



**GOVERNMENT OF NIGER STATE, NIGERIA
NIGER STATE AGRO CLIMATIC RESILIENCE IN
SEMI ARID LANDSCAPE (ACRESAL)**

FINAL REPORT
FOR:
**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT (ESIA)**

**MOKWA FLOOD AND GULLY EROSION PROJECT
MOKWA LGA, NIGER STATE
NIGERIA**



April 2026

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ASSESSMENT (ESIA)**

Project ID: P175237

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MOKWA TOWN. MOKWA LGA
NIGER STATE. NIGERIA**

Submitted To:

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LIST OF ABBREVIATIONS

ACReSAL	Agro-Climatic Resilience In Semi-Arid Landscape
AQMP	Air Quality Management Plan
ARAP	Abbreviated Resettlement Action Plan
BMP	Best Management Practices
CAI	Community Administrative Institution
CBO	Community Based Organization
CDO	Community Development Organization
CIP	Community Involvement Program
CMP	Chemical Management Plan
COC	Chemicals of Concern
CRMCI	Community Resource Management and Conservation Initiative
DADSON	Dadson Engineering Services Limited
EIA	Environmental Impact Assessment
ERIP	Emergency Response and Incident Plan
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ESO	Environmental Safeguard Officer
FBO	Faith-Based Organization
FEPA	Federal Environmental Protection Agency
FGD	Focused Group Discussion
FGN	Federal Government of Nigeria
FME _{env}	Federal Ministry of Environment
FoNGO	Focal Non-Governmental Officer
FPMU	Federal Project management Unit
FSLC	First School Leaving Certificate
GBV	Gender Based Violence
GEF	Global Environmental Fund
GIS	Geographic Information System
GRASS	Gully Rapid Action and Slope Stabilization
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IDA	International Development Association
LGA	Local Government Area
MDAs	Ministries, Departments and Agencies
NGO	Non-governmental Organization
NGS-ACRESAL	Niger State Agro Climatic Resilience in Semi Arid Landscape

NGSG	Niger State Government
NIGERPET	Nigerpet Structures Limited
NRO	Natural Resources Management Officers
OP	Operational Procedure of the World Bank
OTG	OTG Enviroengineering Nigeria Limited
PAH	Project-Affected Household
PAP	Project-Affected Person
PC	Project Coordinator
PCC	Project Complaints Committee
PE	Project Engineer
PG	President General
PPE	Personal Protection Equipment
PRS	Government's Poverty Reduction Strategy (PRS)
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SCCF	Special Climate Change Fund
SLO	Social & Livelihood Officer
SMEC	SMEC International (Pty) Ltd, West African Region
SMEEnv	State Ministry of Environment
SMLS	State Ministry of Lands and Survey
SMOH	State Ministry of Health
SMOW	State Ministry of Works
SPMU	State Project Management Unit
ToR	Terms of Reference
TVMP	Traffic and Vehicle Management Plan
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan

EXECUTIVE SUMMARY

Background

The Agro Climatic Resilience in Semi-Arid Landscape (ACReSAL) Project, initiated by the Federal Government of Nigeria (FGN) and funded by the World Bank (WB) and International Development Fund (IDA), is being implemented in Niger State, Nigeria and other participating states to help reduce landscape degradation as well as desertification while promoting climate resilient agriculture. **The Project Development Objective (PDO)** of the Project is to increase the adoption of climate resilient landscape management practices in targeted watersheds of northern Nigeria and to strengthen Nigeria long-term framework for integrated landscape management. The Mokwa flood and gully erosion are of the largest of the many erosion gullies in Niger State creating severe structural and environmental damages to the state. Perennially, these gullies cause destruction to homes, properties, and farmlands as well as unprecedented siltation of community streams with huge socioeconomic losses to the affected communities resulting from the impacts of gully erosion.

With each passing year, uncontrolled storm water flow at these erosion sites threatens lives and properties as the existing gullies become widened and more menacing. The Niger State ACReSAL is targeting to remedy and rehabilitate the existing gullies and reduce the impacts through the ACReSAL opportunity. This Environmental and Social Impact Assessment (ESIA) has been prepared in support of the proposed Mokwa Gully Erosion subprojects in Niger State. This ESIA study covered the community of Mokwa through which the gully corridors traverse.

Description of Project Activities

The Mokwa Gully Erosion Site is located between latitudes N6° 02' 45" - N6° 24' 47" and longitudes E7° 03' 08" – E7° 05' 35". The project consists of remedial structural and non-structural developments that include civil works and vegetative development along the gully corridors. The proposed ground interventions will address, prevent and reverse land degradation for the long-term and will involve rehabilitation and reconstruction of the existing gullies and corridors. The rehabilitation and reconstruction activities will involve civil works as well as bioengineering restoration along the gully corridors and will result in disruptions in the physical environment, habitat, pests and cause involuntary resettlement thereby triggering the relevant World Bank Safeguard requirements guided by the Environmental and Social Framework (ESF).

The proposed erosion control measures for the main gully and the finger gullies include main structures for the gully bed system and the bank stabilization measures. The designed gully bed system comprise of the following structures:

- Installation of collector or trunk drains at the toe and bed of the gullies;
- Drain Inlet Structures;
- Construction of Reno-matress and concrete lined drainage canals with transition structures, energy dissipaters, drop structures etc.;
- Installation chute structures with stilling basins;
- Installation of drop structures and exit system/outlet structures.

The designed bank stabilization measures include main gully bank stabilization (head, gully wall, gully bed) using bioengineering works and involving:

- Gabion retaining walls;
- Gully bank protection works;
- Slope cutting with geo-textile; and,
- Bio-remediation using Vetiver grass and bamboo planting.

Rationale for the ESIA

The Mokwa gully project activities will result in several environmental and social impacts which must be considered and properly addressed to ensure that the environment is not unreasonably further degraded and the socioeconomic life of the people is not adversely disrupted. The rehabilitation of the existing critical infrastructures that serve as inter- and intra-

community linkages (rural roads and drainage channels) providing access to the project area will result in social disruptions and long detours for community members who go to trade/market their goods, and for children who attend schools in neighboring communities.

Additionally, large areas of farmlands will also be majorly impacted with many homes and families losing their primary means of livelihoods. It is envisaged that about 265Ha and 54678m² of land will be required for the stabilization of the gully walls at Mokwa with the attendant loss of economic trees/crops and the permanent loss of use of that portion of land. Consequently, this ESIA as a site-specific safeguard instrument is required to provide necessary procedures and criteria that will guide the proposed Mokwa gully erosion control intervention in accordance with the World Bank Safeguard Policies and the Nigerian national environmental policies, guidelines and assessment procedures as well as those of Niger State and the local agencies.

The objective of this study is to prepare an environmental and social impact assessment (ESIA) for the Mokwa Gully Erosion Subprojects that specifically identifies, evaluates and documents the set of mitigation, monitoring and institutional actions to be taken before and during site construction and rehabilitation to eliminate adverse environmental and social impacts, offset the impacts or reduce the impacts to acceptable levels. The potential impacts associated with the phases of the designed site interventions consisting of pre-construction, construction, and operation and maintenance (O&M) are developed and appropriate mitigation measures established for the impacts.

Policy, Legal and Administrative Framework

This ESIA is guided by the requirements of the World Bank ESF and the relevant and applicable state, national and international regulations, guidelines, conventions, industrial best management practices that are triggered by ACRoSAL. The basic legal framework for the regulation of the environment in Nigeria is braced in the Environmental Impact Assessment (EIA) Act No. 86 of 1992; the National Guidelines and Standards for Environmental Pollution Control in Nigeria (March 1991); the National Environmental Standards and Regulations Enforcement Agency (establishment) Act 2007 (NESREA), as well as the Land Use Act 1978 (modified in 1990). The power to regulate all environmental matters in Nigeria is vested in the Federal Ministry of Environment (FMEEnv).

Existing Safeguard Instruments

The implementation of projects under ACRoSAL is guided by two existing safeguard documents - the Environmental and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF) prepared for ACRoSAL. The ESMF indicates that ACRoSAL is categorized by the WB as a Category A project whose impacts are sensitive, diverse, unprecedented, felt beyond the immediate project environment and are potentially irreversible over the long term. For Mokwa erosion control subprojects, the scale of the construction and development works will involve a significant disturbance of the environmental conditions, with both localized and regional impacts.

Biophysical Environment

Niger State lies within the north-central portion of the Nigerian Basement Complex. About one half of the state's landmass is underlain by the Basement Complex rocks while the remaining half is occupied by the Cretaceous Sedimentary rocks of the Bida Basin and part of the Sokoto Lullemeden Basin. The Basement complex rock is characterized by three lithofacies; the migmatite-gneiss complex, the low grade schist belt and the older granites. The migmatite-gneiss complex is composed of heterogeneous assemblage of migmatites, ortho and para gneisses, and a series of metamorphosed basic and ultrabasic rocks. The schist belt formations are composed of low to medium grade metamorphosed sedimentary and volcanic rocks. The schists in the project area consist predominantly of phyllite, mica schist, talc schist and quartz schist inter-layered with amphibolite. The older granites are granitic rocks which show evidences of ancient tectonic activity in the form of major and minor faults, joints and fractures most especially around the rock exposure at the settlements. Bida Basin is a NW–SE trending intracratonic sedimentary basin extending from Kontagora to areas slightly beyond Lokoja in the South.

Mokwa falls within the Guinea Savannah vegetation zone with distinct dry and wet season. The area experiences a tropical savanna climate which is strongly influenced by the tropical maritime air mass and the tropical continental air mass like in most parts of West Africa. The tropical maritime air mass which originates from the southern high pressure belt is humid in nature and is attended with on-shore south-western winds. The tropical continental air mass on the other hand is dry and accompanied by north-east trade winds.

Rainy season lasts from May to mid-October with a peak in August which has the highest number of rainstorms and sediment generation and uncomfortably high humidity. Niger State has a mean annual rainfall of 1,350mm and relative humidity ranges between 60-80% in the month of July. The average annual relative humidity is 48.9% and average monthly relative humidity ranges from 21% in February to 73% in August. The highest humidity recorded in 2019 was 83% in Kotangora. In 2019, the annual amount of rainfall recorded in Kontangora was 1016.9 mm with December being the only month when no rainfall was recorded. This variation in the annual amount of rainfall received by Kotangora is as a result of latitudinal and continentality factors.

Temperatures in Mokwa are generally high throughout the year with a yearly average of 34°C. The climate is very warm with April as the hottest month of the year while August is the coldest month. In Kotangora, the minimum monthly temperature in 2019 ranged between 19°C and 31°C while the maximum monthly temperature ranged between 29°C and 41°C (in August and April respectively). Typically, the area is affected by two wind patterns, the harmattan wind from the Sahara which is responsible for the cool dry months of November to February (about 24°C) and the Southwest Monsoon Trade Winds blowing across the Atlantic Ocean which is responsible for the rains of June to October. Average relative humidity is put at 42%. The average rainfall is from about 800mm to 1000mm. (Tukur, A 2014).

Air quality assessment was carried out at several locations where active construction operations are anticipated and where human activities are expected to be high. The parameters measured as part of the assessment include carbon monoxide (CO), Ammonia (NH₃), hydrogen sulphide (H₂S), sulphur dioxide (SO₂), nitrogen oxides (NO_x), hydrogen cyanide (HCN) as well as oxygen (O₂). The analytical results of the baseline air quality indicators within and around the project corridor show concentrations below the regulatory threshold limits.

The surface and groundwater conditions at the Mokwa sites were assessed through laboratory analysis of parameters that affect the quality of water in the environment. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. The analytical results of the baseline water quality indicators within and around the project corridor show concentrations that are either below the regulatory threshold limits or are considered not significant.

Baseline soil parameters indicate the state of soil ecosystem characteristics, which especially reflect productive, buffering, filtering and other soil functions. Soil quality is significantly affected by physical, chemical, biological and biochemical properties sensitive to changes in the environment and land management. The analytical results of the baseline soil quality indicators show concentrations of key soil quality below the regulatory threshold limits.

Socio-Economic Characteristics

Based on the 2006 national population census records and the 3.42% annual population growth factor recommended by the National Population Commission (NPC), Mokwa LGA has projected population of 430,159 for 2023. Mokwa town is essentially semi-urban community whose residents are generally trading/business men and women as well as farming. Mokwa has male/female population distribution at the household level of about 51/49%. There is a seeming low public participation among the women at Mokwa possibly due to their predominant occupation with petty trading activities.

The people of Mokwa are of the Nupe, Yoruba and Hausa ethnic groups. They generally, speak and write mainly the respective ethnic and English languages. Clanism and kinship are strong elements and driving forces in control of political and cultural institutions and service points. The community however, in recent times, is witnessing an exodus of persons to other parts of the state/ country as a result of infrastructural decay, severe gully erosion and flood menace and harsh economic downturn in the area.

Residents of Mokwa community are predominantly of the mixed faith, mostly Muslims and Christians with some traditionalists. Three major types of customary land tenure system exist in the village, viz: – (1) individual land ownership; (2) family land ownership; and, (3) communal land ownership. Individual ownership may be for indigenes or for residents of the community. Family lands (as well as individual lands) are inherited from generational relatives. Communities retain family lands which may be sold and mostly used for developmental purposes. About less than 10% of land is committed to agricultural production of food crops.

About 44% of the households in Mokwa project area are below the age of 21 years. About 40% are between the ages of 22 and 60 years for Mokwa while 13% in the communities are in their 60s and above. The household size distribution ranges from 1-35 persons in Mokwa, with an average household size of 4 persons in the communities. About 36% of the households in Mokwa are married; about 14% are single and about 2% are widowed.

The literacy level within Mokwa communities are 55% of the surveyed population having attained the FSLC level of education and higher. Education in the Mokwa project communities and indeed the LGA is poor considering the existence of poor educational infrastructure support that exists for a significant number of primary and secondary schools serving the area. There is a moderate rate of unemployment (about 8-15%) in the communities. This situation potentially could pose some serious social risk when not properly managed. The community must come together to address unemployment as a social risk within its fold.

Solid wastes pose considerable hazards to human health due to the indiscriminate dumping of household wastes at illegal points or dumpsites adjacent to and along the gully corridors in Mokwa. The continued and uncontrolled waste dumping in the communities cause regular obstructions to the storm water drainage systems. The common diseases in project area include diarrhea, malaria, typhoid, pneumonia, cough, skin diseases, deficiency diseases, eye diseases, ear diseases, and waterborne diseases resulting mainly from malnutrition and lack of hygiene. The quality of the health services in the area is generally poor with most residents patronizing quacks and medicine shops for their medical treatment. The socioeconomic infrastructures (roads system, electric power and access to water) in the area are also generally in fair to poor state. Public access to potable water is non-existent and power is generally not steady. Market facilities are fairly developed complimented by numerous home-based commercial shops located throughout the community.

Potential Impacts and Mitigation Measures:

There are both positive and negative impacts associated with this project. On the positive side, this project will effectively control the gully erosion and perennial flooding of Mokwa communities and improve the flow of traffic in and out of the communities. The successful remediation of the gully corridors will reclaim useful land and expectedly will greatly appreciate the value of properties within the area as most erosion threatened properties have lost market value. It is also expected that people who have been displaced by the erosion will return back to their settlements. Other positive impacts include reduced costs of transportation and delays on travel time; improved livelihoods for the area residents due to reduced cost of transportation; improved landscape vista; and provision of temporary job opportunities for both skilled and un-skilled labors.

The potential adverse impacts for which appropriate mitigation and monitoring measures have been provided include Loss of physical assets, Loss of means of livelihood, loss of vegetation, dust generation and air quality, surface and groundwater quality, noise and vibration impacts, earth movements, occupational and community health and safety, HIV/AIDS and STIs risks,

waste generation as well as impacts of road diversion and climate change impacts. About 265.13Ha and 5436m² of land will be required as setback for the stabilization of the gully walls at Mokwa, particularly at the deep sections with the attendant loss of land and economic trees/crops.

The subprojects envisage several permanent involuntary displacements. Several buildings/structures will be impacted by the remedial construction works – many of these existing structures are already partially damaged by gully impacts in both Mokwa. It is however, envisaged that some of the partially damaged buildings/structures may be stabilized during construction to ensure that occupants are not permanently displaced. No sensitive sites or resources such as forest reserve, cemetery, shrine or other places of historical and cultural interests will be impacted by the project. The construction and development works in the two communities are likely to affect some utility lines such as water, electricity or telecommunication lines.

The designed measures to mitigate the identified adverse impacts include: creating of sustained community awareness and sensitivity to the project activities as well as capacity building and training programmes for the various ESMP responsible and implementing agents. Other measures include water dousing and heaped soil covering; regular maintenance of plant and machineries; erection of embankments around fueling and servicing areas; protection of water bodies from deposition of wastes and construction materials; exposure control of workers and the public to noise and vibrations; selective vegetative clearing and quick regeneration of vegetation; erection of road warning signs, imposition of speed limits and road diversions; provision and use of PPE; provision of first aid kits as well as erection of warning signs; sensitization and awareness on transmission and prevention of HIV/AIDS and STIs; segregation and composting of waste and maintaining high hygienic standards.

Analysis of Alternatives

Consideration of alternatives related principally to ways of improving the proposed intervention activities and/or attempting to avoid or minimize potential significant negative impacts. Different alternatives were evaluated consistent with the various components of the Mokwa project intervention. For the proposed project, the alternatives considered include: delayed project alternative; a do-nothing alternative; and the planned project alternative. The selection of the planned project alternative was premised on several considerations, including the desirability/acceptability of the project, the government's position or inclinations to the project, the potential environmental and social impacts of the project, the economic viability of the project and impact to human life.

ESMP Implementation and Management

The primary responsibility for the project execution and ESMP implementation is on the SPMU. The SPMU through its various officers, and may also employ the services of consultants and contractors, shall provide the necessary awareness, mobilization and facilitation, project appraisal, approval & disbursement, capacity building, monitoring & evaluation of all project activities and reporting to the FPMU and the World Bank.

The key actors in the implementation of the ESMP include:

- The contractor - to be awarded the rehabilitation contract and be required to implement the environmental and social safeguard measures by producing the Contractor ESMP (C-ESMP) which will address job specific risks and hazards and bring them to as low as possible; Hold workers accountable to the Code of Conduct and enforce disciplinary measures on the site and workers' camp.
- SPMU - to ensure that environmental and social (E&S) safeguards and other mitigation measures are duly implemented; conduct HSE/OHS/CHS trainings as specified in the ESMP; Ensure adequate documentation of the in-house monitoring of HSE processes at the site;
- FMEEnv/FPMU - to ensure compliance with the ESMP and other relevant approval conditions. Ensure timely conduct of regulatory ESMP implementation Compliance Audit and IMM at specified time

- SMEnv - to oversee the effective implementation of the landscape devastation control project and related E&S safeguards through monitoring and compliance inspections.
- PCC - to address complaints of any aggrieved parties on E&S Safeguards
- SMLS – to ensure appropriate disposition of land matters in accordance with the statutory requirements.

Public/Stakeholder Consultation Plan

A key element of sustaining stakeholders' support in the project is to sustain the consultations and communication process that has already been effectively established in the course of the preparation of this ESIA. Stakeholders' engagement needs to be enhanced and managed through a well-defined and purposeful strategy.

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Stakeholder Engagement Plan which will show the Contractor's specific engagement plan to ensure that all segments of the community and other stakeholders are fully and effectively involved in the project decision process.

Chance Finds Management/Cultural Heritage Management Plan (CHMP)

The Contractor shall be required to address the specific impacts that may occur as a result of any "Archaeological Chance Finds" or existence of cultural heritage resources during the planned construction works. The Contractor shall prepare and submit for approval of SPMU and FPMU, the necessary CHMP to be implemented for the project. The CHMP will set out a formal system by which the Contractor will carry out mitigation measures that will reduce any impacts to the Cultural Heritage. Specifically, the CHMP will provide details regarding the implementation of avoidance, mitigation and management measures for impacts related to the possibility of archaeological chance finds or any existing cultural heritage of significance. The scope of the CHMP will cover pre-construction, construction and post construction/closure phases of the Project.

Occupational/Public Health, Safety and Security Management Plan

The Contractor shall be required to develop and implement an occupational and community health and safety plan that contributes to a healthy workforce and local community. The health and safety plan shall be submitted to the SPMU and FPMU for necessary approvals prior to implementation. The Contractor shall fully comply with World Bank ESHS standards and bear the cost of implementation. Community Health, Safety and Security assessment will identify potential negative risks related to the different phases of the project.

Gender-Based Issues

The Gender Based Violence Management Plan (GBVMP) which include SEA/SH Action Plan; is required to identify and assess key risks, develop mitigation measures to prevent and respond to sexual exploitation, abuse and other forms of Gender Based Violence (GBV). The Contractor is required to prepare and submit for approval of SPMU and FPMU, the necessary GBVMP to be implemented for the project. The GBVMP will set out a formal system by which the Contractor will carry out mitigation measures that will reduce any impacts relating to Gender Based Violence matters. Specifically, the GBVMP will provide details regarding the implementation of avoidance mitigation and management measures for impacts related to the possibility of or any existing risks which may lead to GBV issues. The scope of the GBVMP will cover pre-construction, construction and post construction/closure phases of the Project.

Labor Influx and Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Labor Management Plan (LMP). This shall be included in the ESHS submission by the contractor for the bidding process. The Plan shall evaluate possible issues regarding the working conditions of project workers both primary and secondary, promote fair treatment, non-discrimination and equality of workers. It shall clearly show the GRM to be followed by workers and community members for grievance issues that may arise during the course of the project. It shall also address, illicit behaviors, firearm and security concerns, substance abuse amongst workers associated with the project, influx stress on the host community resources and provide information regarding Worker Code of Conduct in local

languages and inclusion of a cultural sensitization training for workers regarding engagement with local community. **The Contractor shall fully comply with ESHS standards and bear the cost of implementation.**

Vegetation Clearing and Biomass Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Vegetation Clearing and Biomass Management Plan (VCBMP). The specific objectives of the Plan are to identify appropriate, ecologically sustainable, and spatially-explicit management actions, such as re-vegetation with native plant species, based on biological and hydrological factors, as well as the reasonableness of costs, local community expectations, develop monitoring methods to evaluate progress toward Plan objectives, to apply adaptive management to enhance the likelihood of achieving those objectives, and to increase understanding of water and ecosystem interactions, prepare for implementation of rapid, active ecological restoration and other management strategies for threatened, endangered, and other native wildlife species potentially displaced by construction activities, and to enhance pollinator habitat, provide consideration of proper implementation techniques, implementation costs, short- and long-term maintenance needs, water use/savings, and wildfire control.

Air Quality Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Air Quality Management Plan (AQMP). Air quality plans identify potential control measures and strategies, including rules and regulations that could be implemented to reduce air pollutant emissions from construction equipment, on and off road motor vehicles, and other sources. The Contractor shall implement these strategies through rules and regulations, public education and outreach, and partnerships with other agencies and stakeholders.

Emergency Response and Incident Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Emergency Response and Incident Plan (ERIP). The Plan will describe the set of necessary actions to be taken in response to defined circumstances, across all hazards, and through the phases of mitigation, preparedness, response, and recovery during this project. The Plan will provide necessary guidance for how to organize assets to respond to an incident (system description) and processes to manage the response through its successive stages (concept of operations). The Plan will document the combination of facilities, equipment, personnel, procedures, and communications existing within the Contractor's organizational structure and designed to help in the management of resources during incident response. For the Plan to be effective, the emergency incident must be formally defined so that there is clarity and consistency as to what is being managed.

Water Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a Water Management Plan. The Plan will provide information about current water uses and charts a course for water efficiency improvements, conservation activities, and water-reduction goals. An important step in creating a water management plan is to establish a water balance for the project. It is necessary to ensure that water supply, wastewater, storm water issues, and water efficiency Best Management Practices (BMPs) are taken into account prior to commencement of the construction works. Water emergency and other contingency plans should describe how the construction facility will meet minimum water needs during emergency or other water shortages.

Erosion and Sedimentation Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a comprehensive Erosion and Sedimentation Management Plan. It is important that an erosion and sediment control plan is effective in preventing illicit discharge. Measures will include those necessary to delineate areas of work, prevent erosion of unstable or denuded areas, plan for construction staging and storage logistics, construction of stabilized access points, and proper containment measures for construction materials and waste, the name and contact information for the

person responsible for maintaining erosion and sediment control measures throughout the construction work shall be included as Erosion Control Point of contact, location, width, direction of flow and approximate location of top and toes of banks of any watercourses, location and types of existing vegetation on the site.

Traffic and Vehicle Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Traffic and Vehicle Management Plan (TVMP), the TVMP will provide the specific and general guide to vehicular movements throughout the project area in order to protect the community and workforce from accident and safety hazards during construction. The Contractor shall be required to provide appropriate information, training, instruction or supervision necessary to protect all persons from risks to their health and safety. The Contractor must also ensure construction induction training is provided to workers who carry out construction work.

Waste Management Plan

A waste management plan (WMP) is required to achieve the goals set for managing construction waste. The construction Contractor shall prepare and submit for approval of SPMU and FPMU, a comprehensive Waste Management Plan (WMP). The WMP will provide the specific and general guide to the management of solid and liquid wastes throughout the project area and for the duration of the project. The Contractor shall have responsibility for the implementation of the Plan which will include procedures for salvage, reuse and recycling of materials. The implementation of the WMP will protect the community and workforce from the health hazards of indiscriminate waste disposal during construction.

Chemical Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a Chemical Management Plan (CMP). The CMP will provide specific and general guidance in the storage, use and disposal of any chemicals or chemical products associated with activities to be carried out as part of the project. The CMP helps protect the project community and their environment from the harmful effects of chemical substances. The CMP will assess the environmental and human health risks posed by the chemical substances to be used in the project, and also develop measures to be implemented to prevent or manage those risks.

Stakeholders' and Public Consultation

The stakeholders' and public consultation methodology adopted in this study includes a qualitative and quantitative mixed method that offers an effective means to interact widely with the project area general public as well as stakeholder groups. Five broad categories of stakeholders were identified for this project based on the degree to which the project activities affected or involved such persons or group of persons. Individual stakeholders and project affected persons (PAPs) were also engaged during the ESIA preparation. To ensure that the rights and interests of PAPs are considered seriously local level consultative forums serve as community voices and become part of the entire project process.

Grievance Redress Mechanism

A mechanism through which complaints and disagreements can be smoothly resolved has been devised for this project. As part of the grievance redress mechanism, formation of a **community grievance committee (C-GRC)** is recommended to receive and document all public complaints relating to the project. Currently, there is a system of customary avenue that exist in each of the communities to deal with dispute resolution in the community and this will be employed as the "court of first appeal", where relevant. It is anticipated that this will allow unencumbered platform for people to express their dissatisfaction over any environmental and social (E&S) issues arising from the project. The SPMU has also opened toll free lines and a public complaints/suggestion box for Communities to bring up their complaints. This ensures that Communities can forward their grievances at absolutely no cost. All grievances or complaints must be registered and compiled regularly for project management. The devised mechanisms are fundamental to achieving transparency in the ESMP process.

Establishment of Gender Based Violence (GBV) Sensitive GM

The SPMU shall follow the guidance of the World Bank to put in place a GBV-sensitive GM system that has strong elements of confidentiality, empathy and protection and services for survivors.

