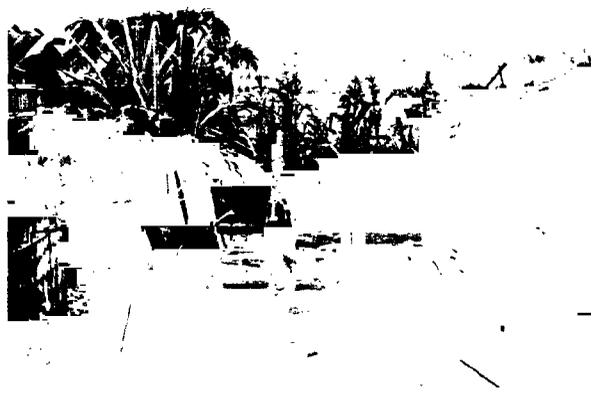


Photo 21. Population settlement within 10m from the line in Marromeu

As in the other district, the population here has been informed of the need to relocate before rehabilitation of the line begins.

3.4 SOCIO-ECONOMIC AUDIT FINDINGS

3.4.1 Population Settlement

The population density is particularly low in the districts traversed by the Sena Line (Table 11).

Table 11. Population density in the Provinces and districts traversed by Sena Line.

Districts	Population	Population Density (inhab/km ²)
Sofala Province	1,289,390	10.0
Dondo	117,719	
Muanza	15,308	
Cheringoma	20,795	
Marromeu	60,895	
Caia	86,001	
Tete Province	1,144,604	11.4
Mutarara	139,611	
Moatize	118,335	

Source: General Census of the population and habitation 1997, INE

3.4.2 Population settlement along the Sena Line

CFM has properties along the Sena Line as well as along the Machipanda Line. These properties consist of lands, several assets, sports and leisure infrastructures.

Regarding the land, CFM has two forms of property. The first form is the land located 10 meters (inside villages) and 50 meters (outside villages) on each side of the railway line (Partially Protected Zone). The second form is land for the construction and expansion of residential areas for CFM workers, or for construction of infrastructures if necessary.

Along the Sena Line, the land located on the 50 m of each side of railway line, from Dondo to Moatize, was occupied in different ways, such as for the practice of subsistence agriculture, house construction and mainly informal markets. In general the construction is made of non-conventional material, as verified in Savane, Muanza, Inhaminga, Marromeu, Caia, Sena, Vila Nova da Fronteira, Doa and Cambulatsisse, among other population agglomerates. However, the occupants have been informed and they know very well that the land belongs to CFM and that they will have to relocate before rehabilitation of the line begins. One reason for the occupation of this land is the perception that the Sena Line would be abandoned definitively, in the sense that it would never be rehabilitated and reused.

The district governments of Dondo, Muanza, Cheringoma and Caia already began the explanation for relocation of people that occupied CFM land illegally. According to the information given by the affected people and by the administrative and local community authorities, up to now the process is being carried out without resistance. It is important to note that the expectation of the communities in relation to the reconstruction of the railway line is so high that they are willing to cooperate with the local governments and with the reconstruction brigade of the line in whatever is necessary.

In Tete Province, the explanation for people's relocation has not started yet, as the local authorities are not yet sufficiently informed about the railway line rehabilitation program.

In Moatize, the temporary occupation of the land next to the Railway Station was consented and authorized by the local management of CFM and Municipal Council during the war moved against Mozambique. Consequently, about 230 houses of conventional type and 310 houses of precarious construction were built. CFM local management confirm that they *possess documents confirming that the users knew that it would be a temporary occupation and that at the end of the war they would leave*. However, no relocation is expected to be required as these are outside the 10m PPZ designated in urban areas.

In Caia, a small inn was built (known as Pensão Maia) next to the line. There are also two conventional houses and some huts. It was not possible to talk to the owner of the Pensão because he was absent, but a source of the administration interviewed said that the owner was advised several times, but he ignored and built the Pensão at his own risk.

Persons who may be relocated indicated that they should be offered areas close to (but outside of the PPZ) railway stations or from the railway line, as their business depend on the people travelling (by road and/or railway).

A summary of the audit findings are presented in Table 12 below.

Table 12. Summary of the Audit Findings for the Sena Line

Audit Finding	Positive/Negative	Major/Minor
The line has been rehabilitated from Dondo (km 0) to near Savane (Km 17). Rehabilitation is progressing well.	Positive	
Some drainage lines adjacent to bridges and culverts show signs of erosion in adjacent areas. Of particular concern is the one at the campsite at km 20 where the embankments immediately adjacent to the culvert require a reduction of gradient/slope to ensure proper erosion control.	Negative	Major
Several bridges and culverts require rehabilitation (only 12 have been rehabilitated). This shall include clearing of vegetation in the surrounding area erosion control measures will be required.	Negative	Major
There is a significant quantity of scrap metal along the entire alignment and especially at the railway stations	Negative	Major
The line crosses wetlands (Zambezi River Floodplain) but no further impacts will occur	Positive	
No water course or natural drainage channel has been or will be blocked. Bridges and culverts have been used in the right places.	Positive	
The line traverses areas mostly with low to moderate risk of erosion. However, the section between Dona Ana (Mutarara) – Doa - Cambulatsisse is a high risk area and shows significant signs of erosion. Of particular concern where the soil eroded below the line leaving the railway line suspended (appearing to be a bridge)	Negative	Major
Although a 10m RoW on each side of the line shall be cleared of vegetation, there will be no loss of plants or animals of special concern	Positive	
Bush fires, slash and burn agriculture and charcoal production are intensive	Negative	Minor

Poaching is intensive in the area (particularly around the Gorongosa National Park)	Negative	Minor
Most of the houses and markets have been built with local material and are outside the 10m PPZ but there is a small inn (Pensão Maia) in Caia right next to the line (within the 10m PPZ).	Negative	Minor
Local District authorities have informed residents of the need to relocate during rehabilitation and this has been well accepted	Positive	

RoW – Right of Way

PPZ – Partially Protected Zone

3.5 RECOMMENDATIONS FOR REMEDIAL ACTIONS

Sections 3.3 and 3.4 above presented the fieldwork results in the form of audit findings. The present section provides recommendations for remedial actions to minimize the negative impacts and enhance the positive ones. Additional recommendations are included in an Environmental Management Plan (EMP).

The study identified the following:

- Actual and potential environmental impacts associated with current activities and facilities at the railway corridors.
- Mitigation and remediation measures together with costs.
- Institutional and monitoring responsibilities.

The following government ministries and Institutions, and other organisations have various capacities, relevant monitoring responsibilities and mandates, and are included in the summary tables that follow.

MICOA: Ministry for Environmental Affairs (environmental pollution)

MOPH: Ministry of Public Works and Housing (sewage)

DNA: Water Affairs (ground water contamination)

MADER: Ministry of Agriculture Rural Development

DNFFB: Forestry and Wildlife (mangroves & natural resources)

IIP: Fisheries Research (fisheries)

INIA: National Institute of Agricultural Research (soil analysis)

MIREME: Ministry of Mineral Resources and Energy (radioactivity testing)

DNCH: National Directorate of Coal and Hydrocarbons (coal and oil pollution)

ENH: National Enterprise for Hydrocarbons

INNOQ: National Institute of Quality and Norms (standards)

3.5.1 Background Information

The materials transported in Maputo, Beira and Nacala Corridors comprise a full range of products handled at the ports, including foodstuff, chemicals and fuels. Hazardous

materials are transported, and it is unlikely that the majority of the workforce take any special precautions when handling any of the products. However, the station masters at Machipanda, Manica and Chimoio guaranteed that special precautions are taken and that there are clear procedures in place to deal with incidents and accidents. In any case, this chapter includes recommendations for handling, storage and disposal of hazardous materials.

There is a CFM manual concerning Health and Safety on railways, but it is out of date and rarely consulted.

Although the last audit report (Environmental Audit and Management Plan for the Rail and Port Restructuring Project, 1998), mentioned that herbicides are used on the track, the Director of Sena Line informed that CFM is not using herbicides for vegetation killing on the Sena Line.

Protective gear (e.g. helmets, overalls, gloves) is provided to all workers. The use of this equipment must, however, be enforced.

3.5.2 Concerns and Recommendations

This section presents the concerns and recommendations following the same system of sections used above and taking into account the tables containing a summary of the audit findings. The EMP below will provide additional recommendations that are pertinent to the rehabilitation and operational phases of the lines, as well as workshops and railway stations.

It is also important to highlight that although the audit findings considered that despite the fact that a 10m RoW on each side of the line shall be cleared of vegetation, there will be no loss of plants or animals of special concern, important recommendations should be followed during clearing of the vegetation, especially in areas where important commercially valuable hardwood species such as *Androstachys*, *Azelia* and *Millettia* are common. General methods for clearing the vegetation along the RoW are given in section 7.7.18.

The Concrete Sleepers Factory

All audit findings are positive (Table 9 above).

Although the use of protective gear is generally adequate, its use should be enforced at all times.

Should CaCO_3 be used in the laboratory it is recommended that the following conditions be taken into consideration:

Exposure limits: OSHA PEL: TWA $15\text{mg}/\text{m}^3$ (total) TWA $5\text{mg}/\text{m}^3$ (resp).

Storage: cool and dry place

Handling: Avoid contact with skin and eyes. Avoid ingestion and inhalation

Protection: Wear appropriate eyeglasses or chemical safety goggles, as well as gloves and protective clothing to minimise contact with skin.

In case of small spills or leaks: sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal. Avoid generating dusty conditions.

It is recommended that water quality in the ditch be monitored.

The Warehouse in Dondo

Although most of the audit findings have been considered negative, only one is of major concern, the location of fuel tanks (please refer to Table 10 above).

Table 13. Summary of the audit findings for the Warehouse in Dondo

Audit Finding	Recommendation
Chemical (welding) material exposed to rain and sun. No MSD Sheet available.	CFM to contact the manufacturer of the product or find the MSD (Material Safety Data) sheet to determine the handling, storage and disposal conditions of the product. CFM to keep the MSD Sheet available in the office. CFM/the Concessionaire to follow MSD sheet recommendations and make sure the drums are adequately stored and disposed of (in case CFM decides it will not be used again in their lines)
Significant quantity of scrap metal on-site	RECLAM has been sub-contracted to collect scrap metal, to remove all scrap waste from site and removal is progressing well. While this does not happen, CFM shall store the scrap according to type on different piles and separately from material/equipment.
Fuel tanks are not placed on bermed/bunded area	CFM/the Concessionaire shall locate any fuel storage facilities with a capacity greater than 1000 litres on flat or gently sloping ground and shall berm the surrounding area to contain at least 125% of the total capacity of the storage containers. In any fuel storage facility, the berms and the floor shall be of impermeable material or be lined to ensure that petroleum products cannot escape. Preferably, all fixed storage shall be fenced and locked and shall contain symbolic signs depicting 'no smoking' 'no naked flames' and 'danger'.
Oil/diesel spills	CFM/the Concessionaire shall take all reasonable precautions to prevent fuel and lubricant spills. To this end,

	<p>CFM shall ensure that:</p> <ol style="list-style-type: none"> a) There is no overfilling of diesel bowsers and equipment tanks. b) Any oils or lubricants discharged during routine vehicle servicing on site are captured using drip trays, containers or other appropriate containment measures. <p>CFM shall ensure that there is sufficient absorbent material available on site to manage accidental spills.</p>
<p>Various types of waste (old tyres, oil/diesel drums, paper, sawdust, etc)</p>	<p>CFM to identify all types of waste and store it in separate piles.</p> <p>Verify the possibility of the suppliers to take back used equipment (e.g. Mabor for used tyres, Petromoc for used oil/diesel drums, etc). In case this is not possible, it is strongly recommended that:</p> <ul style="list-style-type: none"> • Domestic waste shall not be left uncontained and bins shall be emptied daily, • Domestic waste shall be dumped on a dumping site and burnt regularly, • The dumping site shall be fenced and locked at all times to keep out unauthorized people and animals, • Old tyres shall not be stored closed to fuel in order to avoid potential fires, • Until used oil/diesel drums are removed from site they should be stored on a bermed and bunded area and under cover. • Oil filters can be pressed onsite and burnt in a drum to remove all residues, after which can be dumped in the waste pit.

Sena Line

Most of the audit findings have been considered negative. Of major concern is (a) the status of the line requiring complete rehabilitation, status of bridges and culverts and areas showing significant signs of erosion (please refer to Table 12 above).

Although there are properties close to the alignment, most of these are outside the strip of 10 m width considered partially protected zone inside villages. Linked to this is the positive fact that local district administrations have already informed the residents of the need to relocate. Thus, relocation is not considered a major negative issue.

Table 14. Summary of the audit findings for the Sena Line

Audit Finding	Recommendation
<p>Line requiring complete rehabilitation, including clearing of vegetation, rehabilitation of bridges and culverts, opening of access tracks</p>	<p>When clearing vegetation, the Contractor shall not clear any vegetation along the railway line outside of the areas defined for this purpose (10m on each side of the line), unless strictly necessary.</p> <p>When opening access tracks, the Contractor shall clear vegetation to the minimum degree necessary.</p> <p>Although vegetation can be removed mechanically, it is preferable to use manual labour, especially near the riverbanks and steep slope areas in order to avoid further erosion.</p> <p>On no account should herbicides or fires be used. This should be reinforced with awareness education regarding the environmental impacts associated with different methods of vegetation clearance.</p> <p>Cut down tree trunks shall not be deposited on riverbeds, even if temporarily dry (whenever tree trunks fall into the river, these should be removed immediately). Any removed vegetation should be disposed far from rivers or streams. Whenever possible, these remains should be collected manually and never incinerated.</p> <p>No materials originating from the rehabilitation works shall be thrown into watercourses.</p> <p>Trees situated on the banks of rivers and streams must not be uprooted; it is recommended that they are pruned in order to adjust their shape or, if absolutely necessary, cutting the trunk at ground level.</p>
<p>The slopes of some drainage lines adjacent to culverts are showing signs of erosion due to the steepness of the slopes and lack of binding vegetation.</p>	<p>Regarding the culvert at km 20, because it has already been rehabilitated the recommendation is to control erosion. The first step would be to smoothen and flatten the gradient of the banks to < 25% and then cover it with soil binding plants (refer above). However, revegetation of this area may be difficult due to the soil type and it may be necessary to consider hydroseeding (seed cocktails, available in RSA). Hydroseeding shall preferably be carried out in the spring or early summer. The seed mixture shall be purchased commercially and must comprise of a seed mix that includes only indigenous species. The seeding applications shall be strictly adhered to as per instructions from the suppliers. Also to consider is the import of top soil from surrounding areas.</p>

	<p>Regarding all other bridges and culverts, the Contractor shall ensure that slopes are revegetated as soon as rehabilitation of the line has been completed. All steep slopes shall be smoothen and levelled to < 25% gradient.</p> <p>Vegetation with soil binding properties should be planted on any patches of bare earth (e.g. grasses available in the project area, that can be used, include <i>Cynodon dactylon</i>, <i>Digitaria sp.</i>, <i>Panicum maximum</i>).</p> <p>With regards to the site where a drainpipe has been placed next to a culvert, the Contractor shall decide on one of the two. However, it is recommended that the drain-pipe be removed and that erosion control measures put in place. The remaining culvert will have to be rehabilitated and re-adjusted to the conditions without the drain pipe.</p> <p>All bridges and culverts shall be cleared of debris to avoid blockage and ponding.</p>
<p>Bridge at River Zangue requiring complete rehabilitation</p>	<p>When rehabilitating the bridges (at Zangue R. and all the others), the Contractor shall comply with the following:</p> <p>As far as is reasonably practical, the Contractor shall schedule rehabilitation activities to take place during winter when surface and subsurface water flows are lowest, plants are dormant and inundation is limited.</p> <p>During rehabilitation the Contractor shall make provision to maintain the natural flow of any drainage line affected by construction.</p> <p>The river channel embankments shall be returned to the pre-existing (or a more stable) profile than that which existed prior to construction. The Contractor shall establish a pre-construction photographic record of each of the river crossings for comparison with the site after rehabilitation.</p> <p>River embankments shall be stabilised, using any necessary protection measures, including re-vegetation, rip rap, reno mattresses and other measures, to ensure that the banks are protected against erosion. The interface between the backfilled trench and the surrounding area should, as far as possible; be indiscernible, in terms of vegetation, slope and compaction.</p> <p>Contractor is responsible for controlling riparian and in-stream damage to the river systems through which the railway line is routed.</p>

	<p>Trees situated on the banks of rivers and streams must not be uprooted; it is recommended that they are pruned in order to adjust their shape or, if absolutely necessary, cutting the trunk at ground level.</p> <p>No materials originating from the rehabilitation works shall be thrown into watercourses.</p> <p>Debris disposal and clean up shall be carried out to return the river course to its pre-existing condition prior to the Works.</p>
Significant quantity of scrap metal along the alignment and railway stations	RECLAM to proceed with scrap removal.
Intensive bush fires, slush and burn agriculture and charcoal production	<p>Contractor shall take all necessary precautions to prevent the ignition and spread of bush fires caused either deliberately or accidentally as a result of the work being performed.</p> <p>If any bush cleared from the alignment is burnt, this shall be done at times when there is no wind and appropriate fire fighting equipment shall be in attendance.</p> <p>Contractor shall prohibit and actively monitor and prevent poaching or harassment of wild animals by employees</p> <p>Contractor shall prohibit and actively monitor and prevent the harvesting of medicinal or any other plants by employees.</p>
Occupation of the PPZ by local communities	CFM has informed the local communities, through the local authorities, of the need to relocate and this has been generally well accepted.

3.5.3 Additional recommendations for environmental, health and safety management

- CFM shall comply to the Regulation for Inspection, Police and Exploitation of the Overseas Railway Lines (Decree n. 47 043, 1966), until new regulations are approved.
- During transportation of materials, these shall be secured to ensure safe passage between destinations. Loads including sand, stone, cement, etc, shall have

appropriate cover to prevent them spilling during transit. The Contractor shall be responsible for any clean-up resulting from failure by his employees or suppliers to properly secure transported materials.

