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FEDERAL GOVERNMENT OF NIGERIA

FEDERAL ROADS DEVELOPMENT PROJECT (FRDP) NIGERIA

IN COLLABRATION WITH
FEDERAL ROADS MAINTENANCE AGENCY (FERMA)
FINAL REPORT

FOR

ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE PERIODIC MAINTENANCE OF DINGAYA – GALAMBI– RUNGO ROAD

DECEMBER, 2010

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LIST OF ABBREVIATIONS AND ACRONYMS

APHA	America Public Health Association
ASTM	American Society of Testing & Materials
BOD	Biochemical Oxygen Demand
CITES	Convention on International Trade in Endangered Species of Wild fauna & flora
DO	Dissolved Oxygen
DS	Dissolved Solids
EAR	Environmental Audit Report
EIA	Environmental Impact Assessment
ESA	Environmentally Sensitive Areas
ESIA	Environmental & Social Impact Assessment
ESMF	Envi. & Social Mgt Framework
EMP	Environmental Management Plan
FERMA	Federal Roads Maintenance Agency
FEPA	Federal Environmental Protection Agency
FMENV	Federal Ministry of Environment
FGN	Federal Government of Nigeria
FMWHUD	Fed. Ministry of Works, Housing & Urban Development
FRDP	Federal Roads Development Project
GIS	Geographic Information System
HC	Hydrocarbon
HSE	Health Safety and Environment
IEE	Initial Environmental Examination
JSMEnv	Jigawa State Ministry of Environment
MDGs	Millennium Development Goals
LFN	Laws of the Federation of Nigeria
NGO	Non-governmental Organization
NEEDS	National Economic Empowerment & Dev. Strategy.
NIWA	National inland Waterways Authority
NIMET	Nigeria Metrological Agency
OP	Operational Policy
PPE	Personal Protective Equipment
RPF	Resettlement Policy Framework
SEPA	State Environmental Protection Agency
SMENV	State Ministry of Environment
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solids

TOR	Terms of Reference
TSRIC	Transport Sector Reform Implementation Committee
TSP	Total Suspended Particulate
UNEP	United Nations Environmental Programme
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WB	World Bank
WHO	World Health Organisation

UNITS OF MEASUREMENT

cfu/ml	Colony forming unit per milliliter
cm	Centimeter
dBA	Decibel
ft	Feet
g	Gramme
k	Kilogramme
g/cm	Gramme per Centimeter
Km	Kilometer
m	Meter
m^3	Meter Cube
meq	Milliequivalent
mg	Milligramme
mg/Kg	Milligramme per Kilogramme
mg/l	Milligramme per Litre
ml	Millilitre
mm	Millimetre
m/s	Meter per Second
NTU	Turbidity Unit
$^{o}/_{oo}$	Parts per thousand
^{o}N	Degree North
$_{P}H$	Hydrogen ion concentration
ppb	parts per billion
ppm	parts per million
$T^{o}C$	Temperature in degrees Celsius
µg	Microgramme
µS	micro Siemen
µm	micrometer
%	Percentage

CHEMICAL ELEMENTS AND COMPOUNDS

C	Carbon
Ca	Calcium
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Cr	Chromium
Cu	Copper
Fe	Iron
H	Hydrogen
H_2O	water
H_2S	Hydrogen Sulphide
K	Potassium
Mg	Magnesium
Mn	Manganese
N	Nitrogen
Na	Sodium
Na_2PO_4	Sodium phosphate
NaOH	Sodium hydroxide
NH_3	Ammonia
NH_4^+	Ammonium ion
NO_2	Nitrite ion
NO_3	Nitrate ion
NO_X	Nitrogen Oxides
O_2	Oxygen
P	Phosphorus
SO_2	Sulphur dioxide
SO_4	Sulphate ion
V	Vanadium
Zn	Zinc

EXECUTIVE SUMMARY

INTRODUCTION

The Federal Government of Nigeria (FGN) through the Federal Ministry of works (FMW) requested the World Bank's support towards the Federal Roads Development Project (FRDP). The purpose is to meet the immediate and short term funding needs for the federal road network and to support Government's efforts with policy and institutional reforms promoting improved service delivery, road management and financing.

The Roads Sector Development Team (RSDT), who is saddled with the responsibility of implementing FRDP in collaboration with Federal Roads Maintenance Agency (FERMA), is proposing to rehabilitate the Eighteen and a half (18.5) kilometres Dingaya - Galambi - Rungo Road. The road is links the existing paved Gwaram – Basirka and Rungo – Gwaram roads. The road which passes through five (5) communities is currently unpaved with laterite surface.

OBJECTIVES OF THE STUDY

The objectives of the EMP for the Dingaya - Galambi - Rungo Road are to:

- identify the possible negative environmental and social impacts of the project as presently planned for implementation; and
- propose measures required to mitigate these potential negative impacts.
- the identification and assessment of environmental effects of rehabilitation works within the 18.5 km section of the road.
- Identification and address issues arising from involuntary resettlement.
- propose mitigation measures including environmental management plan/ procedure.

POLICY FRAMEWORK

The EMP studies are carried out within the legal framework of both local and international environmental guidelines and regulations. The scope of work of this project involves development of roads and highways and related activities.

The EIA Act and the World Bank safeguard policies are similar. OP.4.01 and Nigerian EIA Act are also similar. World Bank EA Screening Category A is similar to Nigerian EIA Act category I, World Bank EA Category B is equivalent to Nigeria EIA Act Category II, World Bank EA Category C is equivalent Nigeria EIA Act Category III. However in the event of

divergence between WB safeguard policy and the Existing Environmental laws in Nigeria that of the World Bank will take precedence.

PROJECT DESCRIPTION

The proposed activity is a road rehabilitation project of the approximately 18.5 km Dingaya - Galambi - Rungo road. It involves the clearing and filling of most of the section of the Road with laterite, provision of base material, prime coat, Single Coat Surface Dressing, re-instatement of shoulders, construction of concrete lined drains and earth drains.

PROJECT ALTERNATIVES

Approach to the selection of best project implementation and design alternatives will take into consideration the one that suits the purpose best. Potential alternatives considered include; Taking no action or no project option, Using alternative travel modes, Improving the existing facilities and alternative alignments construction of a multi-lane, controlled access facility on new location.

BASELINE DATA ACQUISITION METHODS

A multi-disciplinary approach was employed in the characterization and acquisition of the baseline data from the project area. Literature search, field data gathering exercise as well as laboratory analyses and data interpretation were applied. Field work started in the study area between 3rd and 4th December 2010. The data generated from the literature search include maps, geographic data, meteorological data and information on the vegetation and soils of the Road Route.

POTENTIAL & ASSOCIATED ENVIRONMENTAL IMPACTS

Varieties of methodologies exist for environmental impact assessment. The project despite been small in magnitude and scope, is expected to generate the following impacts:

- Site Clearing & Earthworks: at this stage of the project, impacts that are expected to arise include; Air Quality impairment through dust generation during scarification, Biodiversity loss through clearing of adjoining road side vegetation, soil erosion due to loose soil, changes in river hydrology and damage to aesthetics through burrow pit excavation for fill material.
- Soil Erosion: Site clearing will destroy the plant community and wildlife habitat, leading to the death of plants and relatively immobile animals as well as the migration of the animals that are capable of escaping. This will lead to the reduction of

biodiversity in the area and possible soil erosion and landslides caused by rain water due to soil exposure

- Culverts and Drains demolishing/ construction activities will lead to generation of noise from machinery operations, impact on air quality from dust and fumes generation by heavy duty machines/ equipment, traffic obstruction and increased risk of accident.
- Pavement & Surfacing activities would lead to impact on surface water through run off of washed areas/ asphalt into the neighbouring water body, noise generation during surface dressing and air/ gaseous emissions.
- Socio-economic impacts that may arise include displacement of small road side businesses which have in most cases encroach into the main road corridor. There may all be impact on crops due to vehicles manoeuvring during site preparation and surfacing activities. There would also be loss of farmland due to burrow pit acquisition. The project may in addition lead to Social & health problems (new communicable diseases, sexually transmitted infections (STIs), HIV/AIDS) from influx of job seekers. Aside of the negative impacts, the project is expected to generate a lot of positive impacts such as job creation (even though for a short term), ease of transportation leading to reduced transport fares and significant reduction in rate of accidents.

PUBLIC CONSULTATION

Public consultation was conducted at major towns/villages all along the project road as many are to be affected by the project. This was in form of interviews with individuals belonging to different social and/or economic categories and concerned local administrative bodies were made. Questionnaires were also administered to individuals, local or international NGOs as were available during fieldwork for their opinions on the construction works in relation to their adverse effects on the environment.

Stakeholders for the purpose of this project are defined as all those people and institutions that have an interest in the successful planning and execution of the project. 3 main groups were consulted in Dingaya, Galambi and Rungo on the same day sampling was made.

Majority of the stakeholders welcomed the project as it would improve transportation of their goods from farms and homes to other areas with less hitches. They also believe that the rehabilitation of the road would go a long way in reducing vehicular accidents as well as

further open-up the areas affected. Also, there is hope of increasing income level through job creation albeit temporarily associated with the project.

On the other hand, there is the concern that there may be land take from the affected communities for burrow pit construction which could lead to loss of farmland as well as possible ejection of road side businesses which could lead to loss of livelihood where implemented. However, some of the people interviewed expressed willingness to give out their land provided that the road would be rehabilitated for a very low financial compensation as their contribution.

In addition, there are fears of loss of houses that may be considered to have encroached on the existing road corridor, thus rendering some people homeless. Other concern expressed by some of the project likely affected persons include the issue of introduction of alien cultures by some non-indigene workers as well as the possibility of increasing level of HIV/AIDs infection

In response to their concerns, it was explained to community that the rehabilitation work is going to be restricted to the existing carriageway; hence their structures will not be affected. The project will not trigger WB/OP/BP 4.12 since no land will be acquired and the only likely structures to be affected are temporary structures which people are willing to move away from the construction zone and more consultation will be carried out with the stakeholders during the implementation of the project.

ENVIRONMENTAL MONITORING PLAN

This Environmental Monitoring Plan will ensure that the integrity of the Road Project has been developed covering the project activities from site preparation, through construction, commissioning, operation of the highways, decommissioning and abandonment. The plan relates to the handling of hazardous materials and wastes, soil erosion, emission and discharge monitoring, site inspection and auditing, adverse weather preparedness, and decommissioning. The programme will help to verify the effectiveness of the prescribed mitigation measures is designed to guarantee and achieve the implementation of the EMP findings.

On the social concerns of the project, the issue of Social & health problems (new communicable diseases, sexually transmitted infections (STIs), HIV/AIDS) from influx of job seekers & post-construction demobilisation of large contingent of workers would be given adequate attention in view of its socio-economic implication when project implementation commences. This would be through Awareness campaign to enlighten the communities/field

workers on the implications of drug and alcohol abuse, unprotected sex, prostitution and the need to sustain healthy lifestyle and behaviour including the use of BCC/IEC materials

INSTITUTIONAL ARRENGEMENT FOR IMPLEMENTING THE EMP

The overall objective of the project is to ensure that the project implementation is integrated harmoniously into the communities. The monitoring staff and personnel shall achieve the following objectives: propose management rules and specific measures that are compatible with sustainable development while implementing the project, promote awareness to construction workers and the general public regarding environmental protection and execute concrete means of applying the EMP.

In the execution of the project, the RSDT will be responsible for the implementation of the mitigation measures through their contractor who would be accountable to the RSDT. This contractor shall have an Environmental Engineer on site who will be responsible for all environmental issues. Whereas the World Bank will monitor the execution/ implementation of the project by RSDT. FERMA on the other hand will regulate the contractor work, while the EIA Division the Federal Ministry of Environment in collaboration with affected state Ministry of Environment will carry out regulatory monitoring to ensure that all agreed mitigations are actually implemented in line with regulatory requirements.

EMP BUDGET

Based on available data, a sum of N750M will be allocated to the project. Of the total budget, it is recommended that at least 0.01% of the total budget will be allocated for environmental and social concerns.

Budget and Responsibilities

Item	**Budget** (estimate)	**Responsibility**
Mitigation	N9m	Contractor
Management	N4.0m	RSDT
Capacity Strengthening	N3.75m	RSDT/World Bank
Monitoring	N5.0m	RSDT/FMENV/State Min Env
Total	**N21.75m**	

CONCLUSION

The Environmental Impact Assessment study of the project was carried out in compliance with existing national guidelines and regulation. The study has described the baseline condition of the affected area, identified the project's potential environmental impacts and proffered appropriate mitigation measures. In view of the fact that all stakeholders have been carried along during the EMP study there is no stern environmental, health, social or cultural issues that may warrant the cancellation of the proposed project, it is therefore recommended that project implementation can commence with strictly adhering to the proffered mitigation measures.

Extensive consultation was coordinated with different groups within the project area. The groups included religious and other social groups who expressed optimism towards the project. They were also intimated with environmental and social concerns mitigated in this EMP. For this project, consultation was carried out at two main levels - **public** and **institutional** consultation.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

The Federal Government of Nigeria through the Road Sector Development team (RSDT) has proposed to rehabilitate the Eighteen and a half (18.5) kilometres Dingaya - Galambi - Rungo Road which is one of the roads identified to be in deplorable conditions to ease the difficulty being faced by road users. Over the past years, the road network has expanded rapidly to accommodate steady increase in freight and passenger traffic. This rapid expansion of the road network was only made possible by spreading the available resources as widely as possible through the construction of primarily single and intermediate Lane State and Local Government Area Roads.

The Road is an important link road for the state covering several L.G. in Jigawa state. Also, the road serves as the important link between two existing tarred roads of Gwaram – Basirka and Gwaram - Rungo which also connect other parts of the state. As the population of the country increases, so the need for reliable transport system particularly the road increases. With a current estimated population growth rate of about 3%, there is no doubt that pressure on the nation's roads would also continue to increase with attendant increase rate of failures at various sections.

Dingaya - Galambi - Rungo Road located in Jigawa State North West Nigeria is very strategic particularly for the economy of surrounding communities, the entire state and the North West and some North-east states of the country.

While the justification of road development and maintenance projects from socio-economic considerations cannot be overemphasized, the cumulative environmental consequences of such projects need to be brought to fore with due emphasis on scientific basis. It is apparent that previously the planning and designing of highways are normally done, almost purely, on the basis of economic and traffic flow considerations. However, the environmental impacts of road construction and operation and maintenance activities with potential air and noise pollution and possible dislocation and disruption of the delicate balance of the fragile eco-system and the need to evolve an efficient approach to deal with such effects are now receiving focused attention. In fact, the issue of transport and the environment has assumed a relatively high priority at the national and global level. This is well reflected in the ion plan for sustainable transport development into 21st century, which emerged from the United

Nations conference on environment and development (Rio De Janeiro, June 1992). The set of principles drawn up at the Rio-conference has led to renewed interest in Environmental Assessment studies.

In order to ensure environmental protection vis-à-vis the highway sector projects, an Environmental Management Plan (EMP) is required. It is mandatory in Nigeria as stipulated by Environmental Impact Assessment Act No. 86 of 1992 of the Federal Ministry of Environment (formerly Federal Environmental Protection Agency (FEPA). Similarly the multilateral aid agencies, African Development Bank and the World Bank require EMP as part of their conditions for project funding. The need for EMP of road projects may be seen in the context of sustainable development, to:

- Ensure that environmental concerns are explicitly addressed and incorporated into the project decision making process,
- Anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals,
- Maintain eco-system and conserve bio-diversity,
- Protect the productivity and capacity of natural systems and the ecological processes which maintain their functions,
- Promote development that is sustainable and optimizes resource use and management opportunities.

It is in compliance with the national and international regulations of minimizing impact on the environment in which it operates that RSDT planned to prepare an Environmental Management Plan(EMP) of the project area prior to its commencement. Presented here is the report of the environmental studies and impact assessment of the road development project in compliance with the provisions of the EIA Act 86 of 1992 and RSDT's Corporate Health, Safety and Environmental policy.

1.2 NIGERIA

The Federal Republic of Nigeria, the host nation, covers an area of 923,768 km^2 with a population of over 140 million. It lies in the tropics between latitudes 4^oN and 14^oN and longitudes 3^oE and 14^oE. Nigeria's economy as elsewhere hinges on good road network. The Nigerian transport infrastructure comprises 200,000km road network, 3,600 km of narrow gauge Railway, 6 Sea Ports and inland waterways, 4 international and 14 domestic airports and 4,000km of pipeline. The road network is the dominant internal transport mode for the haulage of people, goods and services, accounting for 95% of the domestic traffic flows and

providing the only access to the rural communities where majority of the economically active population live. The network of roads comprises 33,000km Federal Highways, 50,000km State Highways and 117,000km Local Government feeder roads. The demand for good road network is growing with the rapid rise in the traffic volume. The number of vehicles in Nigeria is presently put at about 1,000,000 of which 44% are passenger cars, 20% are buses and 30% Lorries and vans, 1% road trors and 5% motorcycles. However, current estimates show that only about 11 % of the Federal roads are still in good condition.

Figure 1.1 Map of Nigeria

1.3 THE APPLICANT

The Federal Roads Maintenance Agency (FERMA) which is an Agency under Federal Ministry of Works was established to assume responsibility for the maintenance of all Federal roads nationwide. FERMA is now Collaborating with RSDT (the multilateral unit of Federal Ministry of Works) in rehabilitating this road.

In their recognition for the importance of comprehensive environmental planning and management to any successful project RSDT/FERMA are committed to undertaking the necessary studies to understand the environmental situation and to address areas where significant environmental impact may be experienced. The key premise which affects this EMP process was established from the initial stages of development to provide general

guidance, framework and a commitment to standards acceptable nationally and internationally.

1.4 OBJECTIVES OF THE ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The objectives of the EMP study for the Dingaya - Galambi - Rungo Road are to:

- identify the possible negative environmental and social impacts of the project as presently planned for implementation; and
- propose measures required to mitigate these potential negative impacts.

Specific objective of the EMP will focus on the following issues:

- the identification and assessment of environmental effects of Maintenance works of the 18.5km road.
- Identification and address issues arising from involuntary resettlement.
- propose mitigation measures including environmental management plan/ procedure.

1.5 EMP TERMS OF REFERENCE

1.5.1 Objective of the Consultation:

The objective of this consultation is to undertake an EMP with a view to ensuring that implementation of the federal roads project does no harm to the environment and population. In preparing this EMP, Cirrus Global Service in strict observance of the EMP Terms of Reference (TOR) carried out the following:

- Review of Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) prepared for the project (FRDP).
- Review of relevant Nigerian law and procedures;
- Review EMPs prepared for other recent World Bank projects in Nigeria
- Consultation with relevant stakeholders
- Conducted Field Work for the collection of original and relevant data (Qualitative and Quantitative Data)
- Compiled Data collation, and Analysis
- Prepared and Submission of Draft Reports

1.5.2 Scope of Work:

The scope of Work covering the following tasks describing the most important work done under this study was also strictly observed.

i). Description of Proposed Projects

ii). EA Requirements/Regulations.

iii). Description of the Environment

iv). Determination of the Potential Impacts of the Proposed Project.

v). Analysis of Alternatives of the Proposed Project

vi). Development of Environmental Management Plan (EMP) to Mitigate Negative Impacts

vii). Institutional Arrangement for the Implementation of EMP:

viii). Monitoring and Evaluation:

ix). Public Information and Consultation

1.6 REVIEW OF ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK FOR THE FEDERAL ROADS DEVELOPMENT PROJECT

The Federal Roads Development Project (FRDP) seeks to improve Federal Highways in Nigeria to reduce travel costs and increase access to goods and services.

A 1999-study on selected sections of the road network in Nigeria found that only about 26% were in good condition. Current estimates show that only about 11 % of the Federal roads are still in good condition.

Hence, the Federal Government of Nigeria (FGN), through the Federal Ministry of Works (FMW), requested World Bank's support for the FRDP. The project is meeting the immediate and short term funding needs for the Federal road network and supporting Government's efforts with policy and institutional reforms promoting improved service delivery, road management and financing.

The principal development objectives are: (i) to reduce road transport costs along the roads supported by the project; (ii) to introduce total asset management methods for delivery and management of federal roads; and (iii) to plan and facilitate sustainable financing arrangements for the road sector.

The FRDP is organized into three components to support both the implementation of the proposed reform and the financing of critically needed investments. The three main components are:

- Policy and Institutional Reforms
- Institutional Capacity Building
- Upgrading, Rehabilitation and Maintenance of Federal Roads

The main activities under the Federal Roads Development Project entail the upgrading and maintenance of the **Dingaya - Galambi - Rungo Road** using modern methods based on best practices.

The **Dingaya - Galambi - Rungo Road** is classified as a **Category B project**, implying that the impacts are small scale and site-specific; thus easily remedied. In recognition of the fact that environmental and social concerns may arise as a result of the proposed project, the RSDT commissioned an Environmental and Social Management Framework (ESMF) study in fulfilment of the World Bank requirements.

The ESMF was prepared to satisfy national and state regulatory requirements as well as World Bank's mandate for project of such magnitude and it addresses the environmental and socio-economic consequences of the project.