Budget and Schedule of Work

The budget estimate for the E&S safeguards as determined under this ESIA, including cost for administration, monitoring and evaluation is **N190,520,000.00** (One Hundred and Ninety Million Five Hundred and Twenty Thousand Naira) only. The proposed budget will facilitate the implementation of the various ESMP management, monitoring plan and capacity building measures to be executed by the SPMU and should be made an integral part of financing for the Mokwa gully erosion intervention and development project. The specific E&S safeguards obligations for the contractor should be incorporated into the contract specifications along with other contract provisions.

The estimated mitigation cost for the environmental and social management plan has been developed with due consideration in the three project phases (pre-construction, construction and post-construction) to the following factors:

- The magnitude of the gully/flood control problem;
- The type of technology to be employed;
- The volume of the project affected households and persons; and,
- The area of coverage of the proposed project.

Disclosures

This ESIA is subject to public review by advertising its disclosures in Two (2) major National Newspaper and radio jingles in affected communities LGA and it should be disclosed in the state to the general public for review and comment at designated locations in Niger State and in World Bank Information Website. Display centers will include Niger ACRReSAL SPMU office, ACRReSAL FPMU office, EA Department of FMEnv., State offices of the Ministry of Agriculture and Ministry of Water Resources, Office of State Commissioner for Environment, LGA ACRReSAL Liaison office, Project Community, and Office of the State Commissioner for Local Government matters.

Contractor Responsibility for Implementation of ESMP

The Contractor shall be responsible for implementing all impact mitigation measures as detailed in the ESMP provisions of the ESIA Report for the project. Prospective Construction Contractors are therefore required to competitively bid for the implementation of the Impact Mitigation Measures. The Mitigation Measures are contained in Table 6.1 of the ESIA Report and are summarized in the Table below.

Bidding Contractors are also required to include as part of their costs all elements associated with (i) ESMP Management, (ii) Mitigation Monitoring, and (iii) Capacity Building & Trainings as provided in Table 6.9 of the ESIA Report. This shall be a one line item in the BEME to ensure adequate budget.

Bidding Contractors are further required to provide Environmental, Social, Health and Safety (ESHS) Performance Guarantee to the tune of the specified sum or percentage of the project cost in accordance with the World Bank ESHS requirement.

For purposes of clarity, ALL BIDDING CONTRACTORS shall obtain as part of the bidding process a full copy of the ESIA Report prepared for this project to fully understand the scope of the ESIA implementation and required mitigation actions. In the event that the ESIA Report is not provided, the contractor shall request for it from the SPMU as part of the bidding process requirements.

Contractor's Environmental and Social Management Plan (C-ESMP)

The contractor is required to provide a C-ESMP to guide its operation during the project implementation – the provision of the project ESIA notwithstanding. This management plan is

expected to address all that the contractor plans to do at different phases following the prepared ESIA.

Summary of Impacts and Mitigation Measures for Mokwa Gully Site

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
PRE CONSTRUCTION		
1	<u>Impacts on Community and PAP Management (Loss of physical assets; Loss of means of livelihood; Displacement of persons (temporary))</u> • Possible damage to building structures and other structural elements along the Mokwa gully corridor; • Permanent acquisition of land for gully setback to be used for gully wall stabilization; • Temporary use of land for project staging areas, erection of workers' camp and temporary offices (Agreement between Mokwa and Contractor). • Croplands and economic trees along Mokwa gully setback may be destroyed during gully wall stabilization. • Construction activities may affect persons with critical health conditions, including old persons, children and other vulnerable persons, such persons may be temporarily relocated for the construction phase. • Possible disagreement over siting of staging areas and temporary facilities between community and contractor	• Appropriate compensations shall be paid for structural damages; project acquired lands; temporary use of lands; destroyed crops and economic trees. • Compensation to persons (PAPs) within Mokwa gully project area who will need to be temporarily relocated prior to beginning of construction activities (Covered under RAP). • Create awareness among Mokwa community members and sensitize the people to all project activities • Seek the consent of Mokwa Communities and landowners to erect the site office for the specified duration of the project; • Sign Agreement with Community and for the temporary acquisition of land; • Agree on other measures to render the site safe and usable to the satisfaction of the landowners at completion of project. • A stand-alone Resettlement Action Plan has been prepared for this project addressing impacts on Mokwa communities and the PAP management. The SPMU shall be required to implement the RAP in accordance with the provisions therein. • To be resolved in accordance with provisions in the Agreement by the Mokwa Communities and landowners and the Contractor.
2	<u>Community Cultural Heritage</u> • There may be shrines or other cultural relics in the vicinity of the gully corridor which could be impacted during construction activities.	• Relocation of identified shrines/cultural relics; • Compensation for any damaged cultural relic or for relocation issues. • The Contractor shall be required to prepare and submit a Cultural Heritage Management Plan to the SPMU for approval and adoption for the contractor's implementation

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
3	<u>Public/Stakeholders Participation</u> • Effective project implementation requires active involvement and cooperation of the project community.	• Build capacities within Mokwa communities; • Incorporate community feedback into project implementation process • Disseminate project ESIA study findings to Mokwa Communities; • Ensure that period of inaccessibility to land is as short as possible • Awareness campaigns and capacity building. • The Contractor shall be required to prepare and submit a Stakeholders' Engagement Plan to the SPMU for approval and adoption for the contractor's implementation
4	<u>Vegetation and Biomass Removal Management</u> • Damage to the natural and planted vegetation on acquired Mokwa gully setback lands during site clearance, areas for siting of temporary office and workers camp. • Impact on flora and fauna. • Impact on wild life.	• Mark out areas for clearance & where possible use manual method of vegetation clearing; • Undertake selective clearance by removing tall woody species leaving saplings for quick regeneration of vegetation; • Prevent colonization by invasive species. • Prevent damage to critical ecosystems and habitats. • Prevent destruction of flora and fauna. • The Contractor shall be required to prepare and submit a Vegetation and Biomass Management Plan to the SPMU for approval and adoption for the contractor's implementation
CONSTRUCTION PHASE		
5	<u>Dust and Air Quality Management</u> • Air pollution is expected from dust and emissions from construction vehicles, plant and equipment. • Dust is generated by excavation and earth moving operations and causes nuisance to residents and other sensitive receptors. • Exhaust emissions occur from poor maintenance of plant and equipment or over revving of engines.	• Dust generation will be controlled mainly by the use of water, especially in the dry season. • Use of water tanker for purposes of water dousing to control dust emission. • Erection of speed control signals and ramps mounted in communities; • Covering of hauling trucks carrying sand and other aggregates; • Covering of heaped material e.g. sand will be covered; • Use of nose masks by all workers at road maintenance/works sites. • Surfaces of vegetation along the maintenance road will be monitored to verify the effectiveness of dust suppression method. • The Contractor shall be required to prepare and submit an Air Quality Management Plan to the SPMU for approval and adoption for the contractor's implementation.
6	<u>Water Resources, Erosion and Sedimentation, Run-off Control Management</u>	• Location for heaping construction material (e.g. sand and other aggregates) not less than 50m

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
	- Increased sedimentation and runoff may result from activities during the construction works. - Earthworks release suspended particles into watercourses, which can have temporary detrimental effects on water organisms. Spillages of fuel and other petroleum products cause contamination of the soil and water resources. - Excavation at the borrow pits may cause land degradation in the vicinity of the borrow pits; may cause soil erosion and siltation of nearby roads.	- from water bodies and drainage channels (i.e. a separation distance of 50m will be observed); - Site for fueling of machinery and servicing of equipment will be located at a minimum distance of 100m from any water bodies, wetlands and drainage channels; - Embankment erection around fueling and other liquid or spill-able storage sites in order to limit or contain such material from escape to potentially pollute water resources; - Side drains (where appropriate) will be provided with settling basins near water bodies to remove silt and debris from road surface and construction site run-off, before discharge to adjoining streams or rivers; - Adequate side drains provided to carry run-off into drainage channels to prevent erosion; - Culverts of suitable capacity constructed to contain and direct flow, especially at peak flow and run-off; - Road maintenance works to be carried out off peak rainy season; - Provision of toilets and urinal at locations not less than 50m away from water bodies; and - Adequate worker awareness on sanitation and measures to avoid water resource contamination. - The Contractor shall be required to prepare and submit a Water management Plan and an Erosion and Sedimentation Management Plan to the SPMU for approval and adoption for the contractor's implementation.
7	<u>Noise and Vibration Exposure Management</u> - Noise will emanate from moving vehicles, excavators, generators, power tools (e.g. for vegetation clearing), and compressors during construction. - Vibrations may come from soil compaction equipment and other vibroequipment to be used at the gully heads.	- Equipment servicing plan will be prepared and strictly followed to ensure efficient machinery performance and optimum noise generation. - Stationary equipment shall be sited at safe distances from sensitive areas to minimize noise impacts - Workers operating noisy equipment will not be exposed continuously for more than 3 hours a day. - Workers will be provided with ear plugs. - Workers handling vibrating equipment or parts will be given pads to absorb the vibrations and will not be exposed continuously for longer than 3 hours a day. - Sanctions (ranging from a warning to dismissal) will be instituted by the contractor against workers who do not observe the use of appropriate PPEs
8	<u>Occupational/Public Health and Safety Management</u>	Health, safety and environmental training and awareness will be extended to Mokwa community members and local residents;

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
	• Occupational accident during construction. • Construction operations pose hazards to people living or working near construction areas or employed to work on site. • Excavations, construction traffic and stockpiled materials pose particular threats to children and livestock. • Children may be inadvertently recruited to work on construction sites.	• Erection of warning signals and use of reflective tapes at approaches to excavations, heaped materials, stationary equipment, etc. • Posting of speed limits of 25km/hr at approaches to construction sites; • Safety meetings held twice a week and documented accordingly; • Inductions and awareness programmes held for all employees on occupational health and safety practices; • Contractor must ensure that children are not inadvertently engaged to do work on the construction site. • A First Aid team formed to provide first aid services to workers and where appropriate make referrals to the nearest Health Centre or hospital; • First Aid team to be trained by a medical team from the Health Centre; • Accident records at construction site and neighbourhoods to be maintained both for workers and the public; • Stocks of PPEs to be maintained and supplied to workers regularly as needed; • Workers required to wear the appropriate PPEs e.g. helmets, ear plugs, nose masks, vibration pads, hand gloves, etc. • The Contractor shall be required to prepare and submit a Community/ Occupational Health Management Plan to the SPMU for approval and adoption for the contractor's implementation
9	<u>Gender Based Violence Management</u>	• Inductions and awareness programmes held for all employees on GBV issues; • GBV awareness will be extended to Mokwa community members and local residents; • GBV records at construction site and neighbourhoods to be maintained both for workers and the public; • Workers required to report any GBV issues to the construction management. • The Contractor shall be required to prepare and submit a Gender Based Violence Management Plan to the SPMU for approval and adoption for the contractor's implementation
10	<u>HIV/AIDS and STIs Management</u>	• Provide quarterly HIV/AIDS and STIs awareness programmes for workers and nearby communities; • Health and HIV awareness team arranged from the State Health Ministry for the quarterly programmes;
	• Construction workers camp give rise to health risks associated with poor sexual practices and prostitution.	

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
		• Sponsored educational package put together by the team to be implemented to enlighten both workers and communities; • Training of peer educators within the work force and in communities by the team; and • The contractor to provide free condom supplies and encourage free discussions, counseling and testing.
11	<u>Construction Operation and Slope Stabilization</u> • Construction operations will result in topographic alterations. • Construction operations may result in landslides, rock cave-ins, and mudflow/flooding. • Construction operations can pose earth movement hazards to people working near the construction areas due to unstable soil profiles from site excavations.	• Maximize local employment (including women) on construction works (there should be a contractual requirement to hire a percentage of local workforce including women) • Provide occupational health and safety awareness training and workshops, • Use of child labor shall be strictly prohibited • Routinely Monitor and maintain construction work for continued stability and quality • Shortcomings in the control structures including the check dams (retention basins) along the gully corridor should be corrected before they develop into serious problems. • The Contractor shall be required to prepare and submit an Emergency Response and Incident Plan to the SPMU for approval and adoption for the contractor's implementation
12	<u>Traffic and Transportation Hazards</u> • Traffic movements associated with site staff transportation, delivery of materials and the removal of waste during the construction is likely. • Occasional movement of abnormal vehicular loads on local roads may result in temporary diversions.	• A temporary structure to be constructed on one lane to allow for traffic flow while work is on-going on the other lane; • Traffic wardens to be posted at positions 100m from the construction points on either side of the road to ensure orderly traffic flow; • Actual working areas to be secured with barricades; • Adequate road warning signs to be posted at vantage points to warn and direct traffic; • Traffic and transport associated with project will adhere to existing roads or follow specified routes as established. • All measures shall be effectively monitored by Contractor to ensure their implementation. • The Contractor shall be required to prepare and submit a Traffic and Vehicle Management Plan to the SPMU for approval and adoption for the contractor's implementation
13	<u>Waste Management (solid and liquid wastes)</u> • Proposed project will generate waste during construction including off specification	• Waste bins to be provided for the disposal of waste generated; • Waste will be segregated into three at source - organic (food residues), recyclables (woods, metals) and non-recyclables (plastic and glass wastes);

Item No	COLUMN 1	COLUMN 2
	Environmental and Social Impact Source	Mitigation Measures
	materials such as cement, wood, plastic, paper and domestic waste from construction areas and worker camps. This could result in increased pressure on local waste dump facilities as well as potential for unauthorized disposal and littering if not properly managed.	• Organic waste to be composted near the site office to enrich the soil, while plastics and glass are taken to the district dump-sites; • Topsoil removed from the right of way for maintenance work to be spread on the land to avoid disrupting drainage network; and • Toilets and urinals to be sited at least 100m from any stream or drainage channel and decommissioned at the end of project. • The Contractor shall be required to prepare and submit a Waste Management Plan to the SPMU for approval and adoption for the contractor's implementation
OPERATIONS & MAINTENANCE PHASE (POST CONSTRUCTION)		
14	<u>Land use restriction</u> • Use of the acquired land associated with Mokwa gully setback will be altered and restricted to community recreational uses. Structures may never be erected on this portion of land but economic trees could be planted.	• Create awareness among community members; • Build capacities within community; • Incorporate community feedback mechanism into process • Ensure periodic monitoring of restricted areas • Continuous maintenance of erosion control structures including concrete channels and check dams, and bio-remediated areas for continued effectiveness.
15	<u>Closure of temporary office, staging areas and decommissioning of project</u> • Damage to land forms and vegetation	• Ensure that agreements with the community and landowners on post construction hand-over are kept. • Enforce agreed measures to render the site safe and usable post construction to the satisfaction of the community and landowners.
16	<u>Erosion control system failure management</u> • Check dams that are not properly constructed may suffer damage that could reduce the structural integrity of the erosion control structures during post-construction phase.	• Any treated gullies should be checked regularly and the healing process monitored closely. • Structures built in the channelization for stabilization purpose should be observed for damage especially during rainy seasons and after heavy storms. Any damage observed should be repaired immediately to avoid further damage and the eventual collapse.

CHAPTER 1: INTRODUCTION

1.1 Background

The Government of Nigeria is implementing the multi-sectorial Agro Climatic Resilience in Semi Arid Landscape (ACReSAL), which is financed by World Bank (WB), and the Federal Government of Nigeria (FGN). ACReSAL was initiated by the FGN and designed to address critical challenges of regional desertification control and landscape management in the 19 northern states of Nigeria and the Federal Capital Territory (FCT). These participating states include **Niger**, Adamawa, Taraba, Yobe, Gombe, Borno, Bauchi, Jigawa, Kano, Katsina, Kaduna, Kwara, Zamfara, Kebbi, Sokoto, Plateau, Kogi, Nasarawa, FCT and Benue States. The **Project Development Objective (PDO)** of ACReSAL Project is to address land degradation and build climate resiliency in the Semi-Arid Landscapes in Nigeria. In particular, the project will support activities to develop multi-sectoral approaches for desertification control and landscape management, improve community livelihoods and resilience, and strengthen institutions.

In Niger State, desertification/sustainable land management is considered one of the most serious environmental problems and poverty alleviation is considered a high priority. Niger State is located in the Northcentral geopolitical zone of Nigeria and is known to be under severe landscape and desertification problems. These issues require urgent and focused action to scale-up cost-effective land restoration practices as well as ensure more sustainable future food and water security in the Niger changing climate.

In an effort to redress degraded lands and foster land restoration practices within the State, the Niger State Government (NGSG) has targeted to rehabilitate and remedy the Mokwa gully erosion sites through the ACReSAL opportunity. The location coordinates of Mokwa town, the intervention subproject site are shown in Table 1.

Table 1: Location Coordinates of ACReSAL Intervention in Mokwa, Niger State

S/N	SUBPROJECT DESCRIPTION	LOCATION	LATITUDE	LONGITUDE
1	Unguwan Hausawa/Eko Raba Gully Erosion Subproject	Mokwa town in Mokwa LGA	10°17'18.07"N	5°22'59.51"E

The proposed Niger State ACReSAL intervention subproject is the rehabilitation and restoration of the gully erosion site in Mokwa town in Mokwa LGA of the State. Figure 1-1 shows the location of Niger State in Nigeria and Figure 1-2 is the map of Niger State showing the location of Mokwa LGA.

Figure 1-1: Map of Nigeria Showing Location of Niger State

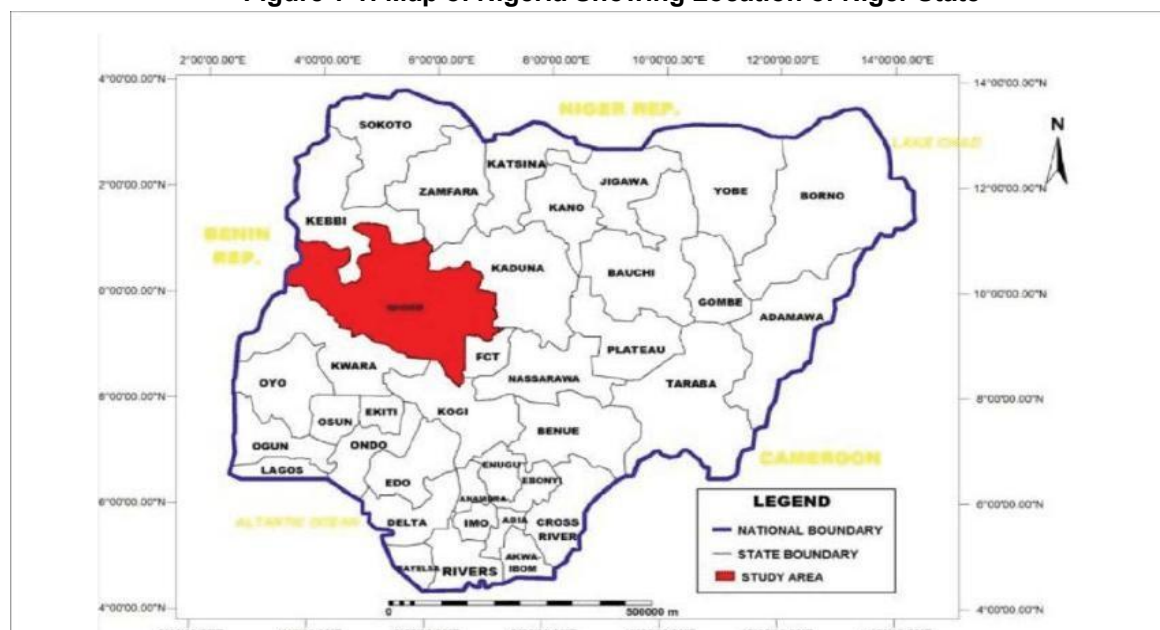




Figure 1-2: Map of Niger State Showing Local Government Areas (LGAs)

The lead agency at the FGN level is the Federal Ministry of Environment supported by the Federal Ministry of Agriculture and Rural Development and the Federal Ministry of Water Resources. The Niger State Government (NGSG) through the State Ministry of Environment and Climate Change to be supported by the State Ministry of Agriculture and that of Water Resources is responsible for the implementation of ACRoSAL activities at the State level with the State Project Management Unit (SPMU) as the lead implementation unit.

Following the ACRoSAL Project preparation, an ESIA was carried out and cleared by the Bank in May 2024. The scope of the study covered was the site-specific areas where subproject intervention activities were expected to take place. This, essentially, excluded Nigeria Railway Lines and associated track embarkments running from Southern Nigeria through Mokwa town to the Northern parts of the country. In May 2025, Mokwa witnessed a devastating flash flood that washed away the railway track embarkments between Chainage xxx and xxx. This resulted in the destruction of many homes and structures as well as severe damages to the environmental terrains. Many deaths were recorded due to the flash flood.



Figure 1.3: Damage to Rail-Line Embarkment in Mokwa Due to Flash Flood



Figure 1.4: Destruction of Rail-Line Embankment by the Flash Flood

1.2. Mokwa Subproject Objectives:

The objectives of the Mokwa subproject are:

- (i) To assess and address environmental and social impacts of the proposed project;
- (ii) To prevent and mitigate undue harm to the people of Mokwa and their environment in the development process;
- (iii) Reclamation of degraded lands and to reduce long-term erosion vulnerability in the two communities;
- (iv) To ensure sustainability of Mokwa watershed management through community participation and gender initiatives;
- (v) To improve soil-water interface without endangering the quality or consistency of either of them;
- (vi) To support transformation of land uses/sustainable land management in Mokwa;
- (vii) To inculcate in the communities the spirit of ownership and to ensure sustainability of the project.



Figure 1.5: Environmental and Social Destructions by the Flash Flood in Mokwa



Figure 1.6: Environmental and Social Destructions by the Flash Flood in Mokwa



Figure 1.7: Soil/Land Degradation Resulting from the Flash Flood in Mokwa

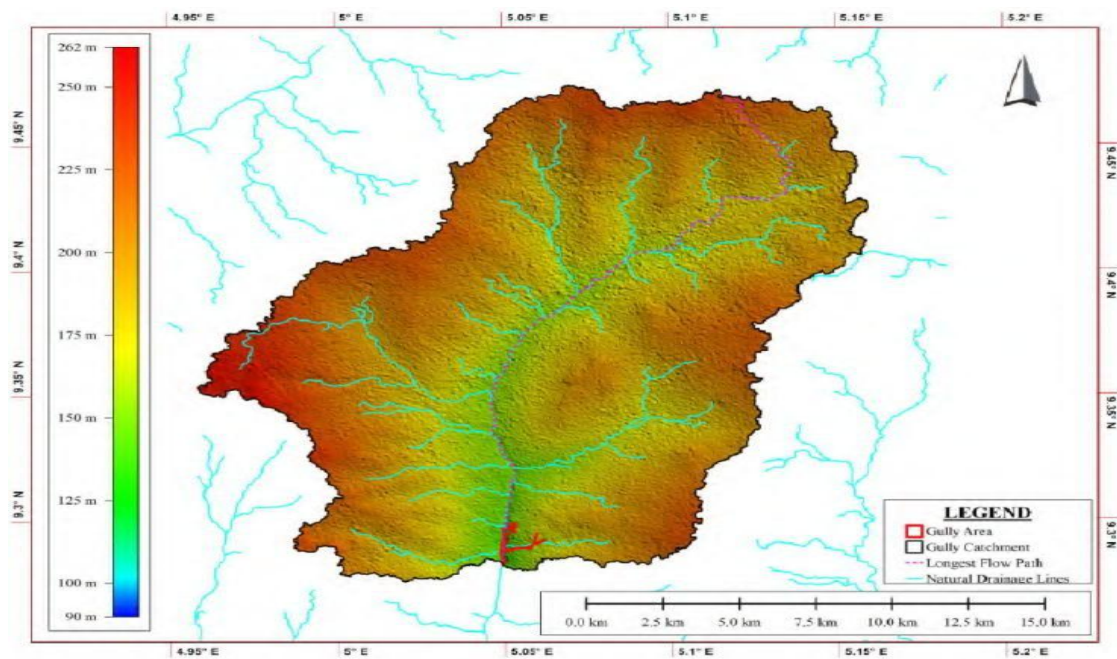


Figure 1.8: Subproject Catchment Area in Mokwa

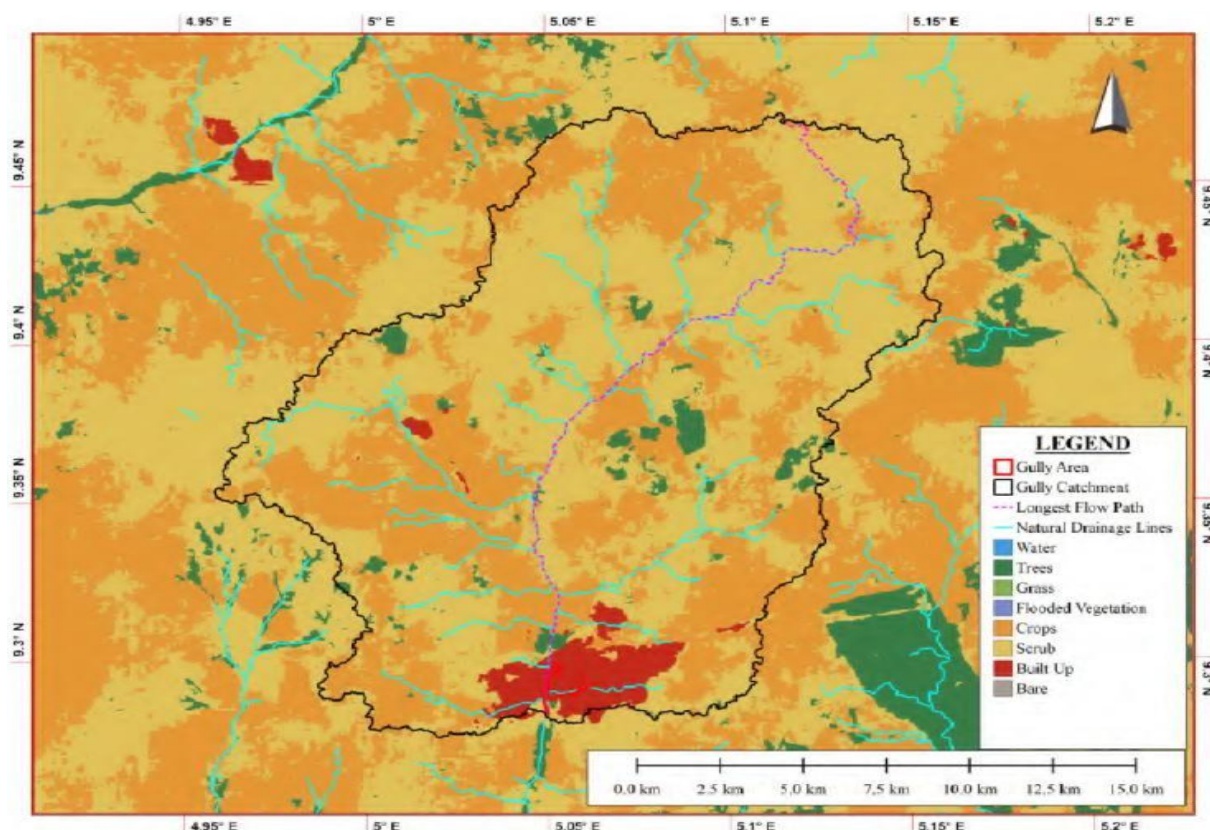


Figure 1.9: Land Use Profile Within the Subproject Catchment Area

1.3. Subproject Description

The proposed gully intervention in Mokwa will rehabilitate the degraded erosion corridors, redress the impacts of erosion and flood on the affected corridors and reverse land degradation within the watershed for the long-term. These activities will result in disruptions in the physical environment; habitat of birds, rodents and reptiles, cause inland river siltation as well as involuntary resettlement thereby triggering the relevant World Bank Environmental and Social Standards (ESS).