- Use only designated waste facilities. No on-site burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted.
- Littering and the random discard of solid waste on the site shall be prevented
- Pollutant materials, such as fuels, lubricants, detergents, cement and others must be handled with special care, in order to avoid spillage.
- Concrete residues with no further use should not be arbitrarily disposed, but broken down into small pieces and disposed in appropriate landfill sites.
- Biodegradable packages (paper, cardboard, wood) can be either disposed in landfills or incinerated. Plastic bags and packages that were used as toxic waste containers (fuels, lubricants, etc) should be rendered useless (torn or perforated) and deposited in landfills; any re-usable containers etc can be made available to local populations
- Limiting access and construction disturbance in drainage lines, approaches to pans and depressions is considered to be vital.
- When dismantling any campsite, the following recommendations shall be followed:
 - All structures erected by the contractor should be dismantled, removed and where possible used for the construction of future campsites.
 - Any rubble generated from the dismantling of campsites should be dumped at an approved disposal site.
 - Pollution control structures (sumps, septic tanks, grease traps etc.) should be emptied and the waste dumped according to the waste management procedure.
 - Once emptied these structures should be removed with particular care to avoid any possible ground or water contamination.
 - Once the area has been cleared of all material the ground should be prepared for rehabilitation.
 - This may involve ripping, harrowing or disking areas where ground has become compacted by equipment and structures.
 - The original topsoil stockpiled at the campsite should then be evenly spread over the disturbed areas.
 - The stockpiled rootstock should then be spread over the topsoil and where necessary erosion control structures (contours and furrows) should be placed.
 - The area should then be left to rehabilitate through the process of natural succession.
- Put warning notices and gates at all crossing points and limit people crossing the line at any place.

- Fence the area whenever public safety is an issue (high density areas, school close to the line, etc)
- Ensure that the positive work of the relocation of people living close to the railway line, which is being carried out by the district administrations of Dondo, Muanza, Cheringoma and Caia be extended to other areas. In fact, the experience of the districts above mentioned should be shared with the district authorities of Tete and Manica.

CHAPTER IV
FIELDWORK RESULTS
MACHIPANDA LINE

4. INTRODUCTION

It is important to highlight that this is not an Environmental Impact Assessment Report and that most of the impacts occurred during construction of the railway lines. Examples of these are permanent loss of habitats, including wetland habitats; destruction or damage of threatened plants; construction-induced erosion; reduction of biodiversity as a consequence of habitat fragmentation; increased unsustainable hunting and poaching as a consequence of improved accessibility, accelerated transformation of natural habitats from harvesting of natural resources such as timber, fuel wood, charcoal production, etc).

At this stage, very few negative impacts will result from the rehabilitation and operation of the lines.

4.1 APPROACH

Fieldwork was conducted over a 6-day period from 6 -11 October 2003. During this period most of the railway lines (Sena and Machipanda) were ground truthed on a chainage kilometre basis.

For the sake of brevity only the key environmental and socio-economic features of each of the lines are described here.

With reference to chainage kilometre, km 0 refers to Dondo (the origin of the line).

It is also important to highlight that according to the Land Law (Decree 66/98 of the 19/97 Land Law) the Partially Protected Zone for Railway Lines is 50 m on each side of the line. *However, CFM has decided to reduce the Partially Protected Zone inside the villages to a width of 10 m on each side.*

This chapter presents the findings of the audit for the Machipanda Line.

4.2 ENVIRONMENTAL AUDIT FINDINGS

This is the only operational railway line in the Beira Corridor and it links Beira and Zimbabwe. However, only cargo trains are operational at the moment.

The line runs mainly on the Pungue River Basin and traverses areas with distinct broad vegetation types, as described in Chapter II above. The area is mainly characterised by different types of Miombo woodland and savana, with moist forest formations occurring on foothills, on slopes and in valleys. However, anthropogenic vegetation (transformed by humans) is common along most of the alignment as it traverses many urban centres.

A Moist Semi-Deciduous forest of the mesoplanaltic slopes and lowlands, with main species *Pleteopsis myrtifolia* or *Newtonia-Erythoppleum* runs in the southern part of the Pungúe River in parallel to a tail strip of the *Julbernardia globiflora* with *Ostryoderris-Sclerocarya* extension. Along the eastern border with Zimbabwe where the Mozambique plains rises up sharply to the western rim of the great southern African plateau, Afromontane elements are common and occur in small “island” habitats.

Regarding the risk of erosion, most of the line runs on low risk areas (from Dondo to Chimoio), but in the areas closer to the border with Zimbabwe, the risk of erosion is moderate (4) to high (6). In fact, the line from Machipanda Railway Station to the border with Zimbabwe shows many areas with signs of erosion, some of which have already been covered with imported soil in an attempt to control erosion.



Photo 22. Erosion on the Machipanda Line (Machipanda)

Signs of erosion are found in scattered places along the entire alignment but these are not significant. In fact, most of slopes where the lines run are well covered by a grass layer (mainly *Panicum maximum*). Special attention should be given to erosion control in the bridges.

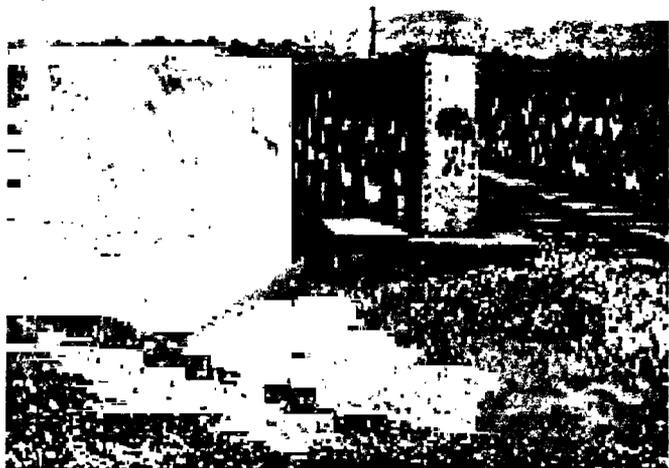


Photo 23. Machipanda – Vila Manica

The main issues of concern along this alignment would be related to the occupation by local communities of the partially protected zone (10m inside the villages and 50m outside the villages, in each side of the line). However, most of the houses are outside the 10m PPZ in the villages and therefore do not constitute a problem.

Despite the fact that during the war moved against Mozambique, people concentrated along the main roads and railway lines, in certain towns, like Vila Manica, the Municipal Council has given land concessions within CFM land (Please refer to section 4.3 below).

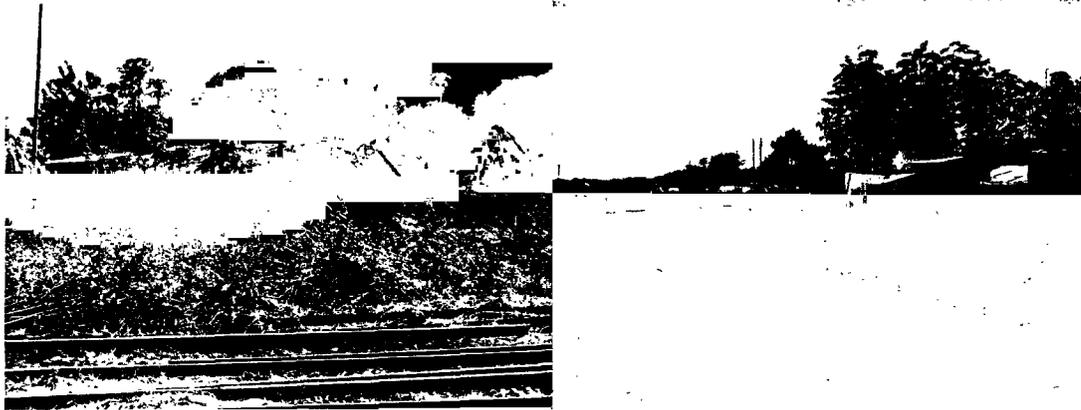


Photo 24. Population settlements close to the railway line (mostly outside the 10m strip of PPZ)

Small churches (mainly Jehova Witnesses) and stands belonging to informal markets are also a common feature in the main population centres. At Vila Manica, the market is bisected by the railway line and a warning notice and gate have been put in place for the village's traffic crossing the railway line. It is important to highlight that these markets were established long after the railway line was built.



Photo 25. Vila Manica: informal market divided by line with a warning notice and gates

CFM has an Operational Safety Plan in place and officers perform their duties accordingly. According to the referred Plan, inspections are carried out on a quarterly basis (Railway Director), monthly basis (Chief Civil Engineer), weekly basis (Section Chief) and daily by Captains.

Small quantities of scrap are found, mainly in the railway stations (Manica, Chimoio and especially in Gondola).

The railway stations at Machipanda, Vila Manica and Chimoio are well organized.

Railway Station at Machipanda

This station is divided into a station, warehouses, Diesel station, and locomotive's deposit.

According to the stationmaster no hazardous products are stored on-site. However, 2 Petromoc diesel tanks are located at approx. 100m from the railway line. These tanks are within a bermed and bunded area.

There are no fire extinguishers on-site, except for two small ones, with an expired date.

Several diesel and oil spills along the line. Contaminated soil is not removed.

Waste (mainly paper) is burnt in a waste pit. There is no scrap metal. Grass is burnt along the lines in a process controlled by CFM.

There are no polluting industries in the region. The water quality is considered to be very good.

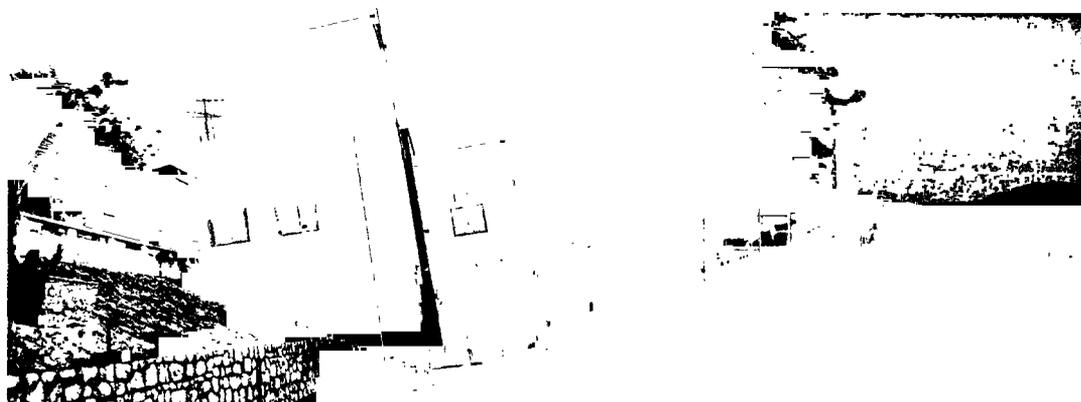


Photo 26. Railway Station at Machipanda



Photo 27. Railway Station at Machipanda

It is composed of the station itself, a waiting room and a warehouse for the cargo. Cargo may include chemical and/or hazardous products (e.g., explosives) and when that is the case the cargo is accompanied by a police, who verifies the condition of the cargo. If for any reason the cargo is not in proper conditions to be loaded onto the train, it is held back and stored separately. In case of infringement, penalties are applied.

Waste (mainly grass and paper) is taken to a waste pit and burnt.

There are no polluting industries in the region.

The area is kept very clean.

CFM's partially protected zone (10m inside the villages) is not occupied by any houses.

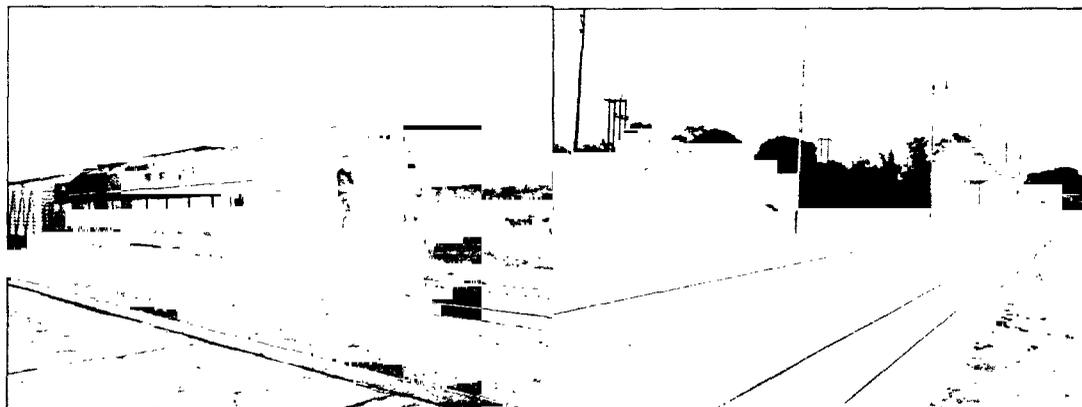


Photo 28. Railway Station at Chimoio

This station is composed of the station, a canteen and a warehouse where diverse cargo is stored. According to the stationmaster, no hazardous products are stored there.

Waste (mainly paper and waste from the canteen) is taken to a waste pit and burnt.

The Station is kept clean and the line is inspected on a weekly basis. In case of accidents, there are clear procedures in place.

4.3 SOCIO-ECONOMIC AUDIT FINDINGS

4.3.1 Population Settlement

While the districts crossed by the Sena Line show low concentration and population density, those crossed by the Machipanda Line concentrate a high number of people. These areas present a high social – economic development due to the existence of infrastructures, mainly the operational state of the Line and the national road no. 6.

Table 15. Population and population density of the Provinces and districts traversed by the Machipanda Line.

Districts	Population	Population Density (inhab/km ²)
Sofala Province	1,289,390	19.0
Dondo	117,719	
Nhamatanda	137,930	
Manica Province	974,208	15.8
Gondola	184,629	
Chimoio	193,657	
Manica	155,731	

Source: General Census of the Population and Habitation 1997, INE

4.3.2 Population settlement along the Machipanda Line

In contrast to the Sena Line, the operation of the Machipanda line was never interrupted and the government with the support of Zimbabwe provided much security to protect the line. Consequently, during the war moved against Mozambique, thousands of people looked for safer places along the Beira Corridor, especially in places like Beira, Dondo, Nhamatanda, Gondola, Chimoio, Vila Manica and Machipanda. Humanitarian considerations led the resettlement of the “war moved people” to be carried out in a disorganized way, without obeying the rules of the territorial and urban planning. Thus, ad hoc occupation of CFM properties occurred.

In the city of Chimoio, the land from the entrance to the exit of the city was object of occupation. It was not possible to determine the exact number, but it is estimated that up to 1000 huts have been built. Once again, the people occupied the land on a temporary basis, but with the end of the armed conflict nobody wanted to leave the land.

In the Manica city besides the ad hoc occupation of the land along the line, the Municipal Council has distributed land within the 50 m PPZ but outside the 10 m PPZ. However, in case CFM needs this land, they should liaise with the Municipal Council and the Provincial Services of Geography and Cadastre.

In Machipanda the problems of land occupation are not serious. Just some 20 huts and a church of precarious construction exist close to the station, whose owners are informed that they might be relocated.

Finally, it is important to remind that the Partially Protected Zone (PPZ) inside the villages is 10 m and outside is 50 m. As most of the properties are concentrated in the villages, only those within 10 m from the line shall be relocated.

The summary of the audit findings are presented in Table 16.

Table 16. Summary of the Audit Findings for the Machipanda Line

Audit Finding	Positive/Negative	Major/Minor
CFM has an Operational Safety Plan in place. According to the referred Plan, inspections are carried out on a quarterly basis (Railway Director), monthly basis (Chief Civil Engineer), weekly basis (Section Chief) and daily by Captains. Regular inspections should be enforced.	Positive	
The railway line has always been operational and is in rather good condition.	Positive	
Some culverts are small and blocked by natural vegetation	Negative	Minor
There is a small quantity of scrap metal, but only at the railway stations of Manica, Chimoio and especially Gondola.	Negative	Minor
The line crosses wetlands (Pungue River Floodplain) but no further impacts will occur	Positive	
No water course or natural drainage channel has been or will be blocked. Bridges and culverts have been used in the right places.	Positive	
The line traverses areas mostly with low to moderate risk of erosion. However, the section closer to the border with Zimbabwe has a high risk and signs of erosion can be seen. In certain areas imported soil has been brought in an attempt to cover the eroded area.	Negative	Major
Some bridges and culverts show signs of erosion in adjacent embankments.		
There will be no loss of plants or animals of special concern	Positive	
There are houses, churches, machambas, fruit trees and informal markets close to the line in various parts along the alignment. Most of the houses and markets have been built with local material and are outside the 10m width designated as PPZ inside villages. The ones that need to be relocated are aware of that and	Negative	Minor

relocation will be pacific.		
Local authorities (Municipal Council) have been giving out land within CFM's land (mostly within their Real Estate Land) and not within the 10m PPZ.	Negative	Minor
Railway crossings do not always have a warning notice and/or gates - potential safety hazard. A positive example is at Vila Manica.	Negative	Minor

RoW – Right of Way

PPZ – Partially Protected Zone

The findings for the railway stations are presented separately in Table 17 below.

Table 17. Audit Findings for the Railway Stations on the Machipanda Line

Audit Finding	Positive/Negative	Major/Minor
Clear procedures to deal with incidents and accidents, as well as emergency situations are in place	Positive	
Material/equipment is generally stored in an adequate way	Positive	
The number of fire extinguishers at the stations is not sufficient	Negative	Minor
Diesel tanks are stored on concrete bermed/bunded area (Machipanda)	Positive	
There are oil/diesel spills along the line and clean up procedures in place.	Negative	Minor
All stations are kept clean and have adequate waste disposal procedures in place	Positive	
The Municipal Council has given out land within CFM's Real Estate Land.	Negative	Minor

4.4 RECOMMENDATIONS FOR REMEDIAL ACTIONS

Sections 4.1.2 and 4.1.3 above presented the fieldwork results in the form of audit findings. The present section provides recommendations for mitigatory actions to minimize the negative impacts and enhance the positive ones. These recommendations are included in an Environmental Management Plan (EMP).

The study identified the following:

- Actual and potential environmental impacts associated with current activities and facilities at the railway corridors.
- Mitigation and remediation measures
- Institutional and monitoring responsibilities.

The following government ministries and Institutions, and other organisations have various capacities, relevant monitoring responsibilities and mandates, and are included in the summary tables that follow.