As a category B project, the **Dingaya - Galambi - Rungo Road** is not expected to have large-scale adverse impacts on the natural environment, health and safety, of communities and individuals. The ESMF provided guidelines to follow as to how to prepare the Environmental and Social Management Plan (ESMP)/ or Environmental Management Plan (EMP).

1.7 STRUCTURE OF THE EMP REPORT

Deliverables and Reporting Requirements

The EMP report is concise and limited to significant environmental issues. The main text focused on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. The Report was organised according to the outline below:

- Executive Summary
- Introduction (Chapter One)
- Project Justification (Chapter Two)
- Description of the Proposed Project (Chapter Three)
- Description of the Environment (Chapter Four)
- Significant Environmental Impacts (Chapter Five)
- Mitigation Measures (Chapter Six)
- Environmental Management Plan (Chapter Seven)
- Remediation Plan after closure of Construction Phase (Chapter Eight)
- List of References
- Appendices:
    - List of Environmental Assessment Preparers;
    - List of Persons and Stakeholders met
    - Environmental and Social management clauses that would be inserted in Contracts

1.8 POLICY FRAMEWORK

In EMP study such as this, all actions that will result in physical, chemical, biological, cultural and social modifications of the environment as a result of the new project/development are assessed. Also, the EMP report should serve as a means of assessing the environmental impacts of a proposed action plan, rather than as a justification for decisions already made or actions already taken. Usually the EMP study is carried out using a systematic, multi-disciplinary approach and should incorporate all relevant analytical disciplines to provide meaningful and factual data, information and analyses. Also, EMP studies are carried out within the framework of both local and international environmental guidelines and regulations. The work scope of this project involves development of roads and highways and related activities.

1.8.1 The 1999 Constitution of the Federal Republic of Nigeria

The constitution of the Federal Republic of Nigeria (Section 30) confers jurisdiction on the Federal Government to regulate the operations and development activities in this sector. These, together with applicable International conventions provide a basis for an EMP of the project. The development will take account of the following Nigerian laws and regulations, and international conventions that apply to the subject development:

1.8.2 The National Policy on Environment

The National Policy on the Environment was launched by the President in Abuja on 27 November 1989 (FEPA, 1989). The goal of that policy was to achieve sustainable development in Nigeria and, in particular to:

- Secure for all Nigerians a quality environment adequate for their health and well-being.
- Conserve and use the environment and natural resources for the benefit of present and future generations.
- Restore, maintain and enhance ecosystems and ecological processes essential for the functioning of the biosphere and for the preservation of biological diversity and to adopt the principle of optimum sustainable yield in the use of living natural resources and ecosystems.
- Raise public awareness and promote understanding of essential linkages between environment and development and to encourage individual and community participation in environmental improvement efforts.

- Co-operate in good faith with other countries, international organisations and agencies to achieve optimal use of trans-boundary natural resources and effective prevention or abatement of trans-boundary environmental pollution.

1.8.3 Economic Policy Framework

The Federal Government of Nigeria's recently adopted National Economic Empowerment & Development Strategy (NEEDS) clearly defines its medium-term economic reform agenda and provides an overall policy objective for the country. The policy rests on promoting growth through a market-based economy with greater private sector participation in the economy and Government's role limited to the provision of adequate infrastructure and necessary services.

The implementation of the NEEDS is crucial to the attainment of the country's Millennium Development Goals (MDG).

1.8.4 National Transport Policy

As part of the Government's reform policy; the Transport Sector Reform Implementation Committee (TSRC) formulated a National Transport Policy in 2003. The goal of the policy is to:

- Promote an efficient and affordable integrated transport network.
- Improve the safety, security, quality and speed of movement of goods and people.
- Increase the involvement of the private sector in the financing and operation of transport related services.
- Promote qualitative road infrastructure and operations through greater effectiveness and efficiency in meeting customer needs.
- Structure the infrastructure to ensure environmental sustainability and internationally accepted standards.
- Promote a culture of maintenance and upgrading of existing infrastructure.
- Build strong financial base (both public and private) for the creation, maintenance and upgrading of transport infrastructure.

1.9 LEGAL FRAMEWORK

1.9.1 National Legislations

- Federal Roads Maintenance Agency Act No. 7 of 2002 of 30 November 2002 as amended by 23 May 2007**,** the Federal Roads Maintenance Agency (Amendment) Act 2007.
- Federal Environmental Protection Agency Act No 58 of 30 December 1988 : FEPA Act, cap 131, LFN, 1990
- National Environmental Protection (Pollution abatement in Industries and Facilities generating Waste) Regulations, 1991
- National Environmental Protection (Effluent Limitation) Regulations S.I.8 (FEPA, 1991).
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulation S.I. 15
- Environmental Impact Assessment Act No. 86 of 10 December 1992
- Federal Ministry of Environment Procedural Guidelines for EIA
- Harmful Waste Act No. 42 of 25 November 1988
- August 1991 Federal National Parks Act
- Forestry Act, 1958
- Land Use Act 1978
- National Policy on the Environment
- Quarries Act 350 LFN of 1990
- Environmental Impact Assessment Sectoral Guideline for Infrastructure development projects (1995) of the Federal Ministry of Environment.
- Federal Highways Draft Act 2001. It provides guidelines and standards for construction, maintenance and operation of highways,

1.9.2 National Environmental Guidelines

The introduction of guidelines and standards was part of the implementation of the National Policy on Environment and the environmental pollution abatement strategy contained therein. The guidelines and standards relate to six areas of environmental pollution control:

- Effluent limitations.
- Water quality for industrial water uses at point of intake.
- Industrial emission limitations.

- Noise exposure limitations.
- Management of solid and hazardous wastes.
- Pollution abatement in industries.

National Environmental Protection (Effluent Limitation) Regulations S.I.8 (1991)

This regulation was issued in 1991. It provides national Guidelines and Standards for industrial effluents, gaseous emissions, noise, air quality and hazardous wastes management for Nigeria.

National Environmental Protection S. I .9 (Pollution and Abatement in Industries in Facilities Producing Waste) Regulations, 1991

This provides general guidelines for the containment of pollution in industries that generate harmful wastes.

National Environmental Protection (Management of Solid and Hazardous Wastes) Regulation S.I. 15

This provides general guidelines for the management of solid and hazardous wastes in Nigeria and emphasises the followings;

Waste Notification :Industries are obliged to notify the FMENV of all toxic hazardous and radioactive wastes which are stored on site or which are generated as part of operations (*Regulations 1991*, Article 2).

Waste Management: With regard to waste management, a legal basis exists in Nigeria for the establishment and implementation of a "*cradle-to-grave*" tracking system. Specifically, the *Solid and Hazardous Wastes Management Regulations 1991* provide for the establishment of a documentation scheme to cover the generation, transport, treatment and disposal of hazardous wastes.

Environmental Impact Assessment Act No. 86 of 10 December 1992

This Act provides the guideline for activities or development projects for which EIA/EMP is mandatory in Nigeria. Such developments include oil and gas fields, conversion of mangrove swamps covering area of 50 hectares or more for industrial use, land/coastal reclamation projects involving an area of 50 hectares or more. Pursuant to this, the EIA Act No 86 of 1992 sets out the procedure for prior consideration of environmental and social issues in certain categories of public and private development projects.

Federal Ministry of Environment Sectoral Guidelines for EIA

The FEPA Act, cap 131, LFN, 1990 allocates powers of environment legislation making and enforcement to the Federal Environmental Protection Agency (FEPA), now Federal Ministry of Environment. (FMENV)

In-line with its functions, FEPA has published the EIA/EMP Sectoral Guidelines (revised in September 1995). The guidelines cover major development projects and are intended to inform and assist proponents in conducting EIA/EMP studies.

1.9.3 Nigerian EMP Procedure

The FMEnv developed a National EMP Procedure (FEPA 1985) in response to the promulgation of the EIA Act No. 86 of 1992. The procedure indicates the steps to be followed from project conception to commissioning in order to ensure that the project is implemented with maximum consideration for the environment.

The procedure for EMP involves the project proposal stage where the project proponent notifies FMEnv of the proposed project in writing. The project proposal is expected to contain all relevant information on the project, including a land-use map.

This stage is followed by the screening phase, during which the Ministry will carry out, an Initial Environmental Examination (IEE) and assign the project into a category based on the following criteria;

• Magnitude, • extent or scope, • duration and frequency, • risks, • significance and • Mitigation measures available for associated and potential environmental impacts.

The location of the project if in Environmentally Sensitive Areas (ESAs) is also an important criterion in project categorization. The areas categorized as Environmentally Sensitive Areas (ESAs) include coral reefs, mangrove swamps, small islands, tropical rainforests, areas with erosion-prone soils, natural conservation areas, etc.

There are three categories (I, II, III) in FMEnv's EIA/EMP Procedural Guideline. Category 1 projects are subjected to full-scale EIA/EMP. It consists of, among others, construction of Roads and Infrastructure projects like, Railways, Ports and Harbours, airports, Electrification Projects etc.

Projects listed in Category II may not require a full-scale EIA/EMP except when such a project is located in an Environmentally Sensitive Area (ESA) and in this case the project will be automatically assigned to Category I. The requirement for Category II projects is a partial EIA/EMP. Also, mitigative measures or changes in project design (depending on the nature and magnitude of the environmental impacts) as well as further actions may be required from

the proponent. Category II projects include reforestation/ afforestation projects, land and soil management, small-scale irrigation and drainage, mini hydro-power development, small-scale development of petroleum or related activities, etc.

Category III projects are those expected to have essentially beneficial impacts on the environment. For projects in this category, the Ministry will issue an Environmental Impact Statement (EIS). Projects in this category include family planning programme, institutional development, environmental awareness projects, etc.

Another stage of FMEnv's EMP procedure which comes up after the project proposal stage in the scoping stage, the main feature of which is that the proponent will be required to submit a Terms of Reference (TOR) for the proposed EMP study. In some cases, the Ministry may demand a Preliminary Assessment Report, and any additional information from the proponent to assist in vetting the scope and the TOR of the proposed EMP study. This stage is followed by actual implementation of the EMP study, preparation of Draft Final and Final EMP Reports, review process and approval/certification.

Apart from the general EIA/EMP Guidelines, the Ministry has also prepared sectoral guidelines for EMP in different industrial sectors, including the Infrastructure Sector.

1.9.4 Other National Legislations

Apart from the FMEnv guidelines highlighted above, there are other legislations that have been put in place to serve as a check on the operators of oil and gas industries. Some of these are summarized below:

(i) *Penal Code*

The Nigerian Penal code makes it an offence punishable with up to 6 months imprisonment for "Any person who: Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhoods or passing along a public way or, does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, whether human or animal".

The Explosives Act

This Act was promulgated in 1964 and empowers the Minister of Mines & Power (now Solid Minerals) to make regulations on the importation, manufacture, storage and use and the ownership and possession of explosives.

Endangered Species Act (1985)

The endangered species Act No. 11 of 1985 prohibits the hunting, capture and trade of endangered species.

Quarries Act Cap 385 Laws of Federation of Nigeria, 1990

The act provides for and regulates quarrying activities in Nigeria. It prohibits unauthorized quarrying activities for industrial use and diversion of water course or impounding of water for that purpose. The Act gives the Minister for Mines and Power the power to make regulations for prevention of pollution of natural water supply.

Land Use Act 1978

States that "… it is also in the public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families should be assured, protected and preserved".

National Inland Waterways Authority Act (1997)

Act 13 of 1997 establishing the National Inland Waterways Authority (NIWA) repeals the Navigable Waterways (Declaration) Act of 1988. The NIWA is managed by a governing board, whose functions, among others, include the following:

- Serve as the body providing regulations for all inland navigation;
- Ensure the development of infrastructural facilities for a national inland waterways network connecting the creeks and the rivers to meet the challenges of modern inland waterways transportation;
- It is charged with undertaking capital and maintenance dredging, and hydrological and hydrographic surveys;
- Design of ferry routes and operate ferry services within the inland waterways systems; and
- Involved in the survey, removal and receipt of derelicts, wrecks and other obstructions from inland waterways, and undertake the installation and maintenance of lights, buoys, and all navigational aids along water channels

1.9.5 State Legislations

The Nigerian Constitution allows States to make legislations, laws and edicts on the Environment as environmental is listed under the concurrent schedule of the 1999 Constitution.

The EIA Act No. 86 of 1992 also recommends the setting up of State Ministries of Environment (SMENV) and Environmental Protection Agencies (SEPA), to participate in

regulating the consequences of project development on the environment in their area of jurisdiction. SMENVs thus have the responsibility for environmental protection at the state level within their states.

In accordance with the provisions of Section 24 of Act FEPA 58 of 1988 Chapter 131 of the Laws of the Federation of Nigeria (LFN), the State Environmental Protection Agencies and subsequently the State Ministry of Environment were formed in **Jigawa State** which are important stakeholders in the proposed project because the site of the project is within the State.

The functions of the SMENV/SEPAs include:

- Routine liaison and ensuring effective harmonisation with the FMENV in order to achieve the objectives of the National Policy on the Environment;
- Co-operate with FMENV and other relevant National Directorates/Agencies in the promotion of environmental education;
- Be responsible for monitoring compliance with waste management standards;
- Monitor the implementation of the EMP and the Environmental Audit Report (EAR) guidelines and procedures on all developments policies and projects within the State.

Figure 1-1: The flow chart of the EMP process in Nigeria

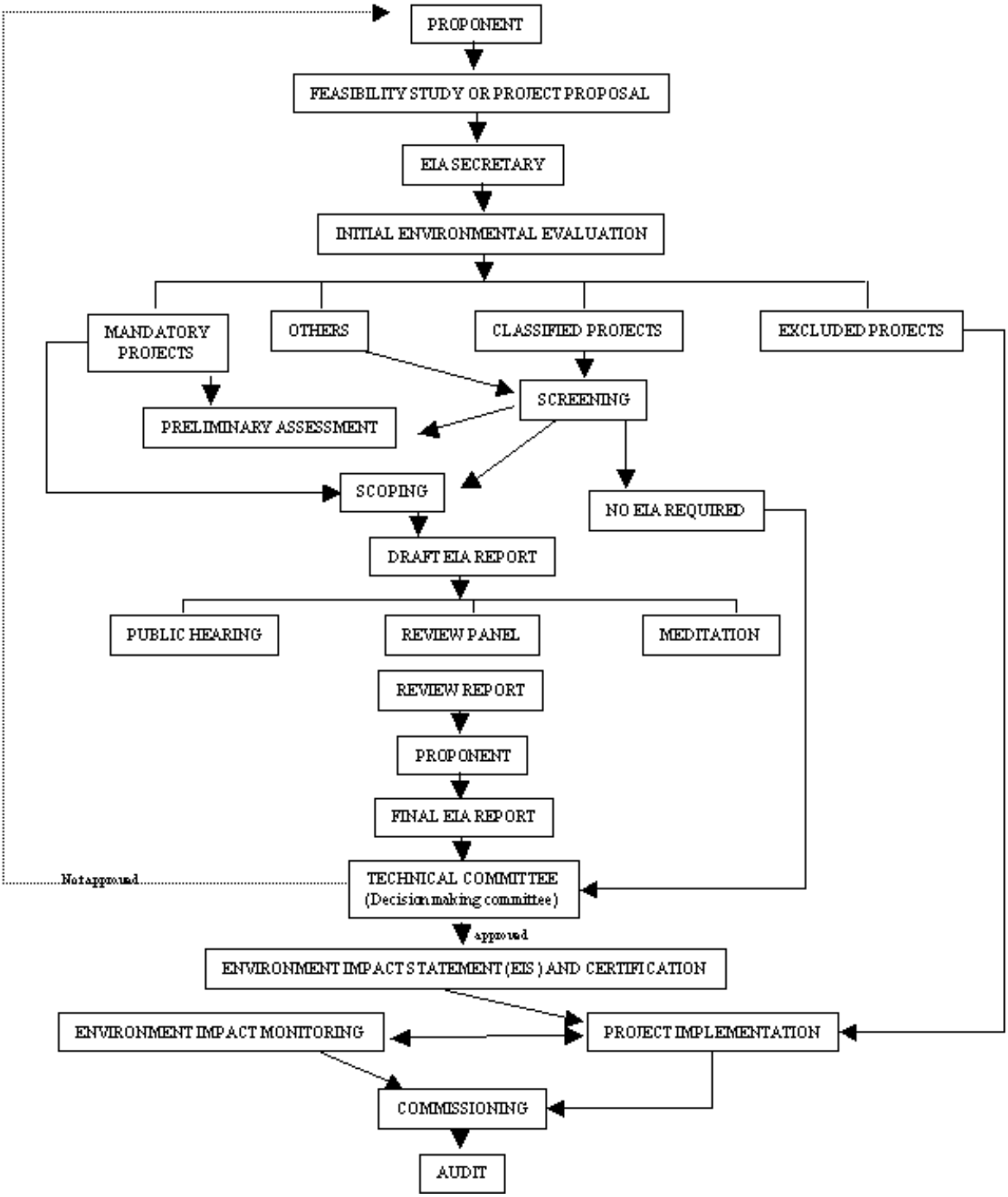
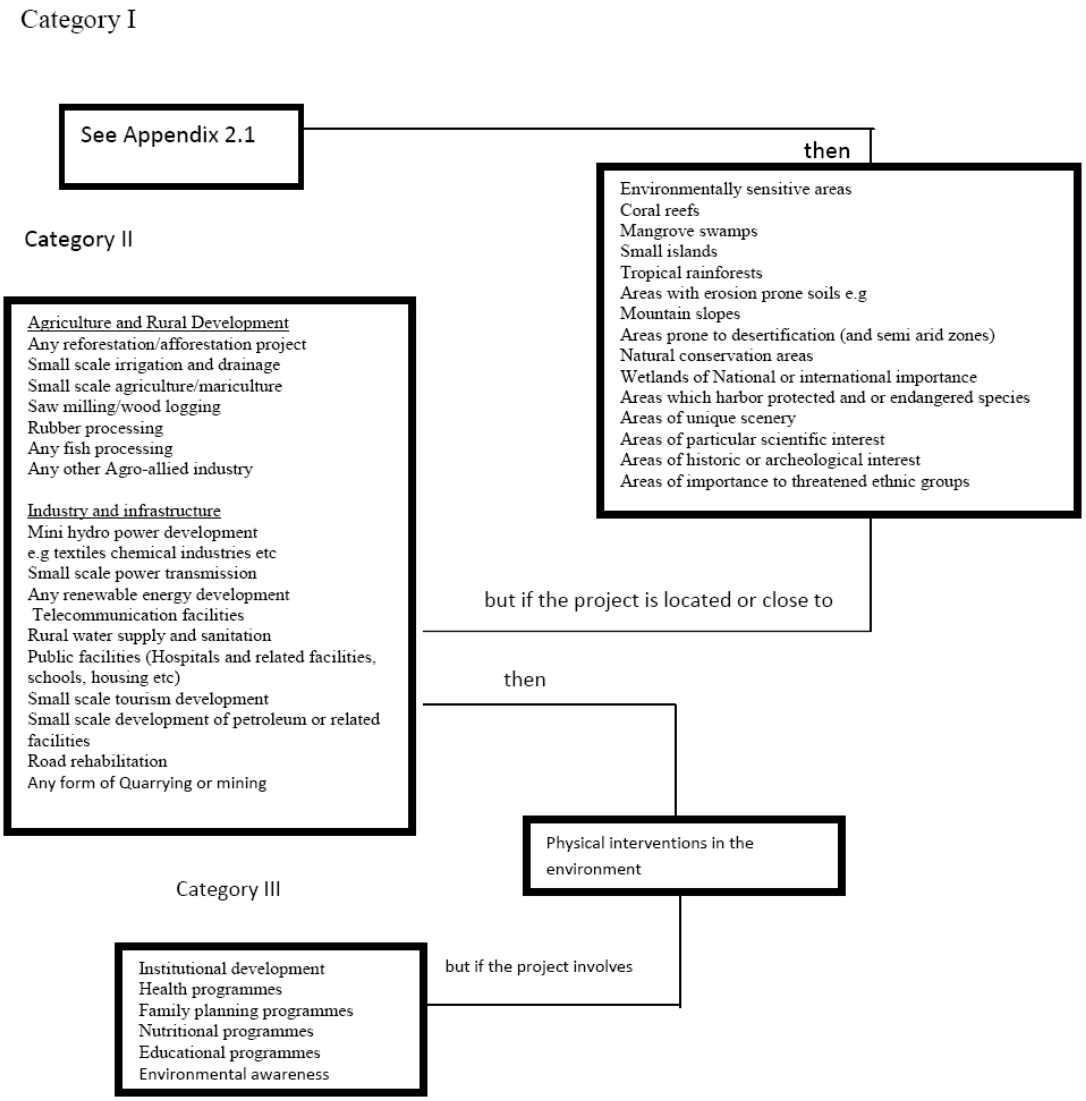


FIGURE 2.2: CHECKLIST FOR THE CATEGORISATION OF EIA PROJECTS



1.10 WORLD BANK SAFEGUARD POLICIES

The World Bank has operational safeguard policies, which apply to various development projects which the bank is either implementing or funding. The objective of these policies is to prevent or at least minimize social environmental risks while increasing socio-economic benefits of approved projects. The effectiveness and positive impact on development of projects and programmes supported by the Bank has substantially increased as a result of these policies. The Bank's safeguards policies include:

- OP 4.01 Environmental Assessment
- OP 4.04 Natural Habitats
- OP 4.09 Pest Management
- OP 11.03 Cultural Property
- OP 4.12 Involuntary Resettlement
- OD 4.20 Indigenous Peoples
- OP 4.36 Forests
- OP 4.37 Safety of Dams
- OP 7.50 Projects in International Waterways
- OP 7.60 Projects in Disputed Areas

The World Bank Operational Directive 4.01: "Environmental Assessment" of 1991, classifies projects according to the nature and extent of their environmental impacts.