Mokwa catchment occupies relatively flat to gently undulating low plain under the Niger Trough in north-west of Bida Basin of north-central Nigeria. The plain is underlain by sedimentary rocks, majorly, Nupe Sandstone (Ojanua, 2006). Due to undulating nature of the landscape coupled with underlying parent rock, intensity of gully erosion remains high particularly in the poorly planned built-up areas of Mokwa metropolis. The catchment empties directly into River Niger at Raba village. This project will involve the construction of concrete and gabion drainage structures as well as bioengineering restoration to safely channel runoff away from the project areas into part of the River Niger. The main structures in the design include channel beds and bank stabilization.

Drainage Bed Structures

The drainage bed structures will include:

- i) Drain Inlet Structure;
- ii) Main lined canal with the fingers;
- iii) Chute structure;
- iv) Drop structures; and,
- v) Exit system/outlet structure.

Other subproject activities during the pre-construction, construction, and operation phases of the works are:

- a) Clearing of vegetation to create access and expansion work where relevant.

- b) Demolition of existing structures like houses within the project right of way (ROW) or (15m X15m) setback and failed hydraulic infrastructure.
- c) Rehabilitation of access routes for heavy-duty equipment conveyance.
- d) Reclamation of degraded land area by sand filling or stabilization of dormant gully fingers.
- e) Bioremediation and creation of 5m x 5m buffer zones along the gully channel.

A riprap basin is provided at the channel outlet to serve the dual purpose of energy dissipation and pond for small scale irrigation purposes. The basin is designed based on principles outlined in HEC-14 (2006) for culverts and channels.

Bank Stabilization

The designed bank stabilization measures include main gully bank stabilization (head, gully wall, gully bed) using bio-engineering works and involving:

- Gabion retaining walls;
- Concrete retaining wall with weeping holes;
- Gully bank protection works;
- Slope cutting with geo-textile; and,
- Bio-remediation using Vetiver grass and bamboo planting.

Energy dissipators and cascade canals are provided to adapt the abrupt bed profile changes and lower the erosive power of stormwater. Retaining walls are provided to retain the soil in the unstable banks and as a stream bank protection.

Many infrastructures (access roads and drainage channels) located in the communities have been washed away, destroyed or severely degraded. These infrastructures are critical inter and intra-community linkages and their disruption have resulted in detours for community members who travel to neighboring communities to trade/market their goods and children who attend schools in neighboring communities. Large areas of land are majorly eroded with many homes and families losing their primary means of livelihoods.

1.3.1 Description of Intervention Works

Rehabilitation/Renovation Construction Works:

- The key activities in putting up the rehabilitation/renovation works at the subproject sites include:
 - cutting and filling for percentage recovery
 - compaction of soils
 - concrete casting
 - assembling of structures and,
 - slope stabilization.
- The key Biological Works include:
 - Terracing;
 - Structured vegetation;
 - Specific trees planting with known root strength
 - Economic trees planting
- The foundations of the lattice structures and concrete casting may be dug mechanically. The depth will be consistent with the geotechnical study and the engineering designs.
- Vegetation clearing will be done manually.
- A number of transport vehicles shall be employed in the project but there may be no on-site maintenance of vehicles.
- Skilled and unskilled labour shall be employed in the project.

Mokwa community is being progressively urbanized due to the influence of the Trunk A Roadway corridor that runs from Lagos to Sokoto. The residents and land users in the immediate vicinity of the gully corridors live in constant fears not knowing whether with the next heavy rainfall, building structures, farmlands, economic trees and crops, and their basic means of livelihoods sustenance will be washed away by collapsing gully walls and heavy stormwater flows. The subproject is designed to rehabilitate the degraded access roads,

restore gullied drainage corridors and provide a combination of structural channelization and vegetative gabion rehabilitation of the gully corridors. For the most part, based on the project engineering designs, about 8-meters of land from the gully edges will be required as easement for the stabilization of the gully walls along the corridors.

The recent flood event and the creation of finger gullies in the residential areas as well as along the main channel have led to the destruction of many houses, farmlands, public utilities, and means of livelihood. Tragically, several deaths were also recorded. Consequently, Mokwa site, has been identified as a site requiring urgent remediation.

As part of the Mokwa design measures for the complete mitigation of the gully corridors, relevant structures were selected on the basis of social, economic and technical sound options for the subproject site. The characteristics and components of these structural/protective elements are:

- Reinforced concrete rectangular open channels of various widths and heights conforming to different alignments as provided in the design.
- Reinforced concrete rectangular open channels of 4.2m to 12.0m widths and 2.2m heights conforming to main drains as provided in the design.
- Reinforced concrete rectangular open channels of 0.6m widths and 0.6m heights conforming to the different side drains as provided in the design.
- Reinforced concrete rectangular open channels of 16.0m widths and 2.2m heights conforming to stilling basins as provided in the design.
- Gabion/Renomattress rectangular open channels of 50.0m widths and 2.2m heights conforming to the gabion/renomattress alignments as provided in the design.
- Bio-Remediation treatment to natural stream end

Riprap basins are provided at the reinforced concrete channel outlets for the subproject to serve the dual purpose of energy dissipation and water retention pond for small scale irrigation purposes. The types of plants proposed along the discharge path of the drain (on the natural drainage path) and the side slopes are:

- 1) *Vertiver* grass – along the direct path of discharge onto the natural bed. Spacing to be at 10m strip of Vertiver from Gabion wall to the first tree)
- 2) *Irvingia* species, *Dacryodes edulis*, *Mango*, other locally available medium height plants on the side slopes, on each side of channel.

1.4 Description of the Subproject Area

The Unguwan Hausawa/Eko Rabba gully erosion site is located about 215km south of Minna, the State capital with the center of its gully lying at coordinates 9°17'50"North, 5°3'12"East approximately. The gully system consists of two main arms - the first being Unguwan Hausawa main gully corridor (D01) which begins upstream of Mokwa-Jebba road where various finger gullies joined the main gully before the road. This gully runs in the North to Southern direction terminating inside a stable wetland. After the road, the flow corridor then passes under a bridge which currently does not show any sign of failure.

The second main arm of the gully is Eko Rabba gully corridor (D02) which commenced from the General hospital, passes through Eko Rabba community. This gully runs in the East – West direction linking with the Unguwan Hausawa main gully downstream as shown in Figure 1.2. The remaining section of the gully corridor runs relatively straight terminating inside a stable wetland as indicated earlier.



Figure 1.10: Image of Mokwa Metropolis Showing Flooded Corridors

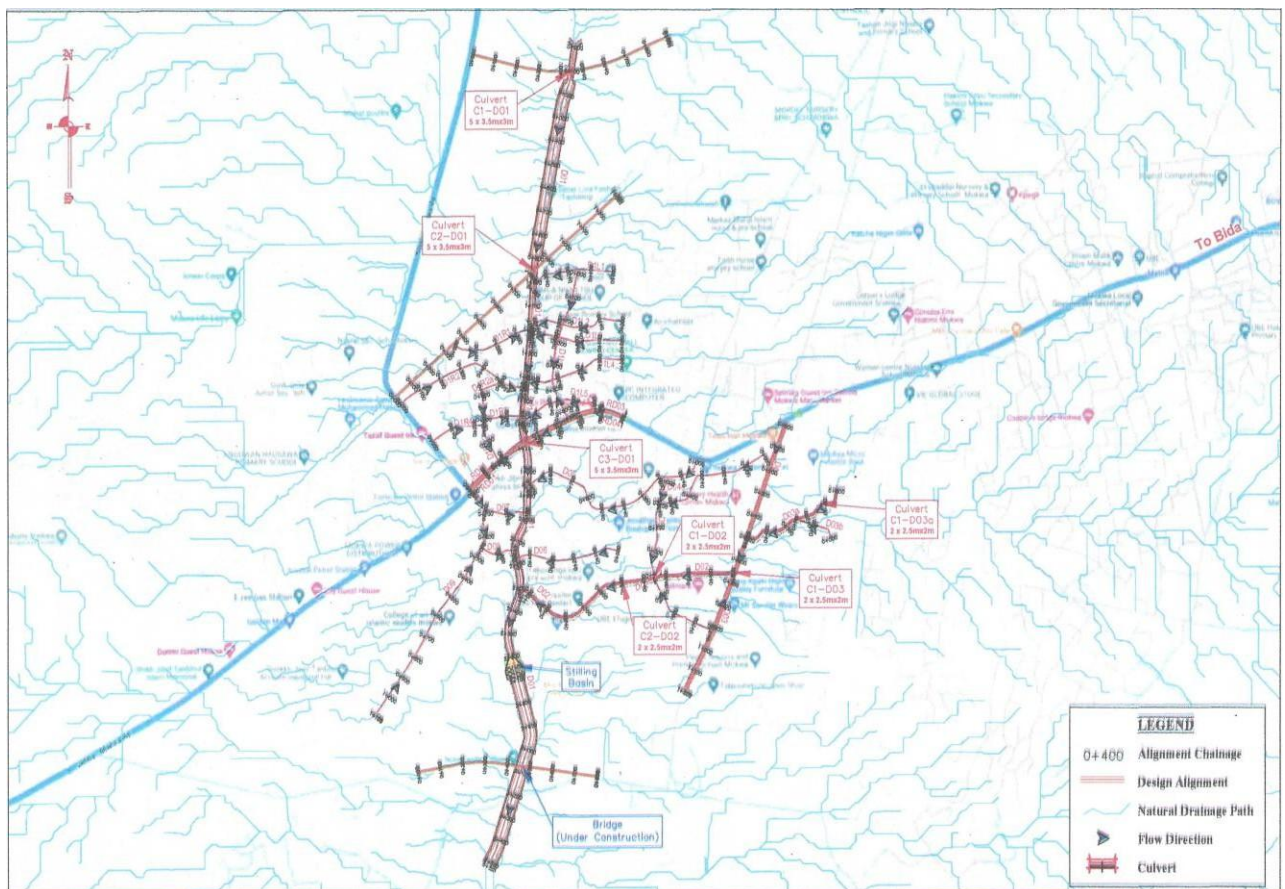


Figure 1.11: Subproject Gully Remediation Layout

The total gully system to be remediated consists of about **17.434km** length as shown in Figure 1.11 and summarized in Table 2 below.

Table 2: Unguwan Hausawa/Eko Rabba Main Gully Corridors:

S/N	Unguwan Hausawa Community							
1	Gully Alignment	D01	D1L (1-6)	D1R (1-4)	RD01	RD02	RD03	RD04
	Length (m)	3,521.12	367.42	411.67	317.90	304.04	469.56	462.61
S/N	Eko Rabba Community							
2	Gully Alignment	D02	D03(LHS)	D03(RHS)	D03a	D03b	D04	D04a
	Length (m)	1,041.40	910.00	910.00	504.00	376.71	778.04	553.93
	Gully Alignment	D05	D06	D07	D08	D09		
	Length (m)	921.25	462.36	188.31	162.88	1,103.40		

The total catchment area that contributes to the gully is estimated at approximately 294.89 sq. km. The gullies are adversely affecting the Unguwan Hausawa community livelihoods. The community which is predominantly engaged in farming and cattle rearing is a lively suburb of Mokwa with schools and churches, private and commercial dwellings, roads and other public infrastructures that are now continually under threat. The gullies have severed roads and caused loss of lives, damage to properties, farmlands, public infrastructure (e.g. power lines, roads) and the ecosystem (e.g. loss of biodiversity and wildlife habitats) and continually endangering lives.

The project site has experienced very rapid gully expansion and development of new erosion gullies with the recent Mokwa flooding event. The major contributors to the erosion gullies include inadequate termination of existing drains at existing culverts, leading to development of the main gully heads. The erosion has continued downstream and finger gullies have also developed. There has also been expansion of the finger gullies along the upstream catchment area of the main gully.

In several locations surveyed during the post-flood field assessment (May–June 2025), soil compaction and sediment deposition were observed. Farmlands closer to the breach site were buried under coarse sediments, silt, and debris, rendering them unsuitable for immediate cultivation. The alluvial properties of the Mokwa region, while typically fertile, made these soils particularly vulnerable to displacement when saturated and exposed to sudden hydraulic force. Moreover, the erosion of riparian zones adjacent to the tributary worsened gully formation and bank destabilization, threatening nearby infrastructure and increasing the risk of future land loss. The unregulated conversion of natural flood buffers into residential areas compounded the damage by removing vegetation that would have otherwise slowed runoff and stabilized the soil.

In areas downstream of the embankment, sheet erosion was also prevalent, stripping large swaths of land of organic matter and microbial life essential for nutrient cycling. In some

residential areas, exposed subsoil layers and muddy residue created public health risks, while also increasing susceptibility to invasive species colonization. The cumulative result is a landscape marked by: Reduced agricultural viability, Increased erosion hotspots, Lowered land resilience to future climate events. These effects call for urgent soil remediation strategies, such as re-vegetation, erosion control structures, and targeted soil fertility recovery programs.

1.5 Description of Intervention Activities

The proposed intervention subproject in Mokwa is expected to address, prevent and reverse the land degradation at the subproject area for the long-term and will involve the rehabilitation and restoration of the degraded land areas. The rehabilitation and restoration activities will involve civil works as well as bioengineering restoration and will result in disruptions in the physical environment, habitat, and cause inland river siltation as well as involuntary resettlement thus triggering the relevant World Bank environmental and social standards (ESS) requirements.

The Mokwa subproject consists of remedial structural and non-structural developments that include civil works and vegetative development. The rehabilitation works consist of reinforced concrete drains for the main and secondary drains with an end section of gabion and renomattress drainage channel. Based on the detailed engineering designs for the subproject, the remedial activities will include the construction of 17,434.31km length of drainage channels at different sections of the project area as shown in Table 3 as well as seven (7 No.) culverts of various lengths located along three alignments as shown in Table 4.

Table 3: List Of Proposed Drains With Their Locations And Lengths

S/N	ALIGNMENT NAME	CHAINAGE FROM (m)	CHAINAGE TO (m)	LENGTH (m)	BOTTOM WIDTH (m)	FLOW DEPTH (m)
1	D01	0+000.00	0+150.00	150.00	16.00	2.50
2	D01	0+150.00	0+900.00	750.00	30.00	2.00
3	D01	0+900.00	1+700.00	800.00	16.00	2.50
4	D01	1+700.00	2+600.00	900.00	20.00	2.50
5	D01	2+600.00	3+521.12	921.12	30.00	2.50
6	D1L1	0+000.00	0+381.68	381.68	0.70	0.70
7	D1L2	0+000.00	0+426.70	426.70	0.70	0.70
8	D1L3	0+000.00	0+412.61	412.61	0.70	0.70
9	D1L4	0+000.00	0+448.34	448.34	1.50	1.50
10	D1L5	0+000.00	0+352.89	352.89	1.50	1.50
11	D1L6	0+000.00	0+460.00	460.00	1.50	1.50
12	D1L6	0+046.00	0+638.31	178.31	1.00	1.00
13	D1R1	0+000.00	0+359.96	359.96	0.70	0.70
14	D1R2	0+000.00	0+616.96	616.96	1.00	1.00
15	D1R2a	0+000.00	0+094.82	94.82	0.70	0.70
16	D1R3	0+000.00	0+168.32	168.32	0.70	0.70
17	D1R4	0+000.00	0+305.98	305.98	1.00	1.00
18	D1R4a	0+000.00	0+240.23	240.23	0.70	0.70
19	D02	0+045.00	0+450.00	450.00	4.50	2.00
20	D02	0+450.00	1+041.40	591.40	4.50	2.00
21	D03 (LHS)	0+000.00	0+250.00	250.00	0.70	0.70
22	D03 (LHS)	0+025.00	0+675.00	425.00	4.50	2.00

S/N	ALIGNMENT NAME	CHAINAGE FROM (m)	CHAINAGE TO (m)	LENGTH (m)	BOTTOM WIDTH (m)	FLOW DEPTH (m)
23	D03 (LHS)	0+679.00	0+910.00	235.00	1.50	1.50
24	D03 (RHS)	0+000.00	0+250.00	250.00	0.70	0.70
25	D03 (RHS)	0+025.00	0+675.00	425.00	0.70	0.70
26	D03 (RHS)	0+679.00	0+910.00	235.00	0.70	0.70
27	D03a	0+000.00	0+504.00	504.00	4.50	2.00
28	D03b	0+000.00	0+376.71	376.71	1.00	1.00
29	D04	0+000.00	0+425.00	425.00	1.00	1.00
30	D04a	0+429.00	0+778.04	353.04	1.00	1.00
31	D04b	0+000.00	0+553.93	553.93	0.70	0.70
32	D05	0+000.00	0+500.00	500.00	1.00	1.00
33	D05	0+500.00	0+921.25	421.25	1.50	1.50
34	D06	0+000.00	0+462.36	462.36	1.00	1.00
35	D07	0+000.00	0+188.31	188.31	1.00	1.00
36	D08	0+000.00	0+162.88	162.88	1.50	1.50
37	D09	0+000.00	0+260.00	260.00	1.00	1.00
38	D09	0+260.00	0+850.00	590.00	1.50	1.50
39	D09	0+850.00	1+103.40	253.40	1.50	1.50
40	RD01	0+000.00	0+317.90	317.90	2.50	2.00
41	RD02	0+000.00	0+304.04	304.04	0.70	0.70
42	RD03	0+000.00	0+469.56	469.56	1.50	1.50
43	RD04	0+000.00	0+462.61	462.61	0.70	0.70
TOTAL				17,434.31		

Table 4: List Of Culverts Showing Sizes And Lengths

S/N	CULVERT NAME	ALIGNMENT NAME	CHAINAGE (m)	CULVERT SIZE (Cells x Width x Depth)	LENGTH (m)
1	C1-D01	D01	0+110.92	5 x 3.5mx3m	30
2	C2-D01	D01	0+985.21	5 x 3.5mx3m	50
3	C3-D01	D01	1+684.20	5 x 3.5mx3m	30
4	C1-D02	D02	0+352.03	2 x 2.5mx2m	15
5	C2-D02	D02	0+487.38	2 x 2.5mx2m	15
6	C1-D03	D03	0+666.59	2 x 2.5mx2m	15
7	C1-D03a	D03a	0+124.07	2 x 2.5mx2m	10

As part of the design measures for the complete mitigation of the gully corridors, relevant structures selected on the basis of social, economic and technical sound options are designed for the subproject sites. The characteristics and components of these structural/protective elements are:

- Reinforced concrete rectangular open channels of various widths and heights conforming to different alignments as provided in the design.
- Reinforced concrete rectangular open channels of 4.2m to 12.0m widths and 2.2m heights conforming to main drains as provided in the design.
- Reinforced concrete rectangular open channels of 0.6m widths and 0.6m heights conforming to the different side drains as provided in the design.

- Reinforced concrete rectangular open channels of 16.0m widths and 2.2m heights conforming to stilling basins as provided in the design.
- Gabion/Renomattress rectangular open channels of 50.0m widths and 2.2m heights conforming to the gabion/renomattress alignments as provided in the design.
- Bio-Remediation treatment to natural stream end.

Riprap basins are provided at the reinforced concrete channel outlets for the subproject to serve the dual purpose of energy dissipation and pond for small scale irrigation purposes. The types of plants proposed along the discharge path of the drain (on the natural drainage path) and the side slopes are:

- 3) *Vertiver* grass – along the direct path of discharge onto the natural bed. Spacing to be at 10m strip of Vertiver from Gabion wall to the first tree)
- 4) *Irvingia* species, *Dacryodes edulis*, *Mango*, other locally available medium height plants on the side slopes, on each side of channel.

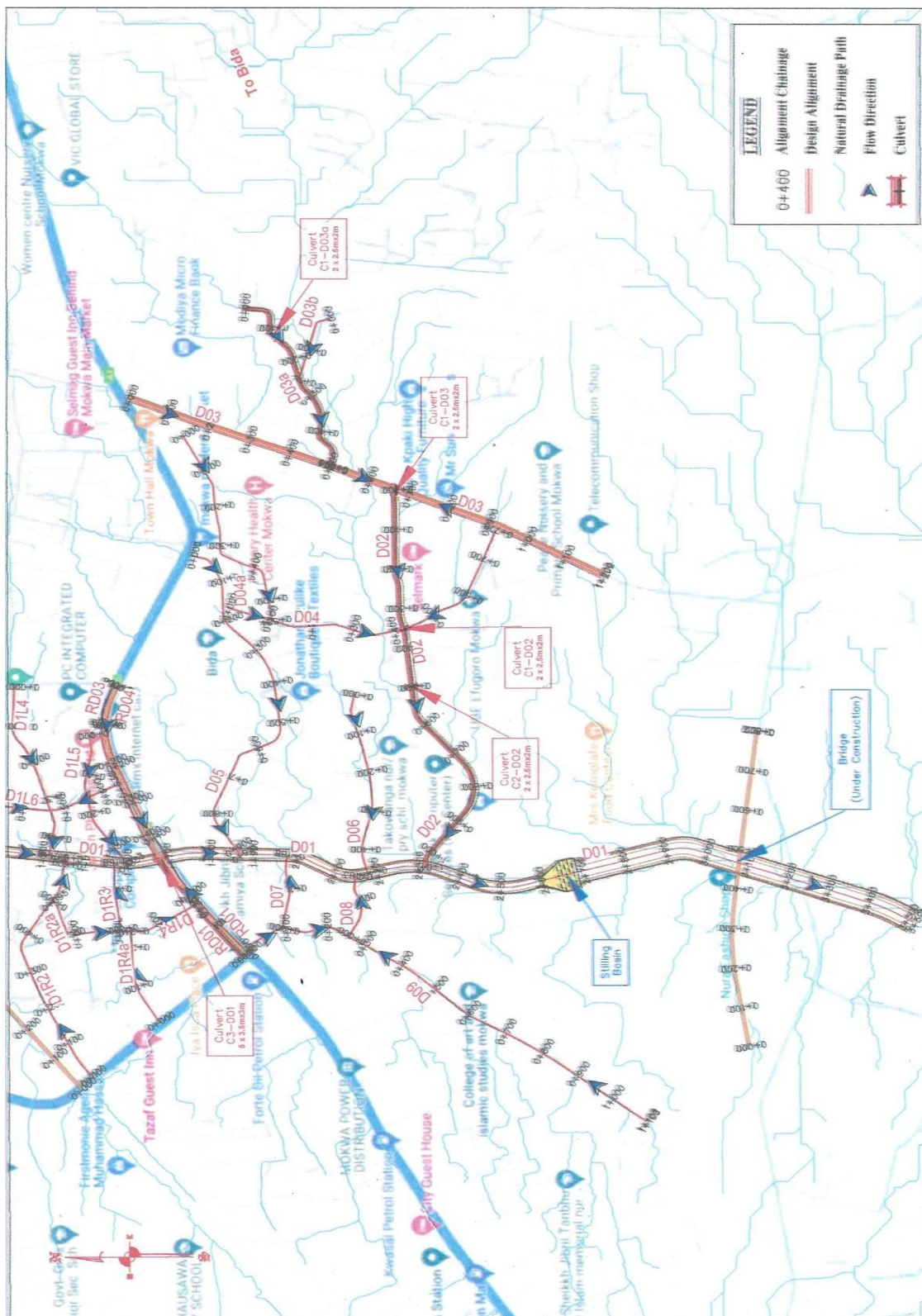
The physical developments in the communities and the general life style of the people (such as unsustainable farming practices, indiscriminate waste dumping and sand excavation) are not in tandem with nature conservation resulting in increased runoff and the blockage of natural storm water flow routes within the catchment and sub-catchment areas thereby precipitating the erosion problem.

The gully rehabilitation activities pose potential risks and impacts that may occur before and during project implementation. These risks and impacts include land acquisition along the expanded Right-of-Way (ROW), permanent and/or temporary physical displacement of residential or commercial households (HHs), temporary economic displacement of some vendors and businesses along the ROW, loss of economic trees and crops, risk of gender based violence (GBV) and road accidents, etc.

1.5.1 Project Area General Characterization

The overall gully occupies a total of 265.13Ha of land within Mokwa community. The topographical, hydrogeological and geotechnical characteristics of the project area have greatly influenced the mass movement and land wasting activities along the peripheral fringes of the Mokwa gullies. Steep slopes cause water to runoff at a rapid rate, particularly where water percolation into the soil is slow. Top soils of silty sand with low clay content are less cohesive and are inherently more unstable. These soils are at greater risk of erosion by runoff. Landslides are usually caused by an increase of pore water pressures within the slope material which causes a reduction on the effective shear strength of the unconsolidated medium to coarse grained sand zone along the seepage area in the gully wall. The sand zones are gradually loosened and eroded.

At the gully head banks and along the gully corridors, major destructions have occurred and many buildings have collapsed. Additionally, gully bank failures have occurred at several locations subjecting buildings and land masses in the area to the continued imminent risk of collapsing. The upper project areas are releasing their surplus water directly to the main collector trunk over the gully wall/bank resulting in sloughing of the gully bank walls.



1.6 Rationale for the ESIA Study:

The basic legal framework for development projects in Nigeria with respect to environmental and social safeguards is braced in the Nigerian Environmental Impact Assessment (EIA) Act No. 86 of 1992 and in the World Bank Environmental and Social Standards (ESS) for projects supported by the Bank. According to the WB Environmental and Social Framework (ESF) prepared specifically for the ACRReSAL project, the project is considered of “High” environmental and social risk rating. The project is also considered an EIA category “A” project

that will result in several significant environmental and social impacts which must be considered and properly addressed to ensure that the environment is not unreasonably further degraded, and the socioeconomic life of the people is not adversely disrupted.

Based on the ESMF and ESIA-RAP Scoping Report for Mokwa flood/gully erosion intervention, the subproject at Unguwan Hausawa/Eko Rabba in Mokwa will result in several significant environmental and social impacts which must be properly mitigated. This therefore requires the preparation of an environmental and social impact assessment (ESIA) together with the associated environmental and social management plans (ESMP) to guide the proposed intervention at the site. This ESIA, as a site-specific safeguard instrument, is required to provide necessary procedures and criteria that will guide the proposed gully rehabilitation and erosion control intervention subprojects in accordance with the World Bank Environmental and Social Standards (ESS) and the Nigerian national environmental policies, as well as those of Niger State and the local agencies.