MICOA: Ministry for Environmental Affairs (environmental pollution)

MOPH: Ministry of Public Works and Housing (sewage)

DNA: Water Affairs (ground water contamination)

MADER: Ministry of Agriculture Rural Development

DNFFB: Forestry and Wildlife (mangroves & natural resources)

IIP: Fisheries Research (fisheries)

INIA: National Institute of Agricultural Research (soil analysis)

MIREME: Ministry of Mineral Resources and Energy (radioactivity testing)

DNCH: National Directorate of Coal and Hydrocarbons (coal and oil pollution)

ENH: National Enterprise for Hydrocarbons

INNOQ: National Institute of Quality and Norms (standards)

4.4.1 Background Information

The materials transported in Maputo, Beira and Nacala Corridors comprise a full range of products handled at the ports, including foodstuff, chemicals and fuels. Hazardous materials are transported, and it is unlikely that the majority of the workforce take any special precautions when handling any of the products. However, the station masters at Machipanda, Manica and Chimoio guaranteed that special precautions are taken and that there are clear procedures in place to deal with incidents and accidents. In any case, this chapter includes recommendations for handling, storage and disposal of hazardous materials.

There is a CFM manual concerning Health and Safety on railways, but it is out of date and rarely consulted.

4.4.2 Concerns and Recommendations

This chapter will present the concerns and recommendations following the same system of sections used above and taking into account the tables containing a summary of the audit findings. The EMP below will provide additional recommendations that are pertinent to the rehabilitation and operational phases of the lines, as well as workshops and railway stations.

4.4.3 Machipanda Line

Although most of the audit findings have been considered negative, only one is considered of major concern: the areas showing signs of erosion (please refer to Table 16 above).

Table 18. Summary of the audit findings for the Machipanda Line

Audit Finding	Recommendation
<p>There is an Operational Safety Plan in place, according to which regular inspections are carried out.</p>	<p>Although this was considered a positive finding, it must be enforced, hence its presence in this table.</p> <p>CFM/the Concessionaire to ensure that regular inspection be carried out in order to avoid incidents/accidents.</p> <p>It is recommended that:</p> <p>a) procedures be put in place so that action is taken to prevent recurrence and avoid potential environmental, health and safety impacts.</p> <p>b) an Emergency Plan be developed to enable rapid and effective response to all types of environmental, health & safety emergencies with recognized international standards.</p>
<p>Line requiring vegetation clearing along the railway line and culverts and bridges</p>	<p>When clearing vegetation, the Contractor shall not clear any vegetation along the railway line outside of the areas defined for this purpose (10m on each side of the line), unless strictly necessary.</p> <p>Although vegetation can be removed mechanically, it is preferable to use manual labour, especially near the riverbanks and steep slope areas in order to avoid further erosion.</p> <p>On no account should herbicides or fires be used. This should be reinforced with awareness education regarding the environmental impacts associated with different methods of vegetation clearance.</p> <p>Any removed vegetation should be disposed far from rivers or streams. Whenever possible, these remains should be</p>

	<p>collected manually and never incinerated.</p> <p>Trees situated on the banks of rivers and streams must not be uprooted; it is recommended that they are pruned in order to adjust their shape or, if absolutely necessary, cutting the trunk at ground level.</p>
Erosion along railway alignment	<p>CFM to ensure that all areas showing signs of erosion are controlled immediately. Vegetation with soil binding properties should be planted on any patches of bare earth (e.g. grasses available in the project area, that can be used, include <i>Cynodon dactylon</i>, <i>Digitaria sp.</i>, <i>Panicum maximum</i>).</p> <p>CFM shall ensure that slopes are revegetated as soon as rehabilitation of the line has been completed. All steep slopes shall be smoothen and levelled to < 25% gradient.</p> <p>River embankments (bridges) shall be stabilised, using any necessary protection measures, including re-vegetation, rip rap, reno mattresses and other measures, to ensure that the banks are protected against erosion.</p> <p>All bridges and culverts shall be cleared of debris to avoid blockage and ponding.</p>
Blocked/small culverts	<p>Keep culverts clear of debris to avoid blockage and ponding.</p>
Small quantities of scrap metal at the railway stations	<p>Reclam to proceed with scrap removal.</p>
Diesel/oil spills	<p>CFM shall take all reasonable precautions to prevent fuel and lubricant spills. To this end, CFM shall ensure that:</p> <ul style="list-style-type: none"> c) There is no overfilling of diesel bowsers and equipment tanks. d) Any oils or lubricants discharged during routine train servicing on site are captured using drip trays, containers or other appropriate containment measures. <p>CFM to ensure that there is sufficient absorbent material available on site to manage accidental spills.</p> <p>CFM to ensure that all contaminated soil is removed from site and treated accordingly.</p>
Occupation of the PPZ by local communities.	<p>CFM has informed the local communities, through the local authorities, of the need to relocate and this has been generally well accepted.</p>

CFM Land given out by Municipal Councils.	If necessary, CFM shall liaise with the Municipal Councils and the Provincial Directorate of Geography and Cadastre (DINAGECA), but these concessions are not within the 10 m PPZ.
Possibility of accidents and the safety of local populations	CFM shall ensure that warning notices and gates are placed at all line crossings to avoid potential accidents.

4.4.4 Additional recommendations for environmental, health and safety management

- CFM shall comply to the Regulation for Inspection, Police and Exploitation of the Overseas Railway Lines (Decree n. 47 043, 1966), until new regulations are approved.
- During transportation of materials, these shall be secured to ensure safe passage between destinations. Loads including sand, stone, cement, etc, shall have appropriate cover to prevent them spilling during transit. The Contractor shall be responsible for any clean-up resulting from failure by his employees or suppliers to properly secure transported materials.
- Use only designated waste facilities. No on-site burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted.
- Littering and the random discard of solid waste on the site shall be prevented
- Pollutant materials, such as fuels, lubricants, detergents, cement and others must be handled with special care, in order to avoid spillage.
- Concrete residues with no further use should not be arbitrarily disposed, but broken down into small pieces and disposed in appropriate landfill sites.
- Biodegradable packages (paper, cardboard, wood) can be either disposed in landfills or incinerated. Plastic bags and packages that were used as toxic waste containers (fuels, lubricants, etc) should be rendered useless (torn or perforated) and deposited in landfills; any re-usable containers etc can be made available to local populations
- Limiting access and construction disturbance in drainage lines, approaches to pans and depressions is considered to be vital.
- Put warning notices and gates at all crossing points and limit people crossing the line at any place.
- Fence the area whenever public safety is an issue (high density areas, school close to the line, etc)

- Ensure that the positive work of the relocation of people living close to the railway line, which is being carried out by the district administrations of Dondo, Muanza, Cheringoma and Caia be extended to other areas. In fact, the experience of the districts above mentioned should be shared with the district authorities of Tete and Manica.

Railway Stations

Most of the findings are positive and the negative ones have been considered minor.

The main recommendations are:

- The contractor shall ensure that there is basic fire-fighting equipment available at the stations at all times,
- Clean up procedures are in place and all oil/diesel spills are cleaned accordingly,
- All land conflicts with local Municipal Councils are solved. Liaison with DINAGECA should be considered.

CHAPTER V

**POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK FOR
ENVIRONMENTAL MANAGEMENT IN RELATION TO PORTS, HARBOURS
AND RAILWAYS OPERATIONS**

5. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT IN RELATION TO PORTS, HARBOURS AND RAILWAYS OPERATIONS

This chapter provides an overview of the relevant national and international laws, regulations, policies and conventions that are relevant to railway lines. Some information, despite being relevant, has not been included as it would be a repetition of a similar chapter in the report Environmental Audit and Management Plan for the Rail and Port Restructuring Project (1998).

5.1 NATIONAL POLICIES AND STRATEGIES FOR ENVIRONMENTAL MANAGEMENT

5.1.1 Background

Mozambique has recently formulated and approved a variety of national policies and strategies that seek to promote sustainable economic growth and environmental protection. Several of these new policies give greater emphasis on community rights over land and natural resource. The National Environmental Management Programme and the National Strategy and Action Plan for the Conservation of Biodiversity are cross sectoral and seek to incorporate environmental dimensions into sectoral policies and programmes. The most important framework documents are the following:

- National Environmental Management Programme (NEMP)
- The Land Policy
- The National Strategy and Action Plan for the Conservation of Biodiversity
- National Forestry and Wildlife Policy and Strategy

Below the main features of each of these policies and strategies and the implications are highlighted.

5.1.2 National Environmental Management Programme (NEMP)

The National Environmental Management Programme (NEMP), approved by the Council of Ministers in 1995, seeks to promote and implement sound environmental policy.

The NEMP, formulated by the Ministry for Co-ordination of Environmental Affairs (MICOA), is the master plan for the environment in Mozambique and contains a National Environment Policy, a proposal for Framework Environmental Legislation and Environmental Strategy.

The NEMP consists of Sectoral Plans, for the medium and long term, which are intended to lead to sustainable development in Mozambique. Three policy areas are defined:

- Rural
- Coastal
- Urban

For rural areas, agriculture and forestry issues are considered the most important. In coastal areas mangrove degradation, coastal pollution and erosion are the main issues to be addressed under the programme. For urban areas the degradation of sanitation systems and the poor water quality are the most urgent issues.

MICOA has been given the authority to oversee the implementation of the NEMP. To this effect, environmental rules and regulations are being devised and enforced. In this regard MICOA should evaluate policies of other ministries as well as their capacity to promote and implement sound environmental policy.

The implementation of the NEMP requires a range of actions at all levels and across sectors. In accordance with the NEMP, MICOA, in close co-ordination with other ministries, private and civil groups, is working towards:

- Development of inter-sectoral policies for sustainable development (including transport)
- Development and promotion of integrated resource-use planning
- Promotion of sector legislation and of establishment of norms and criteria for environmental protection and sustainable use of the countries' natural resources
- Creating conditions for law enforcement and environmental monitoring.

5.1.3 National Strategy and Action Plan for the Conservation of Biodiversity

The Ministry for the Co-ordination of Environmental Affairs (MICOA) has recently formulated a National Strategy and Action Plan for the Conservation of Biological Diversity for Mozambique: this was passed by the Council of Ministers in August 2003.

The overall goal of the National Strategy and Action Plan is:

“The conservation of biological diversity and the maintenance of the ecological systems and processes taking into account the need for sustainable development and a fair and equitable distribution of the benefits arising from the use of biological diversity”

The areas for action identified in the Strategy are as follows:

- Identification of important components of Mozambique's biodiversity
- To determine the conservation status of species in Mozambique and to identify and implement appropriate conservation measures for threatened species

- To establish and manage a representative system of areas for the protection of natural habitats and maintenance of viable populations of species in natural surroundings
- Strengthen the capacity for *ex-situ* conservation of animals, plants, fungi and micro-organisms
- To ensure that biodiversity considerations are an integral part of the agricultural, forestry and fisheries sectors legislation, policies, strategies and practises
- Promote community-based sustainable use of biodiversity, and recognise, document and promote the use of traditional knowledge systems of importance to the conservation of biodiversity.
- Integrate the conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programmes and policies.
- To develop guidelines for environmental impact assessments and to ensure that environmental impact assessments are conducted for projects and activities, likely to have significant adverse effects on biodiversity.
- Control the introduction and spread of alien species and genetically modified organisms that threaten or have the potential to threaten Mozambique's biological diversity
- Improve the knowledge of important components of Mozambique's biodiversity
- Improve public awareness and education related to conservation and sustainable use of biodiversity
- To ensure the prioritised and co-ordinated participation of Mozambique, internationally and regionally, in initiatives aimed at the conservation and sustainable use of biological diversity.

5.1.4 The Land Policy

The patterns of land tenure in Mozambique reflect the history of customary tenure, colonization, privatization and state control. Following Independence the new Constitution of the People's Republic of Mozambique (1975) stated that:

'The land and the natural resources located in the soil and subsoil, in territorial waters and on Mozambique's continental shelf, are owned by the State. The State shall decide the conditions of their exploitation and use'

This policy effectively altered the property rights and access to property of all land owners and land right holders which eventually, together with the armed conflict, impacted on the Mozambican economy.

The Government, however, recognised that the post-independence land laws were out of step with new developments in national economic and political life, and when misapplied or incorrectly interpreted, could result in the unjust treatment of local populations. It, therefore, charged the Land Commission to develop a programme to revise the Land Law and implement measures to modernise and upgrade all institutions and services required to implement the new policy and law.

The new Land Policy (approved on 12 September 1995) maintains the basic principle that land ownership is vested in the State, but recognizes the legitimacy of customary law, or the rights attributed by such law (e.g., traditional usage rights), and the role local leaders in land management and conflict resolution. The Policy document provides the framework for the new Land Law passed in 1997 (see below). Other goals of the new Land Policy include: (i) promote food production; (ii) develop the family sector's agriculture; (iii) promote private investment; (iv) preserve areas of ecological and natural resource's interest; and (v) update the taxation system.

5.1.5 Forestry and Wildlife Strategy

The **National Directorate of Forestry and Wildlife (DNFFB)**, one of seven directorates within the Ministry of Agriculture and Rural Development, has the responsibility for managing forestry and wildlife resources in Mozambique. The DNFFB Forestry and Wildlife Strategy (April, 1997) takes its lead from the Agricultural Policy and has as its overall objective:

"To conserve, utilize and develop forest and wildlife resources for the social, ecological and economic benefit of the present and future generations of the Mozambican people".

The Forestry and Wildlife Policy and Strategy, approved by Government in April 1997. The overall goal of the DNFFB Strategy is to realize the full potential of the forest and wildlife resources of Mozambique through sustainable use and the conservation of biological diversity.

This will be achieved through a series of interventions based on economic, social, ecological and institutional objectives as defined in the Forestry and Wildlife Policy and Strategy document.

The Institutional Objective seeks to improve the organizational and operational capacities at central, provincial and district levels in conformity with the requirements for decentralization and participatory natural resource management.

The Economic Objective aims at realizing the full potential of forest and wildlife resources in economic development, satisfying the needs of people for forest and wildlife products, and generating and collecting revenues efficiently to contribute to the national finances.

The Ecological Objective aims at improving the management and conservation of forest and wildlife resources in order to contribute to sustainable national and local development, proper use of the land and conservation of biological diversity.

The Social Objective addresses the role of forest and wildlife resources in alleviating poverty and recognizes the need for local communities to assume greater responsibility for management and sustainable use of the resources.

These objectives are translated into four sub-components and are effectively the strategy for implementation:

- Strengthening of the State Institutions for Forestry and Wildlife
- Rehabilitating the State Protected Areas for Forestry and Wildlife
- Developing Community Based Management of Forestry and Wildlife in areas adjacent to gazetted protected areas.
- Developing the Production Forestry Estate

5.2. LEGISLATION AND REGULATIONS²

The following legal documents collectively define the framework for land use and natural resource management in Mozambique.

- Framework Environment Law (1997) and Regulations
- Land Law (1997)
- Forestry and Wildlife Law (1999)

In addition the Work Act and the 2000 Decree for Regulations to Establish Procedures Related to the Granting of Concessions for the Production, Transport, Distribution and Marketing of Electrical Energy as well Import and Export of Energy are pertinent to the project.

5.2.1 Overarching Environmental Legislation

The main legislative instruments for general environmental management are the following.

- The Framework Environmental Law
- EIA Regulations
- EIA Guidelines (“Directivas”)

5.2.2 The Framework Environmental Law

The Framework Environmental Law was passed by the Mozambican Parliament in July 1997.³

This law acknowledges the responsibility of the Government of Mozambique in the promotion and implementation of the National Environmental Management Programme. The aim of the Law is to provide a legal framework for the use and correct management of the environment and its components such that it assures sustainable development of Mozambique.

The Environmental Law is applicable to all public or private activities, which may influence the environment either directly or indirectly.⁴

The salient features of the Law include the following:

² Note: Laws in Mozambique are generally broad and define certain principles. Specific regulations to implement the Law are drawn up subsequently

³ Law No. 20/97, Boletim de Republica No. 40, 1st Series, 3rd Supplement of the 7th October 1997.

⁴ Article 3, of the Environmental Law

- With regard to liability, those who pollute, or in any way degrade the environment, are under obligation to rehabilitate the environment or to compensate for the resulting damage.⁵
- The Law forbids the pollution of the soil, subsoil, water or atmosphere by any polluting substances, or any other form of degradation of the environment, which fall outside the limits stipulated by the law.⁶
- The law also forbids the importation of dangerous residues or dangerous waste, except for that laid down in specific legislation.⁷
- Projects and operations that are likely to have a negative impact on the environment are subject to an Environmental Impact Assessment by independent assessors.

It also forbids all activities that may threaten the conservation, reproduction, quality and quantity of biological resources, especially those in danger of extinction.⁸ In order to protect the environmental components that have a recognized ecological and socio-economic value, environmental protection zones can be created. These protected zones may be national, regional or local and may cover land areas, lakes, rivers, marine waters and other distinctive nature zones.

Licensing of activities that are liable to cause significant environmental impacts are required. The issuance of an environmental license shall be based upon an environmental impact assessment.

To ensure the effective co-ordination and integration of sectoral policies and plans related to environmental management at the highest level, a National Commission for Sustainable Development (NCSD), linked to the Council of Ministers, has been created (October 2000) by a provision in the Framework Environmental Law.

5.2.3 EIA Regulations

The Framework Environmental Law (see above), establishes the regime of environmental licensing based on an environmental impact assessment. Decree no. 76/98 of 29 December 1998 defines EIA Regulations for Mozambique.

Article 2 specifies the scope of application. The provisions contained in the Decree are applicable to all public or private activities that may have a direct or indirect impact on the environment. Activities related to emergency situations resulting from natural disasters are exempt from the requirement for an environment impact study. They must, however, receive the guidelines from the Ministry for Coordination of Environmental Affairs and may be subject to a later audit.