It is the responsibility federal government Nigeria for ensuring that safeguards are not violated. Applicable World Bank's operational policies that are triggered by the project are summarized in **Table 1-1.**

Table 1-1: World Bank Operational Policies

Operational Policy	Brief Description
Environmental assessment (EA)	World Bank financed projects must be environmentally sound and sustainable. The type and detail of the EA is dependent on the nature, scale and potential environmental risks. The safeguard instrument used here is the EMP

From the above it is clear that the EIA Act and the World Bank safeguard policies are similar. OP.4.01 and Nigerian EIA Act are similar. For examples, World Bank EA Screening Category A is similar to Nigerian EIA Act category I, World Bank EA Category B is equivalent to Nigeria EIA Act Category II, World Bank EA Category C is equivalent Nigeria EIA Act Category III.

However in the event of divergence between WB safeguard policy and the Existing Environmental laws in Nigeria that of the World Bank will take precedence.

1.11 INTERNATIONAL STANDARDS, TREATIES AND CONVENTIONS

Global and Regional Treaties and Conventions are, in principle, binding in first instance on National Governments that accede to them. They are obliged to implement such arrangements through national legislation. At the international level, Nigeria is party to a number of Conventions that are relevant to the proposed development project. UNEP (1991) provides an overview of applicable, international Treaties and conventions. The more relevant ones are reviewed briefly below:

Vienna Convention for the Protection of the Ozone Layer, including the Montreal Protocol and the London Amendment

The objectives of this Convention adopted in 1985 are to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the Ozone Layer and to adopt agreed measures to control human activities found to have adverse effects on the Ozone Layer.

Convention on the Conservation of Migratory Species of Wild Animals or Bonn Convention

The Bonn Convention's adopted in 1979 aims at the conservation and management of migratory species (including waterfowl and other wetland species) and promotion of measures for their conservation, including habitat conservation.

Convention on Biological Diversity

The objectives of this Convention, which was opened for signature at the 1992 Rio Earth Summit and adopted in 1994, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources by appropriate transfer of relevant technologies.

Convention concerning the Protection of the World Cultural and Natural Heritage or World Heritage Convention

This Convention adopted in 1972 defines cultural and natural heritage. The latter is defined as areas with outstanding universal value from the aesthetic and conservation points of view.

In addition, Nigeria is a signatory to the following relevant international conventions:

- The African Convention on the Conservation of Nature and Natural Resources, The African Convention, 1968;

- The Convention Concerning the Protection of the World Cultural and Natural Heritage, The World Heritage Convention, 1972;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES, 1973;
- Convention on Conservation of Migratory Species of Wild Animals, Bonn, 1979.
- The Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste and Disposal, 1989;
- The Framework Convention on Climate Change, Kyoto Protocol, 1995;
- The Convention on Biological Diversity, 1992;

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 NEED FOR THE PROJECT

Road Transportation is a key to Nigeria's economy considering its vast area and the near comatose of other means of transportation such as the railway. This however could only be effective with sustainable and motorable road networks across the rural, semi-urban and urban districts of the country. The need for this project cannot be over-emphasized when viewed alongside the distribution and the way of life of the inhabitants of the area which is agriculture and trading. An EMP is required to mitigate the anticipated impacts of this project in this case since the road is in existence but in the state of disrepair instead of an ESIA.

2.1.1 Project Objectives

The primary objective of the Dingaya - Galambi - Rungo Road Rehabilitation project is to provide efficient and motorable road between the affected communities and beyond and further easy the movement of goods and services thereby reducing the cost of transportation and by extension, prices of goods and services.

Other specific objectives of the project include creation of employment and enhancing the life-span of vehicles plying the road.

2.1.2 Benefit of the project

- Reduction of accident rates from the current level.
- Contribute to the development of affected towns and communities
- Reduction of man-hour loss due to improved road network.
- Creation of job opportunities

2.2 Project Alternatives

Approach to the selection of best project implementation and design alternatives will take into consideration the one that suits the purpose best. Potential alternatives considered include;

i. Taking no action or no project option
ii. Using alternative travel modes
iii. Improving the existing facilities
iv. Taking alternative alignments construction of a multi-lane, controlled access facility on new location.
v. Design variations of alignment and grade.

In conceiving the development options and scenarios, the following main factors were also considered:

- availability of raw materials,
- process facilities,
- Cost effectiveness and more effective utilization of resources.

2.2.1 USING OTHER TRAVEL MODES

Other modes of efficient passenger travel and goods movement over long distances include air, rail, transit, and marine. With regards to goods movement the only realistic alternative to trucking is rail. Rail, transit and air travel are all feasible alternatives for transporting passengers. However, currently there is no functional passenger rail service between Dingaya, Galambi and Rungo and very limited long distance transit service. Air service is prohibitively expensive as expressed by majority of stakeholders and by far the least possible sustainable method of travel. Therefore other modes of travel are not seen as effective alternatives. This is a very cost alternative, and shall add no value to the micro economics of the areas even if it is considered. This option is therefore rejected.

2.2.2 ALTERNATIVE ALIGNMENTS

Alternative alignment options would be prohibitively expensive and more disruptive, and could lead to loss of revenues from diverted traffic. It would also entail very high costs for property acquisition and compensation claims, lost employment, a decreased tax base, and reduced access. This alternative is not acceptable as it would be prohibitively expensive. It will also create greater environmental and social impact on the adjoining communities.

2.2.3 DESIGN VARIATIONS OF ALIGNMENT AND GRADE

Since the road is expected to serve the same purpose which is to rehabilitate it to near its original quality and functionality, this alternative is defective as it will create an uneven road alignment. For this reason, this option is rejected.

2.2.4 NO-PROJECT

This a no-project or no-development scenario in which road development/improvement project is not executed. With the “no-project” option, existing levels of service and safety deficiencies in the project area will worsen as automobile and truck traffic volumes continue to increase and would make industrial and socio-economic development impossible or expensive. This will negatively impact the nation’s economy that is highly dependent on good road network. This scenario is therefore rejected as it would prevent meeting the nation’s growing transport needs.

In general all the interactions with the communities were positive. They wanted the project to commence in earnest. The results of the public meetings and the completed questionnaires

supported the Project and considered it a necessity to promote economic development and reduce poverty in the region.

In addition, the consequences of the alternative without the project are inter alia, lack of fluidity of traffic and blockage of sub regional integration, worsening of poverty in the areas concerned and lack of contribution to the development of trade within the nation.

2.2.5 PREFFERED ALTERNATIVE: REHABILITATING THE EXISTING ROADS

Rehabilitate the Dingaya - Galambi - Rungo road to facilitate more efficient haulage of people, goods and services. It will accommodate the existing and projected traffic demand, improve the transportation infrastructure of the region and promote economic development in and around the project corridors. This alternative is acceptable.

2.3 VALUE OF THE PROJECT

It has been estimated that over 593 million naira will be required for the implementation of the project. The proposed project cost includes land acquisition and demolishing of structures/ compensation, mobilization, construction and decommissioning other activities. The project intends to employ about 30 – 40 people directly and over 100 people indirectly during execution. Priority will be given to qualified persons from the host community, followed by nearby communities. The total value of the project that will be brought into the local economy can be regarded as the benefits described earlier. The implication of this is that if identified negative cost and impact can be carefully mitigated, then the project would contribute an overall net positive economic benefit to the nation.

2.3 .1 ENVISAGED SUSTAINABILITY

The sustainability of the project is based on the fact that the intended communities particularly those in and around the existing corridor would continue to use the road as their major access and would ensure that wilful destruction or damage of the road infrastructure is not allowed. Other sustainability factors for the road include;

- **Life Span**

It is expected that the road will remain viable and sustained for at least fifteen (20 - 25) years or more.

- **Technical**

The road rehabilitation project will be executed by experienced engineers and monitored by qualified resident Engineer.

- **Environmental**

An adequate environmental management plan, EMP, to be put in place is envisaged to environmentally sustain the project throughout its life span.

A good housekeeping practice will be maintained and the project will implement all the regulations related to EMP.

- **Social**

FERMA and RSDT will ensure that adequate compensation is paid to all affected person as well as ensuring cordial relationship with stakeholders and communities by the contractor. The people of the area shall be given consideration in employment.

CHAPTER THREE

PROJECT DESCRIPTION

3.0 PROJECT DESCRIPTION

The proposed activity is a road rehabilitation project of the approximately 18.5 km Dingaya - Galambi - Rungo road. It involves the filling of most section of the Road with laterite, provision of stone base, prime coat, asphalt concrete pavement, provision of shoulders, construction of concrete lined drains and earth drains.

3.1. Project Location

The project is located in Jigawa State Nigeria. Jigawa State is a state located in North-Western Nigeria. Created on 1st October, 1991 from the old Kano State, Jigawa State borders Kano State to the west, Borno and Yobe States to the north-east, and Niger Republic to the North. The capital of Jigawa State is Dutse with a total population of over Two Million people.

Jigawa State is a showcase in agriculture self reliance and admirable resource management. Before the creation of Jigawa State, there were over 120 earth dams established by the then Kano State Government, several of which are located in the present Jigawa State. Today, these dams ensure that all year round farming activity is achieved in their various catchment areas. Jigawa is known today as one of the most irrigated states in the country with over one million hectares of cultivable land. In area of educational achievements, Jigawa State is now a pacesetter with well motivated teachers and improved educational infrastructure. Its senior secondary schools are emulated by others while the primary schools management board has now become a national phenomenon.

Tribes

Hausa, Fulani and Kanuri

Local Government Areas in the State

Dutse, Malam-Maduri, Kafin Hausa, Ringim, Auyo, Gwaram, Birnin Kudu, Jahun, Hadejia, Gumel, Kazaure, Babura, Burji, Gagarawa, Garki, Guri, Gwuiwa, Kaugama, Kiri Kasamma, Kiyawa, Maigatari, Miga, Roni, Sule Tankarkar, Taura, and Yankwashi.

The route is located within Jigawa State covering Dingaya - Galambi and Rungo. The section of the route stretches through a distance of about 18.5 km along linking Gwaram – Basirka and Gwaram – Rungo axis.

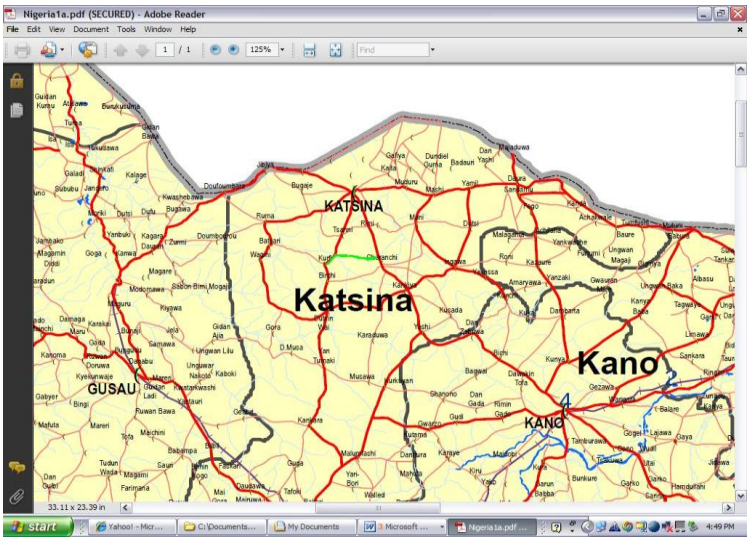


Fig. 3.1. An example of road network in part of North-west region

A. Outskirt of Towns

B. Inside Dingaya Town

Figure 3.2 (A &B)Typical Section of Dingaya – Galambi-Rungo Road

3.2 DESIGN STANDARDS

The horizontal and vertical alignments of this route as they exist will in a lot of cases meet with the design standards required of Federal highways by the Federal Ministry of Works & Housing without much impediment and re-alignment. In general, the road design has been carried out to the Federal Ministry of Works' "Highway Manual Part I – Design", from inception. The design speed required is 100Km/hr. Permanent features like bridges and culverts shall be rehabilitated in accordance with the Federal Highways standards.

3.3 LAYOUT AND EXISTING CONDITIONS OF THE ROAD

A site assessment of the project roads, covering the full length of the road was undertaken. The objectives of this study were:

- To assess the present condition of the local network at each location so as to determine the present state of effects of the local environment
- To ascertain the details of the road geometry (width, slopes, curvature, etc) pavement construction method and pavement conditions, drainage location and condition of structures;

- To identify rock cuts, agricultural farms, steep side slopes and other control, bridge crossings, expensive buildings and structures are also noted; and
- To ascertain the present site of the road development in its locality, the communities served by the section of the highway, the common goods moved, the alternative mode of transportation, problems militating transport and travel within these locations.

Road inventory sheets were prepared along the route of the project during the detailed assessment study. The following were the observations made:

3.3.1 Carriageway and Shoulders

The existing Right of Way of the road is about 6.30m wide laterite surface which is largely eroded and has no shoulders. This road alignment has never been paved with coulter despite the significance of the road. The condition of the road has fallen below acceptable standards because of neglect and poor maintenance.

3.3.2 Pavement

The entire section of the road has not been paved thus exposing the road to significant threat of erosion particularly water erosion during rainy season and wind in the dry season. This makes life difficult for the entire farming communities along the road who commute to their various farms and local markets on daily basis.

3.3.3 Existing Alignment

The alignment generally traverses a flat to gently rolling terrain with sharp decent and ascends in various points along the route. Most part of the existing alignment between Dingaya – Galambi and Rungo has long strained sections with some granite rock-outcrops that would need to be cut through. Thus some of the horizontal alignment has to be improved upon to satisfy geometric design requirements particularly within Dingaya and Galambi communities.

3.3.4 Drainage

The proposed road is criss-crossed by few seasonal streams. There are therefore various types of existing drainage structures – mainly culverts along the route to ensure adequate drainage of throughout the rainy period of year. There are a number of box and ring culverts along the Dingaya - Galambi - Rungo section of the road, which is apparently because of the high incidence of rainfall and the fact that the terrain is undulating thus forming many water pathways. However, from the assessment, it was noticed that over a significant part of the road, side drains were not provided which is likely one of the reasons why the pavement has completely failed in places.

3.3.5 Road Furniture

The traditional highway furniture such as road markings and safety warning signs and kilometre posts for proper direction of traffic are not available on this road. Embankments and some culverts also lack guardrails. The reason for this deplorable condition of road furniture could be traced to poor routine maintenance of such type of road.

3.4 SCOPE OF WORKS / PROJECT OVERVIEW

The rehabilitation of the Road involves (a) Site Clearance (b) Provision of Stone Base (c) provision of Prime Coat (d) Asphalt Concrete (e) Reinstatement of Shoulders (f) Construction of concrete lined drains and earth Drains. The Detailed scope of works area is as follows:

(a) Site Clearance and Earthworks

- Site Clearance on either side of road up to limits of construction width of all bush, grass and trees including topsoil
- Vegetation Clearing viz; cutting of bush, grass, shrub and trees etc on either side of the roadway and/or median
- Excavation of burrow pits etc.

(b) Culverts and Drains

- Demolition of failed pipe Culvert
- Removal of Debris
- Excavation and backfilling works for pipe, box, culverts and side drains
- Laying of precast single RC pipes Culvert
- Concrete works

(c) Pavement and Surfacing

- Provision, spread and compacting of base and sub base material
- Laying of prime Coat
- Surface dressing
- Laying of Asphaltic concrete binder

3.5 INPUT AND OUTPUT OF RAW MATERIALS AND PRODUCTS

3.5.1 Construction Materials

Quality construction materials - gravel and fill material are abundant around the road corridor. Aggregates can be sourced from neighbouring quarry sites while sand can be obtained from the several riverbanks that are easily accessible from the project site.

3.5.2 Raw Material Supply

Major inputs in the road project include the various construction equipment and machinery for scarification, grading/ earth (soil) movement, topographic levelling, creation of road pavement, Asphalt overlay (coal tarring) and bridge works, and construction materials including bitumen, gravel and fill material usually excavated on site.

3.6 STAFFING AND SUPPORT

The project is expected to provide employment for reasonable number of people (both skilled and unskilled) directly and indirectly through sales of food to the workers by the local community.

3.6.1 Facilities and Services

Sources of Energy Available to the Project

Petroleum products which include motor gasoline, dual purpose kerosene, automotive gas oil, liquefied petroleum gas, low- and high-pour fuel oil and base oil represent major energy sources in Nigeria available to the project.

3.6.2 Base Camp

A temporary base camp for construction activities shall be located adjacent to FERMA Field Observation Office and Camp. All necessary sanitary and messing facilities shall be provided for an estimated 45 workers expected on site.

3.7 PROJECT SCHEDULE

The total duration from zero date to commissioning of the road will be determined. The remaining phases required prior to construction include completion of the environmental impact assessment, detailed field survey for the Highway rehabilitation project. The Highway is expected to be maintained and to remain in operation for a long time to come before another round of maintenance work.

CHAPTER FOUR

BASELINE DESCRIPTION

4.0 DESCRIPTION OF THE ENVIRONMENT

Environmental baseline data provide information on the quality and sensitivity of the environment in which the development is being proposed. The data are also used in the project design, operation and general management decisions.

4.1 BASELINE DATA ACQUISITION METHODS

A multi-disciplinary approach was employed in the characterization and acquisition of the baseline data from the project area. Literature search, field data gathering exercise as well as laboratory analyses and data interpretation were applied.

The field data gathering exercise on the project route was carried out with the following objectives:

- to identify soil, water quality and vegetation properties;
- to assess air quality and noise levels; and
- to obtain information on the socio-economic status of the project route.

The data generated from the literature search include maps, geographic data, meteorological data and information on the vegetation and soils of the Road Route.

4.1.1 Sampling Design and Field 'Measurements

The analytical method employed in analysis of all samples in this study involves the following steps:-

- Sample Collection
- Preservation / Storage
- Analysis
- Quality Control and Assurance
- Report of Analysis Result

Just like other steps, sample collection is a vital process in analysis and it can limit the accuracy of an analytical procedure when it is done in a haphazard manner. In the same line, all samples were carefully collected to achieve accurate result.

The composition of the all the samples (water and soil) reflect as closely as possible, the average composition of the bulk material.

4.1.2 Goal of Sampling

All samples collected represent a portion of material small enough in volume to be transported conveniently & handled in the laboratory while still accurately representing the material being sampled. This means that the concentrations of all components of the material sampled will be the same as that of the sample collected.

Precautions Taking in Sampling include the followings;

- Sample containers were rinsed with water to be collected about two or three times.
- All containers were fill for most organic determinations
- Air space of about 1% was Leave in container for samples that will be shipped to allow for thermal expansion.
- Grab method of sampling was adopted, in stream and at mid depth.

4.1.3 Sample Containers

The type of sample container used to store samples collected can affect the constituents of such samples. Therefore plastic containers with plastic screw caps were used for analysis of water, Glass containers are generally preferred with volatile organics (APHA,1992).

The following procedures summarize the major aspects of chain of custody.

1. Sample labels: - All samples were properly labeled to prevent misidentification; labels were affix or tags to samples containers before or at time of sampling. Each sample was number, name of collector, date and time of collection, and place of collection were all contained in the sample sheet attached here for your comment.

2. Sample seals:- labels were used to detect unauthorized tampering with samples up to time of analysis. Seal were attached in such a way that it would be necessary to break the seal to open the sample container.

3. Field log book:- The sampling personnel have a log book where all information on the place of sample collection and the sample itself were recorded. The following are put down in the field log book:-

- Date and time of sampling
- Name of sample
- Purpose of sampling
- Location of sampling point (State, Town and Area)
- Name and address of field contact
- Type of sample
- Number and volume of sample taken
- Description of sampling point

- Sampling method employed
- Field observations and measurements
- Signature and name of sampling personnel
- Sample analysis request sheet
- Sample delivery to Laboratory
- Receipt and logging of sample
- Assignment of sample for analysis

4.2 LITERATURE REVIEW/USE OF DOCUMENTED INFORMATION

Meetings, discussion and sites visit with the relevant authorities and the detail engineering layout of the project and profile collected formed an important source of information on the project scope. Detailed maps of the project areas were used in the reconnaissance planning and studies. Published and unpublished information collected from various academic institutions and Government departments and agencies, including National Meteorological Agency, Federal Ministry of Environment, Jigawa State Ministry of Environment, Jigawa State Ministry of Land & Surveys and Gwaram Local Council Area were used to define scope of field work.