1.7. ESIA Objective

The objective of this study is to prepare an Environmental and Social Impact Assessment (ESIA) for the revised Mokwa gully intervention subproject. The ESIA will specifically identify and assess the environmental and social impacts that may be associated with the revised engineering design for the gully erosion rehabilitation project and all other activities aimed at rehabilitating the gully corridor within the project watershed. The study will also identify, evaluate and document the set of mitigation; monitoring and institutional actions to be taken before, during and after site remedial construction and rehabilitation works to eliminate any identified adverse socioeconomic and livelihood impacts or offset/reduce the impacts to acceptable levels.

The potential impacts associated with the phases of the redesigned site interventions consisting of pre-construction, construction, and operation and maintenance (O&M) are developed and appropriate mitigation measures established for the impacts. This ESIA documentation includes an environmental and social management plan (ESMP) detailing measures needed to implement the identified remedial actions, addressing the adequacy of the monitoring and institutional arrangements for the upper and lower watersheds on a sustainable basis. The ESMP provides necessary institutional framework and monitoring actions to be carried out before, during and after the construction and development works.

The overall project study was based on both quantitative data and qualitative inputs collected through research of historical environmental and social data for the project area, and the socioeconomic survey questionnaire. Qualitative inputs through consultations and discussions with potential project affected persons (PAPs), local community members and other stakeholders provided additional information for inclusion in the assessment.

The affected communities in Mokwa have been mobilized to contribute actively to project implementation and to sustainably maintain the works following implementation. This ESIA Report includes measures necessary to implement identified actions. The mitigation measures adopted are guided by and consistent with recommendations in the Environmental and Social Management Framework (ESMF) for ACRReSAL.

The following project-specific background documents were reviewed and together with collected field-based information and data formed basis upon which analytical determinations were made:

- Environmental and Social Management Framework (ESMF) for ACRReSAL
- ACRReSAL Project Appraisal Document (PAD)
- ACRReSAL Project Implementation Manual (PIM)
- World Bank Environmental and Social Framework (ESF)
- World Bank Environmental and Social Standards (ESS1 through 10)
- Mokwa Intervention Engineering Design

- Revised Mokwa Intervention Engineering Design
- Mokwa TOR For ESIA-August2025

During project preparation, six Environmental and Social Framework instruments were prepared including an Environmental and Social Management Framework (ESMF), a Resettlement Policy Framework (RPF), Integrated Pest Management Plan, Stakeholders engagement Plan, Labour Management Procedure and Security Risk Management Framework. These instruments are frameworks that need to be translated into specific cost, measurable, and monitorable actions for specific sites intervention through the preparation of site-specific management and action plans.

Projects proposed for financing by the Bank or its affiliate Agencies are guided by the World Bank environmental and social framework (ESF) in order to comply with applicable WB environmental and social standards. These are designed to ensure that the projects are environmentally and socially sustainable, and thus improve the decision-making process associated with the project. The ACRoSAL project is being funded by the World Bank and other affiliate agencies. Considering the nature of these works proposed for Mokwa, their scope, geographic coverage and clients capacity, the following World Bank's Environmental and Social Standards will apply. Viz

- ESS1 Assessment and Management of Environmental and Social Risks and Impacts,
- ESS2 Labor and Working Conditions,
- ESS3 Resource Efficiency and Pollution Prevention and Management,
- ESS4: Community Health and Safety,
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement,
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources,
- ESS8: Cultural Heritage,
- ESS10: Stakeholder Engagement and Information Disclosure

1.8 Phases of the Intervention Works:

The proposed project scope of work can generally be classified into three phases, namely:

1. Pre-construction phase;
2. Construction phase; and,
3. Post-construction (maintenance) phase.

1.8.1 Pre-construction Phase

As part of the pre-construction stage, SMEnv/NGS-ACReSAL commissioned Messrs Dadson Engineering Services Limited develop the detailed engineering designs for Mokwa site. The remedial intervention and development of the Mokwa gully corridors shall follow provisions as contained in the said design. The preparation of this ESIA is also part of the pre-construction phase. The commencement of the remedial construction activities is expected to begin after the completion of the ESIA and the RAP process, if required.

The pre-construction activities which also includes site clearance, demolition along the RoW, vegetation clearance, and silt and dredge clearance from the gully beds are expected to commence as soon as the RAP implementation has concluded. Construction of campsites and staging areas would lead to vegetation clearing and susceptibility to washing of soil and contamination of surface water resources, liquid and solid wastes generation. It is therefore necessary to avoid the risks and effects that arise with the commencement of these pre-construction activities. In order to guarantee project sustainability, the activities associated with the pre-construction phase are linked to both positive and negative risks and impacts of the project. Consequently, the appropriate and relevant Management Plans should serve as guide.

As designed, the proposed intervention works when completed will mitigate the gully formation by slowing down the process of erosion (upstream) and (siltation downstream), and also eliminate the flooding problems. Also, it shall protect biodiversity, which is important for livelihoods of the inhabitants, and strengthen natural buffers against climate and erosion risk, while also creating employment opportunities for skilled and unskilled labour.

1.8.2 Construction Phase

The construction of the gully erosion control infrastructure and the site development activities, as designed, will require the use of existing access roadways to reach sections of the project location. The access roadways need to be rehabilitated either as part of the construction works or following the gully rehabilitation works. Civil works associated with the rehabilitation of the access roadways include re-grading and rehabilitation of the drainages (where they exist), and creation of hard standing areas. The need for the rehabilitation of the access roads is heightened by the level of destruction that may arise from movement of heavy duty vehicles and equipment for project construction activities. According to the engineering designs, stone pitching bank protection is to be implemented without terracing on the steeper slopes of the gully corridor to avoid relocation of existing buildings during implementation and to prevent surface erosion because of its impervious character.

The preparation of the construction staging areas will require some localized vegetation clearance along the gully corridor and the removal of incipient solid waste materials. Materials arising from the excavation for the gully corridor, foundations, stabilization walls (soil, rock etc.) and installation of gabions would be used to fill appropriate areas. The foundations will be in-filled with cement supplied via ready-mix-cement trucks or alternatively mixed on site. Vegetation clearing may be done manually or mechanically. A number of transport vehicles will be employed in the project but there will be no on-site maintenance of vehicles. The power equipment is expected to be used in the construction including power saws and compressor to break hard ground (if required). Earth moving equipment such as excavators, compactors, bulldozers and pay loaders will also be used at the site. Additionally, skilled and unskilled labor will be employed during the project implementation.

1.8.3 Post-Construction (Operations & Maintenance) Phase

Routine visual inspection and maintenance of the rehabilitated gully corridor are expected. Access rights may need to be retained through the community watershed association to allow for maintenance works in the future. The erosion and flood control corridor will require routine periodic maintenance of the site infrastructure (culverts, gabions, drainage channels, roadways, etc) as well as necessary oversight of any economic trees associated with the project.

1.9 Use of Construction Materials

Construction materials for the complete rehabilitation of the gully problems include materials for general fill, structural fill, rock for gabions and rock fill, materials for concrete aggregate and water. The materials recommended to be used for general fill and structural fill are materials to be hauled from the specified Borrow Pit. The Borrow pit is located within the coordinates: North West - 10° 17' 35.8" N and 5° 23' 28.47" E; North East - 10° 17' 35.32" N and 5° 23' 34.66" E; South West - 10° 17' 26.95" N and 5° 23' 28.32" E; South East - 10° 17' 27.39" N and 5° 23' 32.17" E.

Based on the geotechnical and material investigation carried out for the site, the field and laboratory results of the engineering properties for the borrow materials, including subsoil and rock materials for construction and gabion set up, the results show that materials obtainable are suitable for all required manner of fill in the subprojects. The engineering parameters of the natural material, indicate existing site material has suitable engineering properties to be used as base for the hydraulic designed structures.

CHAPTER 2: INSTITUTIONAL AND LEGAL FRAMEWORK

The relevant legal and institutional framework applicable to ACREsAL has been fully discussed in the Environmental and Social Management Framework (ESMF) prepared for the project. This ESIA is guided by the requirements of the relevant and applicable state, national and international regulations, guidelines, conventions, industrial best management practices including the World Bank environmental and social framework (ESF) and its applicable environmental and social standards (ESSs) relevant to the Mokwa Subproject. These applicable requirements and regulations are summarized below:

2.1 World Bank Environmental and Social Safeguard Policies

Eight of the 10 WB ESSs are considered relevant to ACREsAL. These are listed under Section 1.7. Based on the specific scope of construction and rehabilitation works required in the Mokwa gully erosion intervention, Table 2.1 summarizes the WB ESSs considered applicable to Mokwa subproject.

Table 2.1: Relevant Environmental and Social Standards for Mokwa Subproject

WB Environmental and Social Standard	Relevant to ACREsAL?		Applicable to Mokwa Subproject?		Relevant To Subprojects Due To	How Project Addresses ESS Requirements
	YES	NO	YES	NO		
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	[x]	[]	[x]	[]	Civil works with environmental and social risks and impacts.	This ESIA with the site-specific ESMP spell out the mitigation measures required for the Mokwa to meet the requirements of the ESS1.
ESS2: Labor and Working Conditions	[x]	[]	[x]	[]	Employment creation with worker-management relationships	This ESIA with the site-specific ESMP spell out the mitigation measures required for the Mokwa to meet the requirements of the ESS2.
ESS3: Resource Efficiency and Pollution Prevention and Management	[x]	[]	[x]	[]	Project may generate pollution to air, water, and land, and consume resources.	This ESIA with the site-specific ESMP spells out the mitigation measures required for the Mokwa to meet the requirements of the ESS3.
ESS4: Community Health and Safety	[x]	[]	[x]	[]	Project, equipment, and infrastructure may increase community exposure to health and safety risks and impacts.	This ESIA with the site-specific ESMP spells out the mitigation measures required for the Mokwa to meet the requirements of the ESS4.
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	[x]	[]	[x]	[]	Land acquisition and restrictions on land use may cause physical and socioeconomic displacement.	Site-specific stand-alone RAP is prepared to guide the required land acquisition and resettlement issues for Mokwa subprojects
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	[x]	[]	[x]	[]	Biodiversity and sustainable management of living natural resources are fundamental to sustainable development.	This ESIA with the site-specific ESMP spells out the mitigation measures required for the Mokwa to meet the requirements of the ESS6.
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	[]	[x]	[]	[x]	Standard is not relevant to ACREsAL	Not Relevant
ESS8: Cultural Heritage	[x]	[]	[x]	[]	Civil works may cause impacts to community traditions and cultural heritage of the people.	This ESIA with the site-specific ESMP spells out appropriate mitigation measures in the event of existence of shrines and other cultural relics at the Mokwa sites

WB Environmental and Social Standard	Relevant to ACRESAL?		Applicable to Mokwa Subproject?		Relevant To Subprojects Due To	How Project Addresses ESS Requirements
	YES	NO	YES	NO		
						to meet the requirements of the ESS8.
ESS9: Financial Intermediaries	[]	[x]	[]	[x]	Standard is not relevant to ACRESAL	Not Relevant
ESS10: Stakeholder Engagement and Information Disclosure	[x]	[]	[x]	[]	Strong constructive and responsive relationships are important for successful management of project risks	This ESIA with the site-specific ESMP spells out the mitigation measures required for the Mokwa to meet the requirements of the ESS10.

NA* = Not Applicable

The eight ESSs that are considered relevant to ACRESAL are summarized below:

2.1.1 ESS1: Assessment and Management of Environmental and Social Risks and Impacts

ESS1 sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing, in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).

The ESSs are designed to help Borrowers to manage the risks and impacts of a project, and improve their environmental and social performance, through a risk and outcomes based approach. The desired outcomes for the project are described in the objectives of each ESS, followed by specific requirements to help Borrowers achieve these objectives through means that are appropriate to the nature and scale of the project and proportionate to the level of environmental and social risks and impacts.

Borrowers will conduct environmental and social assessment of projects proposed for Bank financing to help ensure that projects are environmentally and socially sound and sustainable. The environmental and social assessment will be proportionate to the risks and impacts of the project. It will inform the design of the project, and be used to identify mitigation measures and actions and to improve decision making. Borrowers will manage environmental and social risks and impacts of the project throughout the project life cycle in a systematic manner, proportionate to the nature and scale of the project and the potential risks and impacts.

2.1.2 ESS2: Labor and Working Conditions

ESS2 recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

- To promote safety and health at work.
- To promote the fair treatment, nondiscrimination and equal opportunity of project workers.
- To protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate.
- To prevent the use of all forms of forced labor and child labor.¹
- To support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law.
- To provide project workers with accessible means to raise workplace concerns.

2.1.3 ESS3: Resource Efficiency and Pollution Prevention and Management

ESS3 recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. The current and projected atmospheric concentration of greenhouse gases (GHG) threatens the welfare of current and future generations. At the same time, more efficient and effective resource use, pollution prevention and GHG emission avoidance, and mitigation technologies and practices have become more accessible and achievable.

This ESS sets out the requirements to address resource efficiency and pollution¹ prevention and management throughout the project life cycle consistent with GIIP.

- To promote the sustainable use of resources, including energy, water and raw materials.
- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- To avoid or minimize project-related emissions of short and long-lived climate pollutants.³
- To avoid or minimize generation of hazardous and non-hazardous waste.
- To minimize and manage the risks and impacts associated with pesticide use.

The Borrower will consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention measures in accordance with the mitigation hierarchy. The measures will be proportionate to the risks and impacts associated with the project and consistent with GIIP and, in the first instance the EHSGs. The Borrower will implement technically and financially feasible measures for improving efficient consumption of energy, water and raw materials, as well as other resources. Such measures will integrate the principles of cleaner production into product design and production processes to conserve raw materials, energy and water, as well as other resources. Where benchmarking data are available, the Borrower will make a comparison to establish the relative level of efficiency.

2.1.4 ESS4: Community Health and Safety

ESS4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities.

ESS4 addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

- To anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and nonroutine circumstances.
- To promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure, including dams.
- To avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.
- To have in place effective measures to address emergency events.
- To ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.

This ESS addresses potential risks and impacts on communities that may be affected by project activities. Occupational health and safety (OHS) requirements for project workers are set out in ESS2, and measures to avoid or minimize impacts on human health and the environment due to existing or potential pollution are set out in ESS3. The Borrower will evaluate the risks and impacts of the project on the health and safety of the affected

communities during the project life cycle, including those who, because of their particular circumstances, may be vulnerable. The Borrower will identify risks and impacts and propose mitigation measures in accordance with the mitigation hierarchy.

When the Borrower retains direct or contracted workers to provide security to safeguard its personnel and property, it will assess risks posed by these security arrangements to those within and outside the project site. In making such arrangements, the Borrower will be guided by the principles of proportionality and GIIP, and by applicable law, in relation to hiring, rules of conduct, training, equipping, and monitoring of such security workers. The Borrower will not sanction any use of force by direct or contracted workers in providing security except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.

The Borrower will seek to ensure that government security personnel deployed to provide security services act in a manner consistent with provisions for sexual exploitation (SEA) and abuse as well as sexual harassment (SH), and encourage the relevant authorities to disclose the security arrangements for the Borrower's facilities to the public, subject to overriding security concerns.

2.1.5 ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

Issues relating to Land Acquisition, Restrictions on Land Use and Involuntary Resettlement are captured in the Resettlement Policy Framework (RPF), which has been prepared as a standalone document.

ESS5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons. Project-related land acquisition or restrictions on land use may cause physical displacement (relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood), or both. The term "involuntary resettlement" refers to these impacts. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in displacement.

1 "*Land acquisition*" refers to all methods of obtaining land for project purposes, which may include outright purchase, expropriation of property and acquisition of access rights, such as easements or rights of way. Land acquisition may also include:

(a) Acquisition of unoccupied or unutilized land whether or not the landholder relies upon such land for income or livelihood purposes; (b) repossession of public land that is used or occupied by individuals or households; and (c) project impacts that result in land being submerged or otherwise rendered unusable or inaccessible. "Land" includes anything growing on or permanently affixed to land, such as crops, buildings and other improvements, and appurtenant water bodies.

2 "*Restrictions on land use*" refers to limitations or prohibitions on the use of agricultural, residential, commercial or other land that are directly introduced and put into effect as part of the project. These may include restrictions on access to legally designated parks and protected areas, restrictions on access to other common property resources, and restrictions on land use within utility easements or safety zones.

3 "*Livelihood*" refers to the full range of means that individuals, families and communities utilize to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade and bartering.

Experience and research indicate that physical and economic displacement, if unmitigated, may give rise to severe economic, social and environmental risks: production systems may be dismantled; people face impoverishment if their productive resources or other income sources are lost; people may be relocated to environments where their productive skills are less applicable and the competition for resources greater; community institutions and social networks may be weakened; kin groups may be dispersed; and cultural identity, traditional authority, and the potential for mutual help may be diminished or lost. For these reasons, involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it

will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

- To avoid involuntary resettlement or, when unavoidable, minimize involuntary resettlement by exploring project design alternatives.
- To avoid forced eviction.
- To mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use by: (a) providing timely compensation for loss of assets at replacement cost and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
- To improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure.
- To conceive and execute resettlement activities as sustainable development programs, providing sufficient investment resources to enable displaced persons to benefit directly from the project, as the nature of the project may warrant.
- To ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.

2.1.6 ESS6: Biodiversity Conservation & Sustainable Management of Living Natural Resource

ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. Biodiversity is defined as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems. Biodiversity often underpins ecosystem services valued by humans. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. Requirements related to ecosystem services are set out in ESS1.

ESS6 recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. Habitat is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment. All habitats support complexities of living organisms and vary in terms of species diversity, abundance and importance. This ESS also addresses sustainable management of primary production and harvesting of living natural resources.

ESS6 recognizes the need to consider the livelihood of project-affected parties, including Indigenous Peoples, whose access to, or use of, biodiversity or living natural resources may be affected by a project. The potential, positive role of projectaffected parties, including Indigenous Peoples, in biodiversity conservation and sustainable management of living natural resources is also considered.

- To protect and conserve biodiversity and habitats.
- To apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity.
- To promote the sustainable management of living natural resources.
- To support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.

Based on the environmental and social assessment, the requirements of this ESS are applied to all projects that potentially affect biodiversity or habitats, either positively or negatively,

directly or indirectly, or that depend upon biodiversity for their success. This ESS also applies to projects that involve primary production and/or harvesting of living natural resources.

2.1.7 ESS8: Cultural Heritage

ESS8 recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle.

This ESS sets out general provisions on risks and impacts to cultural heritage from project activities. ESS6 recognizes the social and cultural values of biodiversity. Provisions on Stakeholder Engagement and Information Disclosure are set out in ESS10.

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To address cultural heritage as an integral aspect of sustainable development.
- To promote meaningful consultation with stakeholders regarding cultural heritage.
- To promote the equitable sharing of benefits from the use of cultural heritage.

The term 'cultural heritage' encompasses tangible and intangible heritage, which may be recognized and valued at a local, regional, national or global level, as follows:

- Tangible cultural heritage, which includes movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Tangible cultural heritage may be located in urban or rural settings, and may be above or below land or under the water;
- Intangible cultural heritage, which includes practices, representations, expressions, knowledge, skills—as well as the instruments, objects, artifacts and cultural spaces associated therewith—that communities and groups recognize as part of their cultural heritage, as transmitted from generation to generation and constantly recreated by them in response to their environment, their interaction with nature and their history.

2.1.8 ESS10: Stakeholder Engagement and Information Disclosure

This ESS recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

Stakeholder engagement is an inclusive process conducted throughout the project life cycle. Where properly designed and implemented, it supports the development of strong, constructive and responsive relationships that are important for successful management of a project's environmental and social risks. Stakeholder engagement is most effective when initiated at an early stage of the project development process, and is an integral part of early project decisions and the assessment, management and monitoring of the project's environmental and social risks and impacts.

This ESS must be read in conjunction with ESS1. Requirements regarding engagement with workers are found in ESS2. Special provisions on emergency preparedness and response are covered in ESS2 and ESS4. In the case of projects involving involuntary resettlement, Indigenous Peoples or cultural heritage, the Borrower will also apply the special disclosure and consultation requirements set out in ESS5 and ESS8.

- To establish a systematic approach to stakeholder engagement that will help Borrowers identify stakeholders and build and maintain a constructive relationship with them, in particular project-affected parties.
- To assess the level of stakeholder interest and support for the project and to enable stakeholders' views to be taken into account in project design and environmental and social performance.
- To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
- To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format.
- To provide project-affected parties with accessible and inclusive means to raise issues and grievances, and allow Borrowers to respond to and manage such grievances.

2.2 Federal Policy, Legal, Regulatory and Administrative Frameworks

Pursuant to Section 20 of the Nigerian 1999 Constitution, the state is empowered to protect and improve the environment and safeguard the water, air, and land, forest, and wildlife of Nigeria. The power to regulate all environmental matters in Nigeria is vested in the Federal Ministry of Environment (FMEnv) – a mandate that previously rested with the now defunct Federal Environmental Protection Agency (FEPA) set up by Federal Act 88, of 1988.

The applicable environmental laws include the Environmental Impact Assessment Act No. 86 of 1992; the National Guidelines and Standards for Environmental Pollution Control in Nigeria (March 1991); the National Environmental Standards and Regulations Enforcement Agency (establishment) Act 2007 (NESREA), the Land Use Act 1978 (modified in 1990); the Forestry Act 1958; and the National Agricultural Policy 1988.

2.2.1 National Policy on Environment

The national policy on environment, 1989 (revised 1999), provides for “a viable national mechanism for cooperation, coordination and regular consultation, as well as harmonious management of the policy formulation and implementation process which required the establishment of effective institutions and linkages within and among the various tiers of government – federal, state and local government”. The defined guideline and strategies provide for the effective management of the environment in the following 14 major areas:

Human population; Land use and soil conservation; Water resource management; Forestry; Wildlife and protected areas; Marine and coastal area resources; Toxic and hazardous substances; Energy production and use; Air pollution; Noise pollution; Toxic and hazardous substances; Recreational space; Greenbelts movements; and, Cultural property.

2.2.2 National Environmental Impact Assessment Act 1992:

National EIA Act 1992, Clause 2 provides that public or private sector of the economy shall not undertake or embark on or authorize projects or activities without prior consideration of the effects on the environment. The act makes an EIA mandatory for any development project, and prescribes the procedures for conducting and reporting EIA studies. As part of the effective utilization of the EIA tool, the ministry has produced sectorial guidelines.

2.2.3 Nigerian Land Use Matters

The basic legal framework for the acquisition of land in Nigeria is the Land Use Act 1978 as amended under the Amended Land Use Act of 2004, Chapter L5 under the laws of the Federation of Nigeria. The Part 1 of the amended Act 2004 vests all land within the urban areas of any Nigerian State in the Executive Governor of that state. Land within the rural areas of the state is vested on the Local Government. The Part VI, Section 29 of the law provides for compensation to the holder of any land title when such land is to be acquired for public purposes. For developed land, the Governor (in the case of urban areas) or Local Government (in the case of rural areas) may, in lieu of compensation, offer resettlement in any other place

as a reasonable alternative accommodation and in acceptance of resettlement, the holder's right to compensation shall be deemed to have been duly satisfied.

Although the Land Use Act is not strictly an Act for environmental protection, protection of the environment is one of the considerations which a holder of certificate of occupancy has to observe.

2.2.4 National Erosion and Flood Control Policy 2005:

The general soil erosion & flood control guidelines provide necessary instructions for soil and water resources users to develop, implement and monitor plans that are to assure erosion and flood hazard mitigation. The maintenance of levees and other protective structures are also to be developed at areas with potential impacts. In addition to this, all requests for project plan approvals must include soil type and drainage pattern/structures in and around project area and the likely impact of the project on these duly certified.

2.2.5 NESREA Establishment Act, 2007.

The National Environmental Standards and Regulations Enforcement Agency (NESREA) has responsibility for the enforcement of the environment regulations and biodiversity conservation, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

2.2.6 National Guidelines and Standards for Environmental Pollution (March, 2001):

The National Guidelines and Standards for environmental pollution control in Nigeria (March, 2001) is the basic instrument for monitoring and controlling industrial and urban pollution.

2.2.7 National Waste Management Regulations of 1991

This regulation which is updated under the National Environmental (Sanitation and Waste Control) Regulations 2009, S.I. No. 28 mandates the collection, treatment, and disposal of solid and hazardous waste from municipal and industrial sources. It provides the legal framework for the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

2.2.8 Approved National Forestry Policy 2006

The extant national forest policy which is included within the document "Agricultural Policy for Nigeria" published by the Federal Ministry of Agriculture in 1988 recognized forestry as the management and utilization of forests as renewable natural resources. The policy overall objective is to achieve sustainable forest management that would ensure sustainable increases in the economic, social and environmental benefits from forests and trees for the present and future generation including the poor and the vulnerable groups.

The Forest Policy encourages and supports an aggressive establishment of plantations of economic trees of both exotic and indigenous species. It provides for the preservation of forest and the setting up of forest reserves, and also provides goals, targets and implementation strategies for the management, development and use of forests and their resources and products. Nigeria is at present a wood deficit nation. The policy on forest resources management and sustainable use is aimed at achieving self-sufficiency in all aspects of forest product through the use of sound forest management techniques as well as the mobilization of human and material resources. The overall objectives of forest policy are to prevent further deforestation and to recreate forest cover, either for productive or for protective purposes, on already deforested fragile land.

The national biodiversity conservation strategy continues to be based on a system of Protected Areas, including Forest Reserves, National Parks and Game Reserves. In recognition of the fact that the local communities must share from the benefits of these Protected Areas, there must be a meaningful participation of these communities in their management. Efforts to safeguard biodiversity in private forests and to improve agricultural biodiversity through farm forestry initiatives must be supported.

Government has signed a number of international agreement and conservators that are relevant to the forestry development. It is obligatory that Government should honour these agreements and instruments through domestic legislation; and action. Intergovernmental, bilateral and multilateral cooperation will be upheld to promote sustainable development of forest resources.

2.3 Other Relevant Acts and Legislations at Federal Level

Nigeria subscribes to a number of international regulations and conventions relating to Environmental Protection. The assessments and management standards of these international development partners/agencies, such as World Bank and other financial organizations, must be complied with by project proponents before these institutions will invest in the projects. These guidelines/conventions/treaties to which Nigeria is a signatory are summarized below.

2.3.1 The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Disposal, 1989

The convention focuses attention on the hazards of the generation and disposal of hazardous wastes. The convention defines the wastes to be regulated and controls their trans-boundary movement to protect human and environmental health against their adverse effects.

2.3.2 UN Framework Convention on Climate Change – Kyoto Protocol (1992)

In order to achieve sustainable social and economic development, energy consumption for developing countries needs to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general. This also includes the application of new technologies on terms which make such an application economically and social beneficial, determined to protect the climate system for present and future generations.

2.3.3 Agenda 21 - UN Conference on Environment and Development

At the United Nations Conference on Environment (also the Earth Summit) – held in Rio de Janeiro (1992), with recommendations from the WHO Commission, more than 150 member states adopted Agenda 21 - an action plan to guide future strategies for health and environment activities on a national and international level. This fact provided the background for FEPA's EIA framework to ensure environmental sustainability of all types of activities in the oil and gas industry (FEPA, 1995).