Under Article 3 the Ministry for the Coordination Environment Affairs has the power to:

⁵ Idem, paragraph (g)

⁶ Article 9 of the Environmental Law

⁷ Idem

⁸ Article 12 of the Environmental Law

- a) Issue and publicize general directives on environmental impact assessment procedures;
- b) Approve the Terms of Reference proposed by the proponent for the activity, which will guide the environmental impact studies;
- c) Undertake reviews of environmental impact studies, in collaboration with the interested public entities, civil society and affected communities
- d) Issues environmental licenses based on the EIA

In order to begin the environmental impact assessment the proponent must present the following documentation to the Ministry for Environmental Coordination Affairs (Article 4):

- a) Description, location and characterization of the activity
- b) Executive summary of the project
- c) Data on the environment in the place where the activity is to be implemented

All activities not covered in the appendix of the EIA regulations (see below) but capable of causing significant environmental impact, are subject to a pre-assessment undertaken by the Ministry for Environmental Coordination Affairs (Article 4). The pre-assessment will determine whether or not an environmental impact study is necessary.

Article 6 refers to the Environmental Impact Study *per se*:

- The environmental impact study and the monitoring programme is an obligation that is entirely the responsibility of the proponent of the activity
- The environmental impact study must contain at least the following:
 - a. geographical location of the area of influence of the activity, as well as a description the baseline environmental situation
 - b. a description of the activity and its alternatives, in the planning, construction, operational and (in the case of a temporary activity) de-commissioning phases
 - c. a comparison of the alternatives and a prediction of the environmental impacts of each alternative
 - d. identification and assessment of mitigation measures
 - e. an environmental management programme, including the monitoring of impacts, and accident prevention and contingency plans
 - f. identification of the team that carried out the study

The environmental impact study must also contain a non-technical summary covering the main issues and conclusions for purposes of public consultation. The environmental impact study shall be presented to the Ministry for Coordination of Environmental Affairs, in the form of a report written in Portuguese.

Article 7 refers to Public Consultation:

In order to undertake public consultation during the environmental impact assessment, the Ministry for the Coordination of Environmental Affairs shall ensure full access to all existing information on the matter. The public consultation process, including

mechanisms for receiving petitions, must be fully publicized by the proponent; so as to reach all affected stakeholders.

The Ministry for Coordination of Environmental Affairs shall call for public hearings, whenever the scale or likely effects of the project so justify, or when this is requested by public or private affected parties. In the public hearing, members of civil society, local government bodies, and education and research centers have the right to be represented. All the oral and written submissions must be presented to the Ministry for Coordination of Environmental Affairs at least ten days prior to the close of the review of the environmental impact study by MICOA.

Article 8 establishes criteria for assessing the proposed activity and is based on the following factors:

- a) the number of persons and communities affected
- b) the ecosystems, plants and animals affected
- c) the location and size of the area affected
- d) the duration and intensity of the impact
- e) the direct, indirect, potential, overall and cumulative effects of the impact
- f) the reversibility or otherwise of the impact.

Article 9 deals with the review procedures of the environmental impact study. On receipt environmental impact study report MICOA will undertake its technical review provided that the EIA process is in compliance with the norms established in the EIA regulations. The review will be undertaken on the basis of the Terms of Reference approved during the pre-assessment period. Based on the review the Ministry for Coordination of Environmental Affairs will take a decision on the environmental viability of the proposed activity.

Article 11 refers to limits for communicating decisions. The Ministry for Coordination of Environmental Affairs will observe the following time limits:

- a) Pre-assessment: up to five days
- b) Review of the environmental impact study: up to 60 days
- c) Issuing of environmental licenses: up to ten days after the expiry of the review period (b above)
- d) Communication of the rejection of proposal or of the need to alter the proposal: up to ten days after the expiry of the review period.

An environmental license shall be considered null and void if the activity to which it refers does not begin within two years of the license being issued.

An Appendix in the EIA Regulations lists the activities which may have significant impact on the environment and which require environmental impact studies:

1. Programmes and projects for intensive livestock and agricultural development, covering individual or cumulative areas greater than 350 hectares.
2. Clearing, dividing and harvesting the natural vegetation cover of individual or cumulative areas greater than 100 hectares.

3. Hydraulic works such as dams, dikes, channels and irrigation and drainage systems.
4. High tension electrical energy transmission lines with a capacity or greater than 150KV.
5. Pipelines carrying oil, gas or mineral and underwater cables with a length equal to or greater than 25 kilometers.
6. Urban water supply and sanitation systems, their treatment stations and effluent disposal systems.
7. Extraction, storage, transport and processing of hydrocarbons, and production of hydrocarbon derivatives.
8. Mining and processing of minerals.
9. Industrial and agro-industrial installations and complexes, such as: cement and coking factories, chemical products, paper and cellulose factories, tanning, pesticide factories, drinks industries, cashew nut processing, cold storages, slaughter houses, food processing industries.
10. Hydroelectric power station of any capacity
11. Ports, airport and railways that occupy on areas equal to or greater than 25 hectares, or with a length equal to or greater than 25 kilometer.
12. Building of new road alignment with a unit cost higher than US\$100,000 per kilometer
13. Building of new bridges with a span equal to or greater than 250 metres
14. Transport, processing, storage and elimination of toxic and dangerous (including radioactive) products and residues.
15. Landfills, treatment, incineration and other forms of eliminating municipal, industrial and hospital waste.
16. Fish farming projects, with an area equal to or greater than 5 hectares.
17. Industrial fisheries processing.
18. Programmes and projects that imply the permanent or temporary displacement of populations and communities.
19. Plans and projects for land development and occupation, for any purpose, including tourism
20. Plans, programmes and projects that may affect directly or indirectly, sensitive areas, such as:
 - a) coral reefs
 - b) mangroves
 - c) natural forests
 - d) small islands
 - e) zones of potential erosion, including dunes along the coastline
 - f) areas exposed to desertification
 - g) conservation or protected zones or areas
 - h) wetlands
 - i) zones where the habitats and ecosystems are in danger of extinction
 - j) zones of outstanding landscape beauty
 - k) zones of archaeological, historical and cultural value that should be preserved, zones where plant or animal species threatened with extinction are located
 - l) ground waters used for public consumption
 - m) areas for the protection of spring and water sources.

5.2.4 EIA Guidelines - General

Draft EIA guidelines have been drawn up by MICOA. These have been distributed to the various sectors for comment. As they currently stand the guidelines appear to impose a number of detailed requirements that do not always reflect the reality of the EIA practice.

5.2.5 EIA Guidelines for Specific Sectors

Resolution 5/95 gives MICOA the responsibility for adjustments of laws and regulations of sector ministries in order to make them consistent with the Environment Law. MICOA should therefore be cooperating with the various sectors to formulate EIA guidelines for each sector. No specific sectoral EIA guidelines ("directivas") have been developed to date. Sectoral guidelines can be approved by way of a "ministerial diploma" signed by the Minister of MICOA (the approval of parliament or the cabinet is not required).

5.2.6 The New Land Law and Land Law Regulations

The new **Land Law** was passed in 1997 during the same sitting of Parliament which passed the Environmental Law. The **Regulations** for implementation of the Law was passed by the Council of Ministers by Decree N° 66/98 on 8 December 1998. The Land Law determines that the land is State property and may not be sold. The new Land Law provides a further legal basis for demarcating areas for total protection and conservation (Article 7) and the creation of total and partially protected zones (Article 8). The latter provision permits the conservation and management of ecologically sensitive habitats such as montane habitats and riparian vegetation together with their associated species.

Partial Protection Zones are considered to be areas protected for nature conservation or protected in the interest of the State and include:

- Interior waters, the territorial sea and the maritime exclusive economic zone;
- The continental platform;
- The strip along the maritime coast and around islands, bays and estuaries which is measured from the maximum high tide line to a mark 100 metres inland;
- The strip of land up to 100 metres surrounding a source of water;
- The strip of land up to 250 metres along the edge of dams and reservoirs.
- A two kilometre strip along the territorial border.
- **The strip of land with a width of 50 m on either side of the railway line and the railway stations**

*However, for this project, CFM has considered a **Partial Protected Zone**, the strip of land with a width of 10 m on either side of the line (inside the villages) and 50 m on either side of the line (outside the villages).*

For the first time the new Land Law includes provisions for the participation of local communities in the protection of natural resources and conflict resolution (Article 24). In rural areas local communities will participate in:

- The management of natural resources
- In the resolution of conflicts
- In the titling process (issued by the i.e. the Provincial Geography and Cadastral Services)
- In the identification of the areas they occupy

The above partial protection zones are created by way of recently published **Land Law Regulations** (December 1998). The regulations also describe how communities may gain rights over their land and include several safeguards for local communities in the process land attribution to other individuals or associations.

Chapter III of the **Land Law Regulations (Rights of Land Use and Benefit)** gives local communities rights over the land they occupy (Article 9). Local communities who are occupying land according to customary practices acquire the rights over the land except in cases where the land is legally reserved for a particular purpose or is a Partial Protection Zone. If necessary, or at the request of the communities, the communal land may be delimited and registered on the National Land Cadastre in accordance with requirements which will be defined in a Technical Annex. (Note by author: the definition of what constitutes community land does not appear to be clear at the moment i.e. whether it is the land they occupy/farm or does it extend to larger areas that are used by communities for other purposes. Specific regulations for demarcating community land are currently being drawn up by a Technical Committee and it appears that community land will encompass the more extensive areas that communities depend upon for their livelihoods. There also appears to be some confusion with regards to what constitutes a community, who makes the application on behalf of the community etc.)

Mozambican nationals who have used a parcel of land continuously for 10 years may also acquire the rights to use and benefit from the land (Article 10).

The right to use and benefit from land may also be acquired by individuals or associations, both national and non-national based on the authorization of a formal request made by the proponent (Article 11).

Private sector and state investments are also obliged to involve the Mapping (Cadastral) Services, the local administrations as well as local communities in the identification of the land required (Article 25). The appropriate government agency (according to the area of economic activity e.g., transport, tourism, mining, agriculture etc.) must also submit a technical report regarding the land use plan of the proponent (Article 26).

Article 27 of the regulations stipulates that District Administrators must prepare a written report based on prior consultation with local communities regarding the request for land in the District. In the first instance the Mapping (Cadastral) Services should send a copy of the request to the respective District Administrator requesting the necessary information regarding the status land. A survey will be carried jointly by the

Mapping (Cadastral) Services, the District Administrator (or his/her representative) and local communities. The results of the survey must be written up and signed by a minimum of three or a maximum of ten members of the local community. The report will identify the existence or otherwise of other land-users in the area under request. (Note by author: it is assumed that at that stage the request may be turned down if there is a supra-positioning of the land requested and land used by local communities or other legal users).

The Land Law does not specifically refer to rights associated with involuntary resettlement. Article 19 of the Law refers to extinction of land use rights. As highlighted above, community rights over land is now recognized by the Law even though the areas may not have delimited and registered on the National Cadastre. Local communities have, therefore, rights over the land.

The Law states that "the loss of land use rights in the public interest will be parallel with the process of expropriation and proceeded by payment of a just indemnization and/or compensation".

5.2.7 Use of Pesticides/Herbicides for Clearing Land

The Ministerial Diploma No. 88/87 of 29 July approved the regulations regarding the use of pesticides whilst the Decree of 20 November the Ministries of Agriculture and Health approved the registration of pesticides covered by the regulation.

In terms of the regulations only those pesticides registered with the National Institute for Agronomic Research may be used. In the case of pesticides not registered, the proponent user must obtain written permission from the Department of the Hygiene and Environment of the Ministry of Health.

No herbicides will be used for this purpose.

5.2.8 Forest and Wildlife Laws

A new Forestry and Wildlife Law has recently (2000) been approved by the Council of Ministers and the Parliament. The new Law replaces the out-dated laws promulgated in 1965 (the Forestry Laws) and 1978 (the Wildlife Laws).

The Law confirms the rights of the state over natural forest and wildlife resources in the country. A key principle of the new Forestry and Wildlife Law is that local communities must be more fully involved in the conservation and sustainable use of forestry and wildlife resources. The new Law also recognizes the role of the private sector in the management, conservation and use of forestry and wildlife resources in order to gain maximum added value from the resources as well as enhanced local community development (Article 3(f)).

The National Forest Estate is classified as (Article 5):

- a) Forests requiring conservation – comprising vegetation formations located in protected zones and subject to a special management regime.
- b) Productive forests – vegetation types of high production potential located outside protected zones.
- c) Multiple-use forests –comprising vegetation types outside protected zones with low forestry potential.

The faunal heritage comprises all wildlife occurring in Mozambique and will be classified on the basis of its rarity and economic and socio-cultural value; these species will be officially listed and recognized by law (Article 6).

Article 10 recognizes three types of protected zones for the conservation of biodiversity and fragile ecosystems:

- a) National Parks
- b) National Reserves (Forest and Wildlife Reserves)
- c) Historical – Cultural Use Zones

National Parks are total protection zones for the protection, conservation and management of vegetation and wildlife as well as the protection of sites of special scientific, cultural or aesthetic interest and for recreation that are representative of the national heritage (Article 11). Except for scientific or management purposes the following activities are prohibited:

- a) Hunting
- b) Forestry exploitation, agriculture and mining
- c) Prospecting, digging and land-filling
- d) All activities that may modify the character of the land or vegetation, pollute water and, in general, any activity that may detrimentally affect flora and fauna
- e) The introduction of animal or plant species, whether indigenous or exotic, wild or domesticated.

National Reserves are designated for the protection of rare species of fauna and flora, endemics, species threatened with extinction or in decline, sensitive ecosystems such as wetlands, dunes, mangroves and corals as well as the conservation of flora and fauna within these ecosystems (Article 12). Activities that are prohibited in national parks are also prohibited in national reserves. However, there is an important proviso: the resources within the reserves may be exploited upon issuance of a license provided that the activity is in accordance with the management plan of the reserve and that it does not detrimentally affect the reserve.

The recognition of Historical–Cultural Use Zones (Article 13) is a completely new category for Mozambique reflecting the new policies to ensure that local communities are involved in natural resource management. These Use Zones are areas for protection of forests of religious importance or cultural use in accordance with the customary norms and practices of the respective communities. The forestry and wildlife resources within the zones may be used in accordance with customary norms and practices.

The Council of Ministers must approve the creation of National Parks and Reserves and is required to approve the establishment of a buffer zone around a Protected area in which multiple use will be permitted in accordance with a prescribed management plan. The Council of Ministers may also authorize the de-proclamation of a protected area or its modification. The Provincial Governor may declare the creation of Historical-Cultural Use Zones.

Forestry resources may be exploited through (a) a simple license or (b) a forestry concession contract (Article 14). A forest concession contract may be awarded to individuals, associations or local communities for a lease of 50 years. A forestry management plan for the concession area must be formulated and implemented (Article 16). Importantly, the authorization of a forestry concession area is dependent upon prior consultation or negotiation with local communities through the local government administration (Article 17).

The exploitation of wildlife is authorized through (a) simple hunting license, (b) sports hunting and (c) commercial hunting (Article 20). Sports hunting on wildlife may be authorized in controlled hunting areas (Coutadas) or on game farms through a contract between the State and individuals or companies (Article 22).

The role of local communities is further strengthened through Article 31 of the new Law (Participatory Management) in which local management committees comprising local communities, the private sector, associations and the local administration may be created. Management must ensure the full participation of the local communities with benefits generated from the exploitation of forestry and wildlife resources being accrued by the communities.

The new Forestry and Wildlife Law appears to provide new opportunities for the involvement of local communities, the private sector and the state to sustainable use the equitable distribution of benefits arising from their use.

5.2.9 Employees Health and Safety

With regards to the employees' health and safety, the most important legal documents are the Legislative Diploma n° 3057 of 12 December 1970 and the Legislative Diploma 48/73 of 5 July 1973, which determines the license regime of industrial establishments. These also determine the general conditions for the technical licensing of industrial buildings – the authorization for the construction of industrial buildings. The Legislative Diploma 48/73 stipulates the General Hygiene, Health and Safety Rules that regulate industrial buildings. Extracts of the Diplomas are given below.

a) Ventilation

The document establishes that the place of work, as well as all outbuildings, must have good ventilation, either natural or artificial, so as to ensure the supply of clean air and the elimination of stale air, of noxious gases, and/or smoke and dust. It also establishes limits for the speed of air circulation in cold and in warm weather, and it limits the use of air conditioners solely to control extreme temperatures or in special cases.

The document stipulates that all gases, dust, vapours, smokes and fogs or mists produced or discharged during plant operations must be captured, as far as possible, at their production site, so as to avoid contamination of the atmosphere in the work place as well as adjoining areas.

b) General norms for hygiene and cleanliness

The document prescribes that general cleaning should preferably be performed outside working hours and in such a way as to reduce the raising of dust to a minimum. The cleaning should, preferably, be carried out by means of a pressurised water jet. The use of compressed air is expressly forbidden.

The document also highlights the need of handling and disposing of all residues in such a way as to render them innocuous to the employees and to the public in general.

c) Special conditions for ablution facilities

The document states that there must be separate ablution facilities for both sexes near the work area but without direct communication with the work area. The ablution facilities must always have an anteroom where wash basins are located.

When the work activities involve unhealthy operations, such as exposing the workers to noxious substances, or dirt, it is compulsory to provide cold and hot water showers, with change rooms, at a rate of one per ten people.

d) Health Conditions

The document stipulates that salt tablets are given to those workers who have to work in intense heat, for reasonably long periods.

e) Noxious, dangerous or toxic emissions

The document makes it compulsory that containers containing noxious, dangerous or toxic substances, which may contaminate the environment or, by accident, the employees, must have appropriate characteristics so as to avoid contamination risks or illnesses. Workers dealing with these substances must:

- Be aware of the risks to which they are exposed and know how to avoid them,
- Be obliged to use the personal protective equipment provided to them,
- Not introduce, prepare or eat any food in the places where such risks exist,
- Be compelled to respect the personal hygiene practices required in such cases.

The document also stipulates that operators must take the necessary steps to reduce the employees' exposure to ionising radiation. The operators must also guarantee their efficient protection against the same through individual and collective preventative measures.

Finally, there is a Work Act 8/85 of 14 December, which refers to work safety, hygiene and protection. Articles 136 to 138 deal with the general principles and regulations for work hygiene whereas Articles 139 to 145 deals with the issues related to work accidents and work-related diseases.

5.3 INTERNATIONAL CONVENTIONS

The GOM has signed and ratified several International conventions regarding environmental management. The status regarding other Conventions is shown in Table 19.