4.2.1 Reconnaissance Survey

Initial inspection of the identified study area was conducted to assess the geo-physical characteristic and hydrology formation on the basis of visual observations. One kilometer radius corridors were determined. The main purpose of the reconnaissance was to determine the boundaries of the study area. The key features of visual assessment included:

- Location and grid referencing of areas of the area under study
- Peculiarity and Nature of the proposed Road Rehabilitation route
- Ecological characteristics of the study area
- Population dynamics
- Community interests and conflict

4.2.2 Field Studies Methods

In order to have detailed information on the biophysical parameters within the study area, the area within the 3km radius of the selected sites along the route was chosen; this included the area between the project route road corridor. The focal point was on the major activities that are likely to receive the maximum impacts. **Field work started in the study area between 3rd and 4th December, 2010.**

The sampling procedures adopted were designed to achieve scientific accuracy. The following methods were considered:

- Collection of soil samples: surface soil (depth of 0-20cm) and sub soil depth of (20-50cm) to obtain data on the quality of soil.
- Quantity of samples collected.
- Sample points identification/geo -referencing
- Samples storage and preservation
- Stratified random sampling

Physico-Chemical Characteristics

Physico-chemical characteristics of the soil (pH, moisture content, Total Organic Content (TOC), N_2-NO_3, PO_4, SO_4) were also determined.

4.2.2.1 Metals

The sample were first digested following standard method using aqua-regia in a fume cupboard and heated before determination of the concentration of exchangeable cations (Na, Fe, Ca, and Mg) and heavy metals in an atomic Absorption Spectrophotometer (AAS).

4.2.2.2 Particulate Size

Dry sieving and the percentage of sand, silt and clay determined Grain size by sediment using a hydrometer.

4.2.2.3 Soil

Soil samples were collected at each sampling sites using soil auger from two depths (top soil 0 – 15cm and sub – soil 20cm-2M). The samples were properly bagged, labelled and contained information on sample reference number and collection site.

4.2.2.4 Soil Quality

Soils of the study area were sampled at the surface or from within 0-20cm of the surface and 50 – 2m below the surface with Soil auger of uniform cross section. Twenty soil sample locations were randomly established across the study area to represent the soil zones. A trowel was used to recover surface soil samples. Auger of uniform cross section was used to ensure that uncontaminated and reproducible unit of soil samples were collected.

The samples were taken to laboratory after properly labelled sample bottles and preserved in accordance with Standard Procedures of ASTM, FMENV (1991) and APHS (1975). Permeability tube was used to collect soil sample for soil permeability analysis, erodability, compaction and characteristics.

Surface Water

There is no major water body in the proposed project area.

4.2.2.5 Air Quality

The air quality monitoring and field investigation methods used include Sound Level and GPS (Global Positioning System) were used to determine the coordinates of the sample points

Air quality parameters that include NO_2, SO_2, H_2S, CO, NH_3, Suspended Particulate Matter (SPM) and Sound level, were measured in-situ. The measurement was carried out between 9.00am and 11.00am and between 4.00pm and 6.00pm. All equipments were calibrated before use.

Table 4.1 Analytical technique and equipment used in laboratory analysis of water and soil

S/No	Parameters Determined	Equipment/ Technique
1.	pH	Hanna meter 991301
2.	Temperature	Hanna meter 991301
3.	Conductivity, $\mu S/cm^{-1}$	Hanna meter 991301
4.	Salinity	Salinometer
5.	Dissolved Oxygen, mg/l	DO meter, Hanna C2561
6.	Transparency (m)	Secchi disc
7.	Grain size	Granulometry and sedimentation
8.	BOD_5 mg/l	Hach BOD track
9.	NH_4 mg/l	Hanna Photometer C200
10.	NO_3 mg/l	Hanna Photometer C200
11.	PO_4 mg/l	Hanna Photometer C200
12.	SO_4 mg/l	Hanna Photometer C200
13.	THC mg/l	Capillary GL
14.	Aliphatic and Aromatic mg/l	GC-MS
15.	TOC	Graphite furnace and gravity
16.	N	Graphite furnace and gravity
17.	TDS mg/l	Gravimetry after drying to constant weight
18.	TSS mg/l	Gravimetry after drying to constant weight
19.	Heavy Metal mg/l or ppm	AAS, UNICAM 424
20.	Soil Moisture Content %	Gravimetry after drying to constant weight
21.	Soil permeability	Falling heed permeability test

S/No	Parameters Determined	Equipment/ Technique
22.	Exchangeable cations mg/l	AAS

4.2.2.6 Water chemistry

The Physico-chemical and heavy metal characteristics of samples collected along the road, and Hand dug well were determined using the standard method and equipment.

4.2.2.7 Socio-economics and Community Health

Data on socio-economics were generated using structured questionnaires, interviews and observation of behaviours together with literature survey. Information obtained included the demographic and political structures, employment/wages status, community health status, infrastructure and aesthetics.

4.3 QUALITY ASSURANCE AND QUALITY CONTROL

All the equipment and materials used for the fieldwork were duly documented and certified functional. A waybill was issued to this effect to ensure a stress-free trip. Daily project report sheets were used to document and report daily progress of work. The reports were confirmed and endorsed by the project manager and client's representative on a daily basis to ensure accuracy of the documentation.

4.4 DESCRIPTION OF EXISTING ENVIRONMENT

The description of the components of the physical environment of the proposed project area established during this study is discussed below.

4.4.1 Climate

The project area is within the tropics, it is dominated by two contrasting seasons, the dry and wet (rainy) seasons. The two season regimes are dependent on the two prevailing air masse blowing across the country at different times of the year, the south-westerly humid maritime air mass blowing from across the Atlantic and the north-easterly air mass of Saharan origin, i.e. Harmattan.

4.4.2 Winds

The prevailing wind in the project area is the north-easterly, which is usually light in the morning and picks up by mid-day to attain a speed of up about 0.5 - 16.5 m/*s* in the drier months (November - March), and 0.5 – 10 m/s in the wet months (May - October) with considerable dust. In the rainy season, the southwest trade wind frequency is 20 - 40% while in the harmattan, the northeast trade wind accounts for 15 - 45% of the winds (Federal Surveys, 1978).

4.4.3 Visibility

The weather is fine on most days. Usually, during the harmattan, especially in February, spells

of extensive dust haze sometimes last for 3 to 7 days, reducing visibility to below 2km, and constituting a serious hazard to land and air transport. This harmattan haze (dust particles) may extend from the ground surface up to 3000 metres high or higher above sea level (Federal Surveys, 1978).

Visibility often improves at night during the harmattan due largely to the night-time inversion which inhibits convection and thus permits the dust particles in suspension to settle out of the lowest layers of the atmosphere (Federal Surveys, 1978).

In May, however, when there are intrusions between the southwest maritime wind and the dry northeast continental air mass, the dust particles suspended in air often absorb vapour molecules, become heavy and fall from the atmosphere, thus improving visibility. May therefore, is the month with the best visibility. (Oguntoyinbo, et al, 1987).

4.4.4 Rainfall

Wet season in the project area commences as late as May and ends in October with August as the peak, while the dry season occurs between November and April when the harmattan wind sweeps over the entire area bringing moderate temperatures and lower humidity. Table 4.1 below gives a record of ten year period of rainfall as obtained from NIMET, Mallam Aminu Kano International Airport, Kano.

Table 4.2: Average Monthly Rainfall Data Dutse (1996-2006) in mm

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.
1996	0.0	0.0	0.0	0.0	25.9	146.6	341.0	179.8	308.0	24.2	0.0	0.0
1997	0.0	0.0	0.0	0.0	21.7	200.8	128.2	336.2	298.2	35.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	44.8	186.2	138.6	324.5	157.3	39.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	37.0	211.1	282.0	192.8	399.6	28.2	0.0	0.0
2000	0.0	0.0	0.0	0.0	38.6	192.4	197.4	334.1	265.0	34.1	0.0	0.0
2001	0.0	0.0	0.0	0.0	43.2	200.8	272.1	300.4	340.2	39.9	0.0	0.0
2002	0.0	0.0	1.12	0.0	54.9	269.1	320.8	273.6	199.0	54.2	0.0	0.0
2003	0.0	0.0	0.0	0.0	53.5	11.13	420.0	424.1	246.9	40.5	0.0	0.0
2004	0.0	0.0	0.0	0.0	28.6	178.1	358.7	316.5	345.9	23.9	0.0	0.0
2005	0.0	0.0	0.0	0.0	36.4	215.4	203.8	234.8	151.1	51.9	0.0	0.0
2006	0.0	0.0	0.0	0.0	46.1	107.0	166.2	230.4	198.4	45.8	0.0	0.0

Source: NIMET, Kano.

4.4.5 Temperature

The project area is characterised by cloudless sky on most days. The maximum temperatures (32 - 38°C) are recorded in the months of March to May, while the minimum temperatures (18 - 24°C) are recorded between December and January (Oguntoyinbo et al, 1987).

4.4.6 Relative Humidity

The relative humidity of the project area decreases steadily and changes abruptly with the seasons. The annual maximum values of 76 to 86% occur around August while the minimum (10

to 30%) are recorded between November and March (Federal Surveys, 1978). Daily relative humidity values in the area are usually higher around dawn (5 - 7 a.m.) and drop as the day progresses. It could rise to about 90% at dawn from June to October and 60% in the afternoon, in the rainy season, while in the dry season, from November to April, it is about 45% at dawn and about 15% in the afternoon (Federal Surveys, 1978). Also, NIMET keeps records of daily meteorological conditions nationwide and below is data obtained for monthly evaporation for 1996 – 2005. (see table 4.3 below)

Table 4.3: Meteorological Data (Monthly Evaporation)

Year	Jan.	Feb.	March.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual total
1996	338	356.1	374.5	283.5	155.3	115.3	95.4	72.2	88.8	129.7	273.6	364.1	2646.6
1997	351	354.9	289.2	172.3	109.6	109.6	97.8	73	80.9	141.4	275.5	316.99	2645.79
1998	544	411.4	349.4	227.1	148.4	107.5	102.1	79	67.2	2.10	189.4	266.7	2702.6
1999	305	396.8	448.5	254.4	147.1	107.3	88.2	70.8	77.7	91.3	263.4	289.7	2540.4
2000	319	316.8	14.8	273.9	169.2	127.7	84.1	76.7	66.4	110.6	251.4	318.8	2430.5
2001	346	374.9	443	265.6	191	116.3	98.2	77.4	77.6	124.9	258.7	292.3	2666.2
2002	341	345.3	393.9	241.2	152	104.4	58.9	63.2	70	158.5	267.4	319	2539.2
2003	348	341.9	342.1	219.9	200.3	111	85.1	67.3	72.5	109.4	212.3	280.3	2388.1
2004.	283	318.5	421.3	205.9	212.5	97.8	88	67.7	68	100.2	221.5	272.4	2342.8
2005	307	342.1	388.7	234.6	128.9	100.4	82.3	64.5	74.2	120.9	221.5	272.4	2390
Total	3479	3555	3865.8	2495	1697	1097.3	907.1	712	744.3	1296.9	2435	311.0	25292.19
μ	348	355.5	385.58	249.5	169.7	109.73	90.71	71.2	74.43	129.69	243.5	311.0	2600.19

Source: NIMET, Kano. μ = Mean monthly evaporation.

4.4.7 Sunshine

The mean daily sunshine in the project area is between eight (8) and ten (10) hours in the dry

season and six (6) and nine (9) hours in the wet season (Federal Surveys, 1978). The study area experiences a mean annual sunshine of 3048 hours, which represents (31 %) of maximum possible amount of sunshine in the environment. The lowest values of sunshine are recorded in July (about 7 hours) and August (about 6 hours) due to greater amount of cloudiness in the sky (Federal Surveys, 1978).

4.4.8 Geology *I* Hydrogeology

The project area is in the region with gently undulating sandy drift plains with scattered ironstone hills and low outcrops overlying Pre-Cambrian Basement Complex rocks formed by gneisses and other igneous rocks (FORMECU, 1998). The aquifer consists mainly of laterite clay, coarse sands, gravels and decomposed granite (at the bottom). The pump test boreholes dug in the region produced free flow yields of up to 8,160 litres/hour and an average specific yield of about 33,120 litres/hour/metre. The boreholes were dug to 75.8m below the surface soil. The high yields may be from deeply fractured zones of the basement rocks (Offodile 1992).

4.4.9 Ambient Air Quality

The establishment of the baseline air quality status of the proposed project area was carried out to provide basis for future monitoring requirements.

Respiratory problems arise from high levels of air pollutants released or present in the atmosphere. Exposure to oxidant gases such as SO_X and NO_X alters pulmonary immunologic responses and may increase susceptibility to bacteria infection. SO_X at concentrations above 5ppm could stimulate broncho-constriction and mucus secretion in man and other animals. Levels of NO_X and $S0_3$ at levels above 5ppm and 0.3ppm may cause pulmonary diseases (ACGIH, 1995). Ambient accumulation of carbon monoxide beyond 200ppm could bring about formation of carboxy-haemoglobin, and prevent oxygenation of the blood (OSHA, 1989).

Suspended particulate matter (SPM) comprises of light materials, usually dust and other particles found suspended in the atmosphere, and carried around by the wind. Ambient concentrations of SPM above a daily average of 0.15 to 0.25mg/m^3 (FEPA, 1991 and WHO, 1993) and yearly average of 0.06 to 0.09mg/m^3 (WHO, 1993), may cause or aggravate respiratory problems such as cough and asthma.

The Air quality was assessed in the three major settlements and along the road corridor using portable air quality meters.

From the results, all the air quality parameters are within acceptable limits set by the Federal Ministry of Environment, (FEPA Standards). The mean concentrations for NO_2, SO_2, NH_3, CO,

H_2S are 0.10, 0.01, 0.10, 0.00, and 0.00 PPM respectively and that of Suspended particulates is 6.92µgm^3 and these are within the acceptable standard.

The concentrations of heavy metals in the air as recorded at Dingaya, Galambu and Rungo settlements are generally below the limits set by the Federal Ministry of Environment.

Table 4.4a. Air Quality Measurement Result

S/No	Settlement	State	Local Govt.	GPS Coordinate	PPM					
					NO_2	SO_2	NH_3	CO	H_2S	Suspended Particulate in µgm^3
1	Outskirt of Dingaya town	Jigawa	Dingaya	11^0 55. 264' N 008^0 28. 296' E	0.01	0.00	0.10	0.00	0.00	2.03
2	5km from Dingaya town	Jigawa	Dingaya	11^0 55. 267' N 008^0 28. 292' E	0.01	0.00	0.10	0.00	0.00	2.00
3	Dingaya Town Centre	Jigawa	Dingaya	11^0 55. 600' N 008^0 28. 698' E	0.01	0.00	0.00	0.00	0.01	4.74
4	Galambi motor park	Jigawa	Galambi	11^0 55. 601' N 008^0 28. 760' E	0.00	0.00	0.00	0.01	0.00	7.53
5	Galambi Mosque	Jigawa	Galambi	11^0 55. 604' N 008^0 28. 762' E	0.00	0.00	0.00	0.01	0.00	4.53
6	5km from Galambi town	Jigawa	Galambi	11^0 55. 614' N 008^0 28. 781' E	0.00	0.00	0.00	0.01	0.00	2.35
7	Entrance of Rungo town	Jigawa	Rungo	11^0 55. 656' N 008^0 28. 542' E	0.01	0.00	0.00	0.00	0.01	3.14
8	Rungo town	Jigawa	Rungo	11^0 55. 656' N 008^0 27. 942' E	0.01	0.00	0.00	0.00	0.01	6.14
9	5km from Rungo town	Jigawa	Rungo	11^0 55. 637' N 008^0 28. 642' E	0.01	0.00	0.00	0.00	0.01	2.17
10	Control Area	Jigawa	Galambi	11^0 54. 634' N	0.00	0.00	0.00	0.01	0.00	2.32

S/No	Settlement	State	Local Govt.	GPS Coordinate	PPM					
					NO_2	SO_2	NH_3	CO	H_2S	Suspended Particulate in μgm^3
	10km from Galambi			008^0 29. 792' E						
Mean					0.10	0.01	0.00	0.01	0.01	3.695µg m^3

Source: In-situ measurement (Fieldwork)

Table 4.4b Nigerian Ambient Air Quality Standards (FMEnv, 1991)

Pollutant	Time of Average	Limit
Particulates	Daily average of 1 hr values	250ug/m3 – 600 ug/m3
Sulphur Oxides (Sulphur dioxide)	Daily average of 1 hr values	0.01ppm (26ug/m3) – 1ppm (260 ug/m3)
Non-methane hydrocarbon	Daily average of 3hr values	160ug/m3
Carbon monoxide	Daily average of hourly value 8hr average	10ppm (11.4 ug/m3) 20ppm (22.8 ug/m3)
Nitrogen oxides (Nitrogen Dioxide)	Daily average of hourly value (range)	0.4 ppm – 0.06 ppm (75.0 g/m3 – 113 ug/m3)
Photochemical oxidant	Hourly values	0.06 ppm

Table 4.4c: World Health Organization (WHO) Guidelines for Maximum Exposure to Major Pollutants and Possible effects if limits are exceeded

Pollutant	**Possible Effects**	**WHO Guidelines**
Sulphur dioxide (SO_2)	Worsening respiratory illness from short term exposure, increased respiratory symptoms, including chronic bronchitis, from long-term exposures	40-50 $mg/^3$ (annual mean); 100-150 mg/m3 (Daily average)
Suspended Particulate Matter (SPM)	Pulmonary effects are associated with the combine exposure to SPM and SO_2	Black: 40-60 mg/m^3 (annual mean). 100-150 mg/m3) Total SPM: 60-150 mg/m^3 (annual mean); 150-230 mg/m^3 (daily average)
Nitrogen dioxide (NO_2)	Effects on lung function in persons suffering from asthma from short-	150 mg/m^3 for 24 hr mean;

	term exposures	400 mg/m^3: Not to be exceeded
Carbon Monoxide (CO)	Reduced oxygen – carrying capacity of blood	10 mg/m^3 (for 8 hr); not to be exceeded

4.4.10 Noise

Prolonged exposure to noise of certain frequency can either cause temporary hearing loss (temporary threshold shift) which disappears in a few hours or days, or permanent loss (permanent threshold shift). Temporary threshold shift is generally not damaging to the ear unless prolonged. Repeated noise of high intensity over a long time leads to permanent threshold shift. It is anticipated that during the road rehabilitation noise level of higher decibels will be generated due to the loud sounds produced by the machines and other equipment to be used.

Noise

Details of noise levels recorded at each of the settlements around the Road Route using handheld Noise Level meter are presented in table 4.5. The noise levels ranging from 47dB – 75dB are within the acceptable limits. The major sources of noise within each settlement are motorcycles, moving vehicles and grinding machines.

Table 4.5a; Noise Exposure Limits for Nigeria

Duration per day, hour	Permissible Exposure Limit (dBA)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Table 4.5b: Noise Levels (dB) measured along the Dingaya - Galambi - Rungo Road

S/No	Settlement	State	Local Govt. Area	GPS Coordinates	Noise Level (dB)
1	Outskirt of Dingaya town	Jigawa	Dingaya	11^0 55. 264' N 008^0 28. 296' E	49.30
2	Dingaya Town Centre	Jigawa	Dingaya	11^0 55. 600' N 008^0 28. 698' E	58.60
3	Galambi Mosque	Jigawa	Galambi	11^0 55. 604' N 008^0 28. 762' E	56.30
4	Entrance of Rungo town	Jigawa	Rungo	11^0 55. 656' N 008^0 28. 542' E	53.30
4	Within Rungo town	Jigawa	Rungo	11^0 55. 657' N 008^0 28. 547' E	78.22

Source: Fieldwork

The noise levels were generally high because of vehicular movements and other activities around the nearby major road.

4.4.11 Vegetation

The project area is within Gwaram L. G. A of Jigawa State far in are considered largely rural which falls is in the Sudan Savannah ecological zone characterised by fragmented farmlands growing rain-fed arable cereals and food crops with minor grazing activity. Prominent in this area is scattered trees such as baobab, mango, grasses and shrubs. The grasses and shrubs under natural conditions dry up annually in the dry season, therefore, drought-resistant species dominate.

The crops planted in the surrounding rural areas include; millet, groundnut, guinea corn, beans, okro and tomatoes. The grasses commonly found include, *Cenchrus spp.*, *Imperata cylindrica, Panicum spp.* and *Schizachyrium spp.* The dominant shrubs in this area include *Acacia spp., Balanites aegytiaca, Combretum spp., Guiera senegalensis, Hyphaene thebaica* and *Piliostigma thonningii.* Also, tree resources common in the project area include *Acacia albida, Adansonia digitata, Azadioachta indica, Borassus aethiopicum, Burkea africana, Butyrospermum paradoxum* (shea butter), *Magnifera indica* (mango), *tamarindus indica, Acacia*

senegal (gum arabic), *Acacia nilotica* ('Bagaruwa') and *Parkia clappertoniana* (FORMECU, 1998).