2.3.4 Public Health Legislations and regulations

Several countries have legislation and regulations that stipulate the administrative and policy framework for conducting health impact assessment for a development project, whether as part of an EIA or a standalone study. In addition, a number of international agencies have endorsed this process, such as the World Banks, Asian Development Commission, and the World Health Organizations. In Nigeria, the Public Health Law (L.N47 of 1955, Cap 103) provides justification for the execution of developmental projects under guidelines that promote health by protecting the environment and safeguarding the health of humans.

2.3.5 WHO Health and Safety Component of EIA, 1987

WHO in its report on health and safety component of environment impact assessment (EIA) to protect human health indicates that:

- i. One of the fundamental considerations in the approval of projects, policies and plans should be the health of communities affected by them; greater consideration should be given to the consequence of development policies/programs for human health;
- ii. Environmental Impact Assessment should provide the best available factual information on the consequence for health of projects, policies and plan; and
- iii. Information on health impact should be available to the public.

2.3.6 Convention on Conservation of Migratory Species of Wild Animals, Bonn, 1979

The Bonn convention concerns the promotion of measures for the conservation (including habitat conservation especial for endangered species and management of migratory species.)

2.3.7 United Nations Guiding Principle on the Human Environmental

The United Nation (UN) published the concept of guiding principles on the Human Environment in 1972. Ten of these Guiding Principles were defined as formal declarations that express the basis on which an environmental policy can be built and which provide a foundation for action.

2.3.8 The Rio Declaration on Environmental and Development

The UN Conference on Environment and development met at Rio de Janeiro in June 1992, at which time it reaffirmed the 1972 declaration on the Human Environment, and sought to build upon it. This was done with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among states, key sectors of societies and people. It was also to aid work towards international agreements, which respect the interest of all, protect the integrity of the global environmental development system, and recognize the integral and interdependent nature of the earth.

Other relevant international conventions include:

- Africa Convention on the Conservation of Natural Resources of 1969
- Convention on the Law of the Seas of 1982
- The Ramsar Convention on Wetlands of 1971

2.4 State Legislations

2.4.1 Niger State Environmental Policy

2.4.2 Niger State Waste Management Act

This Acts provides for the effective development and maintenance of sanitation in all areas of the State. The law further provides for proper disposition of excavated silt or earth and other construction materials after any construction project or repair works. Open burning of wastes is prohibited with stipulated penalties.

2.5 Gaps between Nigerian Legislation and World Bank Standards

The gaps between the triggered Nigerian current legislation and WB policies as they relate to this project are summarized in Table 2.2 below:

Table 2.2: Gaps between Nigeria Legislation and WB ESSs

Project Triggered Policies	Nigerian Legislation	World Bank ESS	Gaps Between the Policies
ESS1 Environmental Assessment	National EIA Act 1992, Clause 2 provides that public or private sector of the economy shall not undertake or embark on or authorize projects or activities without prior consideration of the effects on the environment. The act makes an EIA mandatory for any development project, and prescribes the procedures for conducting and reporting EIA studies. As part of the effective utilization of the EIA tool, the ministry has produced sectoral guidelines. Responsibility for monitoring of EIA activities lies with the NESREA and State ministries of environment but these agencies lack the logistic capability to carry out the tasks assigned to it by the law	An EA is conducted to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. Any World Bank project that is likely to have potential adverse environmental risks and impacts in its area of influence requires an EA indicating the potential risks, mitigation measures and environmental management framework or plan.	Nigeria currently has a comprehensive framework for assessing and managing the environmental impacts of development projects. However, in comparison with the World Bank ESS1, it would appear that the Nigeria framework lacks the provision of clear requirements or guidance in the assessment of the impact of an activity on public health. In this case the policy of the bank prevails.
ESS2 Labor and Working Conditions	The EIA Act in consonance with the NESREA Act recognize the need for compliance enforcement of the provisions of international agreements, conventions	ESS2 recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-	Essentially, there is no difference between the main framework of both policies.

Project Triggered Policies	Nigerian Legislation	World Bank ESS	Gaps Between the Policies
	and treaties on the environment and labor matters. These provisions bring the Nigerian EIA Act to par with the World Bank ESS2.	management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.	
ESS3 Resource Efficiency and Pollution Prevention and Management	The policies, standards, legislation and guidelines under the EIA Act in consonance with the NESREA Act set out compliance requirements to address water quality, environmental health and sanitation, including pollution abatement. The legislations provide enforce compliance with guidelines and legislations on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria's natural resources; The regulations seek to use the most appropriate means to prevent and combat various atmospheric pollution; and to address standards applicable to emission from any new mobile or stationary source which causes or contributes to air pollution and may reasonably be anticipated to endanger public health or welfare using appropriate means to reduce emission to permissible levels.	ESS3 recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. The current and projected atmospheric concentration of greenhouse gases (GHG) threatens the welfare of current and future generations. At the same time, more efficient and effective resource use, pollution prevention and GHG emission avoidance, and mitigation technologies and practices have become more accessible and achievable. This ESS sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle consistent with GIIP.	Essentially, there is no difference between the main framework of both policies.
ESS4 Community Health and Safety	In consonance with the NESREA Act, Section 20(1), the EIA Act provides the specifications and standards to protect and enhance the quality of Nigeria's air resources, so as to promote the public health, welfare and the natural development and productive capacity of the nations' human, animal, marine or plant life including, in particular, minimum essential air quality standards for human, animal, marine or plant health; and the control of concentration of substances in the air which separately or in combination are likely to result in damage or deterioration of the environmental and human health ;	ESS4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities. ESS4 addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.	Essentially, there is no difference between the main framework of both policies.
ESS5 Involuntary Resettlement	The basic legal framework for the acquisition of land in Nigeria is the Land Use Act 1978 as amended under the Amended Land Use Act of 2004, Chapter L5 under the laws of the Federation of Nigeria. The Part 1 of the amended Act 2004 vests all land within the urban areas of any Nigerian State in the Executive Governor of that state. Land within the rural areas of the state is vested on the Local Government. The Part VI, Section 29 of the law provides for compensation to the holder of any land title when such land is to be acquired for public purposes. For developed land, the Governor (in the case of urban areas) or Local Government (in the case of rural areas) may, in lieu of compensation, offer resettlement in any other place as a reasonable alternative accommodation and in acceptance of resettlement, the holder's right to compensation shall be deemed to have been duly satisfied. Although the Land Use Act is not strictly an Act for environmental protection, protection of the environment is one of the considerations which a holder of certificate of occupancy has to observe.	Key objectives of the World Bank's policy on involuntary land acquisition are to avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs; assist displaced persons in improving their former living standards, income earning capacity and production level, or at least in restoring them; encourage community participation in planning and implementing resettlement; and provide assistance to affected people regardless of the legality of land tenure. The policy covers not only physical relocation, but any loss of land or other assets resulting in relocation, or loss of shelter; loss of assets or access to assets; loss of income sources or means of livelihood whether or not the affected people must move to another location. When the policy is triggered, a Resettlement Action Plan (RAP), must be prepared. An abbreviated plan may be developed when less than 200 people are affected by the project. In situations, where all the precise impacts cannot be assessed during project preparation, provisions are made for preparing a Resettlement Policy Framework (RPF). The RAP/RPF must ensure that all Bank's policy provisions detailed in ESS5 are addressed particularly the payment of	Essentially, there is no difference between the main framework of both policies. Lands that would be acquired for this project shall be fully compensated for in accordance with the World Bank policy and principles. The Nigerian regulations while also lacking clear responsibility for monitoring of activities associated with compensations further lack the logistic capability for any agency to carry out the tasks assigned to it by the law. In this case the policy of the bank prevails.

Project Triggered Policies	Nigerian Legislation	World Bank ESS	Gaps Between the Policies
		compensation for affected assets at their replacement cost	
ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	The provisions under the Nigerian EIA Act seek for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general. To the extent of the compliance enforcement provisions, the Nigerian EIA Act and the World Bank ESS3 are similar.	ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. Biodiversity is defined as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems. Biodiversity often underpins ecosystem services valued by humans. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. Requirements related to ecosystem services are set out in ESS1. ESS6 recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. Habitat is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment. All habitats support complexities of living organisms and vary in terms of species diversity, abundance and importance. This ESS also addresses sustainable management of primary production and harvesting of living natural resources.	Essentially, there is no difference between the main framework of both policies.
ESS8 Physical Cultural Resources	National Commission For Museums and Monuments Act of 1990, Chapter 242 seeks to protect and preserve any objects of archaeological interest wherever they may be found. Any person who discovers an object of archaeological interest in the course of operations permitted under section 19 of this Act shall notify the Commission.	The Bank seeks to assist countries to manage their physical cultural resources and avoid or mitigate adverse impact of development projects on these resources. This policy is triggered for any project that requires an EA.	No difference in framework. Responsibility for monitoring of activities and enforcement under this Nigerian Regulations is effectively lacking. In this case the policy of the bank prevails.
ESS10 Stakeholders Engagement and Information Disclosure	The EIA Act in consonance with the NESREA Act recognize the need to create public awareness and provide environmental education on sustainable environmental management, promote private sector compliance with environmental regulations	This ESS recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation. Stakeholder engagement is an inclusive process conducted throughout the project life cycle. Where properly designed and implemented, it supports the development of strong, constructive and responsive relationships that are important for successful management of a project's environmental and social risks. Stakeholder engagement is most effective when initiated at an early stage of the project development process, and is an integral part of early project decisions and the assessment, management and monitoring of the project's environmental and social risks and impacts.	Essentially, there is no difference between the main framework of both policies. Lands that would be acquired for this project shall be fully compensated for in accordance with the World Bank policy and principles. The Nigerian regulations while also lacking clear responsibility for monitoring of activities associated with compensations further lack the logistic capability for any agency to carry out the tasks assigned to it by the law. In this case the policy of the bank prevails.

CHAPTER 3: DESCRIPTION OF AREA OF INFLUENCE AND ENVIRONMENTAL BASELINE

3.1 Introduction

The baseline description has been based on desktop review, field observations and consultations within the proposed project areas. The baseline information has been split into a description of the socio-economic and cultural as well as the physical and biological environments for the proposed subprojects.

This Section discusses the project area of influence as well as the general and specific baseline conditions that characterize the project areas which is approximately 265.13Ha for Mokwa. The discussions are in three parts consisting of (i) the project area of influence; (ii) general environmental conditions; and, (iii) site specific environmental conditions focusing on the gully corridors and areas that make up the project site.

3.1.1 Area of Influence

Based on field observations of Mokwa landscape, soil erosion at the project site and indeed all areas of the project regions, is a result of gravity-driven surface water flow enhanced by the topography of the area. Furthermore, development in the area is not in tandem with the natural stormwater flow routes within the catchment and sub-catchment areas thereby creating flow blockades. The major causes of the erosion problem at Mokwa corridors include the abrupt termination of drainage channels built as part of the construction of the several roads within the Mokwa project communities as well as indiscriminate dumping of solid waste into drainage corridors.

3.1.2 Sources of Baseline Information

The project area environmental characteristics which cut across the gully site and their communities are discussed under Sections 3.2 through 3.7. The geologic and soil characteristics of the project area are summarized below. The natural environmental factors include climate and vegetation, topography and landforms, hydrogeology and hydrologic patterns. Information sources for this evaluation include published literature, preparation of surface geologic map, geotechnical investigation conducted by Dadson Engineering Services Limited and Nigerpet Structures Limited – the engineering design Consultants for Mokwa subproject and the physical observations made during site inspections in the course of the Consultancy.

Prevailing climatic conditions were sourced from the nearest meteorological center with existing literature complimenting field data to establish the sub-project area rainfall, ambient temperature, wind direction and speed, atmospheric pressure and relative humidity. Information and data relating to the vegetation, topographic, geological, hydrogeological, hydrological and hydraulic nature of the area were used to fully characterize the sub-watershed. Road transect or quadrates method was used to sample flora/fauna.

3.2 Environmental Baseline

3.2.1 Climate and Meteorology

Niger State falls within the Guinea Savannah vegetation zone with distinct dry and wet season. The area experiences a tropical savanna climate which is strongly influenced by the tropical maritime air mass and the tropical continental air mass like in most part of West Africa. The tropical maritime air mass which originates from the southern high pressure belt is humid in nature and is attended with on-shore south-western winds. The tropical continental air mass on the other hand is dry and accompanied by north-east trade winds.

Rainy season lasts from May to mid-October with a peak in August which has the highest number of rainstorms and sediment generation and an uncomfortably high humidity. Niger State has a mean annual rainfall of 1,350mm and relative humidity ranges between 60-80% in the month of July. The average annual relative humidity is 48.9% and average monthly relative humidity ranges from 21% in February to 73% in August. The highest humidity

recorded in 2019 was 83% and the annual amount of rainfall recorded in the project environment was 1016.9 mm with December being the only month when no rainfall was recorded. This variation in the annual amount of rainfall received is as a result of latitudinal and continentality factors.

Temperature in Niger State is generally high throughout the year with a yearly average of 34°C. The climate is very warm with April as the hottest month of the year while August is the coldest month. In Kotangora, the minimum monthly temperature in 2019 ranged between 19°C and 31°C while the maximum monthly temperature ranged between 29°C and 41°C (in August and April respectively).

Typically, the area is affected by two wind patterns, the harmattan wind from the Sahara which is responsible for the cool dry months of November to February (about 24°C) and the Southwest Monsoon Trade Winds blowing across the Atlantic Ocean which is responsible for the rains of June to October as shown in Figure 3-1. Average relative humidity is put at 42%. The average rainfall is from about 800mm to 1000mm. (Tukur, A 2014). Figure 3-1 shows the plot of average monthly temperature and rainfall distribution through the year.

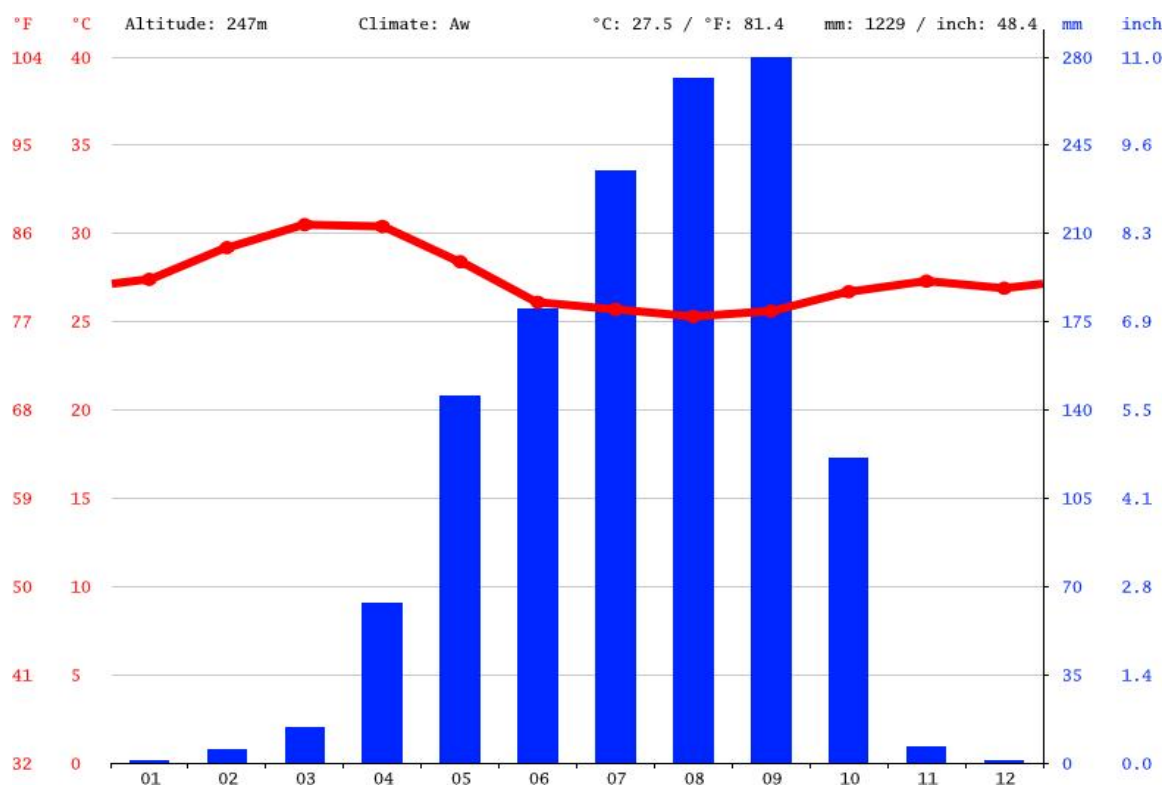


Fig. 3.1: Temperature and Rainfall Distribution in Project Areas
(Source: Climate-data.org)

3.2.2 Geology and Hydrology

The geologic and soil characteristics of the project area and the extent to which implementation of the proposed project could be affected by soil characteristics and other natural environment factors are summarized below. The natural environmental factors include climate and vegetation, topography and landforms, hydrogeology and hydrologic patterns. Information sources for this evaluation include published literature, geotechnical investigations conducted by Nigerpet Structures Limited - the engineering design Consultant for this project and the physical observations made during site visit in the course of the Consultancy.

Geology of Niger State

Niger State lies within the north-central portion of the Nigerian Basement Complex. About one half of the state's landmass is underlain by the Basement Complex rocks while the remaining

half is occupied by the Cretaceous Sedimentary rocks of the Bida Basin and part of the Sokoto Lullemeden Basin (Figure 3.2). The Basement complex rock is characterized by three lithofacies; the migmatite-gneiss complex, the low grade schist belt and the older granites. The migmatite-gneiss complex is composed of heterogeneous assemblage of migmatites, ortho and para gneisses, and a series of metamorphosed basic and ultrabasic rocks. The schist belt formations are composed of low to medium grade metamorphosed sedimentary and volcanic rocks. The schists in the project area consist predominantly of phyllite, mica schist, talc schist and quartz schist inter-layered with amphibolite. The older granites are granitic rocks which show evidences of ancient tectonic activity in the form of major and minor faults, joints and fractures most especially around the rock exposure at the settlements. Bida Basin is a NW–SE trending intracratonic sedimentary basin extending from Kontagora to areas slightly beyond Lokoja in the South.

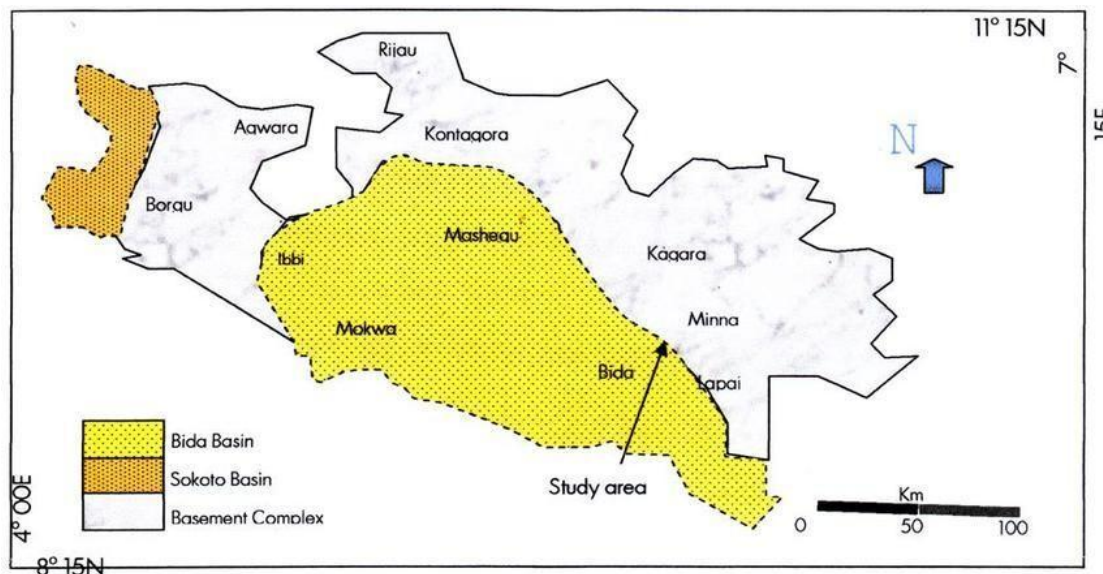


Fig. 3.2: Geologic Map of Niger State Basement Complex and Sedimentary Basins
(Source: researchgate.net)

3.2.3 Soil Types

The project area comprises of meta-sedimentary and meta-igneous rocks which have undergone polyphase deformation and metamorphism. These rocks have been intruded by granitic rocks of Pan-African age.

The schist occurs as a flat laying narrow southwest-northeast belt at the central part with small quartzite ridge parallel to it. The gneiss occurs as a small suite at the northern and southern part of the area forming a contact with the granite. Granitic rocks dominate the rock types in the area and vary in texture and composition.

Solid minerals found in Niger State include Talc, Gold, Ball Clays, Silica, Sand, Marble, Copper, Iron, Feldspar, Lead, Kaolin, Casserole, Columbite, Mica, Quartzite and Limestone.

3.2.4 Biodiversity

There are two contrasting biomes on the Earth's tropical landscapes. These are savannahs-grasslands and closed-canopy forests (Murphy et al., 2016). Mokwa are cities in the Middle Belt of Nigeria and represent typical guinea savannah due to its composition of plants. The biome of guinea savannah is generally categorized by spatial structure of the vegetation and the heterogeneity in the physiognomy (Ademoh et al., 2018). It often has a mixture of tree, shrubs, herbaceous flora, and tall grasses forming a natural habitat or game and provides a beautiful land scale and scenery. In savannah vegetation a mixture of high and low-cover patches is formed by the diverse percentage of woody plants with grass intermixed (Sebata, 2017). The vegetation is a typical woodland savannah; both trees and shrubs abound, and the physiognomic classification of this savannah depends on the woody plants.

The ecological survey of the immediate project areas provides necessary information about the wildlife (vegetation cover and fauna) of the area, which is a vital indicator of its ecological dynamics. It also provides baseline information that can be useful for monitoring and the assessment of project implementation effectiveness.

3.2.4.1 Vegetation

Niger State has the largest landmass with about 70% arable and cultivable land. The vegetation is predominantly Guinea Savanna and comprises of both woody and herbaceous plant species. The soil is luvisols and the vegetation is mainly short grass and shrubs with scattered trees. The State was stratified into three in accordance with three Agricultural Zones namely: Zone A (Niger- South), Zone B (Niger- Central) and Zone C (Niger- East) with the headquarters of each of these Agricultural zones at Bida, Kuta and Kontagora respectively. The Climatic and ecological conditions of the State is favored with mean annual rainfall of 782-1250 mm. The State has abundant wild vegetation of Shea trees and is dominated by small scale farmers. The major crops cultivated are Millet, Rice, Maize, Guinea Corn, Beans, Yam, Cassava, Shea Butter, Sorghum, Groundnuts, Cowpea and Sweet Potatoes. About 85% of the population of the state are farmers, while 15% are involved in other vocation such as white collar jobs, businesses, crafts and arts. Majority of the famers keep livestock like poultry, goat and sheep. Others engage in crafts such as sculptures, weaving and blacksmith.

The floristic composition of the project area is highly diverse in species even over a seemingly homogenous area. The vegetative cover of the project area is highly heterogeneous due to severe anthropogenic disturbance. Sampling of flora and fauna in the project area was conducted using quadrats in each of the identified land use categories and 100% enumeration of trees within each quadrat was carried out. Known species and other species of interest were identified and classified using standard taxonomic procedures. A listing of plant species with frequent or abundant distribution identified in the various categories are shown in Table 3-1.

Table 3.1: Listing of Prominent and Indicator Plant Species Found at the Mokwa Project Site Showing Life Forms, Families and Distribution of Species.