Table 19. Status of Mozambique's Participation in International and Regional Conventions, Agreements and Organisations Relevant to Environmental Management

Convention concerning the Protection of the World Cultural and Natural Heritage	Paris, 1972; Ratified 1982
Convention on Biological Diversity	Rio de Janeiro, 1992; ratified in 1996
Convention on Conservation of New Breeds of Plants	Paris, 1961, not signed
Convention on Wetlands of International Importance Especially as Waterfowl Habitats (Ramsar Convention)	Ramsar, 1971; not signed but steps being taken to accede.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, or Washington Convention)	Washington, DC., 1973; signed but not ratified
Convention on the Conservation of Migratory Species of Wild Animals	Bonn, 1979, not signed
Convention on Migratory Birds	Bonn, 1991, not signed
Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region and related Protocols	Nairobi, 1985; Ratified in 1996
International Maritime Organisation	Member since 1991
Organisation on the Indian Ocean Marine Affairs Co-operation-IOMAC	Member since 1991
The Basel Convention on the control of transboundary movements of hazardous wastes and their disposal.	Basel, 1989; Ratified 1997
The Bamako Convention on the ban of the import into Africa and the control of transboundary movement and management of Hazardous wastes within Africa.	Bamako, 1991; Ratified in 1997
Protocol on Shared Watercourse Systems in the SADC Region.	Signed, 1995
The Zambezi River Basin Multilateral Agreement	Signed 1987
United Nations Convention on the Law of the Sea	Jamaica, 1982; Signed 1982
International Convention to Combat Drought and Desertification	Ratified 1996

With regards to the trans-border transport of hazardous materials by rail the following two Conventions are especially pertinent:

BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL (RATIFIED BY THE GOVERNMENT OF MOZAMBIQUE BY RESOLUTION Nº 18/96, PUBLISHED IN THE BOLETIM DA REPÚBLICA, Nº 47, 1ST SERIES ON 28TH NOVEMBER 1996).

This convention imposes obligations on the parties thereto with a view to: (a) reducing Trans-boundary movements of wastes subject to the Basel Convention, to a minimum, consistent with the environmentally sound and efficient management of such wastes, (b) minimising the amount and toxicity of hazardous wastes generated and ensuring their environmentally sound management (including disposal and recovery operations) as close as possible to the source of generation; (c) assisting developing countries in environmentally sound management of hazardous and other wastes they generate.

It is stated in the preamble to the Convention that parties recognise the increasing desire for the prohibition of Trans-boundary movements of hazardous wastes and their disposal in other states, especially developing countries.

Scope of the Convention

For the purposes of the Convention, the following wastes that are subject to Trans-boundary movement are considered "hazardous wastes":

- (a) Wastes that belong to any category contained in Annex I (of the Convention), unless they do not possess any of the characteristics contained in Annex III; and
- (b) Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the Party of export, import or transit.

The parties to the Convention have, subsequent to the incorporation of annexures I, II, and III, realised that the classification is too onerous and is in fact stifling development and it is envisaged that the categorisation of waste will be reconsidered.

Summary of the provisions of the Convention

- (a) Trans-boundary movement of hazardous waste is allowed *inter alia* if the wastes in question are required as a raw material for recycling or recovery industries in the State of import. Such movement is, however, subject to the provisions of the Convention.
- (b) Parties prohibiting the import of hazardous wastes shall inform the other Parties of their decision pursuant to article 13.
The other Parties, when so informed, shall prohibit or shall not permit the export of hazardous wastes to the Parties that have prohibited the import of such waste. Mozambique has not issued such a prohibition to date;⁹

⁹ art. 4(1)(a)

- (c) Parties are to prohibit the export of hazardous wastes if the State of import does not consent in writing to the specific import, in the case where the State of import has not prohibited the import of such wastes;¹⁰
- (d) Parties are to prohibit all persons under their national jurisdiction from transporting or disposing of hazardous wastes unless such persons are authorised or allowed to perform such types of operations;¹¹
- (e) Parties are to designate or establish one or more competent authorities as focal points to receive notifications;¹²
- (f) Parties are to co-operate with each other in order to improve and achieve environmentally sound management of hazardous wastes;¹³

THE BAMAKO CONVENTION ON THE BAN AND IMPORT INTO AFRICA AND THE CONTROL OF TRANSBOUNDARY MOVEMENT AND MANAGEMENT OF HAZARDOUS WASTES WITHIN AFRICA. RATIFIED BY THE MOZAMBICAN GOVERNMENT BY RESOLUTION Nº 19/96. PUBLISHED IN THE BOLETIM DA REPÚBLICA, Nº 47, 1st SERIES, 5th SUPPLEMENT ON 28th NOVEMBER 1996.

This Convention resulted from the unsatisfactory wording of the Basel Convention from the African point of view. In fact, only the OECD countries banned completely the export of hazardous wastes to non-OECD countries in 1994. The first wording of the Basel Convention permitted the possibility of these exports as long as the hosting country agreed, and this would have exposed the African countries to the temptation of solving immediate cash flow problems with lucrative operations derived from dumping.

The Convention imposes the following obligations to the states that are parties to the Convention:

- i) enact internal legislation which identifies and categorises hazardous wastes not already identified and listed in the Convention;
- ii) create mechanisms for the enforcement of a ban on the dumping of such wastes at sea or in the internal waters;
- iii) establish monitoring and regulatory authorities to report and act on the Trans-boundary movement of hazardous waste;
- iv) co-operate with other state parties and international and/or regional organisations in the fulfilment of the obligations under the Convention.

¹⁰ art. 4(1)(a)

¹¹ art. 4(7)(a)

¹² art. 5

¹³ art. 10

5.4 INSTITUTIONAL FRAMEWORK

5.4.1 Environmental Management: Ministry for the Coordination of Environmental Affairs - MICOA

The Ministry for the Coordination of Environmental Affairs (MICOA) is responsible for implementing the National Environmental Management Programme and associated environmental policy and legislation.

The Ministry, as indicated by its title has, primarily, a co-ordinating role: all ministries share environmental management, and sector policies must incorporate environmental dimensions into sectoral policies, programmes and activities. During the five years of its existence MICOA has been working on the development of its organization. Currently, MICOA comprises 5 National Directorates each headed by a national director:

- The Directorate for Environmental Impact Assessment
- The Directorate for the Management of Natural Resources
- The Directorate for Land Planning
- The Directorate for the Promotion of Environmental Awareness
- The Directorate for Planning

Each directorate comprises several departments (see Figure 10 below).

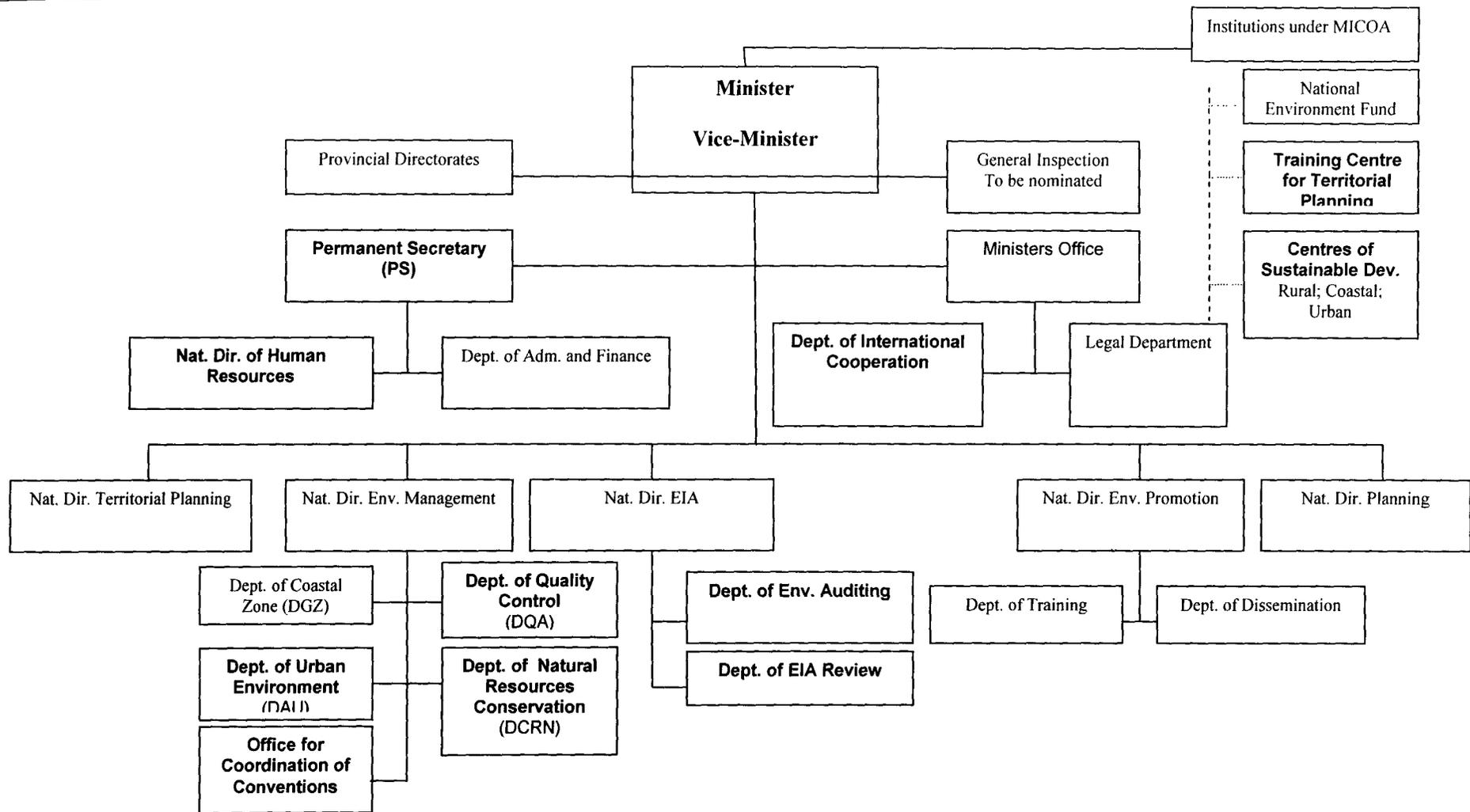


Figure 10. Central level MICOA organisational structure

The responsibilities of MICOA are:

- To revise and develop policies and sustainable, inter-sectoral development plans
- Promote sectoral legislation
- Co-ordinate policy implementation
- Educate and promote public awareness
- Create regulations (e.g. EIAs)

MICOA is also responsible for regulating and overseeing Environmental Impact Assessment (EIA) procedures in Mozambique. As indicated above (Legislation), all projects likely to have significant environmental impacts are obliged by the new Environmental Law to carry out an EIA prior to authorisation.

Legislation stipulates that it is MICOA's role to coordinate, assess, control and evaluate the utilization of the natural resources of the country, and in doing so, to promote their preservation and rational use. It should also coordinate the activities in the area of environment, in order to ensure the integration of environmental considerations in the process of planning and managing socio-economic development.

Due to its role as a coordinating ministry, MICOA's performance depends to a large extent on the degree to which it manages to co-operate with the other ministries and sectors (including the energy sector), as these sectors remain responsible for the integration of environmental matters in their own sectoral programmes. This means that MICOA has to establish a working relationship with each of the sectors that are dealing with the environment. Due to the crosscutting character of environment, this signifies that a working relationship with all the other sectors has to be established, although the significance will vary from one to another. UTIP, dealing with hydro-electric are important partners. MICOA and its partner sectors are still defining roles, positions and modes of co-operation. This, in general, has taken time, with periods of limited co-operation with a consequently limited coordinating role for MICOA. The situation has gradually improved. It can be stated that at the end of 1999, with the closing of the first mandate MICOA has become an accepted ministry. The challenge for the second mandate will be that the ministry improves its quality in order to consolidate and strengthen its acquired position.

Key areas of MICOA's interventions include the following:

- Environmental impact assessment
- Environmental audit and inspection (regulations still being drafted)
- Environmental quality standards (regulations still being drafted)
- Environmental Management Plans

These are discussed below:

The Role of MICOA with regards to Environmental Impact Assessment

Regulating Environmental Impact Assessments (EIAs) is one of the most important roles of MICOA. This role requires significant interaction and coordination with other government sectors involved in development and investment projects and, consequently MICOA has assumed a much more visible and high profile.

Initially, EIA in Mozambique was applied through the Law of Foreign Investment that was passed in 1993. However, there were no clear guidelines for carrying out EIAs under this Law. Nevertheless, the Law of Foreign Investment gave a certain level of legal support to control potential environmental impacts arising from several project applications for investments which were submitted to the Investment Promotion Centre.

The Framework Environmental Law passed July 1997 specifically referred to the formulation of EIA regulations. In 1998 EIA Regulations were passed by the Council of Ministers and an EIA Department (within the National Directorate for the Management of Natural Resources) was created in MICOA in order to oversee the implementation of EIA regulations and procedures in Mozambique.

During its first mandate the EIA Department was small (comprising a department head plus four to five technical staff). This period was also characterized by high staff turnover including several changes of head. To the lack of human resources and operational support the EIA Department was generally unable to efficiently implement EIA procedures and regulations although this in no way reflects on the capacity of the staff *per se*: the staff in place attempted to carry out their tasks under difficult circumstances.

In December 1999, an independent consultancy mission performed functional analysis and capacity needs assessment on the EIA Department. Based on the recommendations arising from this mission the EIA department has been upgraded to a national directorate and, consequently, the institutional and political importance of EIA is increasingly recognised both within, and outside of, MICOA.

Concomitantly, co-ordination with other government sectors involved in development and investment projects has also improved although there are still comments regarding the lack of specific information about the EIA procedures and the varying levels of co-operation.

The competence of MICOA to review and process environmental assessment Terms of Reference and reports has improved. Agreements of understanding have been informally negotiated with and accepted by the national directors in charge of tourism, industry and forestry and wildlife. The EIA Directorate intends to work with other sectors to draw up specific sectoral guidelines. To date only draft EIA Guidelines for the roads sector in collaboration with National Administration for Roads (ANE) have been formulated – these require a substantial amount of reformulation in order to achieve an acceptable working document.

The Role of MICOA with regards to Environmental Audit and Inspection

Environmental audit and environmental inspection are the tools specified in the Environmental Law for the control of activities that were in operation before the passing of environmental legislation in 1997 as well as all subsequent activities that have been implemented since 1997 with or without an environmental license.

Environmental audits should be required for all activities of high impact and pollution potential and should be performed by an independent environmental audit company.

MICOA has started to draft environmental audit and inspection regulations for internal discussion and future external consultation. However, the present versions of the draft regulations still require considerable technical review and improvement prior to submission to the Council of Ministries for approval.

The Role of MICOA with regards to Environmental Standards

Since 1997 MICOA has been developing environmental quality standards through the Environmental Quality Standards of Mozambique Projects (PEPA) with the following objectives:

- To define and prepare adequate environmental quality standards for the country.
- Through the establishment of a national committee, prepare regulations to be submitted to the Council of Ministries for approval.

Draft environmental standard regulations have been prepared and discussed with a broad participation of representatives of relevant agencies. However, the draft is still undergoing revision before submission to the Council of Ministries.

The Role of MICOA with regards to Environmental Management and Land Use Plans

The National Institute of Physical Planning (INPF) has, until recently, been responsible for urban and rural planning (mainly the former).

After several years of negotiations, the INPF has been integrated into MICOA as the National Directorate for Land Planning (DNOT). The precise organizational aspects and mandate of DNOT are currently under discussion by MICOA's Consultative Council.

Currently the mandate of DNOT is being finalized and its role appears to be a mix as a co-ordinating agency (including creation of norms and procedures) and an executing agency (i.e. formulating and implementing land use plans). The responsibilities of the National Directorate for Territorial Planning are currently as follows:

- Promote policies and legislation relevant the territorial planning
- Establish norms, regulations and guidelines territorial planning activities
- Study and propose the best location for large development projects
- Promote and carry out research into habitats in urban areas
- Promote, formulate and monitor the implementation of territorial development plans at the national, regional and local levels
- Promote and formulate urban plans
- Provide technical evaluations of related to territorial development plans
- Provide technical evaluation for processes related to the grating of land rights for rural zones, settlements, towns and cities where there are no approved plans
- Participate in the classification of human settlements and urban centers
- Collaborate on the territorial division of the country

Coordination of Environmental Affairs: Provincial level

Since 1995 MICOA has been establishing Provincial Directorates in all the Provincial capitols. The level of organisation and capacity varies from Province to Province. MICOA is not represented at lower levels of government (i.e. District level) in any of the Provinces. The Provincial structure follows, but not strictly adheres to, the structure at central level. The capacity of provincial directorates with responsibility for overseeing environmental assessments and monitoring of impacts arising from development projects are limited by lack of human resources and logistical support.

5.4.2 Land Management

Registering/Mapping of Land Concessions

Central Level

The National Directorate of Geography and Mapping (DINAGECA) is part of the Ministry of Agriculture and Rural Development. One of its responsibilities is to ensure that the national land policy is implemented. In addition, it must co-ordinate, promote, develop, supervise and monitor activities related to mapping, large-scale land surveying and satellite imaging.

The National Directorate of Geography and Mapping (DINAGECA) has a central directorate in Maputo and Provincial Services of Geography and Mapping in each of the country's Provinces.

Provincial Level

At Provincial level Tete has a Provincial Directorate of Geography and Mapping based in Tete comprising various sectors: documentation, procedures, topography, surveying and cartography.

(Authors note: the Provincial Directorate of Geography and Mapping will have a key role in delimiting and registering community land rights according to the new Land Law).

There are no District Directorates of Geography and Mapping, although a representative with temporary functions is nominated for areas where the demand for land is more intense or problematic. This representative does not reside in the District in question.

The responsibilities of the Provincial Geography and Mapping Services include:

- Drawing up a land-use map (based on title rights) at Provincial level and documenting all the procedures in the process of authorizing land use rights. The Provincial Geography and Mapping Services do not authorize/allocate land use and utilization rights, but simply prepares and channels the respective documentation.
- Responsibility for the land law and regulations, the resolution of disputes, the transfer of land use and utilisation rights and the collection of land use fees.

- Registration of community land acquired under customary law and documenting the rights acquired by individual persons under customary law (according to the new Land Law).
- Sharing and providing information relevant to economic planning in the Province by supplying information about areas occupied or abandoned. The Directorate also assists in the preparation of master plans for land occupation in co-ordination with other institutions.