Fig. 4.1. Sample of Soil in the study area

4.4.12 Wildlife Studies

Considering the lack of vegetation cover in the project area wildlife commonly found include bush rats, brown doves, lizards and snakes. Wildlife in the area is of little economic importance (monetarily) as they are too few and far between

4.4.13 Soil Characteristics

The soils of the project area are well-drained, shallow, immature sandy soils with little profile differentiation. They are formed mainly from unconsolidated sands or Aeolian drift and are characterised by low organic matter, cation exchange capacity and available phosphate hence are poorly buffered so that resistance to changes in pH when fertilizers are added is low (FMANR, 1990).

4.4.14 General Characteristic and Classification

Based on the soil map of Nigeria (Kang 1988), available secondary data and empirical data analyses the soil characteristic of the proposed road rehabilitation route falls under Entisols (Aeolian Deposit). This Entisols (Alluvial & Aeolian deposits) are young soils of the alluvial plains of the large rivers, the inland valley bottom lands, the coastal swamps and estuarine deposits, as well as the Aeolian deposits of the Sudan and Sahel (NARESCON 1992)

4.4.15 Land Use

The project area is predominantly occupied by residential settlements and other service provision companies. Apart from residence, land use in the area also include educational and economic (commercial activities such as trading) with no any form of agricultural practices due largely to the fact that the area is in the heart of the city.

4.4.16 Soil Physico-chemical Characteristics

The soil samples collected were generally of mildly coarse texture dominated by sand and silt. The mean contents of sand and silt were 78.7% and 21.3%, respectively with no trace of clay in the samples analysed. This is attributed to the granitic and gneissic origin of the parent material.

The mean pH of the soils (within 30cm) was 7.19 while the nitrate, sulphate and phosphate mean concentrations were *7.40mg/kg* and *225mg/kg* and *23.3mg/kg*, respectively. These values compare favourably with the characteristics of soils of the study area (FMANR, 1990).

The mean concentration of iron in the soil was *8,189mg/kg.* The high iron concentration may be due to the presence of ironstone hills in the study area (FORMECU, 1998).

From the results the soil in the area, which is the receiving environment, has the capacity to assimilate the treated (to FMENV standards) effluent from the power plant's operations without being significantly degraded.

4.4.17 Soil Microbial Status

The microbial population of the soils of the project route showed that the total heterotrophic bacteria count ranged from 6.50 x 107 to 5.55 x 108 cfu/ml while the population of hydrocarbon utilising bacteria ranged from 1.50 x 106 to 6.65 x 106 cfu/ml. The total fungal count ranged from 1.85 x 103to 5.85 x 103cfu/ml

The predominant bacteria species isolated from the soil samples were *Klebsiella, Bacillus, Streptomyces, Pseudomonas and Micrococus,* while the dominant fungal species were *Rhizopus, Mucor, Saccharomyces, Aspergillus, Candida* and *Penicilliu*

4.4.18 Groundwater

The water table at the project site is considered high as groundwater can be found at just about 3 to 5m below the surface soil. The colour, odour, and most other water quality parameters for the hand-dug wells are for now satisfactory.

Fig. 4.2 One of Source of water inside Galambi Town (well)

Table 4.6b: Water Samples Analysis Result

PARAMETER	Well	FME LIMIT	REMARKS
PHYSICAL TEST			
Appearance	Clear	NS	Observed
Ph	7.00	6-9	Satisfactory
Turbidity	0.067		
Colour	Colorless	NS	Observed
Odour	Odorless	NS	Not Applicable
Conductivity ($mS.cm^{-1}$)	0.40	0.4-0.8	Within Limit
TDS (mg/L)	1.14	2000	Within Limit
TSS (mg/L)	0.07	30	Within Limit

Dissolved Oxygen (mg/L)	4.9	>4	Within Limit
Temperature	28.2^0C		
CHEMICAL TEST			
Total Phosphorus (mg/L)	0.09	5	Within Limit
Total Chlorine (mg/L)	0.01	<1	Within Limit
ORGANICS			
Oil and Grease (mg/L)	0.00	10	Within Limit
COD (mg/L)	3.01	50	Within Limit
BOD (mg/L)	10.00	40	Within Limit
Phenol (mg/L)	ND	0.2	Satisfactory
Total Coliform MPN/100ml	ND	NS	Not Applicable
THC (mg/L)	ND	24	Within Limit
HEAVY METALS			
Nitrate (mg/L)	0.01	20	Satisfactory
Chromium (mg/L)	ND	<1	Satisfactory
Lead (mg/L)	ND	<1	
Cadmium (mg/L)	ND	<1	
GPS	11^0 55. 604' N 008^0 28. 762' E		

Source: Laboratory analysis results

4.5 SOCSOCIO-ECONOMIC STUDIES

4.5.1 General

Changes in human activities, culture perceptions, attitudes and values, technology and institutions have become prominent in the planning of development projects. Consequently, it is exigent to integrate socio-economic issues into project planning. Thus, for the purpose of this project, data on socio-economics of the affected areas was collected using informal interview, structured questionnaire administration (sample copy in the appendix) and field observation during the sampling period.

4.5.2 Host Communities

The main communities are Dingaya, Galambi and Rungo, It also has multiethnic populations such as Hausas, Fulanis, Ibos, Yorubas. It is composed of Hausas, Fulani Cattle herdsmen, Ibo and Yoruba petty traders and skilled workers from almost all the major Northern Minority tribes.

4.5.3 Settlement and Land Ownership

The settlement pattern in Dingaya, Galambi and Rungo communities is characterized typically into linear and or clustered/nucleated type. Most of the houses are built with bricks although in traditional Hausa building pattern with few others built with mud walls plastered with cement and aluminium zinc roofs. Over 80% of the respondents to the questionnaire are non-natives

while about 20% are natives of the state that came and settle from other areas. The project will not trigger WB/OP/BP 4.12 since no land will be acquired

Inside Dingaya Town

Part of the Road inside Galambi Town

Fig. 4.3. Settlement Pattern in Dingaya and Galambi

4.5.4 Population Structure

The nature of the population of the host community consists of about 48% youth of ages between 14 and 45 and 32% of children below the age of 14. The middle aged (46-59 years old) and elderly (60-80 years old) make up the remaining 20% of the population.

4.5.5 Religion, Culture, Beliefs and Festivals

There are no shrines or other archaeological structures in the surrounding communities as their culture and beliefs are embedded in the religion, which forbids such practices. Festivals in the host communities are mostly tied to Islam such as wedding 'fatiha', naming ceremonies and 'Sallah'. However there are other places for Christian worship (churches), though fewer within the area.

4.5.6 Education

The western educational status of the populace is low compared to towns of equal size in the southern part of the country. Majority are however well schooled in Islamic knowledge with ability to read and write in Arabic or Western education. There are several pre-primary, primary and post primary schools both public and private spread within the area.

4.5.7 Occupation/ Income level

Occupations of the people in the nearby communities are mainly, farming, petty trading, carpentry and civil service. Others include transportation motor \motorcycle mechanics and hand craft particularly among the women folks. The average annual income earning in this area range from N10,000:00 to N80,000:00

4.5.8 Political Structure

The political headship of the communities is monarchical, but the enthronement of a new leader on the demise of his father is subject to the people's consent and confirmation by the Emir of Dutse, who is the Chairman of the state’s traditional rulers council. These leaders appoint illustrious sons of the communities including leaders of youth councils, as cabinet members. The cabinet members offer advice on important leadership matters. Each new paramount ruler appoints his own cabinet. They are paid by the Jigawa State Government.

4.6 CONSULTATIONS

4.6.1 Introduction

Consultation is the process of seeking information from parties or persons affected or likely to be affected by the project, or those having environmental responsibilities, concerns interests about the environmental implications of project activities. Consultation is necessary in order to more efficiently deliver improved project sustainability and to protect the interests of affected

communities, especially the poor and vulnerable. Experience has shown a strong link between project sustainability and effective public consultation.

4.6.2 Consultation Objectives

The objective of the Consultation Process is to acquire and disseminate information, identify and address legislative, community and environmental concerns and to proffer appropriate mitigation options for all identified negative impacts. The intention was to:

- Avoid conflict by addressing issues promptly;
- Ensure that any fears or apprehensions about the nature, scale and impacts of the proposed project have been fully addressed; and
- Avoid any misunderstanding about the project

Consultation is necessary in order to enlist the participation of groups in the assessment of any project. For this project, consultation was carried out at two main levels - **public** and **institutional** consultation. Public consultation was conducted at major towns/villages all along the project road as many are to be affected by the project. This was in form of interviews with individuals belonging to different social and/or economic categories and concerned local administrative bodies were made. Questionnaires were also administered to individuals, local or international NGOs as were available during fieldwork for their opinions on the construction works in relation to their adverse effects on the environment (see copy in appendix). This was to indicate local initiatives to participate in the road development project and assess the key roles to be played by the different stakeholders in terms of delivering services, goods, works, or other elements in the project, mechanisms used for consultation and participation in the project, main outcome and recommendations of the consultation process, and how these recommendations can be incorporated into the project.

Consultation was approached in the following ways:

(i) A Community Liaison Officer (CLO) was appointed and charged with the responsibility of:

- Identifying and establishing contacts with the respective stakeholders;
- Providing a link between the communities and FERMA;
- Acting pro-actively to identify and inform FERMA Management of various community issues and concern;

- Documenting all contacts and actions and advising on appropriate community assistance projects.

(ii) Issuance of notice of intent to carry out an EMP for the proposed development project in cooperation with the local regulatory Agencies (Federal Ministry of Environment, State Ministries of Environment and State Ministries of Works and Housing, Local Government Officials etc.) for a meeting with FERMA and the Project Consultants, where the project was explained to the people and their co-operation solicited;

(iii) Adopting a transparent method of surface right compensation payment to all affected parties;

(iv) Sustaining consultation with stakeholders via "Peoples' forum" both before and after the payment of compensation, with explanations of key issues as they arise and affect the people;

(v) Maintaining effective communication between FERMA and the communities through the Community Liaison Officer (CLO);

(vi) Ensuring the full commitment of FERMA to implement all mutually agreed community Assistance Projects.

The environmental management team has established sound working relationships with FMENV and the three State Ministries of Environment officials.

4.6.3 Identifying Stakeholders

Stakeholders for the purpose of this project are defined as all those people and institutions that have an interest in the successful planning and execution of the project. 3 main groups were consulted in Dingaya, Galambi and Rungo on the same day sampling was made. These include those positively and negatively affected by the project. To identify the key stakeholders, Table 4-1 was developed.

Table 4.7: The Stakeholder Identification Matrix

Those who may be affected by the project or Project Affected Persons (PAPs):	
These may include	**How to identify them**
People living in close proximity of the proposed activity route.	• Identify the local government area(s) that falls within 1 km radius of the proposed sites. • Review available data to determine the stakeholder profile of the whole stakeholder or relevant group. • Use identified groups and individuals to tap into

	stakeholder networks to identify others.
Special interest groups.	• Identify key individuals or groups through organised groups, local clubs, community halls and religious places. • Organisations such as environmental groups would be aware of similar local groups or individuals.
Individual property owners that will be directly or indirectly affected.	• Advertise in local newspapers, requesting people that they may be affected to register interest in attending meetings or receiving further information.
Business (owners and employees).	• Council lists or property registers.

4.6.4 Consultation Strategies

The strategy adopted for consultation during field work was the application of structured questionnaire and oral interview (see copy of questionnaire in appendix). This mode of consultation process shall continue at project commencement and shall ensure that all those identified as stakeholders are continually consulted. Subject to approval by RSDT and FERMA, the contractor for the project should share information about the project with the public, to enable meaningfully contribution and enhance the successful implementation.

Public consultation should take place through public forum, seminars, meetings, radio programs, request for written proposals/comments, questionnaire administration, public reading and explanation of project ideas and requirements. The consultation plan would be monitored by relevant regulators who will set their own verifiable indicators to assess the degree of participation of the key stakeholder during all the phases of the project implementation.

4.6.4.1 Level of Engagement

The level of stakeholder involvement would be based on the project phase, location and expected outcome. Small projects would require less complicated stakeholder involvement programs as the issues are likely to be less complex and their imp smaller. This section is a guide to determining the level of stakeholder involvement required.

Specifically, the extent of stakeholders' involvement would be based on the following

- The project is likely to have significant impacts, that is, high impacts in one area/location, or relatively small impacts spread out over a large area.
- The project involves significant issues, that is, the wider stakeholder may be affected.

Through these engagement strategies; RSDT and FERMA would be able to:

- clarify the project's objectives in terms of stakeholders' needs and concerns.
- identify feasible alternatives (in particular alternative locations) and examine their relative merits in terms of environmental, social and economic factors.
- identify and prioritize environmental issues, and establish the scope of future studies.
- identify processes for continued stakeholders' involvement.

Federal Road Maintenance Agency (FERMA) recognizes that early stakeholders' participation in the execution of the proposed road rehabilitation project would lead to better mutual understanding and can serve as basis for proper use of the reclaimed area by the affected community members. Therefore, for this reason, consultation has been put in the center for decision making for this project and consequently, the following stakeholders have been identified;

- Regulators (FMENV and KSMENV),
- Host Communities,
- Contractors, distributors, marketers etc

The primary objectives of consultation in this EMP process are:

- to notify regulatory authorities in order to work with and meet statutory requirements,
- to explain to both government and host communities the proposed operations in a meaningful environmental terms, and exchange information to facilitate good working relations; and
- to identify issues and local concerns at an early stage to avoid unnecessary public opposition.

Fig. 4.4 Consultation session at Rungo one of the affected towns

4.6.5 Gender of the respondents

The area of project influence is dominated by Hausa/ Fulani speaking languages of Nigeria and adherents to Islamic faith. Thus interaction with females who are usually in Furdha was limited

and considered unacceptable. However, the elderly few who were encountered during the field work on their way to the local markets were interacted with albeit 'informally' by way of asking few questions. Generally, the male respondents were the most interacted with bearing the religious sensitivities and cultures of the host communities.

4.6.6 Concerns of the affected communities.

Majority of the stakeholders welcomed the project as it would improve transportation of their goods from farms and homes to other areas with less hitches. They also believe that the rehabilitation of the road would go a long way in reducing vehicular accidents as well as further open-up the areas affected. Also, there is hope of increasing income level through job creation albeit temporarily associated with the project.

On the other hand in Galambi, there is the concern that there may be land take from the affected communities for burrow pit construction which could lead to loss of farmland as well as possible ejection of road side businesses which could lead to loss of livelihood where implemented. However, some of the people interviewed expressed willingness to give out their land provided that the road would be rehabilitated for a very low financial compensation as their contribution.

In addition in Dingaya, there are fears of loss of houses that may be considered to have encroached on the existing road corridor, thus rendering some people homeless. Other concern expressed by some of the project likely affected persons include the issue of introduction of alien cultures by some non-indigene workers as well as the possibility of increasing level of HIV/AIDs infection

In response to their concerns, it was explained to communities that the rehabilitation work is going to be restricted to the existing carriageway, hence their structures will not be affected. The project will not trigger WB/OP/BP 4.12 since no land will be acquired and the only likely structures to be affected are temporary structures which people are willing to move away from the construction zone and more consultation will be carried out with the stakeholders during the implementation of the project. Annex 4 show the list of Stakeholders consulted.

CHAPTER FIVE
ASSOCIATED & POTENTIAL ENVIRONMENTAL IMPACTS

5.0 BACKGROUND

Several approaches and techniques have been developed for evaluating associated and potential impacts of projects on the environment. These approaches and techniques that are approved by the regulators in Nigeria have their advantages and disadvantages.

The associated and potential impacts of the project on the environment were evaluated using the Leopold Matrix (Leopold *et al*, 1971) approach and technique. Leopold *et al.* (1971) were the first to suggest the use of a matrix method for impact assessment. This method reflects the fact that impacts from projects result from interaction of project development activities and the environment. This method is applicable in almost any type of construction project because of its comprehensive checklist designed for assessment. One hundred possible project actions are listed on one axis and eighty-eight human and natural environmental elements on the other axis. The Leopold matrix is also used to present the results of an appraisal.

In evaluating the project impacts, the following steps were employed in preparation of this EIA:

- Identification of effects
- Prediction of effects
- Evaluation and Interpretation of impacts
- Communication
- Inspection procedures

The following considerations were the goals of the assessment methodology used:

- Comprehensiveness - ability to handle all possible range of elements and combinations thereof;
- Selectivity - capability to identify early in the procedure those aspects that are important;
- Mutual exclusiveness - should be able to examine every component of an impact from different perspectives
- Confidence limits - is the method able to ascertain and isolate uncertainties;
- Objectivity- should allow no bias either from the assessor or project initiator;
- Interactions - should be able to examine both sides of a coin and provide feedback

5.1 Basis for Screening

In assessing the impacts of the proposed road project the following information were used:

(a) Knowledge of the project activities, equipment types, construction activities, commissioning activities, operational maintenance, procedures, and abandonment procedures,

(b) The results of baseline studies (biophysical, health and socio-economic)

(c) Findings of previous EMP and Audits of similar projects and other literature findings on the primary project activities,

(d) Comparison with FMEnv/WHO/EEC/World Bank guidelines and standards,

(e) Series of expert group discussions and seminars,

(f) Past experience on other EMP projects.

The criteria applied to the screening of various activities were:

(i) Magnitude - Probable level of severity.

(ii) Prevalence - likely extent of the impact.

(iii) Duration and frequency – likely duration - long-term, short-term or intermittent.

(iv) Risks – Probability of serious impacts.

(v) Importance - value attached to the undisturbed project environment.

The various components of the project environment likely to be impacted by the proposed road rehabilitation project activities and the associated impact indicators were identified and are listed in Table 5.1 below.

Table 5.1: Impact Indicators for Various Environmental Components

	Environmental Components	**Impact Indicators**
Air Quality	Emissions	Particulates, NO_X, SO_X, CO_2, CO, Oil and grease
	Noise & Vibration	Day-time disturbance, hearing loss, communication impairment, annoyance
	Climate	Humidity, temperature, rainfall, wind speed and direction
Land Resources	Soil/Landuse	Erosion, fertility, subsidence, farming, hunting, recreation.
	Ecology	Diversity, distribution & abundance of Aquatic & Terrestrial Flora & Fauna.
Hydrology	Hydrology	Drainage, discharge, hydrologic balance, sedimentation, erosion.

	Environmental Components	**Impact Indicators**
Water Quality	Water Quality	Solids (DS, SS), turbidity, toxicity, eutrophication, contamination, microbiology, *E. Coli*
	Hydrogeology	Ground water level, quality & availability
Biological	Fisheries	Productivity, diversity & abundance.
	Wildlife & Forestry	Abundance, diversity of species, numbers of unique, rare or endangered species.
Socio Economics	Socio-economic, gender issues & poverty alleviation	Population, income, settlement pattern, health, safety and security.
	Archaeology	Cultural relics, shrines & taboos.

5.2 Scoping

Scoping identifies the various aspects (activities) of the proposed road project that could have significant impact on the environment. It identifies issues of critical concerns. Scoping of the proposed project also seeks to provide solutions to issues such as:

- What are the potential impact from the execution and operation of the road project?
- What will be the magnitude, extent and duration of the impacts?
- Of what relevance are the impacts on the environment within local, contexts?
- What mitigation or amelioration measures can be put in place to reduce or avoid the negative impacts or to enhance and maximize positive impact?

Consequently, scoping was used to identify the biophysical, health, and socio-economic components of the environment that will significantly be affected by the proposed project activities. The project activities that will have impact on the environment are:

- Site Preparation/clearing
- Blasting/Excavation/piling
- Civil works & Asphalt Laying
- Operation and maintenance activities
- Decommissioning and abandonment

5.3 IMPACTS IDENTIFICATION

The main effects of the residues and emissions from site preparation/bush clearing, road construction, operations and abandonment, were identified and analyzed in sufficiently clear and comprehensive manner. These residuals and emissions include but were not limited to:

- Emissions to air.
- Noise and vibrations.
- Discharges to land and soil.
- Effects on ecosystems.
- Influx of job seekers

5.4 IMPACTS QUANTIFICATION & DETERMINATION OF SIGNIFICANCE

The identified associated and potential impacts of the proposed Road Project were quantified using the Risk Assessment Matrix (RAM) and the ISO 14001 criteria for identifying significant environmental aspects/impacts. The following are ISO 14001 based Criteria and Ratings for identifying significant environmental impacts of the proposed project.

LEGAL/Regulatory Requirements (L)

Is there legal/regulatory requirements, or a permit requirement?

0 = There is no legal/regulatory requirement

3 = There is legal/regulatory requirement

5 = There is a permit required

RISK (R) - What is Risk/Hazard rating based on Risk Assessment Matrix

1 = Low risk

3 = Medium/Intermediate risk

5 = High risk

Environmental Impact Frequency (F) - What is frequency rating of impact base on RAM?