S/N	Scientific Name	Family	Life Form	Common Name	Local Name	Conservation Status	% Occurrence	Economic Importance
1	<i>Adansonia digitata</i>	Bombacaceae	Tree	Baobab	kúka/muci	LC	1.25	Food/Medicinal
2	<i>Ageratum conyzoides</i>	Asteraceae	Herb	Goatweed	Enyígi	DD	5.59	Weed/Medicinal
3	<i>Albizzia lebbek</i>	Fabaceae	Tree	Silk Flower	-	DD	0.06	Medicinal
4	<i>Anacardium occidentale</i>	Anacardiaceae	Tree	Cashew	eko nasara	LC	3.12	Fruit
5	<i>Anchomanes difformis</i>	Araceae	Herb	Blume	-	DD	0.36	Weed/Medicinal
6	<i>Annona senegalensis</i>	Annonaceae	Shrub	wild custard-apple	ishenebobo	DD	0.17	Fruit
7	<i>Asparagus africanus</i>	Asparagaceae	Herb	Wild sunflower	èyà yaká	DD	0.36	Weed/Medicinal
8	<i>Anthocleista vogelii</i>	Gentianaceae	Tree	Murderer's Mat	-	LC	0.08	Timber/Medicinal
9	<i>Azadirachta indica</i>	Meliaceae	Tree	Neem	Nimu	LC	4.31	Timber/Medicinal
10	<i>Balanites aegyptiaca</i>	Zygophyllales	Tree	Desert date	Adúwaci	LC	0.06	Weed/Medicinal
11	<i>Boerhavia erecta</i>	Nyctaginaceae	Herb	Erect spiderling	-	DD	0.14	Weed/Medicinal
12	<i>Borassus aethiopum</i>	Arecaceae	Tree	Fan-palm	ègbà/gbàci	DD	0.17	Food/Medicinal
13	<i>Calotropis procera</i>	Asclepiaceae	Shrub	Sodom apple	Èpukó	DD	0.45	Food/Curdle of Milk
14	<i>Centrosema pubescens</i>	Fabaceae	Herb		-	DD	6.15	Fodder
15	<i>Chromolaena odorata</i>	Asteraceae	Herb	Siam Weed	èkpe gbàkū	DD	4.04	Weed
16	<i>Cleome viscosa</i>	Cleomaceae	Herb		-	DD	0.64	Weed
17	<i>Cochlospermum planchonii</i>	Cochlospermaceae	Shrub	Cochlospermum	Balagande	DD	0.11	Medicinal
18	<i>Cochlospermum tinctorium</i>	Cochlospermaceae	Shrub	Cochlospermum	Raawayaa	DD	0.08	Medicinal
19	<i>Cocos nucifera</i>	Arecaceae	Tree	Coconut palm	yikūnu kpótá	DD	0.22	Food/Oil
20	<i>Commelina erecta</i>	Commelinaceae	Herb	Slender dayflower	-	DD	0.31	Weed
21	<i>Cynodon dactylon</i>	Poaceae	Herb	Couch grass	-	DD	0.97	Fodder
22	<i>Cyperus rotundus</i>	Cyperaceae	Herb	Swamp sedge	fángi bàtà	DD	0.70	Food
23	<i>Daniellia oliveri</i>	Fabaceae	Tree	copaiba balsam	Dānci	DD	0.81	Timber
24	<i>Dichrostachys cinerea</i>	Leguminosae	Shrub		ekān nankó	DD	0.08	Medicinal
25	<i>Elaeis guineensis</i>	Arecaceae	Tree	Palm-fruit	yikūnu/lánká	LC	0.72	Oil/Palmwine

S/N	Scientific Name	Family	Life Form	Common Name	Local Name	Conservation Status	% Occurrence	Economic Importance
26	<i>Euphorbia heterophylla</i>	Euphorbiaceae	Herb	Mexican fireplant	-	LC	3.09	Weed
27	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb	Asthma plant	kinkèrè cintàrà	LC	2.17	Medicinal
28	<i>Ficus benjamina</i>	Moraceae	Tree		-	LC	0.11	Ornamental
29	<i>Ficus thonningii</i>	Moraceae	Tree	Wild Fig	Guluba	LC	1.25	Medicinal/Shade
30	<i>Ficus exasperate</i>	Moraceae	Tree	Sand Paper Tree	-	LC	0.64	Timber
31	<i>Flueggea virosa</i>	Phyllanthaceae	Shrub	Bushweed	-	LC	0.14	Medicinal
32	<i>Gardenia ternifolia</i>	Rubiaceae	Shrub		Langbà	DD	0.06	Fruit
33	<i>Gliricidia sepium</i>	Fabaceae	Tree	Gliricidia	-	LC	0.14	Shade/Fence
34	<i>Gmelina arborea</i>	Lamiaceae	Tree		-	LC	0.92	Timber
35	<i>Gomphrena globosa</i>	Amaranthaceae	Herb	Bachelor's Botton	-	LC	1.11	Medicinal
36	<i>Grewia bicolor</i>	Malvaceae	Shrub	Bastard brandy bush	-	LC	0.28	Medicinal
37	<i>Hyptis suaveolens</i>	Lamiaceae	Herb	mosquito guardian	tamwòtswági	DD	21.04	Weed
38	<i>Jatropha curcas</i>	Euphorbiaceae	Shrub		Kasha	LC	0.39	Medicinal
39	<i>Jatropha gossipyfolia</i>	Euphorbiaceae	Shrub		kasha eba	LC	0.22	Medicinal
40	<i>Khaya senegalensis</i>	Meliaceae	Tree	mahogany	Wuci	VU	0.08	Medicinal/Timber
41	<i>Lagenaria siceraria</i>	Cucurbitaceae	Liana	Bottle gourd	kókpa/bàbò	LC	0.28	Medicinal
42	<i>Luffa cylindrical</i>	Cucurbitaceae	Herb	Vegetable Sponge	bongi/kànkàni	LC	0.36	Local Sponge
43	<i>Mangifera indica</i>	Anacardiaceae	Tree	Mango	Mangoro	DD	1.22	Fruit
44	<i>Nauclea latifolia</i>	Rubiaceae	Shrub	African peach	ìgyàà	LC	0.19	Medicinal
45	<i>Newboldia laevis</i>	Bignoniaceae	Tree	Fertility Tree	Aduruku	LC	0.47	Fence/Medicinal
46	<i>Parkia biglobosa</i>	Fabaceae	Tree	Locust bean	lonci/búsú	LC	0.81	Condiment/Medicinal
47	<i>Physalis angulate</i>	Solanaceae	Herb	Wild gooseberry	Àlāsàngì	LC	0.42	Medicinal
48	<i>Piliostigma thonningii</i>	Fabaceae	Shrub	Thonning's piliostigma	Cáncálíí	DD	0.19	Medicinal
49	<i>Psidium guajava</i>	Myrtaceae	Shrub	Guava	Góóbàà	LC	0.31	Fruit
50	<i>Pteridium species</i>	Dennstaedtiaceae	Herb	Bracken fern	-	LC	0.45	Weed
51	<i>Senna occidentalis</i>	Fabaceae	Herb	African Coffee	Àlbàrkàà	LC	3.42	Medicinal
52	<i>Senna obtusifolia</i>	Fabaceae	Herb	Foetid cassia	gayà ebá	DD	3.20	Fodder
53	<i>Sida acuta</i>	Malvaceae	Herb	Broomweed	sàngì yèkó	DD	9.71	Weed
54	<i>Sida rhombifolia</i>	Malvaceae	Herb		Fàskàrà sáiwóó	DD	5.73	Weed
55	<i>Sterculia setigera</i>	Sterculiaceae	Tree	Faux platane	kokongigà	DD	0.11	Medicinal
56	<i>Tamarindus indica</i>	Fabaceae	Tree	Tamarind fruit	Dará	LC	0.06	Food
57	<i>Terminalia catappa</i>	Combretaceae	Tree	Indian Almond	-	LC	0.97	Fruit/Shade
58	<i>Terminalia mantaly</i>	Combretaceae	Tree	Mantaly	-	LC	1.17	Ornamental/Shade
59	<i>Tridax procumbens</i>	Asteraceae	Herb	Coat buttons	Kùngbará	DD	2.45	Weed
60	<i>Triumfetta rhomboidea</i>	Malvaceae	Herb		Dángèrèè	DD	2.14	Weed
61	<i>Urena lobata</i>	Malvaceae	Shrub	Caesarweed	-	LC	2.23	Weed
62	<i>Vitellaria paradoxa</i>	Sapotaceae	Tree	Shea-kernel	Kparal/kòci	VU	1.50	Food/Timber/Oil

Source: Field Survey, September, 2025.

Note: DD (Data Deficient); LC (Least Concerned); VU (Vulnerable)

The prominent ecosystem services rendered in the Mokwa study area is mostly farming. Mixed farming is the most common agricultural system practiced in the sampled area with the cultivated predominant crops being sesame, groundnut, millet, sorghum and maize. Mixed cultivation of sesame, millet and groundnut was the most common practice. A listing of the predominant crops observed is presented in Tables 3.2 below.

Table 3.2: Major Cultivated/Agronomic Species at the Mokwa Project Site

S/N	Scientific Name	Family	Life Form	Common Name	Local names (Nupe)	Distribution
1	<i>Sesamum indicum</i>	Fabaceae	Herb	Sesame	Kîn Nyilagi	Abundant
2	<i>Arachis hypogaea</i>	Fabaceae	Herb	Groundnut	GUZHYA	Abundant
3	<i>Citrullus lanatus</i>	Cucurbitaceae	Herb	Egusi melon	Epí	Most Abundant
4	<i>Pennisetum glaucum</i>	Poaceae	Annual grass	Pearl millet	Kpàyi/Kuyi/Màyi	Abundant

S/N	Scientific Name	Family	Life Form	Common Name	Local names (Nupe)	Distribution
5	<i>Zea mays</i>	Poaceae	Annual grass	Maize	Lyákpyági	Most abundant
6	<i>Sorghum bicolor</i>	Poaceae	Annual grass	Guinea-corn	Efi	Common

Source: Field Survey, September, 2025.

Animal Inventory of the Watershed

Animal Species distribution: The animal composition of the project area is classified into domesticated animals and wild animals. The domesticated animals includes all the farm animals seen which are breeds of cattle (white Fulani), goats (Red maradi), sheep, and dogs. Wild birds such as doves, guinea fowl were predominant; also domestic birds such as local fowl, guinea fowl, duck etc were also prominent at the visited sites.

Similarly, there are some wild animals in existence rarely seen at the present such as the wolfs. Commonly seen wild animals includes; The terrestrial animals include such as: *Varanus Spp* (Monitor Lizard), *Riopa Fernandii* (West African Skink), *Bitis Caudalis* (African Viper), *Hyperilius Spp.* (African Tree Frog), *Otus scops* (African scops owl), *Stimentopelia Senegalensis* (Laughing dove), *Tyto Alba* (Bam Owl) *Rattus spp* (Rat); *Funisciurus anerythus* (squirrel); *Hyperolius spp* (African frog), *Lepus capensis* (Brown Hare). The aquatic animals include: *Tilapia spp* (cat fish); *Cymbacephalus beauforti* (Crocodile fish) while the reptiles include: *Iguana iguana* (Green lizard), *Crocodylus niloticus* (Crocodile). Listings of the prominent and indicator of animal species observed in the locations visited are presented in Tables 3.5 below.

Table 3.5: Animal and Livestock Species in Mokwa project site

S/N	Scientific Name	Family	Common name	Local name	Conservation Status
1	<i>Coracias abyssinicus</i>	Coraciidae	Abyssinian Roller	Tsanwaka	LC
2	<i>Oriolus auratus</i>	Oriolidae	African Golden Oriole	Matamasake	LC
3	<i>Accipiter tachiro</i>	Accipitridae	African Goshawk	Kusarkama	LC
4	<i>Treron calvus</i>	Columbidae	African Green-Pigeon	Kurchiyar gamji	LC
5	<i>Tockus nasutus</i>	Bucerotidae	African Grey Hornbill	Cilikowa mai jan-baki	LC
6	<i>Cypsiurus parvus</i>	Apodidae	African Palm Swift	Jirey	LC
7	<i>Terpsiphone viridis</i>	Monarchidae	African Paradise Flycatcher	Dokin	LC
8	<i>Vanellus senegallus</i>	Charadriidae	African Wattled Lapwing	Zakaran dawaki	LC
9	<i>Ciconia microscelis</i>	Ciconiidae	African Woollyneck Stork	Shàamuwaa	LC
10	<i>Lagonosticta rufopicta</i>	Estrildidae	Bar-Breasted Firefinch	Baa'u/Benu	LC
11	<i>Lybius dubius</i>	Lybidae	Bearded Barbet	Jam baka	LC
12	<i>Lissotis melanogaster</i>	Otididae	Black-bellied Bustard	kadaukara	LC
13	<i>Tchagra senegalus</i>	Malaconotidae	Black-Crowned Tchagra	Sùudaa	LC
14	<i>Ardea melanocephala</i>	Ardeidae	Black-Headed Heron	Bákin zalbe	LC
15	<i>Elanus caeruleus</i>	Accipitridae	Black-winged Kite	Dan tukuliji	LC
16	<i>Turtur afer</i>	Columbidae	Blue-Spotted Wood-Dove	Kurchiya dufuwa	LC
17	<i>Eurystomus glaucurus</i>	Coraciidae	Broad-billed Roller	Twanka	LC
18	<i>Spermestes cucullatus</i>	Estrildidae	Bronze Mannikin	Shaya	LC
19	<i>Bubulcus ibis</i>	Ardeidae	Cattle Egret	Balbela	LC
20	<i>Pycnonotus barbatus</i>	Pycnonotidae	Common Bulbul	Koje	LC
21	<i>Pternistis bicalcaratus</i>	Phasianidae	Double-spurred Francolin	Fákaráá	LC
22	<i>Columba livia domestica</i>	Columbidae	Feral Pigeon	Tàntabàraa	LC
23	<i>Dicrurus adsimilis</i>	Dicruridae	Fork-tailed Drongo	Ayagi	LC
24	<i>Falco alopec</i>	Falconidae	Fox Kestrel	Karambata	LC
25	<i>Micronisus gabar</i>	Accipitridae	Gabar Goshawk	Farin komo	LC
26	<i>Indicator indicator</i>	Indicatoridae	Greater Honeyguide	Maganiya	LC
27	<i>Butorides striata</i>	Ardeidae	Green-Backed Heron	Dan dolodolo	LC
28	<i>Phoeniculus</i>	Phoeniculidae	Green-Wood Hoopoe	Jaabak koogoo	LC
29	<i>Falco ardosiacues</i>	Falconidae	Grey Kestrel	Surau	LC
30	<i>Camaroptera brachyura</i>	Cisticolidae	Grey-Backed Camaroptera	Dan Dufuwa	LC
31	<i>Nigrita canicapillus</i>	Estrildidae	Grey-Headed Negrofinch	Tsintsar	LC

S/N	Scientific Name	Family	Common name	Local name	Conservation Status
32	<i>Streptopelia senegalensis</i>	Columbidae	Laughing Dove	Kurciyaa	LC
33	<i>Oxylophus levaillantii</i>	Cuculidae	Levaillant's Cuckoo	Suda/Koukou	LC
34	<i>Egretta garzetta</i>	Ardeidae	Little Egret	Tashi fari	LC
35	<i>Apus affinis</i>	Apodidae	Little Swift	Baiwa	LC
36	<i>Kaupifalco monogrammicus</i>	Accipitridae	Lizard Buzzard	Ci kadangaru	LC
37	<i>Lamprotornis caudatus</i>	Sturnidae	Long-tailed Glossy Starling	Tsakwaikwaika	LC
38	<i>Sylvietta brachyura</i>	Macrosphenidae	Northern Crombec	Dan Arewa	LC
39	<i>Passer griseus</i>	Passeridae	Northern Grey-Headed Sparrow	Eg gatan tumi	LC
40	<i>Euplectes franciscanus</i>	Ploceidae	Northern Red Bishop	Dòogári	LC
41	<i>Cinnyris chloropygius</i>	Nectariniidae	Olive-bellied Sunbird	Shàa kauçi	LC
42	<i>Estrilda melpoda</i>	Estrildidae	Orange Cheeked Waxbill	Taru	LC
43	<i>Chlorophoneus sulfureopectus</i>	Malaconotidae	Orange-Breasted Bush-Shrike	Bambeni	LC
44	<i>Ptilostomus afer</i>	Corvidae	Piapiac	Carkin giwa	LC
45	<i>Corvus albus</i>	Corvidae	Pied Crow	Hànkaakà	LC
46	<i>Vidua macroura</i>	Viduidae	Pin-Tailed Whydah	Sàrdo	LC
47	<i>Lamprotornis purpureus</i>	Sturnidae	Purple Glossy Starling	Wurwuya	LC
48	<i>Tockus erythrorhynchus</i>	Bucerotidae	Red-Billed Hornbill	Cilikowa mai jan-baki	LC
49	<i>Uraeginthus bengalus</i>	Estrildidae	Red-Cheeked Cordon-Bleu	Asisi	LC
50	<i>Streptopelia semitorquata</i>	Columbidae	Red-Eyed Dove	Maibakin zare	LC
51	<i>Coracias naevius</i>	Coraciidae	Rufous-Crowned Roller	Tsanwaka	LC
52	<i>Chalcomitra senegalensis</i>	Nectariniidae	Scarlet-Chested Sunbird	Jan gaba	LC
53	<i>Contopus senegalensis</i>	Cuculiformes	Senegal Coucal	Ragwan mazaa	LC
54	<i>Poicephalus senegalus</i>	Psittacidae	Senegal Parrot	Tsírýáá	LC
55	<i>Ptilopachus petrosus</i>	Odontophoridae	Stone Partridge	Kàazag geezàa	LC
56	<i>Turtur tympanistria</i>	Columbidae	Tambourine Dove	Kurchiya dufuwa	LC
57	<i>Prinia subflava</i>	Cisticolidae	Tawny-flanked Prinia	Tsigi da zanko	LC
58	<i>Cinnyris venustus</i>	Nectariniidae	Variable Sunbird	Shàa kauçi	LC
59	<i>Streptopelia vinacea</i>	Columbidae	Vinaceous Dove	kurchiya maharba	LC
60	<i>Euplectes gierowii</i>	Passeriformes	Black Bishop	Dale	LC
61	<i>Lepisotasp.</i>	Formicidae	Black Ant	Kiyashi	DD
62	<i>Zonocerus variegatus</i>	Pyrgomorphidae	Grass hopper	Fara	DD
63	<i>Musca domestica</i>	Muscidae	House Flies	Kuda	DD
64	<i>Archispirostreptus gigas</i>	Spirobolida	Millipede	Kwarkwasa	DD
65	<i>Danaus plexippus</i>	Nymphalidae	Monarch Butterfly	Fara tsuntsuwa	DD
66	<i>Pentodon idiota</i>	Scarabaeidae	Rhinoceros beetle	Buzuzu	DD
67	<i>Galleriomorpha</i> sp	Heterocera	Common Moth	Asu	DD
68	<i>Achatina achatina</i>	Achatinidae	Giant West African snail	Dodon Kodi	DD
69	<i>Bufo regularis</i>	Bufonidae	True toads	Kwado	LC
70	<i>Hyperloliussp.</i>	Rhacophonidae	Tree frog	Tsalle ruwa	LC
71	<i>Rana temporaria</i>	Ranidae	Common Frog	Mawa ciyawa	LC
72	<i>Agama agama</i>	Agamidae	Agama Lizard	Kadangare	LC
73	<i>Bitis arietans</i>	Viperidae	Puff Ader	Maciji mai guba	LC
74	<i>Bos taurus</i>	Bovidae	Domestic Cow	Shaanu	LC
77	<i>Ovis aries</i>	Bovidae	Domestic Sheep	Rago	LC
76	<i>Capra aegagrus hircus</i>	Bovidae	Domestic Goat	Akuya	LC
77	<i>Canis lupus familiaris</i>	Canidae	Domestic dog	Kare	LC
78	<i>Heterotis niloticus</i>	Osteoglossidae	African Bony tongue	Bargi	LC
79	<i>Clarias gariepinus</i>	Clariidae	African Catfish	Tarwada	LC
80	<i>Gymnarchus niloticus</i>	Gynarchidae	African Knifefish	Dan Sarki	LC
81	<i>Synodontis nigrita</i>	Mochokidae	Moon Fish	Kurungu	LC

Source: Field Survey, September, 2025.

Note: DD (Data Deficient); LC (Least Concerned); VU (Vulnerable)

3.2.5 General Geomorphology

3.2.5.1 Slope Instability and Subsidence

The stability or instability of a slope is greatly dependent upon factors such as gradient, available water content, existing vegetation, and stresses (natural and anthropomorphic) affecting the slope. For example, a denuded, saturated slope could be further destabilized and fail if it was to be stressed by considerable earth moving activities. The terrain of the project area is relatively of uniform surfaces.

Land subsidence is the loss of surface elevation due to removal of subsurface support. Subsidence has many causes, including seismically induced stresses and the extraction of mineral or liquid and gas deposits. Although mineral and gas can and do cause subsidence, it is more common for subsidence to occur as a result of groundwater extraction in excess of groundwater recharge. There are no known studies on subsidence in the project area or surrounding region. However, subsidence in the region as a whole may be limited because the various geologic and hydrologic conditions associated with subsidence are not known to occur in the project area.

3.2.5.2 Natural Drainage Corridors

Niger State is named after the River Niger. The major rivers which originate in or traverse Niger State are River Niger and River Kaduna (which is a tributary of River Niger). Kainji and Jebba Dams are built on River Niger while River Kaduna houses Shiroro and Zungeru Dams. These hydroelectric dams generate about 70% combined power output in the Nation's Power Sector and that has earned Niger State the nickname "Power State". Other rivers and manmade lakes include Tagwai, Kagara, River Dagga and Gurara River (on whose course the famous Guarara Falls is situated). The combined surface area of all the freshwater bodies located in the state is approximately 436,196 hectares. Other rivers and manmade lakes include Tagwai, Kagara, River Dagga and River Kaduna as well as their numerous tributaries and floodplains.

Survey maps that included Satellite Imagery and Topographic profiles were used to guide interpretations of storm water flows throughout the project areas. The watershed drainage features were identified through interpretation of 5-meter contour intervals topographic map. Drainage features within the scope of this investigation included any topographic feature that could potentially concentrate surface runoff, including convergent topography, swales and existing channels.

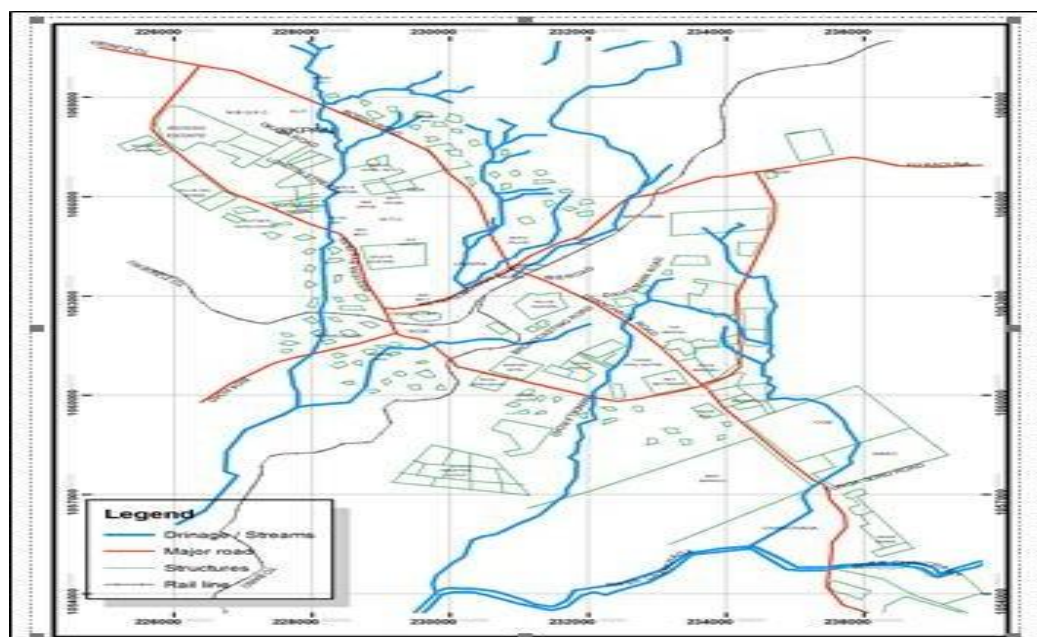


Figure 3.3: Map Showing Drainage Corridors

3.2.6 Archaeology and Cultural Heritage:

There are no World Heritage Sites or areas of cultural importance that would be impacted by the proposed project, nor are there any archeologically sensitive areas. This ESIA spells out appropriate site specific mitigation measures for any archaeological and cultural relics that maybe found during the project implementation.

3.2.7 Traffic and Transport Infrastructure:

The project area is served by several intra-linkage roads which are now severely degraded by the floods and erosion. The access roads to Mokwa project areas currently experience low level of traffic flow due to developmental and flooding/erosion problems. This is envisaged to gradually improve once the flood and erosion control intervention project is completed, and as additional residential areas develop and the road surfacing is improved.

3.2.8 Waste Management:

Waste management provision in the project area is generally lacking. Solid waste is generally handled in individual homesteads and are either burnt or disposed of in small earth fills to rot. There are no structured waste collections within the project areas resulting, to a large extent, in waste being indiscriminately dumped in isolated places. In most cases, the waste is indiscriminately disposed of in/near waterways within the environment. Engagement of accredited waste management vendors by the State Ministry of Environment and Climate Change in the collection and disposal of wastes in the project area is highly recommended. Pit toilets are mainly used by households in the project areas. Many of the people however, still engage in open defecation particularly along the gully corridors. There are also no effective sewerage works in the project areas.

Most of the survey respondents in the communities indicate that their household wastes are disposed of at convenient locations including crevices and drainage channels. In many areas, the waste is also indiscriminately dumped inside the water canals or at illegal dumpsites created only as a matter of convenience. Solid waste management in the project areas is a considerable hazard to the health of the population and the effective functioning of the storm water drainage systems. The unmanaged refuse causes regular obstruction of the storm water drainage systems.

Most residents in the project communities dispose their domestic refuse randomly outside their residential compounds and the flood-prone areas are also treated as de facto waste disposal sites. The situation in the communities are indeed a reflection of the poor waste management and waste disposal mechanisms in most parts of the state. As with other parts of the country, majority of households typically dispose of their domestic refuse inappropriately outside their residences. During the wet season, solid waste is transported by flowing storm water through unplanned drainage paths leaving a trail of refuse. There is therefore a clear need for government-accredited waste management vendors to be engaged by the Niger State Ministry of Environment and Forestry in the collection and disposal of waste from the site.

3.3 Site-Specific Baseline Environmental Setting

3.3.1 Mokwa Communities Baseline Setting

Environmental contaminants in soil, water and air, generally can be of concern to human health in project construction areas. Soil has often been the landing spot for heavy metals, chemicals, and waste as byproducts of industrial and agricultural pollutants. Heavy metals in soils such as Lead, Copper, Arsenic, Cadmium, etc., can be toxic to humans and plants if ingested in high enough quantities. Many of these metals are present in soils naturally, usually in small amounts, although the natural level may vary. (Saunders & Buob, 2018).

Generally, in Niger state, many depend on water wells and boreholes for drinking water due to the country's inefficient and inadequate pipe borne water system. Surface waters, in most areas, have been severely contaminated by natural sources, including humans and animals.

To avoid disease outbreaks and health hazard, continuous monitoring of ground water throughout the state is required.

Air pollution is a major environmental risk to health. By reducing air pollution levels, people can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma. The lower the levels of air pollution, the better the cardiovascular and respiratory health of the population will be, both long- and short-term. The WHO Air Quality Guidelines (Global Update 2005) provide an assessment of health effects of air pollution and thresholds for health-harmful pollution levels. The Guidelines apply worldwide and are based on expert evaluation of current scientific evidence.

It is envisaged that during project implementation, construction activities such as soil excavation, stockpiling and haulage of soil materials, equipment and vehicular movements will all result in site soil dusts. These activities will essentially increase exposure of and bring residents, workers, passersby in contact with soil as well as inhalation of dusts and other vehicular emissions.

Soil, water and air samples were collected from various locations within the proposed Mokwa project areas. The matrix of sampling media and sampling locations for the gully corridors are shown in Table 3.4. The sample locations are also shown on Figure 3.3. The collected samples were submitted to MGG Laboratory for analyses to assess the baseline environmental conditions within the project area.