5.4.3 Management of Forests and Wildlife

Central level

Until March 2001, the DNFFB was responsible for the management of gazetted protected areas in Mozambique as well as for the management and conservation of wildlife and forestry resources outside of the protected areas network. In January 2001 a new Directorate (the National Directorate of Conservation Areas NDCA) was created within the Ministry of Tourism.

Provincial level

At the provincial level, DNFFB operates through SPFFBs (Provincial Services for Forestry and Wildlife) which are located within the Provincial Agricultural and Rural Development Directorates (Direcção Provincial de Agricultura e Desenvolvimento Rural - DPADER). Each Provincial SPFFB (under the responsibility of a provincial "Head") is responsible for the administration of the protected areas and management of wildlife and forestry resources outside the protected areas. (In practice, however, the responsibilities of national and provincial agencies are not always clear.) In some instances the Forestry and Wildlife services may be represented at the District level.

The SPFFB are generally weak regarding human resources and operational capacity

5.4.4 Promotion/Identification of Development Projects in the Zambezi Valley -the Zambezi Valley Development Authority (GPZ)

The Zambezi Valley Development Authority (GPZ) is a legal body created in 1995 by Government Decree 4W95. The Authority has administrative and financial autonomy and is supervised by the Council of Ministers.

Through GPZ the Government promotes, directs, plans, coordinates and monitors the implementation of development programmes and projects in the Mozambican part of the Zambezi River Basin. The geographical area is defined as:

- Tete Province (all districts).
- Zambezia Province (the districts of Marrumbala, Mopeia, Chinde, Milange, Mocuba Maganja da Costa, Nicoadala, Inhassunge and Quelimane)

- Sofala Province (the districts of Gorongosa, Maringue, Chemba, Caia, Marromeu, Cheringoma and Muanza).
- In Manica Province (the districts of Barue, Guro, Tambara and Macossa).

The Zambezi Valley Authority has the following mandate:

- a) To promote, coordinate, plan and monitor the sustainable development of the Zambezi Basin in accordance with development guidelines laid down by the government.
- b) To coordinate the inventory process of the natural resources of the region, and programme their rational and sustainable use;**
- c) To promote the establishment of the infrastructures that are indispensable for the development of the region;
- d) To promote incentives necessary for the development of national communities and to stimulate employment in the region;
- e) To propose for government approval the plans, programmes, projects and activities of various public and private bodies aimed at developing the region.

At central level the Zambezi Valley Authority consists of executive bodies, consultative bodies and services:

The central executive bodies are:

- The General Directorate;
 - The Management Council.
- The central consultative bodies are:
- The Inter-ministerial Commission;
 - The Technical Council.

Services shall be provided by the departments, the number and composition of which are still being defined and shall be fixed in the Internal Regulations.

The General Directorate of the Zambezi Valley Authority consists of the Director General who is supported by a Secretariat. A Management Council consisting of the Director-General, the directors of departments and the Regional Delegates has been set up that is supposed to be set up.

An Inter- ministerial Commission is a body of the Council of Ministers charged with supervising and monitoring the functioning of the Zambezi Valley Authority and comprises.

- The Minister of State Administration
- The Minister of Agriculture and Rural Development
- The Minister of Fisheries
- The Minister for Environmental Coordination
- The Minister of Industry and Trade
- The Minister of Tourism
- The Minister of Foreign Affairs and Cooperation
- The Minister of Public Works and Housing
- The Minister of Planning and Finance

- The Minister of Mineral Resources and Energy
- The Minister of Transport and Communication
- The Director-General of the Zambezi Valley Authority.

The Tete, Zambezia, Sofala and Manica Provincial Governors may be invited to take part in meetings the chairperson deems it appropriate. The Inter-ministerial Commission shall be supposed to meet at least once every three months under the chairmanship of the Prime Minister.

The Technical Council is a consultative body convened and chaired by the Director-General and its mandate is to analyse and provide advice on matters of technical nature related to GPZ activities. The Technical Council comprises the Director-General and departmental Directors of the above ministries as well as the Centre for the Promotion of Investment.

5.4.5 Caminhos de Ferro de Moçambique (CFM)

In January 1995, CFM (Empresa de Portos e Caminhos de Ferro de Moçambique) was established as a public company, as a collective person under public law, with its own legal status and administrative and patrimonial autonomy.

The document published in the official gazette, the "Boletim da República", First Series, NO 36 of 13 September 1994, stresses the important role of CFM in developing the national and regional economies, in raising money, both in local and foreign currencies, in the rail transport of people and goods, and in the handling of cargo.

The CFM management bodies are: the Board of Management (CA) and the Fiscal Council. The CA consists of seven members, one of whom is the chairman. The chairman of the CA is appointed by the Council of Ministers, while the others are appointed by the Ministry of Transport and Communications. One is proposed by the Ministry of Finances, one is an elected representative of the workforce and the other four are proposed to the Ministry of Transport by the chairman of the CA.

The CA draws up CFM management policies, discusses and votes on plans of activity, as well as the balance sheets and accounts of the previous year, which it then submits to a higher appreciation; it also discusses and votes on norms. Co-ordinating the entire activity of the company, giving top level guidance to its services, and managing everything concerned with it are also tasks of the CA. It is part of the CA's sphere of competence to appoint and dismiss Executive Directors and their assistants, to decide on opening or closing commercial offices abroad, as well as appointing and dismissing commercial representatives.

5.4.6 Legal and Institutional Issues, Concerns and Recommendations

Mozambique possesses a wide array of legislative diplomas, decrees and regulations related to environmental management and protection. In addition, Mozambique has acceded to several international conventions. However, the enforcement capacity to ensure that these public and private sectors comply with existing legislation is weak.

The Framework Environmental Law is a broad law covering all aspects of environmental protection. Specific regulations are currently being implemented within the Law. Nevertheless, it is incumbent on the various line ministries to review and where necessary revise sectoral policies, plans, operations and regulations to ensure that these are in conformance with the Environmental Law.

In general, institutions in Mozambique lack operational capacity to carry out effective environmental management, control and enforcement. In addition, there is a lack of formal co-ordination between institutions although there are good ("ad hoc") relations between CFM and MICOA. These institutions require improved co-ordination according to their different responsibilities.

Regarding the regulations that CFM is using, these are outdated (as old as 1966), but still useful. However, CFM should review and update all their regulations, ensuring that they adequately address environmental protection, workers health and safety and emergency situations.

Together with this, CFM should up-date and reformulate the Employees Safety and Health Document and ensure that workers are fully cognisant of safety and health procedures, disseminated through an awareness programme.

CHAPTER VI
ENVIRONMENTAL MANAGEMENT PLAN

6. ENVIRONMENTAL MANAGEMENT PLAN

6.1. INTRODUCTION

The Government of Mozambique has adopted the National Environmental Management Programme (NEMP) as the national policy document for environmental management and protection.

In addition to national environmental policy, Mozambique has promulgated a variety of legislative decrees and regulations related to environmental protection. As operators are required to comply with environmental policies, laws and regulations of the country it is implicit that any company carrying out operations in Mozambique would seek to be in compliance with extant legislation. Failure to do so may constitute a significant liability to the operator. It is in the interest of the CFM and operators to implement sound environmental policy and practices for a variety of reasons including:

- It is more cost-effective to prevent pollution than to manage it after it has been generated
- Improved compliance with Mozambican legislation and regulations
- Enhanced image with customers/markets
- Enhanced employee morale
- Enhanced image with public

The EMP essentially seeks a systematic approach to ensuring that operations are carried out in compliance with Mozambican legislation and to meeting environmental goals. Elements of the management plan may be implemented at two levels *viz.* via the CFM as a holding company and via the concessionaires as operators.

The EMP comprises a range of general and specific recommendations, which collectively act as the basis for environmental management (impact mitigation) and control, during the construction and operation phases of the project. The majority of impacts described above in chapter 6 are of a temporary nature and mostly limited to the construction phase. The remaining impacts can easily be monitored as long as the project makes provision for regular inspection and monitoring.

This document thus serves to identify the principles, responsibilities, activities and (some) methodologies that the contractor shall adopt to effectively manage environmental impacts during the rehabilitation phase of the project and that CFM shall adopt during the operation phase. The EMP is a dynamic document and can be reviewed and updated as necessary throughout the duration of construction by the contractor staff responsible for implementing the EMP

CFM and current/future concessionaires must make a firm commitment to include environmental considerations into planning and operational phases of their activities.

This can be achieved through the formulation of a clear environmental policy and the implementation of practices to improve overall environmental performance.

In order to attain international recognition for CFM's EMP, the long-term target of the company must be to achieve conformance with ISO 14001, a widely accepted international standard for environmental management.

6.2 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PLAN

The purpose of the Environmental Management Plan (EMP) is to provide environmental standards for the rehabilitation, operation, and routine maintenance of the railway line network.

1. The Contractors are legally required to comply with the frame of reference and standards of the project. While this EMP provides background information, it is the Contractor's responsibility to verify the accuracy of any information provided and, irrespective of any inaccuracy or incompleteness, to comply with the frame of reference and standards.
2. The frame of reference for the environmental standards is to avoid impairing (a) the health or well-being of people, and (b) land capability.
3. CFM should monitor compliance with the frame of reference and project standards.

6.3 CFM's POLICY – AN OUTLINE

At a National level, the Government of Mozambique has clearly stated its commitment to the environment through the adoption of the National Environmental Management Programme (NEMP). The NEMP seeks to ensure that environmental considerations are included into all sectoral policies, plans and programmes. The important role of harbours and ports in the economy of the country is recognised in the NEMP.

CFM takes its lead from stated government policy and will ensure that environmental considerations are incorporated into its own operations as well as those of current and future concessionaires.

CFM is firmly committed to compliance with all applicable laws and regulations, the promotion of waste reduction, resource and property conservation and environmental protection, and will train employees to be knowledgeable about all environmental matters relevant to their work.

The Environmental Policy constitutes CFM's declaration of commitment to the environment. The policy serves as the foundation for the EMP and provides a unifying vision of environmental concern by the agency. The Policy will be transmitted to employees at all levels of the CFM structure in order to achieve the environmental objectives and will be subject to continual improvement.

The policy is related to the operations, services, as well as supporting activities in the context of ecologically sensitive areas especially the protection of coastal and marine resources.

6.4. CONTRACTUAL OBLIGATIONS OF CONCESSIONAIRES

In the first instance it should be noted that all entities that sign concession agreements with CFM are obliged by law to comply with extant Mozambican legislation and regulations related to environmental protection (see Chapter 5). This obligation stands regardless of whether or not it is specified in the contracts to be signed between CFM and concessionaires.

The enforcement and control of compliance of the legal regulations for environment conservation belong to several institutions, depending on the specific area of activity. For example: marine pollution control and enforcement will be carried out by the different Maritime Administrations (SAFMAR) of the country whilst the control of toxic waste discharge in the rivers will be carried out by the Regional Water Administrations.

However, CFM can contribute in several ways to guarantee that the concessionaires fulfil all legal obligations, notably through their co-signing of contracts.

Before the Signing of a Contract with a Concessionaire

Before a contract is to be signed, CFM must co-ordinate with institutions dealing with environmental issues related to the planned activity in order to be fully informed of the environmental regulations that should to be included in the contract.

After the Signing of the Concession Contract

A copy of the contractual clauses referring to environmental obligations must be sent to the relevant institutions responsible for environmental protection, enforcement and control.

6.5 LEVELS OF RESPONSIBILITY FOR THE MANAGEMENT AND IMPLEMENTATION OF THE EMP

The responsibilities of key members of the contractor team are detailed below.

Project Director

- Overall responsibility for ensuring that the project EMP, Procedures and Method Statements are prepared and implemented, and that they comply with all legislative and contract requirements.
- Ensuring and partaking in regular reviews of the Environmental Management Plan.
- Provide a regular report to management and ensure that findings and recommendations are responded to and implemented as necessary.

- Ensure non-conformities are reported.
- Ensure non-conformities are corrected within the required time frame and that remedial solutions are effectively implemented.
- Ensure subcontractors fulfil their environmental obligations

Construction Manager

- Procedures and Method Statements
- Organisation of labour, plant, transport and equipment to perform the work in accordance with the environmental requirements
- Responsible for ensuring all sub contractors are aware of the contractor's Environmental Policy and the requirements of the EMP, Procedures and Method Statements
- Ensure the project is constructed in accordance with Project Drawings, the Contract, and the environmental requirements stated in the EMP
- Implement agreed actions resulting from audits or inspections

Environmental Manager

- Review and implement the EMP, Environmental Procedures and Method Statements
- Promoting and communicating environmental issues to personnel and ensuring project staff are briefed on their responsibilities under the EMP
- Advising the Construction Manager of statutory/other environmental requirements
- Liaison with statutory and non statutory authorities and the public
- Provision of environmental induction training for all staff and sub-contractors
- Undertaking environmental site inspections to ensure compliance with the EMP
- Advising the Construction Manager on the actions to be taken arising from audits of the project
- Day to day liaison with the Construction Manager and briefings of crews.
- Recommending solutions to environmental problems as they are foreseen or encountered
- Development of pollution control and emergency response plans, including provision of adequate pollution control equipment
- On-site advice, reporting and investigation of all environmental incidents
- Establishment of adequate arrangements for the storage, disposal and recycling / re-use of waste

- Establishment of adequate arrangements for the storage of fuel, oils and lubricants on the site and at the construction base
- Regular liaison with CFM and Environmental Site Officers (if applicable)

Land Liaison

- Liaison with landowners (commercial and subsistence) and tenants. This process should be used to establish compensation requirements.
- Undertake site inspections to monitor working practices and ensure landowners and farmers requirements are fulfilled.

6.6 INSTITUTIONAL ROLES IN COORDINATING IMPROVED ENVIRONMENTAL SCREENING, MONITORING, ENFORCEMENT AND CONTROL

In the first instance, it should be noted that, in general Mozambican institutions lack institutional and operational capacity to ensure the necessary enforcement and control of activities and operations that may affect the environment. This will require the implementation of an institutional and human resources development strategy for the various institutes, targeting all levels.

However, co-ordination and collaboration between CFM and the different institutions can be improved and strengthened in a number of ways.

Prior to Operations

Inter-institutional co-ordination regarding environmental issues prior to the signing of a contract between CFM and concessionaires is referred to above.

During Operational Phase of the Concession

Although it is not a specific task of CFM to enforce and control environmental regulations, monitoring and checks can be carried out by various agencies including the concessionaires.

The CFM has constituted an "environmental unit" based in Maputo. The unit is currently weak and will require strengthening if they are to play a key role in ensuring compliance with legal and environmental regulations by CFM and concessionaires, and to carry out environmental monitoring. In view of the proposed restructuring, the Unit will need to be small but effective with a clearly defined mandate. The Unit should have mainly a regulatory role, rather than an implementation role. For example, the Unit should have the capacity to conduct environmental audits on a regular basis (at least yearly).

Based on the audit findings, CFM staff will liaise with the concessionaire indicating potential and actual risks and violation of legal regulations. Copies of the audit plus recommendations should be forwarded to the planned "Independent Authority" which

will be constituted to oversee CFMs operations as well to relevant agencies responsible for environmental control and enforcement.

In this way CFM or the Independent Authority can communicate any violations by the concessionaire to the relevant enforcement agency.

The specific roles *vis-a-vis* environmental monitoring, enforcement and punishment must be clearly defined and co-ordinated between the agencies, to avoid duplication of activities and punishments for the same offence. Whereas CFM may have a role in monitoring, other agencies will be responsible for enforcement and punishment in accordance with their legal statutes.

Independent and additional monitoring can be carried out by agencies such as MICOA and the Regional Water Authorities, in addition to their enforcement role.

In the event of an environmental violation, the enforcement agency (e.g., MICOA) must inform CFM of the nature of the violation (and punishment) so that CFM can impose the appropriate fine for the contractual violation.

The Role of the Independent Authority

Under the restructuring programme CFM will be downsized and transformed into a holding company. CFM will enter into contractual agreements with private sector concessionaires who will fulfil components of CFMs current operations. An Independent Authority (IA) will be created to oversee CFMs management and operations to ensure that CFM is performing in the public interest.

The Terms of Reference of the Independent Authority should include the authority to monitor and evaluate the environmental performance of CFM and its concessionaires. An "environment unit" could be constituted within the I.A. specifically to deal with environmental issues.

6.7 COMPONENTS OF THE ENVIRONMENTAL MANAGEMENT PLAN

6.7.1 Health, Safety and Environment

Environmental awareness plays an important role in achieving compliance for environmental management. In this regard the following steps shall be taken to ensure all contractor and sub contractor staff are informed and trained appropriately:

- Environmental Awareness Orientation shall be given to all employees, subcontractors and consultants as part of their general orientation. CFM to verify the HSE procedure for Training and Induction of the contractor.
- Basic environmental auditing and compliance training should be provided to the Safety Officers on site and persons responsible for the day to day monitoring of environmental performance.

- The Environmental manager should have the necessary training to conduct compliance audits throughout the duration of the project.
- The Environmental manager will promote onsite environmental awareness through talks / meetings and promotions throughout the extent of the project.
- All environmental incidents that occur on site will be reported and addressed through the HSE reporting procedure of the contractor
- A register will be maintained that will log all environmental complaints raised by landowners, occupiers or the general public in connection with construction activities. This register will be available to CFM for periodic review.
- The register shall be regularly updated and shall maintain records including the name of the complainant, his or her domicile and contact details, the nature of the complaint and any action that was taken to rectify the problem.
- The Environmental manager in conjunction with the HSE manager will be responsible for drafting the environmental complaints report, handling complaints and maintaining the register.

6.7.2 Health and safety of local populations

The rehabilitation and operation of the railway line will result in:

- Some sections of the lines passing in close proximity to local communities and their crop fields
- Potential accidents involving local people, especially children, crossing the line and not used to it being operational

Lack of care or lack of information can cause accidents, almost always with severe consequences. Thus, people living in the area under direct influence of the railway line and people moving in the vicinity should be informed by CFM or their appointed representative regarding appropriate security precautions, for example:

- Not allowing children to cross the railway line
- Education relating to the hazards of a passing train

This should come together with warning notices and gates at all crossing points and people should be explained on its importance and danger if not accomplished.