1 = Low frequency

3 = Medium/Intermediate risk

5 = High Importance

Importance of Affected Environmental Component and Impact (I) - What is rating of importance based on consensus of opinions?

1 = Low importance

3 = Medium/Intermediate

5 = High frequency

Public Perception (P) – What is the rating of public perception and interest in proposed project and impacts based on consulting with stakeholders?

1 = Low perception and interest

3 = Medium/Intermediate perception and interest

5 = High perception and interest

The significant potential impacts of the proposed project were identified as those impacts in the checklist of indicator parameters in Table 5.7 that satisfy the following criteria:

L+R+F+I+P)≥ 15: This is the sum of weight of the legal requirements, Risk factor, Frequency of occurrence, Importance and public perception greater than or equal to the benchmark (15).

(F+I) IS > 6: Sum of weight of frequency of occurrence and importance of affected environmental components exceeds benchmark (6).

P = 5: The weight of the public perception/interest in the potential impact exceeds the benchmark (5).

Table 5.2: Impacts Significance

Potential/Associated Impacts							**Assessment Criteria**	**Total Score**
Project Scope	Project Activity	Potential/Association Impacts	**L**	**R**	**P**	**I**		
Site Clearing & Earthworks	Roadside clearance	Biodiversity loss, changes in river hydrology,	2	1	2	3	Significant	8
	Vegetation Clearance	Biodiversity loss, changes in river hydrology,	1	1	3	1	Not significant	6
	Scarification & cutting of potholes	Air quality, dusts etc	1	3	3	3	Significant	10
	Excavation of burrow pits	Biodiversity loss, damage to aesthetics and air quality,	3	5	5	5	Significant	18
Culverts and Drains	Demolition & removal of failed pipe culverts	Air quality, dusts etc	3	1	3	3	Significant	10
	Excavation &	Air quality, dusts, noise	3	1	5	3	Significant	12

Potential/Associated Impacts							**Assessment Criteria**	**Total Score**
	backfilling works	etc						
	Laying of pre-cast pipes	Air quality, dusts, noise etc	3	5	5	5	Significant	18
	Concrete works	Air quality, dusts etc	2	3	3	1	Significant	9
Pavement & Surfacing	Compacting of base & sub base	Air quality, dusts, noise etc	2	1	2	3	Significant	8
	Surface Dressing	Air quality, dusts, noise etc	3	1	3	3	Significant	10
	prime Coating	Air quality, dusts, noise etc	3	1	5	3	Significant	12
	Asphalting	Air quality, surface water	1	1	2	1	Not Significant	5
	Transport of Rock Aggregates		1	1	2	2	Not so Significant	6
Demobilization	Barrow pit, scarify soil and asphalt	Solid Waste generation, from camps and barrow pit	1	3	2	3	Significant	9

Table 5.3: Risk Assessment Matrix for Environmental Consequences

CONSEQUENCE					**INCREASING PROBABILITY**			
					A	**B**	**C**	**D**
Severity	People	Assets	Environment	Reputation	Never heard of incident	Incident has occurred in road construction	Incident has occurred in project	Happens several times per year in project
0	No injury	No Damage	No effect	No impact				
1	Slight Injury	Slight Damage	Slight effect	Slight impact		**Low**		
2	Minor Injury	Minor damage	Minor effect	Limited impact		**Risk**		
3	Major Injury	Localized Damage	Localized effect	Considerable impact			**Medium**	

CONSEQUENCE					**INCREASING PROBABILITY**			
					A	**B**	**C**	**D**
4	Single Fatality	Major Damage	Major effect	National impact			**Risk**	**High**
5	Multiple Fatalities	Extensive damage	Massive effect	International impact				**Risk**

Risk Matrix (Adapted: SIEP HSE-MS Manual Part 5, 1999)

Table 5.4 Example of further definition of consequence – severity rating for risk matrix

Severity	**Potential Impact**	**Definition**
0	Zero effect	No environmental damage. No change in the environment. No financial consequences.
1	Slight effect	Local environmental damage within the fence and within systems. Negligible financial consequences.
2	Minor effect	Contamination, damage sufficiently large to affect the environment single exceedance of statutory or prescribed criteria, single complaint.

Severity	**Potential Impact**	**Definition**
		No permanent effect on the environment.
3	Localized effect	Limited loss of discharges of known toxicity. Repeated exceeding of statutory or prescribed limit affecting neighbourhood.
4	Major effect	Severe environmental damage. The company is required to take extensive measures to restore the contaminated environment to its original state. Exceeding of statutory or prescribed limits
5	Massive effect	Persistent severe environmental damage or severe nuisance extending over a large area in terms of commercial or recreational use or nature conservancy, a major economic loss for the company. Constant high exceedance of statutory or prescribed limits.

CHAPTER SIX

MITIGATION MEASURES

6.1 INTRODUCTION

The preceding chapter identified and assessed a number of potential and associated environmental, socio-economic and health impacts of the project. At the end of the assessment, each negative environmental impact was defined as being of high, moderate or low significance. To further assure environmental sustainability of the project, mitigation measures are presented in this chapter for impacts identified as having high and moderate significance. No additional mitigation measures are considered necessary for some impacts of low significance. This is either because these impacts are by their nature of little or no significance, and or because they have been adequately mitigated through design, construction plans and plant operations philosophy.

6.2 APPROACH TO IMPACT MITIGATION

Mitigation measures are options that can be used to either completely eliminate or minimize identified negative impacts of a development project.

The traditional approach to design and operations is to ensure compliance with the applicable safety codes and standards during design. However, compliance with regulations, codes and standards may not be sufficient to achieve an appropriate level of Health Safety and Environmental (HSE) performance in design. Design codes are generic and applicable to facilities in a number of geographical areas that face a wide range of technical challenges unique to the project.

The HSE objective with respect to the design and operation of the project is to implement all cost effective measures to reduce the risk and effects from major hazards including accidents. The approach has been to use this as a goal rather than a prescriptive objective that cannot be achieved without following a documented process of identification, assessment, reduction and continuous monitoring.

Thus the steps taken in the HSE process for the Project included the following:

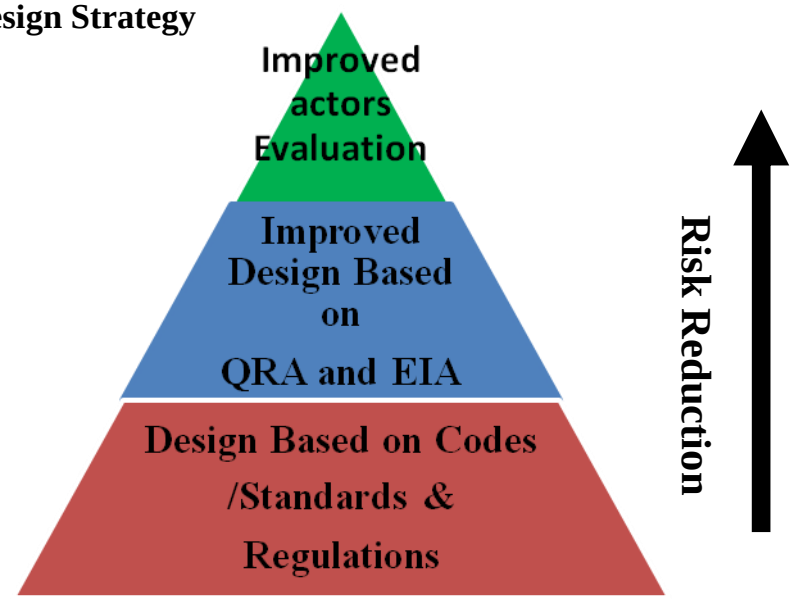
- Design based on Codes, Standards and Regulations.
- Improved design based on Quantitative Risk Assessment and Environmental Impact Assessment

- Improved design from human factors evaluation

The hierarchical order of importance of these HSE design elements is illustrated in Figure 6-1

Figure 6-1

Risk Based Design Strategy



In line with the HSE performance objectives of the Project Development a number of mitigation measures have been built into the project design and operating philosophy. These in-built mitigation measures are expected to significantly improve the environmental sustainability of the project and are therefore presented in subsequent sections together with additional mitigation measures that shall be put in place for moderate and high significance negative impacts identified in the preceding chapter. Some mitigation measures are also aimed at enhancing the positive impacts of the project.

6.3 RECOMMENDED MITIGATION MEASURES AND RESIDUAL IMPACTS

The primary aim of the EMP process is to identify and evaluate the significant environmental impacts of a project with a view to developing methods of mitigating these effects. The ultimate goal of the Project development EMP is therefore to achieve as much as possible, a design and operations that have no significant residual environmental impacts.

The associated and potential negative impacts of the project have been identified and discussed in Chapter 5 of this report. The essence of this section of the report is to address all the identified negative impacts through the provision of mitigation measures that will help to minimize to the barest minimum or completely eliminate the impacts at the various stages of the project implementation.

In this EMP study, negative impacts categorized as being of low significance are considered to have acceptable residual impacts while negative impacts of high and moderate significance are re-examined after mitigation. Comments are then provided as to the nature of residual impacts. Table 6.1 gives a summary of mitigation measures for all the negative impacts.

6.4.0 Environmental Impacts Mitigations

6.4.1 Air Quality:

Emissions and Particulates

The primary air emissions during project construction shall arise from Asphalt Plants, construction vehicles and emissions from cutback bitumen during the pavement asphalt laying process. Some of these emissions have carcinogenic properties. Emissions from earth-moving and construction equipment and other vehicles plying the road are likely to increase the concentrations of Carbon Monoxide (CO), Nitrogen Oxide (NOx), Lead (Pb), Suspended Particulate Matter (SPM) and Hydrocarbons (HC) along the project route. These pollutants can induce severe health problems. For instance, CO can interfere with the absorption of oxyhaemoglobin and an acute exposure to NOx is considered a major cause of respiratory diseases, while HC concentrations can cause severe eye irritation, coughing and sneezing. The changes in air quality are considered significant since they could have direct implications on health.

6.4.1.1Mitigation

Operational emission impact will be mitigated by the upgrading of the existing roads and consequent speeds control to reduce acceleration/deceleration on the roads and reduce CO, HC and NOx emissions.

During site clearing, preparation and *construction, all equipment and vehicles shall have their engines properly maintained and tuned to eliminate noxious emissions.*

Workers shall be made to wear appropriate nose masks and PPEs

6.4.2 Dust

Airborne dust shall be generated from vehicular movements, Road Plants (road dust) and construction equipment. Dusts may be also generated from point or diffuse sources, which include sources such as exhaust stack, Adequate mitigation measures shall be put in place to ensure almost zero fugitive SPM emissions and limit exhaust SPM emission to <200 ppm.

6.4.2.1Mitigation

- *The construction site shall be watered regularly to minimize fugitive dust emissions.*
- *Construction equipment and the Stone crusher and batch mixing plants will be located at least 300m from residential and other sensitive receptors, Stone aggregates granites etc shall be covered where possible.*

6.4.3 Noise

The main noise sources during construction are construction machinery, which are known to generate noise at levels from 76 dB(A) to 98 dB(A) measured 5 m from running machines. The noise will have an impact mostly on construction workers and residents living near the construction sites. The noise sources during site preparation and construction activities are the internal combustion powering diesel engines for civil works. Activities at the road construction and road sites involving blasting, drilling, use of explosives and movement of heavy equipment and envisaged increase in volume of traffic will cause safety problems to the general public. Noise impacts will cause nuisances, hearing loss and general disturbance to workers and the general public.

6.4.3.1 Mitigation

- *During construction and facility operation, workers will be provided with ear muffs and other personnel protectors equipment (PPE);*
- *Limit construction to Daytime*
- *The Equipment will be well maintained so that their noise will be within acceptable level*

6.5.0 Land Resources:

6.5.1 Rivers and Stream crossings

Although the project is a road rehabilitation project along an existing road alignment, however, the road might need to be widened in certain sections. Crossing of rivers and streams by heavy construction equipment shall cause bank failures and loss of riparian vegetation along the river banks in those sections. This is not anticipated because only seasonal stream resulting from rain water run off exist along the entire length of the section.

6.5.1.1 Mitigation

Storm water channels and sluice gates shall be constructed where the need for modification of river channel arises.

6.5.2 Site Clearing

Site clearing will destroy the plant community and wildlife habitat, leading to the death of plants and relatively immobile animals as well as the migration of the animals that are capable of escaping. This will lead to the reduction of biodiversity in the area and possible soil erosion and landslides caused by rain water due to soil exposure.

6.5.2.1 Mitigation

Minimal land take will be affected during the preconstruction stage. Vegetation clearing shall also be restricted to road shoulders. Tree stumps shall be left in place along cleared highway corridors to hold the soil.

6.5.3 Vegetation Clearing

Clearing of surface vegetation especially at the project location and road construction will expose the soils and lead to localized flooding of adjacent farmlands and impairment of associated soils.

6.5.3.1 Mitigation

Development activities, especially land preparation, will be carried out in the dry season (November-April) in order to minimize interference by heavy rainfall, otherwise adequate drainage channels will be constructed to convey storm water runoff from field to retention ponds.

6.6 Waste Management Issues

Experience in Nigeria has shown that sections of newly constructed roads are usually turned into waste dumps due to the absence of sanitary waste dumps especially close to urban areas. Also, abandoned burrow pits by construction firms are usually converted to waste dumps by local authorities thereby also encouraging waste truckers to dump by the road side close to his converted dumps. This project may be affected by this menace. Roadside litters from indiscriminate disposal of waste from vehicles shall also affect the aesthetic and environmental cleanliness of the roads.

6.6.1 Mitigation

- *Very aggressive public relations campaign shall be carried out to enlighten people on the need for proper disposal of waste at Government approved dump sites.*
- *Burrow pits shall be located further away from roads to discourage the dumping of waste in them. The pits could also be reclaimed or converted to fish ponds.*

6.7 Hydrology

6.7.1 Crossing of rivers, streams, canals and ravines;

Construction activities leading to accidental or deliberate dumping and piling of soil material during the project shall cause deviation and changes in river/ stream hydrology and/ or obstruction of the river/ stream. Modifications to the natural drainage patterns and groundwater

elevation are also possible impacts consequent on changes in river hydrology due to road construction. In addition, mud deposits extracted from the river for construction activities will also have negative impacts on the benthic environment. Hydrological changes in river courses can also affect farmland and grazing lands leading to land foreclosure by owners.

6.7.1.1 Mitigation

- *A soil material handling policy shall be adopted by construction firms such that soils are not indiscriminately dumped.*
- *Storm water channels and sluice gates shall be constructed where the need for modification of river channel arises.*

6.7.2 Erosion and Landslides Due to Rains

Heavy rains may result in landslides and erosion at burrow pits. Where these pits are located close to the road construction or close to natural drainages, the hydrology of the rivers shall be affected. Flash flooding could also wash away road sections into river courses.

6.7.2.1 Mitigation

- *Burrow pits shall be located away from road construction areas. The pits shall have their slopes stabilized to prevent erosion.*

6.7.3 Waste Dumps

Waste dumps and road side litter could also block the natural drainage flow and cause changes in flow hydrology and direction.

6.7.3.1 Mitigation

Road side litter shall be discourage and the construction crew shall immediately evacuate waste to recognized dumpsite if found during construction.

6.8 Water Quality

6.8.1 River/stream sedimentation;

During bush clearing and construction stage, silt from disturbed soil and in-river construction activities may result in increased suspended solids (SS) in rivers/ streams immediately downstream from the road. Such impacts will be temporary and limited to small areas downstream, but can affect a large portion of an adjacent fish pond. Furthermore, runoff of sediment resulting from increased soil erosion and from dust and sand at construction sites may lead to increased turbidity in surface watercourses.

6.8.1.1 Mitigation

- *During construction, surface water flows shall be controlled and if necessary channelled to temporary discharge points to minimize the potential threat of erosion and siltation in the receiving water channels. It is expected that construction activities would be limited to dry season period when the stream channel has dried up due to absence of rain water.*

6.8.2 Use of Chemicals and pesticides;

- Construction camps will generate domestic effluent of 60 L per person per day on average, and total wastewater in the largest camp may be up to 60,000 L per day. If discharged directly into natural water bodies, the domestic effluent from construction camps would raise COD concentrations by about 1.2 mg/L in large rivers and up to 34.7 mg/L in smaller streams

6.8.2.1 Mitigation

- *All contractors will be required to build septic tanks at their construction camps for waste disposal. They will also be required to have sound environmental management programs for the storage of hazardous materials, solid waste collection and disposal, and environmental contingency plans.*

6.8.3 Fuel and oil spills;

Contamination of surface and groundwater will arise from chemical effluents, solid waste and domestic sewage discharge and discarded lubricants, fuel and oils. Discharge of effluents has potentials for water pollution with attendant effect on water quality and aquatic life.

6.8.3.1 Mitigation

- *Chemicals and Fuel storage areas shall be properly bunded*
- *Alternative source of potable water shall be provided during construction*

6.8.4 Fuel Spills from Road Usage.

Surface water pollution resulting from spills or accumulated contaminants washed off the road surface. Small quantities of sediment and dripping oil and grease from the road surface may be washed out and discharged to nearby surface water bodies as runoff during the rainy season. Groundwater pollution may result from wastewater produced by construction crews and by the accidental spillage of fuel, lubricants and any other hazardous chemicals used in the process.

6.8.4.1 Mitigation

Although there was no surface water body of serious economic importance identified along the stretch of the road, suitable drainage shall however be constructed for the road to channel run off from rain water.

6.9.0 Biological:

6.9.1 Land clearance and loss of habitat;

The proposed project is expected to have direct impact on wildlife and forestry in the following ways: (a) Site preparation and construction will result in the reduction of wildlife habitats for arboreal and in faunal species. (b) Bush clearing will lead to the loss of important vegetation and economic tree species.

6.9.1.1 Mitigation

- *Selective and controlled clearing of vegetation restricted to what is needed for the project will be carried out*

- *To mitigate the impact of loss of vegetation, trees and bushes will be planted on both sides of the expressway, and land will be seeded to grass the embankment in the road landscape plan.*

6.9.2 Biodiversity loss

Impacts on biodiversity can be caused by facilitation of access to and spontaneous settlements in natural areas as the road shall increase access to hitherto inaccessible areas;

There will also be biodiversity loss caused by facilitation of access as a result of the rehabilitation of the road. Increased mechanized farming activities shall be taken place along the road as it is now easier to haul farm produce to urban centres. Facilitation of greater access by the rehabilitated road shall also lead to rises in the incidences of hunting expedition by local hunters and fuel wood cutting.

6.9.2.1 Mitigation

- *Community assistance programmes will be provided along with project development to boost the health status and socio-economic conditions of the stakeholders;*
- *Trees and plants of economic interest that are not within developed areas will be conserved;*
- *Ornamental trees and shrubs will be planted as additional environmental conservation measures.*

6.10.0 Socio-Economic:

6.10.1 Spread of STIs including HIV AIDS

The proposed rehabilitation of Takai-Albasu-Gaya road has re-potential for the dissemination of STIs including HIV AIDs. This is because most of the workers will be spending long period outside of their homes and usual sex partners. This may result in risky sexual behaviour including unprotected sex with new partners and or commercial sex workers.

6.10.1.1 Mitigation

- *Suitable mix of a range of HIV intervention measures will be adopted. This will include awareness creation on behaviour communication change (BCC) including the promotion of abstinence, fidelity to spouse or usual sex partner and use of condom. IEC materials will be used to convey this message to the workers and the host community.*

6.10.2 Rural - Urban Migration

In-migration occasioned by the increased mobility shall lead to changes in demography as this road shall encourage the rural urban migratory pattern prevalent in Nigeria.

6.10.2.1 Mitigation

- *Youths from the host communities will be given priority in unskilled labour employment;*

6.10.3 Archeological and Heritage Sites

There are no heritage properties, National Historic Sites, or known archaeological/fossil sites within the corridor for the proposed alignment.