Table 3.4: Mokwa Soil Sampling Locations and Coordinates along the Drainage Corridors

S/NO	LOCATION	Landmark	Sample media	SAMPLE CODE	COORDINATES
1	D01	The Railway Track	Soil	MKA-SS1	N 09 18. 032 E005 02.989
2	D01	Bridge Under Construction	Soil	MKA-SS2	N 09 16. 881 E 005 02. 936
3	D01	Bridge Under Construction	Soil	MKA-SS3	N 09 16. 935 E 005 02. 961
4	D01	Under The Transmission Line Yabagi	Soil	MKA-SS4	N 09 17. 229 E005 02. 925
5	D01	Slaughter Slab	Soil	MKA-SS5	N 09 17.489 E 005 02. 980
6	D01	Bridge Along The Main Road	Soil	MKA-SS6	N 09 17. 624 E 005 02. 984
7	D01	Along Main Gully	Soil	MKA-SS7	N 09 17. 916 E 005 03. 004
8	D01	Along Main Gully	Soil	MKA-SS8	N 09 17. 660 E 005 02. 963
9	D05	Back Of Kpege Primary School	Soil	MKA-SS9	N 09 17. 921 E 005 03. 209
10	RD03	Culvert Close To Alh. Mahmud Kolo House	Soil	MKA-SS10	N 09 17. 803 E 005 03. 083
11	D1L5	Mangorori Blacksmith close To The Culvert	Soil	MKA-SS11	N 09 17. 746 E 005 03. 064
12	D02	Former Gbasteff Global Academy	Soil	MKA-SS12	N 09 17. 324 E 005 03. 211

S/NO	LOCATION	Landmark	Sample media	SAMPLE CODE	COORDINATES
13	D02	Mallam Ndabisan Area	Soil	MKA-SS13	N 09 17. 344 E 005 03. 347
14	RD03	Mbb Furniture	Soil	MKA-SS14	N 09 17. 515 E 005 03. 539
15	D09	Alhaji Kumigi Compound	Soil	MKA-SS15	N 09 17. 792 E005 02. 994
16	D09	Mallam Isa Koko Area by Transformer	Soil	MKA-SS16	N 09 17. 816 E 005 02. 881
17	D09	Mallam Isa Koko Area	Soil	MKA-SS17	N 09 17. 785 E 005 02. 927
18	D09	Mallam Dan-Kano House (Head Of Vigilante)	Soil	MKA-SS18	N 09 17. 834 E 005 03. 017
19	D01	Along Main Gully	Soil	MKA-SS19	N 09 16. 977 E 005 02. 977
20	D08	Yabagi (Road Leading to Police Quarters)	Soil	MKA-SS20	N 09 17. 208 E 005 02. 295
21	D06	Leading to Takwangwa Primary School	Soil	MKA-SS21	N 09 17. 295 E 005 03. 000
22	D06	Leading to Takwangwa Primary School.	Soil	MKA-SS22	N 09 17. 318 E 005 02. 969
23	D06	New-Emi Dakuti Close to Kainji Junction	Soil	MKA-SS23	N 09 17 399 E 005 02. 917
24	D06	New-Emi Dakuti Close to Kainji Junction	Soil	MKA-SS24	N 09 17. 406 E 005 02. 948
25	D04a	General Hospital Mokwa	Soil	MKA-SS25	N 09 17. 484 E 005 03. 674
26	D03	Baptist School	Soil	MKA-SS26	N 09 17. 380 E 005 03. 494
27	DO1	The Railway Track	Surface water	MKA-SW1	N 09 18. 025 E005 02.997
28	D01	Bridge Along the Main Road	Surface water	MKA-SW2	N 09 17. 624 E 005 02. 984
29	D01	Bridge Under Construction	Surface water	MKA-SW3	N 09 16.878 E 005 02. 938
30	D01	Bridge Under Construction	Surface water	MKA-SW4	N 09 16. 935 E005 02.961
31	D01	Dummi Area	Surface water	MKA-SW5	N 09 17. 102 E 005 02. 955
32	D01	Slaughter Slab	Surface water	MKA-SW6	N 09 17. 489 E 005 02. 980
33	D01	House Close to The Railway	Ground water	MKA-GW7	N 09 17.979 E005 02.981
34	D01	Solar Powered Borehole by Redcross	Ground water	MKA-GW8	N 09 17. 942 E 005 03. 033
35	D05	Back of Kpege Primary School	Surface water	MKA-SW9	N 09 17. 921 E 005 03. 209
36	D08	Yabagi (Road Leading to Police Quarters)	Surface water	MKA-SW10	N 09 17. 208 E 005 02. 927

S/NO	LOCATION	Landmark	Sample media	SAMPLE CODE	COORDINATES
37	D06	Leading to Takwangwa Primary School	Surface water	MKA-SW11	N 09 17. 295 E 005 03. 000
38	D06	New-Emi Dakuti Close to Kainji Junction	Surface water	MKA-SW12	N 09 17. 406 E 005 02. 948
39	D05	Kpege Primary School (Borehole)	Ground water	MKA-GW13	N 09 17. 875 E 005 03. 182
40	D02	Former Gbasteff Global Academy (Well)	Ground water	MKA-GW14	N 09 17. 302 E 005 03. 215
41	D02	Alhaji Yanda Mosque (Borehole)	Ground water	MKA-GW15	N 09 17. 332 E 005 03. 293
42	D02	Mallam Ndabisan Area (Well)	Ground water	MKA-GW16	N 09 17. 343 E 005 03. 60
43	RD03	Mbb Furniture (Well)	Ground water	MKA-GW17	N 09 17. 502 E 005 03. 535
44	D09	Alhaji Kumigi Compound (Well)	Ground water	MKA-GW18	N 09 17. 804 E 005 03. 001
45	D09	Mallam Isa Koko Area (Well)	Ground water	MKA-GW19	N 09 17. 837 E 005 02. 893
46	DO9	Mallam Isa Koko Islamic School (Well)	Ground water	MKA-GW20	N 09 17. 794 E 005 02. 930
47	D09	Mallam Dan-Kano House (Well)	Ground water	MKA-GW21	N 09 17. 836 E 005 03. 014
48	D04a	General Hospital Mokwa (Borehole)	Ground water	MKA-GW22	N 09 17. 484 E 005 03. 674
49	D03	Baptist College (Well)	Ground water	MKA-GW23	N 09 17. 367 E 005 03. 498
50	D01	The Railway Track	Air	MKA-AS1	N 09 18. 025 E 005 02. 997
51	D01	House Close to The Railway	Air	MKA-AS2	N 09 17. 624 E 005 02. 984
52	D05	Kpege Primary Sch	Air	MKA-AS3	N 09 16. 878 E 005 02. 938
53	D05	Back of Kpege Pri Sch	Air	MKA-AS4	N 09 16. 935 E 005 02. 961
54	D03	Sakpe Compound	Air	MKA-AS5	N 09 17. 102 E 005 02. 955
55	RD03	Mbb Furniture	Air	MKA-AS6	N 09 17. 489 E 005 02. 980
56	D01	Along Main Gully Corridor	Air	MKA-AS7	N 09 17. 979 E 005 02. 981
57	D01	Bridge under Construction (Right)	Air	MKA-AS8	N 09 17. 942 E 005 03. 033
58	D01	Bridge under Construction (Left)	Air	MKA-AS9	N 09 17. 921 E 005 03. 209
59	D01	Dummi (Water) Source	Air	MKA-AS10	N 09 17. 208 E 005 02. 927

S/NO	LOCATION	Landmark	Sample media	SAMPLE CODE	COORDINATES
60	D01	Yabagi (Road Leading to Police Quarters)	Air	MKA-AS11	N 09 17. 295 E 005 03. 000
61	D06	Leading to Takwangwa Primary School	Air	MKA-AS12	N 09 17. 406 E 005 02. 948
62	D01	Under the Transmission Line Yabagi	Air	MKA-AS13	N 09 17. 875 E 005 03. 182
63	D01	Slaughter Slab	Air	MKA-AS14	N 09 17. 302 E 005 03. 215
64	D01	Bridge Along the Main Road	Air	MKA-AS15	N 09 17. 332 E 005 03. 293
65	D06	New-Emi Dakuti Close to Kainji Junction	Air	MKA-AS16	N 09 17. 343 E 005 03. 60
66	D03	Along Peace Secondary School Road	Air	MKA-AS17	N 09 17. 502 E 005 03. 535
67	D03	Peace Seconary School	Air	MKA-AS18	N 09 17. 804 E 005 03. 001
68	RD01	Finger Intercession with the Main Gully	Air	MKA-AS19	N 09 17. 837 E 005 02. 893
69	D01	Along Main Gully Corridor	Air	MKA-AS20	N 09 17. 794 E 005 02. 930
70	D09	Mallam Isa Koko Area by Transformer	Air	MKA-AS21	N09 17. 836 E 005 03. 014
71	D09	Mallam Isa Koko Area	Air	MKA-AS22	N 09 17. 484 E 005 03. 674
72	D09	Mallam Dan-Kano House (Head of Vigilante)	Air	MKA-AS23	N 09 17. 367 E005 03. 498
73	D02	Former Gbasteff Global Academy	Air	MKA-AS24	N 09 17. 302 E005 03. 215
74	D09	Alhaji Kumigi Compound	Air	MKA-AS25	N 09 17. 804 E 005 03. 001

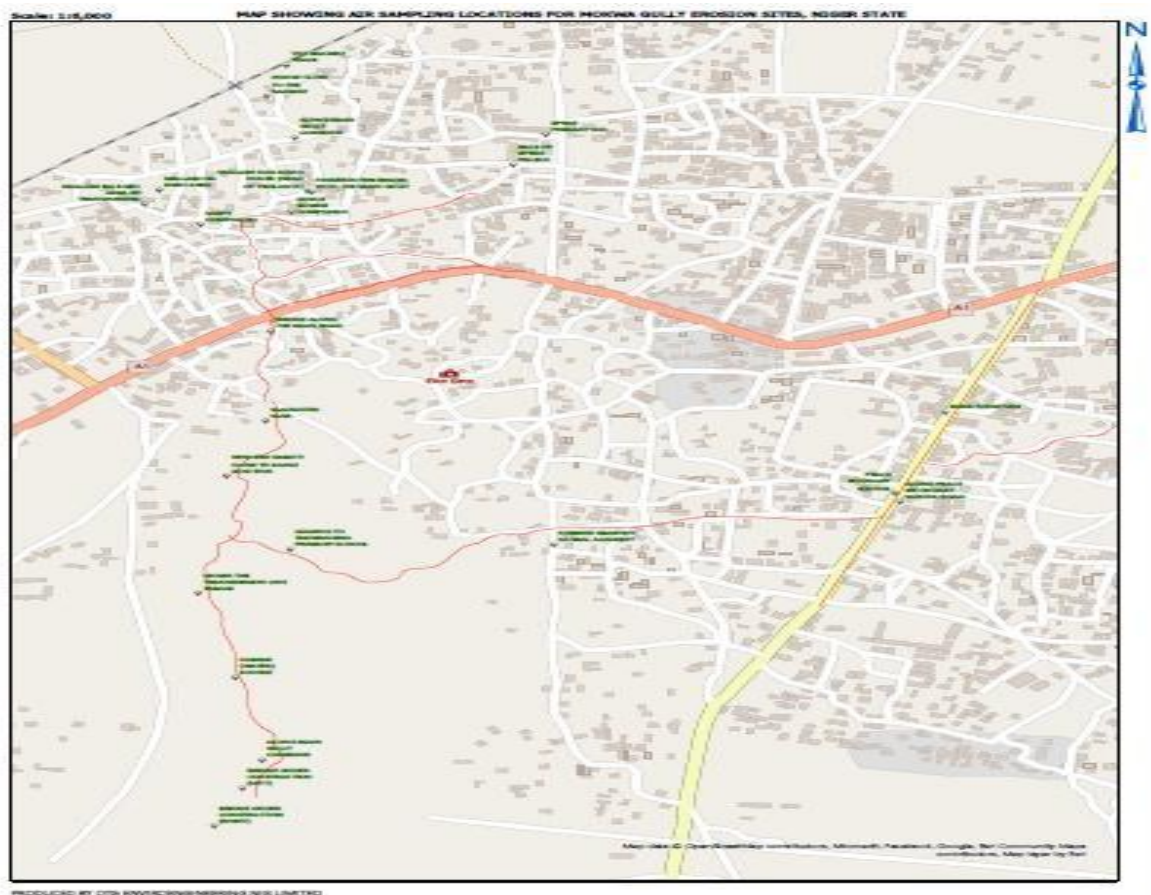


Figure 3.3A: Map Showing Soil Sampling Locations along the Drainage Corridors

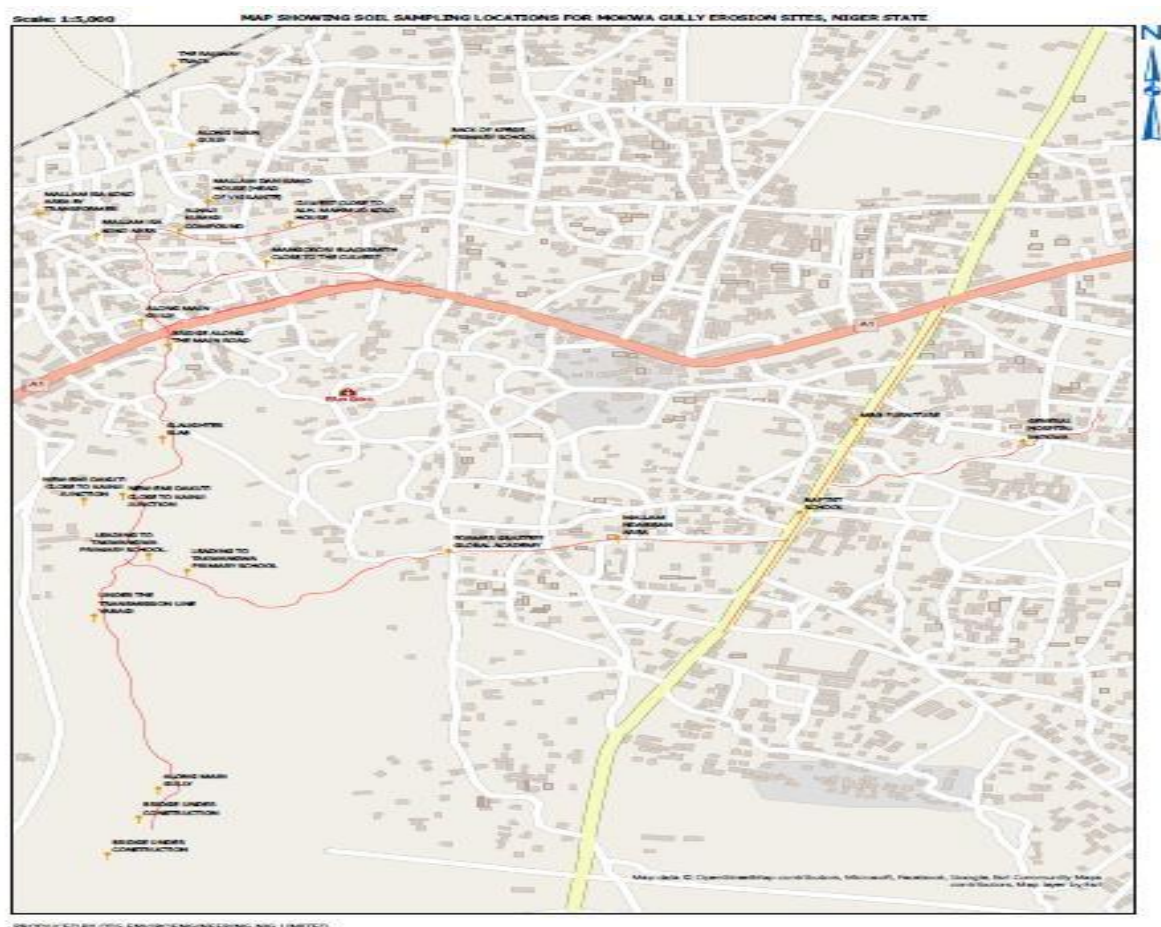


Figure 3.3B: Map Showing Water Sampling Locations along the Drainage Corridors

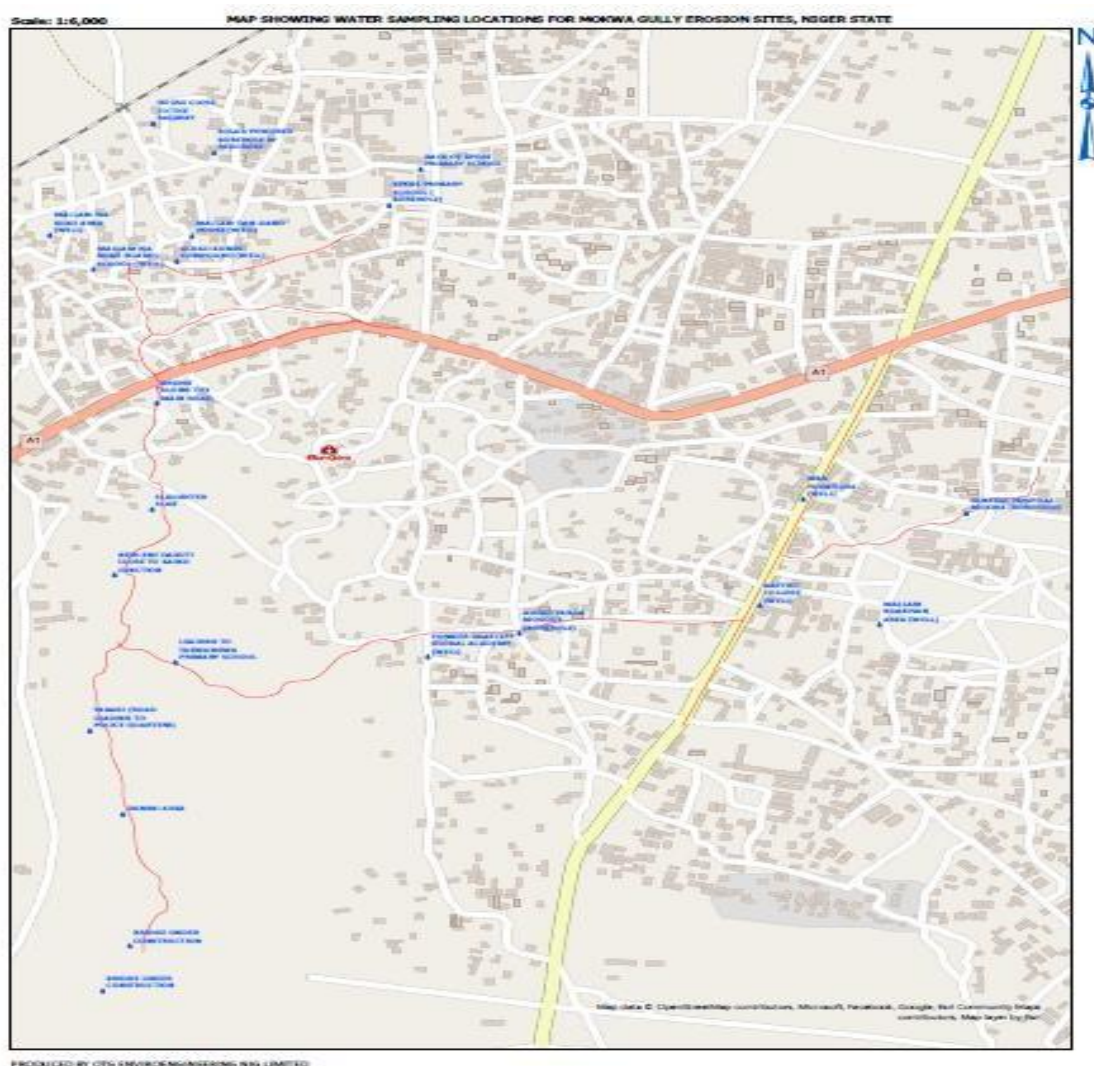


Figure 3.3C: Map Showing Air Sampling Locations along the Drainage Corridors

3.3.1.1 Soil Analytical Conditions

Representative near-surface soil samples for laboratory analysis were collected from five locations (targeted and random) points along the proposed Mokwa drainage corridors. Five targeted locations were selected from areas with observed environmental conditions that suggest contamination while other locations were randomly selected to depict general conditions along the project corridor. The sample locations are shown in Table 3.4. Each near surface soil sample (0 - 6 inches depth) was collected using the Dutch hand auger and put in a properly labeled self-sealing plastic bag for shipment to the FMEnv-certified MGG Resources Laboratory at Nsukka for chemical analysis. The baseline analytical results of the soil samples are summarized in Table 3.5.

Table 3.5: Baseline Soil Quality Analysis for Mokwa Site

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS1	SS2	SS3	SS4	SS5
1	pH (KCl)	-	-	6.7	6.7	7.4	7.1	7.1
2	pH (10% solution @ 25°C)	-	6.5-9.0	7.3	7.3	8.2	7.9	8.2
3	Nitrate	mg/kg	-	70	0.56	0.56	0.84	0.84
4	Moisture	%	-	2.15	2.46	2.77	4.17	3.2

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS1	SS2	SS3	SS4	SS5
5	Electrical conductivity	µS/Cm	-	8	8.4	6.4	7.2	7.2
6	Hydrogen	mg/kg	-	1.6	5.2	1	1.6	1
7	Aluminium	mg/kg	-	0.6	0.8	0.6	0.8	0.4
8	Soil colour	-	-	Brownish	Brownish	Brownish	Brownish	Brownish
9	Potassium (K ⁺)	mg/kg	-	Bdl	Bdl	Bdl	2.22	Bdl
10	Magnesium (Mg ²⁺)	mg/kg	-	10.2	10	10.6	11	10.4
11	Calcium (Ca ²⁺)	mg/kg	-	21.6	29.2	20.6	26.2	25.4
12	Sodium (Na ⁺)	mg/kg	-	2.29	0.41	0.19	1.63	1.64
13	Available Phosphorus	mg/kg	5	5.66	6.6	2.87	7.53	0.53
14	Organic Matter	%	-	0.85	0.62	0.46	0.47	0.47
15	Nitrogen	%	-	0.07	0.13	0.03	0.11	0.08
16	Organic Carbon	%	-	0.24	0.44	0.09	0.96	0.78
17	Iron (Fe ²⁺)	mg/kg	0.03	31	0.22	0.1	0.45	0.36
18	Lead (Pb ²⁺)	mg/kg	164	4	2.5	Bdl	1.54	Bdl
19	Copper (Cu ²⁺)	mg/kg	100	Bdl	Bdl	Bdl	Bdl	Bdl
20	Zinc (Zn ²⁺)	mg/kg	-	Bdl	Bdl	0.22	0.16	Bdl
21	Grain Size Distribution (Coarse Sand)	%	-	52	4	60	7	20
22	Grain Size Distribution (Clay)	%	-	26	28	8	18	22
23	Grain Size Distribution (Silt)	%	-	7	7	5	17	11
24	Grain Size Distribution (Fine Sand)	%	-	15	39	27	58	47
25	Textural Class	-	-	Sandy/Clay/Loamy	Sandy	Sand/L oamy	Sandy/L oamy	Sandy/Clay/Loamy

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS6	SS7	SS8	SS9	SS10
1	pH (KCl)	-	-	7.5	7.2	7.4	7.3	7.5
2	pH (10% solution @ 25°C)	-	6.5-9.0	8.4	8.1	8.2	8.2	8.3
3	Nitrate	mg/kg	-	0.84	0.56	0.56	0.56	0.56
4	Moisture	%	-	3.41	3.2	3.2	3.2	3.2

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS6	SS7	SS8	SS9	SS10
5	Electrical conductivity	µS/Cm	-	15.6	7.2	7.2	7.2	7.2
6	Hydrogen	mg/kg	-	1.4	1	1	1.6	1.2
7	Aluminium	mg/kg	-	0.4	0.2	0.2	0.6	0.2
8	Soil colour	-	-	Brownish	Brownish	Brownish	Reddish	Brownish
9	Potassium (K ⁺)	mg/kg	-	Bdl	Bdl	2.13	Bdl	Bdl
10	Magnesium (Mg ²⁺)	mg/kg	-	10.4	10.6	11.2	10.2	10.2
11	Calcium (Ca ²⁺)	mg/kg	-	22.4	24.6	12.4	21.8	20.02
12	Sodium (Na ⁺)	mg/kg	-	Bdl	0.67	0.22	1.61	0.24
13	Available Phosphorus	mg/kg	5	12.19	6.6	6.6	6.6	6.6
14	Organic Matter	%	-	1.47	0.78	0.78	0.78	0.78
15	Nitrogen	%	-	0.04	0.08	0.04	0	0.04
16	Organic Carbon	%	-	0.21	2.99	0.27	0.18	0.27
17	Iron (Fe ²⁺)	mg/kg	0.03	0.41	0.31	Bdl	0.38	Bdl
18	Lead (Pb ²⁺)	mg/kg	164	Bdl	1.09	1.19	Bdl	0.52
19	Copper (Cu ²⁺)	mg/kg	100	Bdl	Bdl	Bdl	Bdl	Bdl
20	Zinc (Zn ²⁺)	mg/kg	-	0.39	0.11	0.23	0.17	Bdl
21	Grain Size Distribution (Coarse Sand)	%	-	52	26	41	42	63
22	Grain Size Distribution (Clay)	%	-	8	8	8	24	8
23	Grain Size Distribution (Silt)	%	-	3	7	2	9	3
24	Grain Size Distribution (Fine Sand)	%	-	37	59	48	25	26
25	Textural Class	-	-	Sandy	Loamy/sandy	Sandy	Sandy/ Clay/ Loamy	Sandy

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS11	SS12	SS13	SS14	SS15
1	pH (KCl)	-	-	7.5	7.3	7.2	7.2	7.4
2	pH (10% solution @ 25°C)	-	6.5-9.0	8.3	8.1	8.1	8.2	8.2
3	Nitrate	mg/kg	-	0.56	0.56	0.56	0.56	0.56
4	Moisture	%	-	3.2	3.2	3.2	3.2	3.2

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS11	SS12	SS13	SS14	SS15
5	Electrical conductivity	µS/Cm	-	7.2	7.2	7.2	7.2	7.2
6	Hydrogen	mg/kg	-	1.2	1.2	1.2	1	0.8
7	Aluminium	mg/kg	-	0.2	0.2	0.2	0.2	0
8	Soil colour	-	-	Dark	Dark	Reddish	Brownish	Reddish
9	Potassium (K ⁺)	mg/kg	-	Bdl	0.28	Bdl	3.63	5.31
10	Magnesium (Mg ²⁺)	mg/kg	-	20.6	10	20.4	20.08	10.8
11	Calcium (Ca ²⁺)	mg/kg	-	30.23	40	31	40	31.6
12	Sodium (Na ⁺)	mg/kg	-	1.18	0.22	0.89	3.11	0.03
13	Available Phosphorus	mg/kg	5	6.6	6.6	6.6	6.6	6.6
14	Organic Matter	%	-	0.78	0.78	0.78	0.78	0.78
15	Nitrogen	%	-	0.06	0.07	0.028	0.042	0.042
16	Organic Carbon	%	-	0.81	0.808	0.06	0.299	0.18
17	Iron (Fe ²⁺)	mg/kg	0.03	0.25	0.21	0.1	0.2	0.53
18	Lead (Pb ²⁺)	mg/kg	164	Bdl	1.63	0.56	Bdl	Bdl
19	Copper (Cu ²⁺)	mg/kg	100	0.13	Bdl	Bdl	Bdl	Bdl
20	Zinc (Zn ²⁺)	mg/kg	-	Bdl	Bdl	0.35	Bdl	Bdl
21	Grain Size Distribution (Coarse Sand)	%	-	62	37	46	47	25
22	Grain Size Distribution (Clay)	%	-	8	12	8	8	34
23	Grain Size Distribution (Silt)	%	-	3	7	3	3	13
24	Grain Size Distribution (Fine Sand)	%	-	27	44	43	42	28
25	Textural Class	-	-	Sandy	Loamy/sandy	Sandy	Sandy	Sandy/ Clay/ Loamy

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS16	SS17	SS18	SS19	SS20
1	pH (KCl)	-	-	7.2	7.4	7.4	7.2	7.1
2	pH (10% solution @ 25°C)	-	6.5-9.0	8.3	8.6	8.7	8.3	8.4
3	Nitrate	mg/kg	-	0.56	0.56	0.56	0.56	0.56
4	Moisture	%	-	3.2	3.2	3.2	3.2	3.2