6.7.3 Community health management

- a) As malaria is endemic to the project area, the contractor should prepare and implement a programme to minimise malarial incidence among employees, and the consequent spread of malaria into the surrounding population. The programme should be prepared with the assistance of a medical doctor with experience of malarial infections and their treatment. Areas to be addressed under this programme should include the following:

- Measures to control the breeding of mosquitoes at the construction sites.
- Measures to prevent employees from contracting the disease, including education with respect to malarial prevention and the installation of protective measures in sleeping accommodation and eating areas.
- Measures to determine and effectively treat malarial infection as quickly as possible after the disease is contracted.

b) The contractor should prepare and implement a programme to minimise the risk of the spread of HIV infection as a result of the rehabilitation contract. The programme should be prepared with the assistance of a medical doctor with experience of HIV prevention and treatment. The following measures should be implemented:

- An HIV/AIDS training course and on-going education on transmission of HIV/AIDS and STDs to employees, through workshops, posters and informal information sessions.
- Encouragement of employees to determine their HIV status.
- The supply of condoms at the project site.
- Encouragement of the early treatment of STDs in employees, to minimise the risk of HIV infection.
- Encouragement of early treatment and monitoring of secondary/opportunistic infections such as coughs influenza and pneumonia.
- Promotion of an HIV/AIDS stigma free environment by means of an open and non-discriminatory approach to the epidemic at all levels of employment.
- Development of a comprehensive construction camp management plan including rules for on-site behaviour, entrance and exit policies, and prohibition of the sex worker trade.

6.7.4 Employee Safety and Health Policy for the Ports, Harbours and Railways of Mozambique

The diversity of activities at ports and rails throughout the world e.g. the handling of a broad range of potentially hazardous and/or inflammable materials, and the operation of heavy-duty mechanical equipment necessitate the implementation of a worker safety and health policy. Such a document should take the form of a set of safety rules and guidelines that, if adhered to, will minimise the risk of injury to workers across the full spectrum of routine port activities. A document pertaining to the safety rules for employees must be formulated and published.

Please refer to the document "Environmental Audit and Management Plan for the Rail and Port Restructuring Project, 1998" for the specifications.

6.7.5 Procedures for Emergency Preparedness and Response

The possibility of accidents and other emergency situations always exists. Effective planning and preparation can reduce injuries, protect employees and neighbours, reduce asset losses and minimise production losses.

An effective emergency preparedness and response programme should include provisions for:

- Assessing the potential for accidents and emergencies (such as fires, explosions, spills or releases of hazardous materials, and natural disasters)
- Potential emergency situations hazardous materials used on-site and their locations
- Key organizational responsibilities
- Preventing incidents and their associated environmental impacts;
- Plans/procedures for responding to incidents;
- Periodic testing of emergency plans/procedures; and,
- Mitigating impacts associated with these incidents.
- Training is needed or if emergency plans/ procedures should be revised.
- Arrangements with local emergency support providers

Procedures and guidelines for emergency preparedness and response are provided in the EAMP.

6.7.6 Training

All personnel including, the contractor's own workforce, sub-contractors staff and any external consultants should receive combined Health, Safety and Environmental induction training. This induction should be carried out before any employees are allowed on site and training records, should be maintained by the contractor's HSE department.

The induction course should be supplemented by talks on specialized topics and specific operations. Handouts of instructions and procedures should be issued as required. An extended induction should be delivered to provide further information on environmental management to key personnel.

6.7.7 Consultation with Statutory and Non-Statutory Bodies and the Public

Contractor management are responsible for identifying any additional requirements for consultations, and liaising with CFM. Copies of all correspondence and a summary matrix of consultations undertaken by the contractor should be kept in the project environmental files and copied to CFM.

In this context, it is essential that all stakeholders have access to information about the project and its potential repercussions. This will serve to facilitate collaboration from the public sector and from other institutions regarding the project.

As a minimum, consultations should be undertaken with the following individuals and organizations:

- Local Authorities,
- Property owners and affected communities, to ensure impacts associated with the rehabilitation process have a minimal impact on present activities and agricultural practices and to verify any compensation claims.
- Relevant authorities (especially MICOA) with regard to the working methods and reinstatement of the environment.

6.7.8 Detailed Environmental Impact Assessment and Monitoring

A more detailed environmental assessment and monitoring programme may be required. The need for a more detailed assessment and monitoring may be “triggered” following the completion of the environmental screening form (see above) which may identify parameters to be measured. In which case concessionaires may wish a more detailed base-line environmental assessment of the project area affected by their operations (even prior to signing of the contract if deemed necessary) followed by a longer-term monitoring programme).

The parameters to be measured will be contingent upon the location of the project and the nature of the operations. Each operator should prepare a site-specific environmental monitoring plan that enables correct management and ensures compliance with environmental standards for each Rail Corridor. Generic parameters that may require monitoring during project planning, start-up and operation may include:

- Geotechnical and chemical characterization of sediments;
- Geotechnical and chemical characterization of soils and subsoils;
- Water quality of project area and proposed disposal areas including surface waters (where applicable) and ground water;
- Long-term chemical/physical testing of project area; disposal location sediments and water quality;
- Long-term monitoring of biota for the possible accumulation of contaminants;
- Long-term monitoring of sediment transport, accretion (shoaling), erosion, and the impacts and effectiveness of any man-made structures;
- Maintenance programs to keep a high level of employee environmental awareness;

The frequency of the sampling will be dependent on the parameter to be measured. For example, it may be necessary to measure impacts on biota more than once a year to take into account seasonal variations in populations whilst monitoring of ground water could be carried out on an annual basis.

Where a resource, habitat or ecosystem may be affected by more than a single operator (e.g. an estuary, inland water body, ground water) operators should enter into negotiations in order to cover jointly, the costs of the assessment and monitoring.

The contractor should develop detailed plans and method statements for the elements of construction for which such information is required by the EA and EMP. These procedures and method statements should take into account the findings of the EA and the environmental standards required, and should include:

- Transport of hazardous cargos, forest products (wooden logs), bush meat, etc
- Location and construction of material storage depots
- Workshop environment (environmental housekeeping, storage and management of waste oil, occupational health, fire and safety management)
- Location and construction of temporary construction worker camps

- Disposal of waste disposal arising from the works and rail operation
- Methods to deal with any potentially contaminated ground, water, or ground water
- Land mines
- Dust and air borne control method
- Noise control method
- Impact of traffic burdens

All Plans, Procedures and Method Statements should be reviewed by CFM or an appointed competent representative prior to acceptance and adoption.

A competent ecologist should be employed where required to supervise works in the relevant sensitive areas, and monitor potential impacts designated in this report.

His/her tasks shall include the assessment of cumulative impacts such as the long – range transport of air pollutants and its addition to existing sources or other industrial developments in the area of concern and additional rail traffic.

6.7.9 Transport of hazardous cargos, forest products (wooden logs), bush meat, etc

General conditions:

- a) During transportation of materials, these shall be secured to ensure safe passage between destinations. Loads including sand, stone, cement, etc, shall have appropriate cover to prevent them spilling during transit
- b) The above applies for forest products and bush meat. Bush meat shall be contained in an appropriate form to prevent it from decomposing and releasing bad smell
- c) Licenses shall be provided for transporting forest products and animals
- d) All hazardous materials (chemicals, explosives) shall be transported together with the MSD sheet (Material Safety Data Sheet) and all precautions for safe transportation, use and handling must be taken into account
- e) An effective emergency preparedness and response programme should be prepared as the possibility of accidents and incidents always exist. Effective planning and preparation can reduce injuries, protect employees and local communities, reduce asset losses and minimise production losses.
- f) An inspector/police shall accompany the transport of any hazardous products and significant quantities of forestry products and animals

6.7.10 Location and planning of campsites and construction material storage depots

General conditions:

- a) Campsites and any storage depots should be constructed in areas that minimise the potential for ecological impact and public nuisance.
- b) Campsites should not be located within or in close proximity to main population centres in order to minimise risks of in-migration and other nuisance affecting these communities.
- c) The contractor should comply with all relevant laws and regulations in Mozambique concerning water provision, sanitation, wastewater discharge and solid waste disposal.

In addition campsites should not be located:

- a) In any area in which vegetation is pristine, as defined in this report.
- b) In areas of special sensitivity (wetlands, riparian zones, mangroves, and pristine woodland).
- c) Within 200 m of any watercourse.
- d) In any area that could cause nuisance or safety hazards to surrounding communities (consent must be obtained from local communities).
- e) Without authorisation from CFM.

Prior to the establishment of a campsite, a method statement should be prepared and submitted to CFM for review. The method statement should contain the following information:

- a) Site location and layout
- b) Vegetation types
- c) Topsoil management
- d) Solid waste disposal
- e) Erosion control
- f) Litter management
- g) Water supply
- h) Management of bush fire risk
- i) Rehabilitation

Vegetation clearing and site levelling for campsite and depot construction

1. The extent of the campsite/depot should be marked out to ensure that only the required area is disturbed by construction activities
2. The environmental manager or an appropriate environmental consultant should check the site prior to clearing activities (in the planning phase) to ensure that all the environmental requirements have been fulfilled in the planning phase and to verify that the area does not contain sensitive ecosystems or threatened species
3. If necessary, vegetation clearing should be done by hand
4. All vegetative rootstock material should be stockpiled for use in rehabilitation when the site is to be decommissioned

5. Any topsoil that is graded during site levelling activities should be stored separate from the rootstock for use in rehabilitation later
6. Rootstock and topsoil stockpiles should not exceed 2 m in height
7. All appropriate measures (e.g. berms and contours) should be made to prevent erosion of the stockpiles

6.7.11 Dismantling and rehabilitation of temporary campsites

- a) All structures erected by the contractor should be dismantled, removed and where possible used for the construction of future campsites.
- b) Any rubble generated from the dismantling of campsites should be dumped at an approved disposal site.
- c) Pollution control structures (sumps, septic tanks, grease traps etc.) should be emptied and the waste dumped according to the waste management procedure.
- d) Once emptied these structures should be removed with particular care to avoid any possible ground or water contamination.
- e) If the structures are not to be re-used at other campsites they should be disposed of appropriately.
- f) All other waste should be handled according to the waste management procedure.
- g) Once the area has been cleared of all material the ground should be prepared for rehabilitation.
- h) This may involve ripping, harrowing or disking areas where ground has become compacted by equipment and structures.
- i) The original topsoil stockpiled at the campsite should then be evenly spread over the disturbed areas.
- j) The stockpiled rootstock should then be spread over the topsoil and where necessary erosion control structures (contours and furrows) should be placed.
- k) The area should then be left to rehabilitate through the process of natural succession.
- l) The Environmental manager should monitor the campsite to determine the success or failure of rehabilitation.

6.7.12 Hazardous chemicals and substance (HCS) control

All HCS should be handled, stored and disposed of in a safe and responsible manner, in order to prevent the contamination of soils, pollution of water and/or harm of people or animals as a result of the use of these materials.

The contractor should comply with all applicable Mozambique laws, regulations, permit and approval conditions and requirements relevant to the storage, use, and proper disposal of hazardous materials. Hazardous materials and wastes shall be identified as defined by a recognised international standard.

The contractor shall prepare a method statement for the management of hazardous and toxic materials and waste on or off the construction site. This plan should include, but not be limited to, measures to prevent contamination of soils, pollution of water, accidental fires and risk/injury to people or animals.

Landfill of hazardous materials and wastes on the construction site will be prohibited.

DDT will not be used for malarial control, or for any other purpose on site.

The contractor's HSE procedure for chemical hazards communication and control shall be followed.

In addition to this procedure the following measures should be taken with special emphasis on the storage and handling of fuels and lubricants:

1. Fixed fuel storage tanks should not be located in any area other than at approved plant yards or campsites.
2. Fuel storage facilities with a capacity greater than 1000 litres should be located on flat or gently sloping ground. A bund (berm) should surround the area and be capable of containing at least 125% of the total capacity of the storage containers. The bund and the floor of the storage area should be constructed with impermeable material or be lined to ensure that petroleum products cannot escape.
3. All fixed storage areas should be enclosed by a security fence with a lockable gate. Symbolic signs depicting 'no smoking' 'no naked flames' and 'danger' should be displayed, and should conform to a recognised standard.
4. Fixed fuel storage, the servicing or refuelling of any vehicle or equipment should not be within 100 meters of any settlement, within 100m of a watercourse or wetland, within a floodplain, or where there is the potential for spilled fuel to enter a watercourse or ground water. Fixed fuel storage should always be located within the construction campsites.
5. All reasonable precautions should be taken to prevent fuel and lubricant spills during construction. To this end, the contractor should ensure that:
 - There is no overfilling of diesel bowsers and equipment tanks.
 - Regular audits are performed to verify that no leaking or defective equipment is brought onto site.
 - Any oils or lubricants discharged during routine vehicle servicing on site are captured using drip trays, containers or other appropriate containment measures.
 - Equipment is repaired regularly to ensure that no fuel, oil or hydraulic leaks occur.
6. All equipment that is required to work in fish-bearing waters should be cleaned of oil, grease and other contaminants that may affect aquatic life.
7. Sufficient absorbent material shall be made available on site to manage accidental spills. An inventory of this equipment and its location on site should be prepared and included in the method statement.
8. Accidental spillage of fuels and oils, or other hazardous substances, should be cleaned up immediately and should be reported through the incident reporting procedure and communicated to CFM. Measures taken to remediate the spill problem shall be recorded within the incident report and communicated to CFM

6.7.13 Waste management plan and procedures

Every effort should be made to reduce, re-use, or recycle waste produced by construction activities.

The contractor's HSE procedure for waste management should be followed on site. Additions or modifications to this procedure are provided below:

Handling and disposal of domestic (Bio-Degradable) waste

1. All necessary Mozambique Government approvals shall be obtained for the local disposal of domestic waste. Particular attention should be paid to the requirements of the Environmental Framework Law of October 1997, Article 15.
2. Prior to establishment of each campsite a method statement should be prepared verifying that the proposed waste disposal site and method of disposal meet the requirements of Mozambican Legislation.
3. The method statement should include the following:
 - The nature and quantity of the waste to be disposed
 - The location of the site
 - The legal status of the site (use rights, verification of absence of concessions)
 - The current use of the site
 - Surrounding land use within two kilometres
 - Surface water within 1km
 - Site vegetation
 - The depth to the static water table
 - Geo-hydrological conditions between the surface and the water table
 - The availability and depth of suitable cover material
 - Temporary site security and access control
 - Method of landfill construction and disposal
 - Litter management
 - Final closure and rehabilitation of the site
4. A system should be set up for solid waste control and removal. Domestic waste should not be left uncontained, and temporary storage should be managed to keep out unauthorised people and animals. Bins should be emptied daily. The Works areas should be kept clean and tidy at all times. Littering and the random discard of solid waste on the site should be prevented

6.7.14 Trespassing, poaching and protection of plants and wildlife

1. Measures should be taken to prevent trespassing on working sites.
2. The contractor should prohibit poaching or harassment of wild animals by employees. Any employee found poaching should be disciplined.

6.7.15 Fire prevention and control

1. All necessary precautions should be taken to prevent the ignition and spread of bush fires caused either deliberately or accidentally as a result of the work being performed.

2. The contractor's HSE procedure for fire prevention and protection should be followed to manage this aspect.
3. Open fires should be prohibited except at specified areas of the Works where the risks of escape are low and can be managed.
4. Employees should be briefed during the orientation-training programme of the risks and potential consequences of starting fires. Employees should also be warned of the risks of careless discard of cigarette butts.
5. Adequate fire fighting equipment should be provided at specified localities on the work site to meet any emergency resulting from ignition of a bush fire.

6.7.16 Archaeological sites, graves and sacred sites

Because this project entails rehabilitation and not construction, in principle there will be no further archaeological sites, graves and sacred sites destroyed. However, it is possible that during all the years that Sena Line was not operational, that local communities have put graves near the lines. This must be carefully considered during rehabilitation.

Graves and sacred sites should not be disturbed by construction unless agreement is reached with the affected communities.

6.7.17 Appointment of an Environmental Site Officer (ESO)

A suitably qualified (BSc Honours ecology/environmental science or related discipline) ESO should be appointed by the contractor to be present during rehabilitation of the railway line at the points where is required:

- (a) Re-construction of a bridge (e.g. River Zangue)
- (b) High erosion risk areas (e.g. section between Mutarara - Doa-Cambulatsisse)

6.7.18 General methods for clearing vegetation in the line RoW

- a) Preferably, no machinery (except chain saws) should be used for vegetation clearing.
- b) Any commercially valuable hardwood species e.g. *Androstachys* (Cimbirre), *Milletia* (Panga-Panga) and *Azelia* (Chanfuta) should be separately stockpiled wherever they are cleared from the servitude. The appropriate Mozambican Government authorities should then be informed of the location of these stockpiles.
- c) During clearance all large indigenous trees (basal diameter >400mm) within the RoW are not to be removed (as far as possible). These large trees should be marked using whitewash. It is the responsibility of the contractor to ensure that the vegetation clearing activities does not damage the marked trees.
- d) In principle vegetation should not be cleared outside of the RoW or the areas defined by CFM (10m on each side of the line). In the event that additional space is needed, for example to accommodate temporary facilities, temporary deviations, etc, an Independent Authority or CFM can grant a special authorization.

- e) Within the RoW vegetation should be cleared to the minimum degree necessary for rehabilitation.
- f) Cleared vegetation, in particular indigenous vegetation, should be placed in windrows along the perimeter of the RoW.
- g) In some instances excessive vegetation may need to be dumped to reduce fire risk at the site, and should only be dumped in pre-approved dumpsites.
- h) No form of controlled burning should be permitted to dispose of cleared vegetation.
- i) Where local people should have access to the wood cleared from the construction right of way. Alternatively, access breaks across the railway line should be left at convenient intervals for use by surrounding inhabitants.

6.7.19 Construction at river crossings

The contractor should control damage to riparian vegetation at all minor and major river crossings.

The method statement prepared by the contractor should include:

- The proposed timing and duration of river crossing construction.
- Measures that should be used to ensure that identified and surveyed trees in the riparian fringe within the RoW that are scheduled for protection, shall not be damaged during rehabilitation.
- Measures that should be used to stabilise river embankments after construction (where necessary).
- During construction every provision should be made to maintain the natural flow of any drainage line affected by construction.