6.10.3.1 Mitigation

- *Adequate care shall be taken to enlighten construction workers on the possible unearthing of archeological relics*
- *Awareness training of workers shall be conducted on local heritage sites, graves and shrines to avoid desecration and possible conflicts with the local communities.*

6.10.4 Traffic Congestion and Road Accident

The rehabilitation of Dingaya-Galambi-Rungo Road may lead to Traffic congestion and road accident, if not properly managed

6.10.4.1. Mitigation

- *Traffic congestion and road accident will be properly managed through the use of road signs, diversion and Flag men including the use of e tapes to cordon off the construction sites.*

Table 6.1: Impact and Mitigation Responsibilities

Environmental Component	Impacts	Mitigation Required	Responsibilities for Implementation	Responsibilities for Monitoring	Cost (N)
Air Quality	Noxious Emissions and Particulates	Speed Control, proper Engine maintenance Use of PPEs	Contractors	RSDT, FERMA/ FMENV, State EPA/Min of Environment	N0.75m

Environmental Component	**Impacts**	**Mitigation Required**	**Responsibilities for Implementation**	**Responsibilities for Monitoring**	**Cost (N)**
	Dust	Dust suppressants, water spraying, covering of stockpiles etc	Contractors	RSDT, FERMA/ FMENV, State EPA/Min of Environment	Part of project Cost
	Noise	Use of PPEs, restriction of work to day time and the make sure the machines are in good conditions.	Contractors	RSDT, FERMA/ FMENV, State EPA/Min of Environment	N0.75m
Land Resources	River Bank failures, loss of Riparian vegetation	Construction of storm water drainages and slope stabilization	Contractors	RSDT, FERMA, FMENV, State EPA/Min of Environment	Project determined
	Reduction in biodiversity from soil erosion and landslides from site clearing activity	Minimal land take, vegetation clearing restricted only to road shoulders, Highway corridors to	Contractors.	RSDT, FERMA, FMENV, State EPA/Min of Environment	Project Cost

Environmental Component	**Impacts**	**Mitigation Required**	**Responsibilities for Implementation**	**Responsibilities for Monitoring**	**Cost (N)**
		be left intact			
	Flooding of Adjacent Farmlands from vegetation clearing	Construction activities to be carried out mainly in the dry season Construction of drainage channels	Contractor.	RSDT, FERMA, FMENV, State EPA/Min of Environment	See project Costs
	Waste dumps in burrow pits, loss of aesthetics	Burrow pits to be located far from road corridors, public awareness campaigns	Contractor.	Government health officials, FMENV, State Min of Env, RSDT,	See project Costs
Hydrology	Loss of farmlands due to changes in river hydrology.	Soil material handling policy, storm water drainages etc	Contractar	RSDT, FERMA, FMENV, State EPA/Min of Environment	See project Costs

Environmental Component	**Impacts**	**Mitigation Required**	**Responsibilities for Implementation**	**Responsibilities for Monitoring**	**Cost (N)**
	Erosion and landslides due to heavy Rains	Slope stabilization of burrow pits to prevent erosion	Contractor	Government health officials, FMENV, State Min of Env, RSDT,	See project Costs
	Blockages of Natural drainage from dumping of roadside litter	Evacuation of wastes to approved dumpsite, public awareness campaigns	Contractor	Government health officials, FMENV, State Min of Env, RSDT,	See project Costs
Water Quality	Turbidity and sedimentation	Control of surface water flows, use of turbidity nets,	Contractors	RSDT, FERMA, FMENV, State EPA/Min of Environment	See project Costs
	Reduction in water quality from untreated effluents, chemical spills etc	Biological Sewage treatment, proper handling of chemicals,	Contractors	RSDT, FERMA, FMENV, State EPA/Min of Environment	N1.5m

Environmental Component	**Impacts**	**Mitigation Required**	**Responsibilities for Implementation**	**Responsibilities for Monitoring**	**Cost (N)**
	Contamination of groundwater from fuels spills during road usage	Construction of adequate road drainages	Contractors	RSDT, FERMA, FMENV, State EPA/Min of Environment	See project Costs
Biological	Loss of fauna and flora due to land clearance	Selective clearing of vegetation, re-vegetation where necessary	Contractors,	RSDT, FERMA, FMENV, State EPA/Min of Environment	N0.75m
	Biodiversity loss from opening of access for increased farming and hunting	Public awareness campaigns to reduce tree felling, hunting etc by locals	Contractors,	RSDT, FERMA, FMENV, State EPA/Min of Environment	N0.5m
Socio-Economic	Loss of income from agricultural lands	Compensation for loss of farmlands	RSDT.	RSDT	To be determined
	Social disruptions from Loss of private properties e.g kiosks etc	Payment of compensation, Resettlement	RSDT.	RSDT.	To be determined

Environmental Component	**Impacts**	**Mitigation Required**	**Responsibilities for Implementation**	**Responsibilities for Monitoring**	**Cost (N)**
	Loss of public utilities, eg telephone lines, power cables, water lines etc	Replacement of removed infrastructure, public awareness campaigns etc	Contractors	RSDT	See project Costs
	Creation of Squatter settlements and shanty towns	Control of shanty town development	Contractors	RSDT, FERMA, Town Planning Authorities	To be determined
	HIV Aids and other related health issues	Public awareness on alcohol abuse, unprotected sex, etc, provision of adequate health facilities	Contractors	RSDT, FERMA	N0.75m
	Loss of communal income due to rural urban migration	Youths to be given priority for unskilled jobs	Contractors	RSDT, FERMA,	N0.5m

Environmental Component	Impacts	Mitigation Required	Responsibilities for Implementation	Responsibilities for Monitoring	Cost (N)
	Desecration of archeological sites and heritage areas	Awareness training for workers on heritage sites, taboos and customs	Contractors,	RSDT, FERMA, FMENV	Nil
Traffic Congestion and Accident	Delays in travel time, irritation, injuries and death	Provision of road signs diversion, flag men and security tapes	Contractor	RSDT, FERMA, FMENV	N0.3m

6.11 Stakeholder Consultation Process

All the Environmental Social and Health Monitoring issues to be monitored shall be in conjunction with the State Ministry of Environment and the respective LGA.

Measures for which consultations will be undertaken as well as the goals and expected outcomes of these consultations shall be identified prior to the commencement of monitoring exercises. Mitigation measures for social economic impacts generally require that some consultation is carried out before they are implemented.

Parties to be consulted shall include the primary stakeholders on the Dingaya - Galambi - Rungo road while the secondary stakeholders are; The Federal Ministry of Works, Housing and Urban Development, Federal Ministry of Environment, as well as the Jigawa State Ministry of Environment (SMENVs), State Ministries of Works and Housing, the affected Local Government Area, major Highway users such as the National Union of Road Transport Workers (NURTW) and The Road Transport Employers Association of Nigeria (RTEAN) shall also be consulted during the EMP implementation stages.

For the monitoring aspects, consultation will be carried out at two main levels - public and institutional consultation. Public consultation will be conducted at major towns/villages all along the project road as many are to be affected by the project. Interviews with individuals belonging

to different social and/or economic categories and concerned local administrative bodies will be made.

The consultation process that has started during the preparatory stage would be continued during the construction and operation phases of the project.

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 INTRODUCTION

An Environmental Management Plan (EMP) is a company's organizational plan or programme used in the management of operations to ensure environmental sustainability. The EMP provides the procedures and processes that should be incorporated into the organization's activities to measure and check, in a continuous mode, the compliance with, and effectiveness of the mitigation measures recommended to minimizing or eliminating the identified negative impacts of the planned project throughout its life cycle. In addition to this, the EMP is also regularly used to ensure compliance with statutory requirements and corporate safety and environmental policies attached to the organization's operations.

The application of the EMP usually starts from the pre-construction phase, when all the mechanisms required for effective implementation of recommended mitigation measures are put in place. Other components of the EMP usually find application during the project operational phase, as monitoring tools for the compliance of specific environmental attributes with required operational regulatory standards.

In view of the foregoing, the EMP presented in this section of the report has taken into consideration, all the specific project activities covering the site preparation/construction stage and the project operation/maintenance stage; predicted impacts of the proposed project as contained in Chapter 5; and the prescribed mitigation measures to control or completely eliminate the negative impacts of the proposed project as contained in Chapter 6. The Contractor to the project shall incorporate this EMP into all the stages of its activities to manage, monitor and control all the potential and associated impacts of the project on the bio-physical and socio-economic characteristics, as well as, the health and safety of the workers and the public in the area. The implementation of the EMP by the Contractor in the course of the execution of the project shall also be in accordance with the Nigerian and other applicable international HSE standards and regulations.

In order to make the implementation of the proposed EMP worthwhile, a two-pronged environmental management framework has been developed for adoption. The framework consists of,

a. an Environmental Management System (EMS), and
b. an Environmental Monitoring Programme (EMP).

7.2 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

According to ISO 14001, an Environmental Management System (EMS) is that part of the overall management system which includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the Environmental Policy. What this definition connotes is that, for an EMS to be put in place in an organization, the organization must already have an Environmental Policy[1] which is:

- Commitment by leadership at all levels to foster a culture of operational excellence by assuring alignment of vision, expectations, resources and accountabilities.
- Define and widely communicate the operational excellence mission, vision, values, strategies, and objectives.
- Comprehensively identify high-level issues, risks, opportunities, and gaps in system and operating practices that can impact its current or future ability to achieve world-class performance. Assess and prioritize those identified high-level issues, risks, opportunities, and gaps using a systematic, cross-functional approach. Identify a wide range of possible risk-reduction alternatives (prevention and mitigation) for all identified high-level risks.
- Establish clear metrics to measure statistically significant performance improvement toward goals and targets for operational excellence. Implement the action plans and monitor Operational Excellence (OE) performance.
- Establish a job selection process to fill defined Health, Safety and Environment (HSE)-sensitive jobs to ensure individuals have the knowledge, skills, performance history, abilities, and demonstrated behaviours to conduct their activities in an incident-free manner, in compliance with applicable laws, regulations, company policies, and operational excellence requirements.

- Establish processes to ensure that documents and records that are critical to operational excellence are current, controlled, and accessible. The retention of documentation and records should be established and recorded, and procedures should be maintained regarding their availability, confidentiality, and destruction.
- Implement a process to ensure that contractors ("agents") authorized to act on behalf of the company understand and comply with relevant company policies and procedures.
- Establish and maintain appropriate processes for management to regularly monitor operational excellence performance, Conduct regular operational excellence performance evaluations to ensure that the system is implemented and maintained and remains effective.

The project Contractor shall be committed to incorporate all the elucidated components of an OEMS into its operational procedures for the implementation of the proposed project.

7.3 ENVIRONMENTAL MONITORING PLAN

This Environmental Monitoring Plan will ensure that the integrity of the Road Project has been developed covering the project activities from site preparation, through construction, commissioning, operation of the highways, decommissioning and abandonment. The plan relates to the handling of hazardous materials and wastes, emission and discharge monitoring, site inspection and auditing, adverse weather preparedness, and decommissioning. The plan takes account of national and international standards for (environmental) planning, such as the International Standards Organization, the Health, Safety and Environment Management System, FERMA/RSDT Environmental Management Plans and environmental standards. The monitoring programme has also been outlined. The programme will help to verify the effectiveness of the prescribed mitigation measures is designed to guarantee and achieve the implementation of the EMP findings thus;

- Effective integration of EMP into project design, from construction through abandonment;
- Environmental Monitoring of development phases including operations and close down;
- Specific training of staff and contractors to enhance environmental awareness; and

- Sustained consultation with all stakeholders at all times on the field development.

7.4 MONITORING PLAN

The environmental monitoring program for the implementation of the Road Sector Development Project (RSDP) will serve as an integral part of the operational activities and is expected to generate the requisite information for environmental management and environmental information dissemination.

It is anticipated that monitoring will be conducted during all phases of the project: design, construction and operation. This plan will play a pivotal role in ensuring that the trends for specific parameters are tracked and it will provide information on compliance with legislative norms, set guidelines or desirable operational limits; and form the basis for corrective actions and modification of activities if necessary. The intensity of sampling will depend on the time and location of the development activities and results derived from monitoring data.

7.4.1 Monitoring Objectives

The aim of the monitoring is to establish appropriate monitoring criteria to verify the predicted impact of the project, and to ensure that any unforeseen impacts are detected and the mitigation adjusted where needed at an early stage. The monitoring will keep relevant records to ensure compliance with sound environmental procedures recommended. The monitoring plan will ensure that mitigating measures and impacts of the project during construction and operation phases are implemented. Adequate funds will be provided for this purpose through the project.

Other specific objectives of the monitoring plan are to:

- check the effectiveness of suggested mitigative measures;
- demonstrate that the project activities (construction and operation) are carried out in accordance with the prescribed mitigation measures and existing compliance regulatory procedures; and
- provide early warning signals whenever an impact indicator approaches a critical level.

Impact indicators are defined in terms of carrying capacity, threshold levels, and regulation and enforcement standards. Implementation of the EMP will allow for control and manage the timing, location and level of impacts and potentially provide the cause and effect data for the empirical verification or validation of various predictive models of action/impact relationships.

7.4.2 Monitoring Requirements

A monitoring program requires a number of components to ensure effective results. These include:

- Relevant baseline data

- Verifiably objective indicators for each project and project component for which monitoring will be conducted;
- An independent body responsible for monitoring;
- Those responsible for monitoring must have the capacity for such;
- Monitoring on a regular basis;
- An effective monitoring reporting mechanism including feedback and commitment to action on monitoring results and recommendations.

Table 7.1: Monitoring Variables, Linkages, Indicators and Frequency

Variable to be Monitored	Linkages	Indicators to be Considered	Baseline Data to be Considered	Monitoring Frequency
Natural Habitat				
Habitat	Rare and endangered species needs	Area and quality of habitat	Species abundance	Yearly
Flora		Populations of important flora	Current species list and numbers	Quarterly
Fauna		Populations of important fauna	Current species list and numbers	Quarterly
Fisheries				
Populations	Community economic needs; water quality and quantity	Population size and offtake	Current population and offtake	Quarterly
Species composition	Ecosystem health; water quality and	Species mix	Current species mix	Quarterly

Variable to be Monitored	**Linkages**	**Indicators to be Considered**	**Baseline Data to be Considered**	**Monitoring Frequency**
	water quantity			
Water Resources				
Groundwater quality	Health, crop production, desertification	Quality of water (chemical composition)	Current chemical composition	Monthly
Groundwater quantity	Health, irrigation	Depth and yield	Current depth and yield	
Surface water quality	Health, natural habitats, flora and fauna, irrigation	Quality of water (chemical analysis / indicator species of water quality)	Current chemical composition / fauna and flora inventory (e.g. macroinvertebrates, microinvertebrates, microflora)	Monthly
Surface water quantity	Health, crop production	Yields and flows (seasonal)	Current yields and flows (in different seasons)	Monthly

Variable to be Monitored	**Linkages**	**Indicators to be Considered**	**Baseline Data to be Considered**	**Monitoring Frequency**
Land Resources				
Soil erosion	Crop productivity, cultivation techniques, watering points, livestock management	Sediment loading	Sediment loads	Monthly
Soil quality – chemicals	Pesticide use	Chemical analysis soil	Chemical analysis of soil	
Soil quality – waterlogging	Irrigation, drainage	Soil analysis, crop production	Soil analysis, crop production on controlled plots where possible	Monthly
Air Quality				
Particulates, Emissions	Human Health	Nox, SOX, SPM., COX etc	Ambient Particulates, Emissions levels	Monthly
Social and Health Issues				
HIV/AIDS	General increased	Incidence of	Existing levels of	Yearly

Variable to be Monitored	**Linkages**	**Indicators to be Considered**	**Baseline Data to be Considered**	**Monitoring Frequency**
	activity through the project	HIV/AIDS through clinic records	HIV/AIDS	
Water borne diseases	Drainage, irrigation	Health statistics at local clinics	Status of health re: water borne diseases	Monthly
Economic need from other natural resources (forestry, fishery)	Irrigation, drainage, conflicts	Harvest results, population size, area under forest cover, forest stand condition	Fishery population by species, forest stand volumes and areas	Quarterly
Cultural Issues				
Cultural sites	Cultural and social systems and community needs	Sites remaining	Inventory of sites	Yearly

Variable to be Monitored	Linkages	Indicators to be Considered	Baseline Data to be Considered	Monitoring Frequency
Social systems	General community and individual member satisfaction	Community social structure	Current social structure and important aspects of structure	Yearly
Conflicts	Land and resource use	Number and nature of conflicts	Current conflict levels and number and nature of conflicts from RSDP	Yearly

Specifically, the issue of Social & health problems (new communicable diseases, sexually transmitted infections (STIs), HIV/AIDS) from influx of job seekers & post-construction demobilisation of large contingent of workers would be given adequate attention in view of its socio-economic implication when project implementation commences. This would be through *Awareness campaign to enlighten the communities/field workers on the implications of drug and alcohol abuse, unprotected sex, prostitution and the need to sustain healthy lifestyle and behavior including the use of BCC/IEC materials.*

7.5 RESOURCES FOR EMP IMPLEMENTATION

The resources required for implementing the EMP are basically personnel and finance. The key stakeholders the Road Sector Development Team (RSDT), the Federal Roads Maintenance Agency (FERMA), Federal Ministry of Works, Housing and Urban Development (FMW-HUD), the Road contractor, Federal and State Ministries of Environment, and to the communities.

7.6 INSTITUTIONAL ARRENGEMENT FOR IMPLEMENTING THE EMP

The overall objective of the project is to ensure that the project implementation is integrated harmoniously into the communities. The monitoring staff and personnel shall achieve the following objectives:

- propose management rules and specific measures that are compatible with sustainable development while implementing the project
- promote awareness to construction workers and the general public regarding environmental protection,
- execute concrete means of applying the EMP.

In the execution of the project, the RSDT will be responsible for the implementation of the mitigation measures through their contractor who would be accountable to the RSDT. This contractor shall have an Environmental Engineer on site who will be responsible for all environmental issues. Whereas the World Bank will monitor the execution/ implementation of the project by RSDT. FERMA on the other hand will regulate the contractor work, while the EIA Division the Federal Ministry of Environment in collaboration with affected state Ministry of Environment will carry out regulatory monitoring to ensure that all agreed mitigations are actually implemented in line with regulatory requirements.

RSDT shall be represented by Social and Environmental Officer who will be responsible for the implementation of the EMP in close collaboration with FERMA, FMENV and the Local environmental regulating bodies. Alternatively, an independent consultant may be hired by the RSDT to implement the EMP. The consultant shall have professionals qualified in the following disciplines:

- Environmental Assessment & Monitoring
- Soil & Water Conservation
- Highways and Civil Engineering
- Public Health
- Sociology and Socio-Economics

The social and environmental specialist of the RSDT shall be responsible for the implementation of the environmental monitoring and the EMP. His/her responsibilities shall include:

- Coordinate, liaise with and monitor the contractors
- Compile and prepare periodic environmental reports for submission to the World Bank
- Review Environmental Monitoring reports from consultants in collaboration with Regulators
- Data Management

7.7 CAPACITY STRENGTHENING

Environmental Monitoring oversight responsibilities are vested in the Federal Ministry of Environment. The FMENV has environmental officers for monitoring issues; however, the capacity of the officers to cope is definitely not enough. The World Bank shall also carry out monitoring as one of its safeguard measures. The project shall also assist in the institutional framework and capacity enhancement of the State Ministry of Environment. State Ministries of Environment operate virtually similar structure as the Federal Ministry of Environment. The EIA Dept of the Ministry also has monitoring powers although the Federal Ministry of Environment carries out joint monitoring with the State Ministries as well as the Local Government Areas where projects are sited. Serious gaps exist in the ability of the State Ministries to monitor environmental issues arising from this project. To this effect the Project should train at least five officers from the RSDT, FERMA, State Ministry of Environment and the Host L.G.A. A dedicated Monitoring desk for this road project should also be created in the Monitoring units of the State Ministry. Monitoring kits, personnel protective equipment should also be provided for the project. Table 7.2 shows the capacity strengthening measures.

Table 7.2: Institutional Capacity Strengthening Program

Target Audience	Description	Application	Duration
RSDT staff	General environmental awareness seminar that will include ecological and social science principles, legal responsibilities, consequences of non-sustainable development, costs of poor environmental decisions, and introduction to the	Personnel require appreciation of WB's, Federal/State environmental policies, as well as, an appreciation for the need to support environmentally sustainable development.	Three days seminar

Target Audience	Description	Application	Duration
	EMP process.		
RSDT's Environmental specialist, FMENV and State MOE environmental and social specialists	An in-depth comprehensive course on environmental management including legal requirements, EMP methodology, Impact determination (methods) and mitigation analysis, public involvement methods, EMP preparation, monitoring techniques, preparation of EMPs, TORs, and other. Course will include field visits and classroom exercises.	The target audience will be responsible for EA review at the State level and for preparing TORs for EMP consultants as well as monitoring consultants' work and final approval of EMPs. Target audience will also be responsible for conducting environmental audits on selected sub-projects and for periodic monitoring of sub-project implementation to ensure compliance.	10 days workshop
LGA Staff	General environmental awareness seminar that will include ecological and social science principles, legal responsibilities, consequences of non-sustainable development, costs of poor environmental decisions, and introduction to the EMP process.	Local Government level staff requires an appreciation for the WB's and Nigerian environmental requirements, as well as, an appreciation for the need to support sustainable development.	Three day

7.8 COST ESTIMATES

The cost estimates are based on the assumption that resource person/s (is) are likely to come from other parts of the country and therefore require travel allowances; participants of this training should could come from the collection or selection of members RSDT, FERMA, State Ministry of Environment and the affected L.G.A who should attend the exercise during the day only but will receive a per diem within the range of the estimated/ budgeted amount of about N431,250.00 per training session. It is proposed that the training programme will be implemented two times a year,

over first four years of the project cycle. Thus, the total training cost is estimated at N4.0m for the entire period.

7.9 EMP BUDGET AND RESPONSIBILITIES

Based on available data, a sum of N750M will be allocated to the project. Of the total budget, it is recommended that at least 0.01% of the total budget will be allocated for environmental and social concerns.