The following methods shall be adopted when rehabilitating the riparian zones at river crossings:

- The river channel embankments shall be returned at least to the pre-existing profile;
- Measures using indigenous grasses to permanently stabilise disturbed areas should be used if necessary;
- Debris disposal and clean up should be carried out to return the river course to its pre-existing condition prior to construction.

6.7.20 Drainage lines, approaches to pans and depressions

- a) As far as is reasonably practical, rehabilitation activities should be scheduled to take place during winter when surface and subsurface water flows are lowest, plants are dormant and inundation is limited.
- b) All disturbed areas should be rehabilitated in accordance with the rehabilitation specifications.

6.7.21 Erosion control

- a) Banks of watercourses should be restored in a manner that will resist erosion

b) Where erosion control is required, erosion control measures should be implemented.

6.7.22 Relocation

For WB supported projects the Bank requires that any project that causes displacement must be subject to the requirements of its Operational Policy on Involuntary Resettlement (OP 4.12). The policy covers direct economic and social impacts that are caused by the involuntary taking of land resulting in:

- relocation or loss of shelter;
- the loss of assets or access to assets important to production;
- the loss of income sources or means of livelihood; or
- the loss of access to locations that provide higher incomes or lower expenditures to businesses or persons.

A summary of the national laws governing land tenure, the taking of land and resettlement and compensation is presented in Chapter 6.

However, for this specific project, only the people and properties located within a strip of land of 10 m on both sides of the railway line (inside the villages) and 50 m (outside the villages) may become displaced. According to CFM, should this happen such affected people will not be entitled to resettlement and compensation because CFM considers this occupation illegal in terms of the Land Law.

In terms of the World Bank OP 4.12, should the need for compensation and resettlement arise, then a Resettlement Policy Framework or a Resettlement Framework will need to be produced.

6.7.23 Activities and related costs to CFM

All of the activities described in the EMP are the responsibility of the contractor and any subcontractors with the exception of the following, which remain the responsibility of CFM.

1. Monthly environmental monitoring
2. Appointment of an Environmental Site Officer for ecologically sensitive areas
3. Education/awareness campaigns about the dangers associated with operational railway lines

The list of measures presented in the EMP and analysis of impacts and mitigation measures should be integrated in the construction company contract. Thus, all potential contractors should have access to this information for the purpose of tendering.

In this context, the following components of the EMP are considered to be of particular importance to potential contractors.

- Erosion control measures
- Pollution
- Rehabilitation
- Waste disposal

Table 20 below summarises activities that remain the responsibility of CFM together with cost estimates.

Table 20. Summary of CFM activities and related costs during project implementation

Activity	Estimated costs
During Construction	
Regular (one monthly) monitoring of rehabilitation activities by an independent consultant	5 days consultancy fees at US\$ 450 pd = US\$ 2 200 (includes field vests and reporting) Local travel and subsistence US\$1 200 Total: US \$ 3 400
Appointment of an Environmental Site Officer (ESO) for: <ul style="list-style-type: none"> • Re-construction of a bridge (e.g. River Zangue) • High erosion risk areas (e.g. section between Mutarara-Doa-Cambulatsisse) 	Salary US\$ 7000 per month for three months = US\$ 21 000 Transport, accommodation, subsistence and other sundry expenses US\$ 5000 per month X 3months = US\$ 15 000 Total: US\$ 36 000
Education and awareness campaigns regarding the dangers of a railway line (to be carried out by an NGO)	US\$ 60 000 per annum

CHAPTER VII
CONCLUSIONS AND RECOMMENDATIONS

7. CONCLUSIONS AND RECOMMENDATIONS

This project will have a positive impact on the economy of the Zambezi valley area as well as central Mozambique. For various reasons discussed in this report, the local communities will also benefit from it.

The audit identified several issues of environmental concern (actual problems and potential risks) however these are easily resolved through proper environmental management. Through discussion with local management of the Beira Rail System, CFM has indicated it's commitment to responsible environmental management. The key will be the adoption of the management measures outlined in this report.

Although the project has some risks, it is feasible from the environmental and socio-economic viewpoints. Recommendations for remedial actions have been provided where necessary.

For this specific project, only a limited number of people and properties are located within 10 m of the railway line (inside the villages) and 50 m (outside the villages) and these may be voluntarily relocated if required. In order to prevent any conflict persons who may be relocated should be duly informed by local administration and this process has already been started successfully along portions of the Sena line.

CHAPTER VIII
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ANNEXES

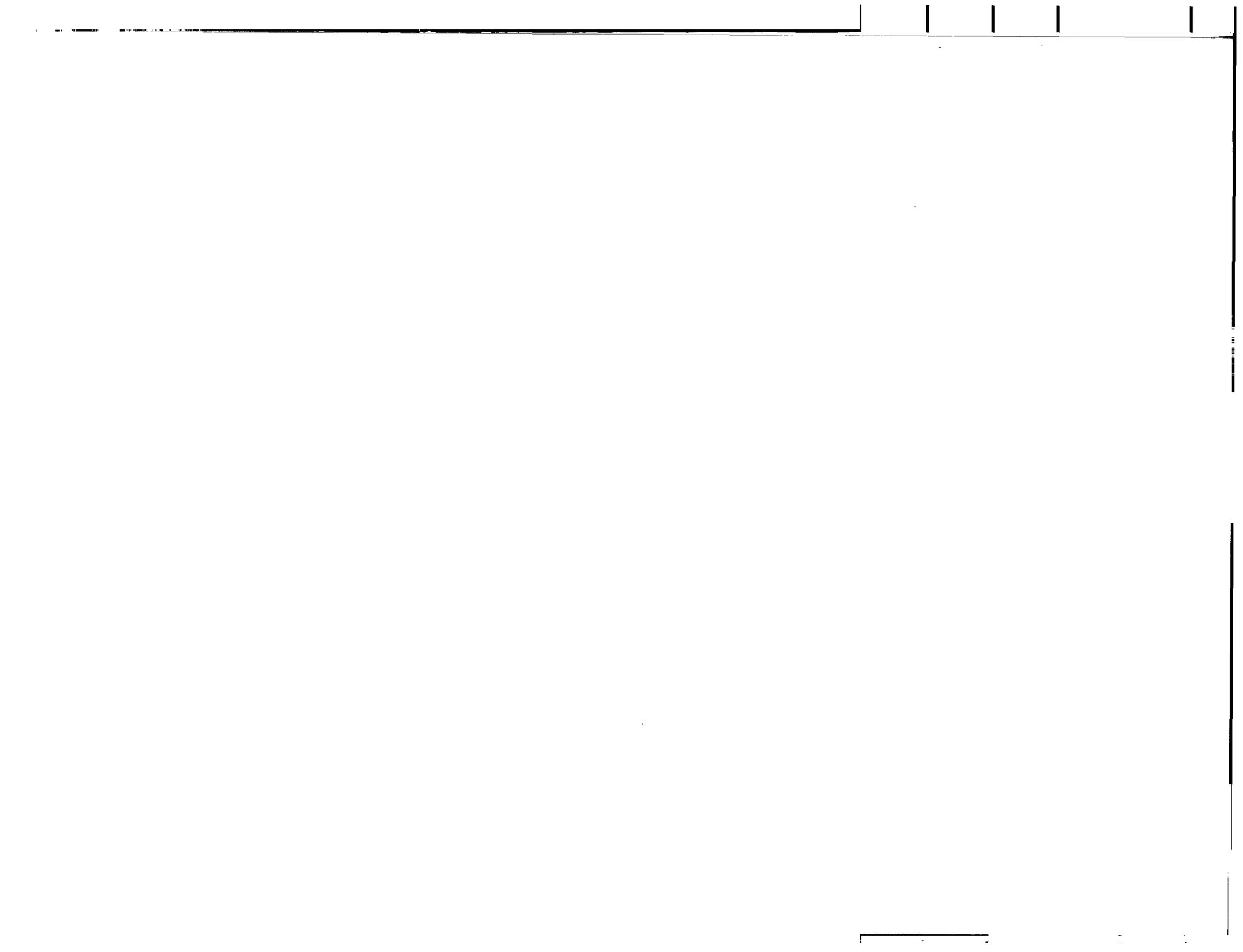
Annex 1
Main Plant Species found along the Railway Line

Plant (Scientific name)	Type
Dondo - Savane	
<i>Azelia quanzensis</i>	Tree
<i>Albizia adianthifolia</i>	Tree
<i>Albizia tangeranyicensis</i>	Tree
<i>Amaranthus sp.</i>	Herb
<i>Amblygonocarpus andongensis</i>	Tree
<i>Annona senegalensis</i>	Tree
<i>Antidesma venosum</i>	Shrub
<i>Brachystegia spiciformis</i>	Tree
<i>Bridelia micrantha</i>	Tree
<i>Canavalia rosea</i>	Shrub
<i>Cassine transvaalensis</i>	Shrub
<i>Cassytha filiformis</i>	Herb
<i>Cynodon dactylon</i>	Herb
<i>Cyperus sp.</i>	Herb
<i>Dalbergia sp</i>	Liana
<i>Diospyros sp.</i>	Shrub
<i>Diplorhynchus condylocarpon</i>	Tree
<i>Ficus sp</i>	Tree
<i>Hugonia orientalis</i>	Shrub
<i>Hyparrhenia rufa</i>	Herb
<i>Imperata cylindrica</i>	Herb
<i>Julbernardia globiflora</i>	Tree
<i>Lantana camara</i>	Shrub
<i>Ludwigia perennis</i>	Shrub
<i>Mangifera indica</i>	Tree
<i>Markhamia obtusifolia</i>	Tree
<i>Maytenus senegalensis</i>	Tree
<i>Millettia stuhlmannii</i>	Shrub
<i>Nymphaea nouchali</i>	Herb
<i>Ochna sp.</i>	Shrub
<i>Oxyanthera abyssinica</i>	Tree
<i>Panicum maximum</i>	Herb
<i>Parinari curatellifolia</i>	Tree
<i>Pennisetum unisetum</i>	Herb
<i>Phoenix reclinata</i>	Shrub
<i>Phragmites australis</i>	Herb
<i>Psidium guajava</i>	Tree
<i>Pteleopsis myrtifolia</i>	Shrub
<i>Pterocarpus angolensis</i>	Tree

<i>Rhynchelytrum repens</i>	Herb
Sapotaceae	Shrub
<i>Schotia sp</i>	Tree
<i>Smilax kraussiana</i>	Liana
<i>Solanum sp.</i>	Herb
<i>Sporobolus pyramidalis</i>	Herb
<i>Strophanthus petersianus</i>	Liana
<i>Strychnos madagascariensis</i>	Tree
<i>Syzygium cordatum</i>	Tree
<i>Tabernaemontana elegans</i>	Tree
<i>Tridax precumbens</i>	Herb
<i>Typha capensis</i>	Herb
<i>Uapaca kirkiana</i>	Tree
<i>Uapaca sansibarica</i>	Tree
<i>Urema lobata</i>	Shrub
<i>Vernonia colarata</i>	Shrub
<i>Vitex sp.</i>	Tree
<i>Ximenia americana</i>	Shrub
Savane - Inhaminga	
<i>Acacia sp</i>	Shrub
<i>Acacia xanthophloea</i>	Tree
<i>Adansonia digitata</i>	Tree
<i>Adenia gummifera</i>	liana
<i>Albizia adiantifolia</i>	Tree
<i>Albizia forbesii</i>	Tree
<i>Albizia sp.</i>	Tree
<i>Amblygonocarpus andogensis</i>	Tree
<i>Androstachys johnsonii</i>	Tree
<i>Annona senegalensis</i>	Shrub
<i>Aristida sp</i>	
<i>Artabotrys brachypetalus</i>	Liana
<i>Bauhinia sp</i>	Shrub
<i>Brachystegia spiciformis</i>	Tree
<i>Catunaregam spinosa</i>	Shrub
<i>Combretum apiculatum</i>	Tree
<i>Combretum imberbe</i>	Tree
<i>Combretum zeyheri</i>	Tree
<i>Crossopterix febrifuga</i>	Tree
<i>Dalbergia melanoxylon</i>	Tree
<i>Diplorhynchus condylocarpon</i>	Tree
<i>Eragrostis sp.</i>	Herb
<i>Erythrophleum africanum</i>	Shrub
<i>Ficus sp.</i>	Tree
<i>Hirtella zanzibarica</i>	Tree
<i>Hyparrhenia rufa</i>	Herb

<i>Hyphaena coriacea</i>	Shrub
<i>Julbernardia globiflora</i>	Tree
<i>Lantana camara</i>	Shrub
<i>Lonchocarpus bussei</i>	Tree
<i>Manilcara discolor</i>	Tree
<i>Millettia stuhlmannii</i>	Tree
<i>Ochna sp.</i>	Shrub
<i>Olax dissitiflora</i>	Shrub
<i>Panicum maximum</i>	Herb
<i>Parinari curatellifolia</i>	
<i>Peliostigma thonningii</i>	Tree
<i>Pennisetum purpureum</i>	Herb
<i>Pericopsis angolensis</i>	Shrub
<i>Piliostigma thonningii</i>	Tree
<i>Pseudolachnostylis maprounifolia</i>	Tree
<i>Pteleopsis myrtifolia</i>	Tree
<i>Pterocarpus angolensis</i>	Tree
<i>Sclerocarya birrea</i>	Tree
<i>Sterculia rogersii</i>	Tree
<i>Strychnos madagascariensis</i>	Shrub
<i>Tabernaemontana elegans</i>	Shrub
<i>Terminalia sericea</i>	Tree
<i>Themeda triandra</i>	Herb
<i>Trichodesma zeylanicum</i>	Shrub
<i>Uapaca kirkiana</i>	Tree
<i>Uapaca nitida</i>	Shrub
<i>Uapaca sanzibarica</i>	Tree
<i>Urema lobata</i>	Shrub
<i>Vernonia colorata</i>	Shrub
<i>Vernonia sp.</i>	Shrub
<i>Vitex sp.</i>	Shrub
<i>Xylothea tettensis</i>	shrub
<i>Ziziphus mucronata</i>	Shrub
Caia - Sena	
<i>Acacia nilotica</i>	Shrub
<i>Acacia polyacantha</i>	Tree
<i>Acacia xanthophloea</i>	Tree
<i>Albizia adianthifolia</i>	Tree
<i>Boscia salicifolia</i>	Tree
<i>Cocculus hirsutus</i>	Liana
<i>Combretum imberbe</i>	Tree
<i>Combretum molle</i>	Tree
<i>Combretum paniculatum</i>	Shrub
<i>Cynodon sp.</i>	Herb
<i>Cyperus sp.</i>	Herb

<i>Digitaria sp.</i>	Herb
<i>Diplorhynchus condylocarpon</i>	Tree
<i>Eragrostis sp.</i>	Herb
<i>Euphorbia aculiata</i>	Shrub
<i>Euphorbia tirucalli</i>	Shrub
<i>Ficus sp.</i>	Tree
<i>Grewia caffra</i>	Shrub
<i>Hermannia boraginiflora</i>	Shrub
<i>Hyparrhenia dissoluta</i>	Herb
<i>Hyparrhenia rufa</i>	Herb
<i>Hyparrhenia sp.</i>	Herb
<i>Indigofera sp.</i>	Shrub
<i>Ipomoea aquatica</i>	Herb
<i>Ipomoea sp.</i>	Herb
<i>Ischaemum afrum</i>	Herb
<i>Kigelia africana</i>	Tree
<i>Lantana camara</i>	Shrub
<i>Lonchocarpus bussei</i>	Tree
<i>Ludwigia perenis</i>	Shrub
<i>Markhamia obtusifolia</i>	Shrub
<i>Maytenus senegalensis</i>	Shrub
<i>Millettia stuhlmannii</i>	Tree
<i>Opuntia sp.</i>	Shrub
<i>Panicum maximum</i>	Herb
<i>Pennisetum unisetum</i>	Herb
<i>Phragmites australis</i>	Herb
<i>Phyllanthus reticulatus</i>	Shrub
<i>Piliostigma thonningii</i>	Tree
<i>Sclerocarya birrea</i>	Tree
<i>Senna petersiana</i>	Shrub
<i>Sesbania sesban</i>	Shrub
<i>Sterculia rogersii</i>	Tree
<i>Tabernaemontana elegans</i>	Shrub
<i>Trichodesma zeylanicum</i>	Shrub
<i>Urochloa mossambicensis</i>	Herb
<i>Xertoderris suhlmgannii</i>	Tree
<i>Xylothea tettensis</i>	Shrub
<i>Ziziphus mauritiana</i>	Tree
Mutarara – Vila Nova Fronteira	
<i>Adansonia digitata</i>	Tree
<i>Agave sizalana</i>	Shrub
<i>Albizia sp.</i>	Tree
<i>Combretum imberbe</i>	Tree
<i>Combretum sp.</i>	Tree
<i>Indigofera sp.</i>	Shrub



Annex 2

Checklist used for Interviews

Grupo alvo

- Residentes de povoações, vilas e cidades ao longo da linha férrea
- Detentores de propriedades, junto ao linha férrea (machambas, imóveis, etc.)
- Autoridades administrativas e municipais
- Líderes comunitários
- Trabalhadores dos CFM nas estações

Campo de observação

- Comunidades estabelecidas nas proximidades da linha de Sena; distrito de Dondo, Muanza, Cheringoma, Marromeu (em Sofala), Mutarara e Moatize (em Tete).
- Comunidades estabelecidas nas proximidades de linha de Machipanda no distrito de Manica, Cidades de Chimoio e distrito de Gôndola

Outra temática de entrevista semi-estruturada

1. População
 - Assentamento
 - Reassentamento pós-guerra e pós-cheias
 - Ocupação e principais actividades
2. Economia da população
 - Agricultura e pecuária (tipo de culturas, e tipo de criação)
 - Segurança alimentar
 - Acesso aos mercados
 - Oportunidades de emprego
 - Actividades complementares a agricultura
3. Infra-estruturas e serviços básicos
 - Água
 - Estradas
 - Energia eléctrica
 - Telecomunicações
 - Saúde
 - Educação
4. Tipo de propriedade situada junto a linha
 - Machamba
 - Imóvel (habitação)
 - Infra-estrutura de prestação de serviço
5. Significado da linha férrea para a população
 - Significado económico
 - Significado social
 - Significado simbólico
6. Espectativas futuras da população