Table 7.3: Budget and Responsibilities

Item	**Budget** (estimate)	**Responsibility**
Mitigation	N9m	Contractor
Management	N4.0m	RSDT
Capacity Strengthening	N3.75m	RSDT/World Bank
Monitoring	N5.0m	RSDT/FMENV/State Min Env
Total	**N21.75m**	

7.10 DEMOBILIZATION PLAN

All projects and/or activities, no matter how durable they are, usually have life spans. The lifespan of any project is primarily hinged on a number of considerations, including: the design basis and construction materials; availability of raw materials and feedstock; acceptability of the end-product; maintenance and technological development. For this project, the lifespan of the current design is not less than 15 years. This, in effect, means that the Dingaya - Galambi - Rungo road will be expected to be fully operational for at least 15yrs, and may be extended, if the route is considered still viable, useful and in good condition for the motorist and the general populace.

Though, the planned project is not expected to be decommissioned since it is a permanent infrastructure development. However, given the known and acknowledged fact that projects necessarily impact the environment, either positively and/or negatively during the construction phase, it is important to put in place plans to recover and/or restore the project site to its original state after the project construction phase is completed. This requires a good understanding of all the environmental components of the project on the ecosystem during the construction phase. It is therefore environmentally wise to take into cognizance, this component during the planning stage.

This section of the report provides an overview of the various decommissioning activities that will accompany this project after the construction phase and therefore need to be planned for even at this conceptual stage.

7.11 DECOMMISSIONING ACTIVITIES

7.11.1. Rehabilitation of Construction Activities

Construction Camps:-

Permanent camp;

- Concrete and compacted earth platforms
- Excavation for septic tank
- Access roads running into and through the camps

Concrete platforms will need to be broken up and rubble taken to an approved waste dump site or used to rehabilitate borrow pits. The exposed surface must be tested for contamination by FMEnv accredited laboratory. If any contaminants are found, the contaminated soil shall be removed along with the concrete to a site acceptable to the ECO. Re-vegetation must take place.

Access roads running into and through the camps and any other well-used thorough (whether pedestrian or vehicular), which have been denuded of vegetation and subsequently been

compacted, are to be checked for any substantial spillage of contamination including oils and fuels will be re-vegetated.

Temporary camps;

Rehabilitation will be necessary in the following areas:

- Compacted earth and un compacted earth platforms
- Access roads running into and through the camps

Compacted and un compacted earth platforms will be rehabilitated according to the methods described above. Access roads will also be rehabilitated.

Borrow Pits and Quarries

Note that this will only be applicable where material has not been obtained from external sources.

Borrow pits shall be filled with as much excess construction material as possible **but** shall be kept free from other waste. They shall be covered in soil stockpiled either from the original excavation of the borrow pit or from other sources, such as excess spoil material from the extensive areas of cut. If adequate amounts of fill material are available, excavation slopes should not be left steeper than 1:3, ripped and top soiled. Borrow pits/quarries must be closed and rehabilitated as soon as possible to reduce erosion and potential aesthetic impact of these areas.

Stockpiles

Once stockpiles have been removed the ground surface is to be inspected for compaction. Should it be required, the surface is then to be ripped and the revegetation process followed.

Spoil Dumps

Permanent spoil dumps could have to be established if required. The exact positions of these spoil dumps to be negotiated with the landowners, local administrators, and officials, and compensation paid as per the accepted procedure. No spoil dumps will be allowed in drainage areas where they will block drainage channels. Spoil material to be minimized through use in filling of erosion gullies, fill for road construction, storm water beams, stone pitching, and any other construction-related use. Spoil material shall be the last option. Permanent spoil dumps to be shaped 1 v: 3h, top soiled and vegetated. Care must be taken to ensure that the material is adequately compacted to allow safe access.

Re-vegetation Process

The basic re-vegetation steps, which need to be adapted to the project-specific environmental conditions, are detailed below.

1. Prepare the area to be re-vegetated for top soiling – this may require soil ripping and/or scarifying, and digging of steps or terraces. The scarification should take place to a depth of 150mm. If ridges are made, they should be about 100mm high and about 400mm wide.

2. Replace stored topsoil on the slope to be re-vegetated to a depth of between 75mm and 150mm (depending on the soil and slope conditions). The topsoil should be spread when it is dry by means of hand raking or mechanical balding and trimmed to a uniform thickness of not less than 100mm.

3. Apply seeds or grass sods according to the supplier's specifications. The seed must be fresh, good quality seed as specified in the sod mix, certified by the supplier and free from contamination by seeds of other species. Seed harvested from the site may be substituted only with the approval of the ECO.

4. If the indigenous grass seeds are used, they should be placed close together and leveled put on each other. Gaps between the sods should be filled in with topsoil. If sods are obtained from land being affected by the road construction process, there may be enough sods for close packing. In this situation, the sods should be placed in about 1m wide and spaced up to 2m apart.

5. Mulch should be applied to protect the seeded area from erosion. The mulch must be excessively fresh and green or in an advanced stage of decomposition as it could smother growth. It must be applied to a depth and manner that will prevent erosion by wind and water, but not completely block out the rays of sunlight to the soil or prevent penetration by young plants.

6. Protect the revegetated area from excessive trampling and any other factor that might cause erosion or compaction. No construction equipment, trucks or heavy equipment should be allowed onto revegetated areas.

7. Ensure that suitable temporary and permanent drainage protection is installed parallel with the revegetation process.

8. Water the seeded/planted area on a regular basis (according to need, but on average of twice per week).

9. Institute an appropriate maintenance and monitoring program for a minimum year. This program should include, monitoring of the success of seed germination growth of the plants, removal of invasive; weeds, replanting of areas revegetation has not been successful once the cause of the inhibiting factor have been identified and remedied, and repair of any funnels or erosion channel by the contractor must not allow erosion to develop on a large scale before implementing repairs.

Seed Mixes

Alternative seed mixes are provided for use under the various topographical condition of Nigeria. Vetiver grass (Vetiveria zizaniodes) for stabilization of steep slopes and erosion areas, are readily available, should a suitable indigenous mix not be available. The seeds applied by utilizing a combination of hand seeding with local labour (for minor work) and hydro seeding (for major grassing works). Vetiver grass (Vetiveria zizanioides) is not indigenous but is sterile and will not be invasive.

CHAPTER EIGHT

8.0 CONCLUSION

The Environmental Impact Assessment study was carried out with strict adherence to the guidelines and regulation of the Federal Ministry of Environment. The study has identified the environmental issues/impacts associated with project activities on the immediate environment. And, in order to minimize these impacts appropriate mitigation has been proffered.

Environmental Management is a planned, integrated programme aimed at ensuring that all of the unforeseen and unidentified impacts of a proposed project are contained and brought to an acceptable minimum. Strong emphasis should be placed on maintaining safe and healthy working conditions for personnel and minimizing the effect of project activities on the natural environment. These objectives are usually achieved through the implementation of the policy and guidance that integrate environmental management approaches into developmental and operational schemes.

In order to measure and quantify the impacts of the development project on the receiving environment, the following monitoring objectives are established:

(i) Monitor alterations in existing physical, chemical, biological and social characteristics of the environment.

(ii) Determine whether any detected changes in environmental components are caused by the project or other natural occurrences.

(ii) Determine the impacts of non compliance with EMP requirements by the contractor(s), in particular to monitor emissions and discharges and ensure compliance with local, national and international standards.

(iii) Determine the effectiveness of the ameliorating measures

(iv) Highlight areas of concern unforeseen in the EMP and provide a basis for recommending further amelioration measures.

On the socio-economic impacts, potentially, the project will provide social and economic opportunities capable of enhancing the economic growth of the host communities in particular and the country in general.

Thus, in view of the fact that all stakeholders shall be carried along during the project construction and operations and that there is no stern environmental, health, social or cultural issues that may warrant the cancellation of the proposed project, it is therefore strongly recommended that project can be embark upon as proposed while strictly adhering to the

proffered mitigation measures. In identifying the key impact indicators, priority is given to environmentally sensitive areas, and, in this regard, it is noteworthy that the entire project area falls under this category. Based on the results of baseline studies and consideration of FMENV limits, the following impact indicators are identified with the corresponding environmental components.

Table 8.1 Environmental Indicators

Environmental Components	***Impact Indicators***
Atmospheric	Particulates, Volume discharged, CH_4, H_2S, SO_x, NO_x, CO, heavy and trace metals, and HC.
Soil	Texture, pH, Total Organic Carbon, Nutrients, Heavy metals
Water Quality:	DO, COD, BOD, pH, Nutrients, Turbidity, TDS, TSS, Heavy metals, Hardness
Aquatic ecology	Diversity, Abundance, Benthic Fauna
Socio-Economic	Economic and Health status

In summary, the EMP did not identify and unprecedented environmental and social impacts such lost of Farm Land, Lost of Habitat, Disruption of Economic Activities, disruption of social activities etc that may result from the periodic maintenance of the proposed Dingaya – Galambi – Rungo Road. However movement of temporary structures is envisaged, which the local community are willing to move and the EMP contains clear mitigation measures that would ensure that the residual impacts are managed within acceptable limits. With these results, it is conclusive that the social, environmental and economic benefits of this project outweigh any impact that may arise during the course of this project.

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ANNEX 1

Summary of World Bank Environmental and Social Safeguard Policies

- ***Environmental Assessment (OP 4.01).*** Outlines Bank policy and procedure for the environmental assessment of Bank lending operations. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA process. This environmental process will apply to all sub-projects to be funded by FRDP.

- ***Natural Habitats (OP 4.04).*** The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g. strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The Bank accepts other forms of mitigation measures only when they are technically justified. Should the sub-project-specific ESMPs indicate that natural habitats might be affected negatively by the proposed sub-project activities with suitable mitigation measures, such sub-projects will not be funded under the FRDP

- ***Pest Management (OP 4.09).*** The policy supports safe, affective, and environmentally sound pest management. It promotes the use of biological and environmental control methods. An assessment is made of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. This policy will most likely not apply to FRDP

- ***Involuntary Resettlement (OP 4.12).*** This policy covers direct economic and social impacts that both result from Bank-assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets,

or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. The RPF report discusses the applicability of this policy in detail.

- ***Indigenous Peoples (OD 4.20).*** This directive provides guidance to ensure that indigenous peoples benefit from development projects, and to avoid or mitigate adverse effects of Bank-financed development projects on indigenous peoples. Measures to address issues pertaining to indigenous peoples must be based on the informed participation of the indigenous people themselves. Sub-projects that would have negative impacts on indigenous people will not be funded under FRDP.

- ***Forests (OP 4.36).*** This policy applies to the following types of Bank-financed investment projects: (a) projects that have or may have impacts on the health and quality of forests; (b) projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests; and (c) projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately, or communally owned. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical habitats. If a project involves the significant conversion or degradation of natural forests or related natural habitats that the Bank determines are not critical, and the Bank determines that there are no feasible alternatives to the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs, the Bank may finance the project provided that it incorporates appropriate mitigation measures. Sub-projects that are likely to have negative impacts on forests will not be funded under FRDP.

- ***Cultural Property (OP 11.03).*** The term "cultural property" includes sites having archeological (prehistoric), paleontological, historical, religious, and unique natural values. The Bank's general policy regarding cultural property is to assist in their preservation, and to seek to avoid their elimination. Specifically, the Bank (i) normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage; and (ii) will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. The management of cultural property of a country

is the responsibility of the government. The government's attention should be drawn specifically to what is known about the cultural property aspects of the proposed project site and appropriate agencies, NGOs, or university departments should be consulted; if there are any questions concerning cultural property in the area, a brief reconnaissance survey should be undertaken in the field by a specialist. FRDP will not fund sub-projects that will have negative impacts on cultural property.

- ***Projects on International Waterways (O 7.50).*** The Bank recognizes that the cooperation and good will of riparians is essential for the efficient utilization and protection of international waterways and attaches great importance to riparians making appropriate agreements or arrangement for the entire waterway or any part thereof. Projects that trigger this policy include hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways. This policy will not apply to FRDP

- ***Disputed Areas (OP/BP/GP 7.60)***. Project in disputed areas may occur the Bank and its member countries as well as between the borrower and one or more neighbouring countries. Any dispute over an area in which a proposed project is located requires formal procedures at the earliest possible stage. The Bank attempts to acquire assurance that it may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed can go forward without prejudice to the claims of the country having a dispute. This policy is not expected to be triggered by sub-projects. This policy is unlikely to be triggered by sub-projects to be funded by FRDP.

ANNEX 2

SOCIO-ECONOMIC IMPACT ASSESSMENT QUESTIONNAIRE

(A) PERSONAL INFORMATION

1. Name of Local Leader_____
2. Type of Leader (e.g. Village Head, Women Leader, etc):_____
3. Age (in years): Below 21_____ 21-40_____ 41-60_____; more than 60 _____
4. Name of Town/Village_____
5. Proximity of household/town to proposed Landfill _____ and ____
6. Local Government Area_____
7. Ethnic Origin_____
8. Sex: Male_____ Female_____
9. Ethnic background_____
10. Education qualification: no formal education____ functionally literate___ primary_____, secondary_____ tertiary_____
11. Number of children: _____Male:_____ Female_____
12. Number of other dependents_____ Male_____ Female_____
13. Total No. of people in household Male_____ Female_____
14. Residential Status:_____ Tenant____ migrant____ indigene_____
15. (a) If tenant or migrant____ what is the name of your home village?_____
    (b) Distance of home village from here: less than 20km;____ b/w 20 – 50kml_____ more than 50km _____
    (c) Why did you move to this community (e.g. for employment)__
    (d) Condition of living since settling here: sane;____ better;____ worse;____ I don't know_____
    (e) For how long have you lived in this community_____
    (f) Future plans:____ relocate in future;___ live permanently here;___ I do not know (give reasons for answer)_____

(g) Relationship with other dwellers: Friendly____ Not friendly __
I don't know___

(B) ECONOMIC SCENARIO

17 What are the usual income-generation activities of the people in this community (see below). Also indicate the gender and generation mainly involved in each activity.

No.	Activity	Gender* M/F/B	Generation C/Y/A/B
1.	Crop farming (list common crops)		
2	Trading		
3.	Livestock rearing (list common ones)		
4.	Fishing		
5.	Hunting		
6.	Processing (garri, local gin, fufu, etc)		
7.	Handicraft (pottery, weaving, tailoring)		
8.	Collection of sea products (periwinkle, crayfish etc)		
9.	Collection of forest products (fruits, vegetables, firewood etc.)		
10.	Artisanship (carpentry, blacksmith, bricklayer etc)		
11.	Civil service/teaching		
12.	Company worker		
13.	Other specify		

* M = Male; F = Female; B = Both sexes

** C = Children, Y = Youth; E = Elderly A = Adult

18. What is your estimated monthly income (N): Less than N1,000____
N1,000 to 10,000_____ N10,000 to 50,000_____
N50,000 to N100,000_____ More than N100,000_____

19. How much do you save monthly? _____ No savings;_____
Less than N1,000 _____ less than N5,000_____
less than N10,000_____ more than N10,000_____

20. Where do you save your excess money? No savings;_____
in the house;_____ Esusu group;____ in the bank;____
(others specify)_____

(C) INFRASTRUCTURE/HEALTH

21. Which of the following do you have in this community and what is the condition of the facility, if present?

S/No.	Facility	No/	Availability Yes/No	Condition poor/fair/good	Distance to the proposed Pipeline	If not available, how far is the nearest facility (km)
1.	Access Road					
2.	Public transportation					
3.	Local market					
4.	Primary school					
5.	Secondary school					
6.	Dispensary/health centre					
7.	Electricity					
8.	Potable water supply					
9.	Others (specify)					

22. Which of the following types of houses is common in this community (Enumerator to note)? Mud and wattle thatch;____ mud and wattle zinc: ____ Earth block/Thatch: ____ Earth Block/Zinc;____ Cement Block/Zinc; ____ Cement Block/Asbestos;____ Timber Wall/Thatch:____ Timber Wall/Zinc ____

23. Which of these items are commonly owned by households in this Community?

Electric fan	[	]
Electric Kettle	[	]
Gas/Electric Cooker	[	]
Refrigerator	[	]
Television	[	]
Bicycle	[	]
Air Conditioner	[	]
Motorcycle	[	]
Motor Car	[	]
Radio	[	]
Kerosene Stove	[	]
Rechargeable Lamps	[	]

24. No of Rooms in the House…….

25. Type of House (To be indicated by Interviewer) Bungalow ( ) Blocks of Flats ( ) Duplex ( ) Huts ( )

26. Type of roofing materials used in the house Thatch ( )
Iron Sheet ( ) Asbestos ( ) Long Span Aluminum ( )
Tile ( ) Others (specify) ( )

27. Type of Building Materials Used in the house
Thatch/Bamboo [ ] Mud [ ] Cement [ ] Burnt Brick [ ] Wood [ ] Others specify [ ]

28. Type of Toilet: None [ ] Pit [ ] Bucket [ ] Hand flush [ ]

29. From which of the following sources is your water supply?
Rain____ River_____ Stored run-off_____ pipe borne _____ borehole _____ well, etc _____

30. How is water from each of these sources treated before use? _____

31. How is solid waste disposed off? Burning_____; Burying ____; dump _____ throwing in running/stagnant water _____

32. How is human waste disposed off? Pit latrine_____; defecation into water channel _____ defecation into surrounding bushes____ pail systems____; pit toilet_____; VIP-ventilate latrines____
Any other (specify)_____

33. What are the common diseases and pests found in this community (especially the last 3 years)_____

34. Specify any form of disease or pest that is found only in this community and not in neighbouring ones _____

35. Why are the above diseases common in your locality? _____

36. What has been done by the village or Govt. to reduce the presence of above mentioned diseases and pests? _____

37. Where do people suffering from various diseases normally go for cure? Churches_____ Native doctors____ dispensary/Health centre/Hospital ____

38. Which of the above places are frequently visited for disease cure? ___

39. Are you aware of this project? Yes [ ] No [ ]

40. If yes, what are the sources of information _____

41. If no, interviewer should tell the respondent about the project

42. How do you think this project will benefit this community during the construction phase?

Item	**Very Minimal**	**Minimal**	**Great**	**Don't Know**
Increase in in-migration				
Increased income				
Job opportunities				
New/ Improved Facilities (road, schools, etc)				
Improvement in living standards				
Changed in style of dressing				
Improved social life				

43. How do you think the project will benefit this community during the operational phase?

Item	**Very Minimal**	**Minimal**	**Great**	**Don't Know**
Increase in in-migration				

Increased income				
Job opportunities				
New/ Improved Facilities (road, schools, etc)				
Improvement in living standards				
Changed in style of dressing				
Improved social life				

44. How do you think the project will adversely affect this community during the construction phase?

Item	**Very Minimal**	**Minimal**	**Great**	**Don't Know**
Overpopulation				
Occupational change				
Sex imbalance				
Out-migration				
Inflation				
Reduction in agricultural products				
Destruction/encroachment on land				
Pressure on social infrastructure				
Loss of farmland				
Pollution of drinking water				
Loss of wildlife species				

Ground water contamination				
Deforestation				
Sexual laxity				
Alcoholism				
Increased Crime				
Discrimination against new migrants				

45. How do you think the project will adversely affect this community during the operational phase?

Item	**Very Minimal**	**Minimal**	**Great**	**Don't Know**
Overpopulation				
Occupational change				
Sex imbalance				
Out-migration				
Inflation				
Reduction in agricultural products				
Destruction/encroachment on land				
Pressure on social infrastructure				
Loss of farmland				
Pollution of drinking water				
Loss of wildlife species				
Ground water contamination				

Deforestation				
Sexual laxity				
Alcoholism				
Increased Crime				
Discrimination against new migrants				

Annex 3

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3.	**Geology/Hydrogeology**	Dr. Ogirima Onimisi
4.	**Pavement Study**	Engr. Sani Abdullahi
5.	**Biodiversity/Wildlife**	Jubril Lawal
6.	**Vegetation/Forestry**	Mr. Hussain Bala
7	**Health Risk Assessment/ Waste Inventory**	Dr. I Sule
8.	**Geo Referencing**	Mr. J. Dalyop
9.	**Computer Analyst**	Mrs. Bolalle Olowo
10.	**Report Reviewers**	Dr. A. Mohamed/ Ibrahim Jauro

Annex 4

List of Persons/Stakeholders Met

S/n	Names	Occupation	Location
1	Kabir Lawal	Trader	Diginya
2	Mati Tukur	Farmer	Diginya
3	Musa sale	Trader	Diginya
4	Aminu Aliyu	trader	Diginya
5	Abubakar Sikiru	vulcanizer	Diginya
6	Yau Hassan	Farmer	Diginya
7	Yahaya Lawal	Farmer	Diginya
8	Bashir Ali	Farmer	Galambi
9	Murtala Mohammed	Farmer	Galambi
10	Habibu Mammon	Farmer	Galambi
11	Jamilu Garba	Farmer	Rungo
12	Lawali Abu	Farmer	Rungo
13	Mallam Sule	Farmer	Rungo
14	Hassan labaran	Farmer	Rungo
15	Ahmad Ali	Farmer	Rungo
16	Talatu Ayuba	Food Vendor	Rungo