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS				
				SS16	SS17	SS18	SS19	SS20
5	Electrical conductivity	µS/Cm	-	7.2	7.2	7.2	7.2	7.2
6	Hydrogen	mg/kg	-	1.6	1	1	1	1.4
7	Aluminium	mg/kg	-	0.6	0	0.2	0.02	0.4
8	Soil colour	-	-	Reddish	Reddish	Brownish	Brownish	Reddish
9	Potassium (K ⁺)	mg/kg	-	3.22	5.75	5.54	3.13	Bdl
10	Magnesium (Mg ²⁺)	mg/kg	-	10	10.4	10.4	10.6	10.8
11	Calcium (Ca ²⁺)	mg/kg	-	20	26	40	40	25
12	Sodium (Na ⁺)	mg/kg	-	0.57	0.06	0.22	Bdl	0.39
13	Available Phosphorus	mg/kg	5	6.6	6.6	6.6	6.6	6.6
14	Organic Matter	%	-	0.78	0.78	0.78	0.78	0.78
15	Nitrogen	%	-	0.084	0.07	0.098	0.07	0.07
16	Organic Carbon	%	-	0.18	0.18	0.299	0.838	0.15
17	Iron (Fe ²⁺)	mg/kg	0.03	Bdl	0.27	0.28	0.48	0.39
18	Lead (Pb ²⁺)	mg/kg	164	Bdl	0.67	Bdl	1.63	Bdl
19	Copper (Cu ²⁺)	mg/kg	100	Bdl	Bdl	Bdl	Bdl	Bdl
20	Zinc (Zn ²⁺)	mg/kg	-	Bdl	Bdl	Bdl	Bdl	0.02
21	Grain Size Distribution (Coarse Sand)	%	-	26	30	47	29	31
22	Grain Size Distribution (Clay)	%	-	32	32	91000	24	26
23	Grain Size Distribution (Silt)	%	-	7	11	5	5	13
24	Grain Size Distribution (Fine Sand)	%	-	33	27	38	42	30
25	Textural Class	-	-	Sandy/ Clay/ Loamy	Sandy/ Clay/ Loamy	Loamy/ sandy	Sandy/ Clay/ Loamy	Sandy/ Clay/ Loamy

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS					
				SS16	SS17	SS18	SS19	SS25	SS26
1	pH (KCl)	-	-	7.2	7.4	7.4	7.2	5.9	5.7
2	pH (10% solution @ 25°C)	-	6.5-9.0	8.3	8.6	8.7	8.3	6.4	6.9
3	Nitrate	mg/kg	-	0.56	0.56	0.56	0.56	0.56	0.56
4	Moisture	%	-	3.2	3.2	3.2	3.2	3.2	3.2

S/N	PARAMETERS TESTED	UNITS	NESRE A/ FMENV LIMITS	ANALYTICAL RESULTS					
				SS16	SS17	SS18	SS19	SS25	SS26
5	Electrical conductivity	µS/Cm	-	7.2	7.2	7.2	7.2	7.2	7.2
6	Hydrogen	mg/kg	-	1.6	1	1	1	0.6	0.8
7	Aluminium	mg/kg	-	0.6	0	0.2	0.02	0	0
8	Soil colour	-	-	Reddish	Reddish	Brownish	Brownish	Reddish	Brownish
9	Potassium (K ⁺)	mg/kg	-	3.22	5.75	5.54	3.13	Bdl	Bdl
10	Magnesium (Mg ²⁺)	mg/kg	-	10	10.4	10.4	10.6	10	10.6
11	Calcium (Ca ²⁺)	mg/kg	-	20	26	40	40	21.2	21.6
12	Sodium (Na ⁺)	mg/kg	-	0.57	0.06	0.22	Bdl	0.3	Bdl
13	Available Phosphorus	mg/kg	5	6.6	6.6	6.6	6.6	6.6	6.6
14	Organic Matter	%	-	0.78	0.78	0.78	0.78	0.78	0.78
15	Nitrogen	%	-	0.084	0.07	0.098	0.07	0.028	0.208
16	Organic Carbon	%	-	0.18	0.18	0.299	0.838	0.09	0.06
17	Iron (Fe ²⁺)	mg/kg	0.03	Bdl	0.27	0.28	0.48	0.17	0.21
18	Lead (Pb ²⁺)	mg/kg	164	Bdl	0.67	Bdl	1.63	Bdl	0.31
19	Copper (Cu ²⁺)	mg/kg	100	Bdl	Bdl	Bdl	Bdl	0	Bdl
20	Zinc (Zn ²⁺)	mg/kg	-	Bdl	Bdl	Bdl	Bdl	Bdl	0.15
21	Grain Size Distribution (Coarse Sand)	%	-	26	30	47	29	46	49
22	Grain Size Distribution (Clay)	%	-	32	32	91000	24	8	3
23	Grain Size Distribution (Silt)	%	-	7	11	5	5	3	3
24	Grain Size Distribution (Fine Sand)	%	-	33	27	38	42	43	40
25	Textural Class	-	-	Sandy/ Clay/ Loamy	Sandy/ Clay/ Loamy	Loamy/ sandy	Sandy/ Clay/ Loamy	Sandy	Sandy

3.3.1.2 Surface Water Condition

To assess the surface water conditions, ten representative samples of surface water samples were collected within the project corridor. The locations of the surface water and groundwater samples collected are shown in Table 3.4. The water samples were collected in a clean sampling bottle for laboratory analysis. The water sample bottles were sealed, labeled and preserved in an ice-filled chest before shipping to the MGG Resources Laboratory at Nsukka for chemical analyses. The summary of baseline analytical results of the surface water samples are as shown in Tables 3.6.

3.3.1.3 Ground Water Condition

To assess the groundwater conditions, thirteen representative samples of groundwater were collected along the proposed Mokwa project corridor. Their locations are as shown in Table 3.4. The water samples were collected in a clean sampling bottle for laboratory analysis. The water sample bottles were sealed, labeled and preserved in an ice-filled chest before shipping to the MGG Resources Laboratory at Nsukka for chemical analyses. The summary of baseline analytical results of the ground water samples are as shown in Table 3.7.

Table 3.6: Baseline Surface Water Quality Analysis for Mokwa Site

S/N	PARAMETERS TESTED	UNITS	NESREA/FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					SW1	SW2	SW3	SW4	SW5
1	Temperature	° C	40	32-34	26	25.7	25.7	25.7	25.7
2	pH	-	6.5 - 8.0	6.5-8.5	7.5	8.1	7.8	8.1	7.7
3	Taste	-	NS	Nil	Has Taste	Has taste	Has taste	Has taste	Has taste
4	Appearance	-	NS	Nil	Has colour	Has Colour	Has colour	Has colour	Has colour
5	Odour	-	NS	Nil	Has odour	Has Odour	Has odour	Has odour	Has odour
6	Total Dissolved Solids	mg/l	2100	500	231	696	909	1.06	1.01
7	Conductivity	µS/Cm	1000µS/Cm	1500	325	980	1317	1471	1418
8	Total hardness	mg/l	NS	120-180	60	170	250	360	330
9	Chloride	mg/l	NS	250	31.24	142	185.2	127.8	85.2
10	Fluoride	mg/l	NS	2.0	0.18	0.28	0.18	0.18	0.18
11	Sodium	mg/l	10	20	Bdl	Bdl	0.13	Bdl	0.84
12	Potassium	mg/l	NS	NS	4.16	8.66	4.57	5.22	6.72
13	Sulphate	mg/l	250	250	8.17	6.68	7.26	6.85	7.26
14	Sulphide	mg/l	NS	0.2	0.1	0.1	0.1	0.1	0.1
15	Ammonia	mg/l	NS	1.5	0.18	0.18	0.18	0.18	0.18
16	Nitrate	mg/l	50	10	16.34	3.99	2.61	3.51	2.66
17	Phosphate	mg/l	5	5	30.9	60.79	27.21	84.5	82.66
18	DO	mg/l	6	6	2.4	3.2	4.8	4	4.8
19	BOD	mg/l	6	6	9.6	4.8	6.4	16	8.8
20	COD	mg/l	30	NS	31.3	166.67	90.48	80	88.37
21	Chromium	mg/l	0.1	0.03	0.05	0.29	1.01	0.53	0.16
22	Copper	mg/l	3	2	0.15	Bdl	Bdl	Bdl	Bdl
23	Iron	mg/l	1	0.3	0.67	0.11	0.79	0.37	0.74
24	Zinc	mg/l	< 1	0.01	Bdl	Bdl	Bdl	0.27	Bdl
25	Lead	mg/l	0.1	0.01	0.23	0.88	Bdl	Bdl	1.52
26	Nickel	mg/l	0.1	0.2	Bdl	Bdl	0.37	Bdl	Bdl
27	Manganese	mg/l	0.01	0.02	Bdl	Bdl	Bdl	Bdl	Bdl
28	Silver (Ag ⁺)	mg/l	< 1	0.10	Bdl	Bdl	Bdl	Bdl	Bdl
29	Calcium	mg/l	NS	NS	24	138	218	332	274
30	Magnesium	mg/l	NS	NS	36	32	32	28	58

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					SW1	SW2	SW3	SW4	SW5
31	Total Alkalinity	mg/l	NS	NS	300	560	920	1200	800
32	Hydroxide	mg/l	NS	NS	Bdl	Bdl	Bdl	Bdl	Bdl
33	Bicarbonate	mg/l	NS	NS	0.2	0.2	0.2	0.2	0.2
Microbial Analysis									
34	E-Coli	cfu/ml	0	0	2.00x10 ¹	0.0x10 ¹	0.0x10	0	1.0x10 ¹
35	Total Coliform M.agar	cfu/ml	0	0	1.00x10 ²	0.0x10 ²	0.0x10 ²	0	3.0x10 ¹
36	Total viable counts	cfu/ml	NS	NS	2.47x10 ³	8.6x10 ²	5.5x10 ²	6.7x10 ²	1.0x10 ³

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					SW6	SW9	SW10	SW11	SW12
1	Temperature	° C	40	32-34	26.1	26.2	26.2	26.2	26.2
2	pH	-	6.5 - 8.0	6.5-8.5	2.3	7.3	7.5	6.8	7.6
3	Taste	-	NS	Nil	Has taste	Has taste	Has taste	Has taste	Has taste
4	Appearance	-	NS	Nil	Has colour	Has colour	Has colour	Has colour	Has colour
5	Odour	-	NS	Nil	Has odour	Has odour	Has odour	Has odour	Has odour
6	Total Dissolved Solids	mg/l	2100	500	12.52	531	849	725	357
7	Conductivity	µS/Cm	1000µS/Cm	1500	17.87	729	1195	1020	509
8	Total hardness	mg/l	NS	120-180	60	80	280	100	130
9	Chloride	mg/l	NS	250	42.6	34.08	34.08	34.08	34.08
10	Fluoride	mg/l	NS	2.0	0.18	0.18	0.18	0.18	0.18
11	Sodium	mg/l	10	20	Bdl	4.72	4.72	12.33	Bdl
12	Potassium	mg/l	NS	NS	4.13	5.28	2.78	4.42	Bdl
13	Sulphate	mg/l	250	250	6.68	7.34	7.43	7.59	8.17
14	Sulphide	mg/l	NS	0.2	0.1	0.1	0.1	0.1	0.1
15	Ammonia	mg/l	NS	1.5	0.18	0.18	0.18	0.18	0.18
16	Nitrate	mg/l	50	10	6.34	9.01	2.5	1.29	3.98
17	Phosphate	mg/l	5	5	60.79	59.04	114.48	64.11	40.5
18	DO	mg/l	6	6	2.8	2.2	3.2	3.2	3.2
19	BOD	mg/l	6	6	8	12.8	4.8	4.8	24.8
20	COD	mg/l	30	NS	100	23.72	82.93	33.33	150
21	Chromium	mg/l	0.1	0.03	0.63	1.34	0.23	0.86	0.85
22	Copper	mg/l	3	2	Bdl	0.24	0.03	Bdl	0.13
23	Iron	mg/l	1	0.3	0.71	0.11	Bdl	0.61	0.36
24	Zinc	mg/l	< 1	0.01	Bdl	Bdl	Bdl	Bdl	Bdl
25	Lead	mg/l	0.1	0.01	0.79	0.71	2.54	1.52	0.98
26	Nickel	mg/l	0.1	0.2	0.96	0.31	0.36	Bdl	0.76
27	Manganese	mg/l	0.01	0.02	Bdl	Bdl	Bdl	Bdl	Bdl
28	Silver (Ag ⁺)	mg/l	< 1	0.10	Bdl	Bdl	Bdl	Bdl	Bdl
29	Calcium	mg/l	NS	NS	24	44	200	48	114
30	Magnesium	mg/l	NS	NS	36	36	308	52	16
31	Total Alkalinity	mg/l	NS	NS	300	360	168	180	340
32	Hydroxide	mg/l	NS	NS	Bdl	Bdl	Bdl	Bdl	Bdl
33	Bicarbonate	mg/l	NS	NS	0.2	0.2	0.2	0.2	0.2
Microbial Analysis									

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					SW6	SW9	SW10	SW11	SW12
34	E-Coli	cfu/ml	0	0	0.0x10	0.0x10	0.0x10	0.0x10	0.0x10
35	Total Coliform M.agar	cfu/ml	0	0	2.0x10	0.0x10	0.0x10	0.0x10	0.0x10
36	Total viable counts	cfu/ml	NS	NS	1.52x10 ³	9.3x10 ²	6.4x10 ²	4.2x10 ²	7.6x10 ²

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					GW7	GW8	GW13	GW14	GW15
1	Temperature	° C	40	32-34	26	26	26.1	26.2	26.2
2	pH	-	6.5 - 8.0	6.5-8.5	6.7	7.1	6.4	7	7.1
3	Taste	-	NS	Nil	Has taste	Has taste	Tasteless	Tasteless	Tasteless
4	Appearance	-	NS	Nil	Has colour	Has colour	Colourless	Colourless	Colourless
5	Odour	-	NS	Nil	Has odour	Has odour	Odourless	Odourless	Odourless
6	Total Dissolved Solids	mg/l	2100	500	708	467	157	690	782
7	Conductivity	µS/Cm	1000µS/Cm	1500	1004	672	223	975	1102
8	Total hardness	mg/l	NS	120- 180	120	110	20	110	120
9	Chloride	mg/l	NS	250	142	34.08	34.08	34.08	34.08
10	Fluoride	mg/l	NS	2.0	0.18	0.18	0.18	0.18	0.18
11	Sodium	mg/l	10	20	4.34	Bdl	Bdl	Bdl	2.1
12	Potassium	mg/l	NS	NS	131.13	4.45	Bdl	8.4	1.2
13	Sulphate	mg/l	250	250	6.93	8.17	6.85	7.1	6.77
14	Sulphide	mg/l	NS	0.2	0.1	0.1	0.1	0.1	0.1
15	Ammonia	mg/l	NS	1.5	0.18	0.18	0.18	0.18	0.18
16	Nitrate	mg/l	50	10	1.37	1.41	1.48	1.14	1.46
17	Phosphate	mg/l	5	5	55.53	53.04	39.58	60.89	59.5
18	DO	mg/l	6	6	4.8	3.2	5.4	4.2	5
19	BOD	mg/l	6	6	8	4.8	5.6	4.8	6.6
20	COD	mg/l	30	NS	75.56	32	28.92	107.32	22.93
21	Chromium	mg/l	0.1	0.03	Bdl	0.62	1.5	Bdl	0.73
22	Copper	mg/l	3	2	0.05	Bdl	Bdl	Bdl	Bdl
23	Iron	mg/l	1	0.3	0.93	0.21	0.25	0.29	0.44
24	Zinc	mg/l	< 1	0.01	Bdl	Bdl	Bdl	Bdl	Bdl
25	Lead	mg/l	0.1	0.01	1.27	2.44	Bdl	1.04	Bdl
26	Nickel	mg/l	0.1	0.2	Bdl	0.1	0.2	0.91	0.07
27	Manganese	mg/l	0.01	0.02	Bdl	Bdl	Bdl	Bdl	Bdl
28	Silver (Ag ⁺)	mg/l	< 1	0.10	Bdl	Bdl	Bdl	Bdl	Bdl
29	Calcium	mg/l	NS	NS	64	78	16	90	80
30	Magnesium	mg/l	NS	NS	56	32	4	20	40
31	Total Alkalinity	mg/l	NS	NS	180	140	60	200	200
32	Hydroxide	mg/l	NS	NS	Bdl	Bdl	Bdl	Bdl	Bdl
33	Bicarbonate	mg/l	NS	NS	0.2	0.2	0.2	0.2	0.2
Microbial Analysis									
34	E-Coli	cfu/ml	0	0	0.0x10	0x10	0.0x10	0.0x10	0.0x10
35	Total Coliform M.agar	cfu/ml	0	0	0.0x10	5.0x10	0.0x10	0.0x10	1.0x10
36	Total viable counts	cfu/ml	NS	NS	8.2x10 ²	1.16x10 ³	6.5x10 ²	7.1x10 ²	8.7x10 ²

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS				
					GW16	GW17	GW18	GW19	GW20
1	Temperature	° C	40	32-34	26.3	26.3	25.3	25.7	26.2
2	pH	-	6.5 - 8.0	6.5-8.5	7	4.9	7.3	6.4	7.6
3	Taste	-	NS	Nil	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
4	Appearance	-	NS	Nil	Colourless	Colourless	Colourless	Colourless	Colourless
5	Odour	-	NS	Nil	Odourless	Odourless	Odourless	Odourless	Odourless
6	Total Dissolved Solids	mg/l	2100	500	768	673	591	0.5	360
7	Conductivity	µS/Cm	1000µS/Cm	1500	1078	948	806	0.7	512
8	Total hardness	mg/l	NS	120-180	210	100	130	40	130
9	Chloride	mg/l	NS	250	34.08	34.08	34.08	34.08	34.08
10	Fluoride	mg/l	NS	2.0	0.18	0.18	0.18	0.18	0.18
11	Sodium	mg/l	10	20	0.56	0.67	0.71	0.05	Bdl
12	Potassium	mg/l	NS	NS	4.16	4.07	6.041	Bdl	2.47
13	Sulphate	mg/l	250	250	7.26	7.26	7.84	8.4	8.19
14	Sulphide	mg/l	NS	0.2	0.1	0.1	0.1	0.1	0.1
15	Ammonia	mg/l	NS	1.5	0.18	0.18	0.18	0.18	0.18
16	Nitrate	mg/l	50	10	1.26	1.63	1.54	1.46	3.98
17	Phosphate	mg/l	5	5	95.39	72.97	72.97	81.09	40.52
18	DO	mg/l	6	6	4.8	3.2	4.2	3.2	4.2
19	BOD	mg/l	6	6	6.4	4.8	5.8	12.8	4.8
20	COD	mg/l	30	NS	61.9	66.67	6	90.48	83.72
21	Chromium	mg/l	0.1	0.03	1.22	1.54	0.54	0.86	0.91
22	Copper	mg/l	3	2	Bdl	Bdl	Bdl	Bdl	0.1
23	Iron	mg/l	1	0.3	0.14	0.15	Bdl	0.28	0.3
24	Zinc	mg/l	< 1	0.01	Bdl	Bdl	0.05	Bdl	Bdl
25	Lead	mg/l	0.1	0.01	0.94	2.4	0.09	0.1	0.82
26	Nickel	mg/l	0.1	0.2	0.42	1.07	Bdl	0.65	0.6
27	Manganese	mg/l	0.01	0.02	Bdl	Bdl	0.11	Bdl	Bdl
28	Silver (Ag ⁺)	mg/l	< 1	0.10	Bdl	Bdl	0.03	Bdl	Bdl
29	Calcium	mg/l	NS	NS	158	76	86	16	118
30	Magnesium	mg/l	NS	NS	52	24	44	24	12
31	Total Alkalinity	mg/l	NS	NS	220	80	140	140	340
32	Hydroxide	mg/l	NS	NS	Bdl	Bdl	Bdl	Bdl	Bdl
33	Bicarbonate	mg/l	NS	NS	0.2	0.2	0.2	0.2	0.2
Microbial Analysis									
34	E-Coli	cfu/ml	0	0	0.0x10	1.0x10	0.0x10	1.0x10	1.0x10
35	Total Coliform M.agar	cfu/ml	0	0	1.0x10	3.0x10	1.0x10	2.0x10	3.0x10
36	Total viable counts	cfu/ml	NS	NS	9.1x10 ²	1.88x10 ²	7.9x10 ²	7.9x10 ³	1.44x10 ³

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS		
					GW21	GW22	GW23
1	Temperature	° C	40	32-34	25.7	25.8	25.8
2	pH	-	6.5 - 8.0	6.5-8.5	7.3	2.9	2.9
3	Taste	-	NS	Nil	Tasteless	Tasteless	Tasteless
4	Appearance	-	NS	Nil	Colourless	Colourless	Colourless
5	Odour	-	NS	Nil	Odourless	Odourless	Odourless

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	WHO LIMITS	ANALYTICAL RESULTS		
					GW21	GW22	GW23
6	Total Dissolved Solids	mg/l	2100	500	1.19	420	2.31
7	Conductivity	µS/Cm	1000µS/Cm	1500	1670	678	3.24
8	Total hardness	mg/l	NS	120-180	172	60	508
9	Chloride	mg/l	NS	250	34.08	34.08	34.08
10	Fluoride	mg/l	NS	2.0	0.18	0.18	0.18
11	Sodium	mg/l	10	20	2.33	1.42	0.23
12	Potassium	mg/l	NS	NS	5.16	Bdl	Bdl
13	Sulphate	mg/l	250	250	7.43	6.65	7.18
14	Sulphide	mg/l	NS	0.2	0.1	0.1	0.1
15	Ammonia	mg/l	NS	1.5	0.18	0.18	0.18
16	Nitrate	mg/l	50	10	1.54	1.29	1.89
17	Phosphate	mg/l	5	5	79.43	61.24	61.07
18	DO	mg/l	6	6	2.4	4.8	4.2
19	BOD	mg/l	6	6	6.6	9.6	4.8
20	COD	mg/l	30	NS	97.56	95.24	55.81
21	Chromium	mg/l	0.1	0.03	0.72	1.31	1.14
22	Copper	mg/l	3	2	0.05	0.22	0.42
23	Iron	mg/l	1	0.3	0.33	0.12	0.42
24	Zinc	mg/l	< 1	0.01	Bdl	Bdl	Bdl
25	Lead	mg/l	0.1	0.01	3.17	0.17	1.13
26	Nickel	mg/l	0.1	0.2	0.23	1.14	0.72
27	Manganese	mg/l	0.01	0.02	Bdl	Bdl	Bdl
28	Silver (Ag ⁺)	mg/l	< 1	0.10	Bdl	Bdl	Bdl
29	Calcium	mg/l	NS	NS	120	24	16
30	Magnesium	mg/l	NS	NS	52	36	44
31	Total Alkalinity	mg/l	NS	NS	200	300	Bdl
32	Hydroxide	mg/l	NS	NS	Bdl	Bdl	Bdl
33	Bicarbonate	mg/l	NS	NS	0.2	0.2	0.2
Microbial Analysis							
34	E-Coli	cfu/ml	0	0	0	0.0x10	0.0x10
35	Total Coliform M.agar	cfu/ml	0	0	2.0x10	1.0x10	2.0x10
36	Total viable counts	cfu/ml	NS	NS	2.03x10 ³	1.6x10 ³	1.13x10 ³

µS/Cm = MicroSiemens per centimeter

Bdl = Below detectable level

mg/L = milligram per litre

cfu = Coliform forming units.

3.3.1.4 Air Quality

Air quality assessment was carried out at several locations along the proposed Mokwa drainage corridor where active construction operations are anticipated and where human activities are expected to be high. Samples were collected using the Dragner CMS Gas Analyzer. Ambient air was drawn into the calibrated equipment at the targeted locations and subsequently the digital readings for the various parameters were read off the instrument. The location coordinates for each sampling location are also taken. The parameters measured as part of the air quality assessment included carbon monoxide (CO), Ammonia (NH₃), Hydrogen Sulphide (H₂S), Sulphur Dioxide (SO₂), Nitrogen Oxides (NO_x), Volatile Organic Carbon (VOC) as well as suspended particulate matter (SPM). The baseline analytical results of the air pollution indicators within and around the project corridor are shown in Table 3.8.

Table 3.8: Baseline Air Quality Analysis for Mokwa Site

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS							
				AS1	AS2	AS3	AS4	AS5	AS6	AS7	AS8
1	Hydrogen Sulphide (H ₂ S)	Mg/Nm ³	5	0	0	0	1	0	0	1	0
2	Carbon monoxide (CO)	Mg/Nm ³	500	0	1	0	0	0	0	0	1
3	Nitric Oxide (NO)	Mg/Nm ³	300	4.92	4.62	4.88	4.82	4.78	4.89	4.82	4.84
4	Nitric dioxide (NO ₂)	Mg/Nm ³	300	2.44	2.42	2.46	2.48	2.48	2.46	2.42	3.42
5	Sulphur dioxide	Mg/Nm ³	500	1.42	1.26	1.36	1.28	1.32	2.42	1.24	1.4
6	Hydrogen Cyanide (HCN)	Mg/Nm ³	NS	3.76	3.78	3.24	3.74	4.26	3.74	3.78	3.74
7	Ammonia (NH ₃)	Mg/Nm ³	NS	3.22	3.26	3.2	3.2	3.2	3.22	3.42	3.22
8	Oxygen	Mg/Nm ³	NS	20.9	20.8	20.8	20.8	20.8	20.8	20.9	20.9

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS							
				AS9	AS10	AS11	AS12	AS13	AS14	AS15	AS16
1	Hydrogen Sulphide (H ₂ S)	Mg/Nm ³	5	1	0	2	0	0	1	0	0
2	Carbon monoxide (CO)	Mg/Nm ³	500	0	1	0	1	1	1	1	1
3	Nitric Oxide (NO)	Mg/Nm ³	300	4.8	4.84	4.86	4.86	4.82	4.86	4.82	4.86
4	Nitric dioxide (NO ₂)	Mg/Nm ³	300	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46
5	Sulphur dioxide	Mg/Nm ³	500	2.42	1.42	1.44	1.44	1.4	1.4	1.44	1.42
6	Hydrogen Cyanide (HCN)	Mg/Nm ³	NS	3.72	3.74	3.72	3.34	3.74	3.74	3.74	3.74
7	Ammonia (NH ₃)	Mg/Nm ³	NS	3.2	3.22	3.24	3.2	3.2	3.2	3.2	3.22
8	Oxygen	Mg/Nm ³	NS	20.8	20.8	20.8	20.8	20.9	20.8	20.9	20.8

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS								
				AS17	AS18	AS19	AS20	AS21	AS22	AS23	AS24	AS25
1	Hydrogen Sulphide (H ₂ S)	Mg/Nm ³	5	1	1	2	2	2	0	2	2	2
2	Carbon monoxide (CO)	Mg/Nm ³	500	1	1	1	0	0	1	1	1	1
3	Nitric Oxide (NO)	Mg/Nm ³	300	4.82	4.82	4.86	4.86	4.86	4.86	4.86	4.82	4.86
4	Nitric dioxide (NO ₂)	Mg/Nm ³	300	2.46	2.44	2.46	2.46	2.46	2.46	2.4	2.44	2.46
5	Sulphur dioxide	Mg/Nm ³	500	1.42	1.42	1.4	1.44	1.48	1.44	1.4	1.44	1.46

S/N	PARAMETERS TESTED	UNITS	NESREA/ FMENV LIMITS	ANALYTICAL RESULTS								
				AS17	AS18	AS19	AS20	AS21	AS22	AS23	AS24	AS25
6	Hydrogen Cyanide (HCN)	Mg/Nm ³	NS	3.74	3.74	3.72	3.74	3.74	3.74	3.74	3.74	3.74
7	Ammonia (NH ₃)	Mg/Nm ³	NS	3.22	3.22	3.2	3.22	3.22	3.2	3.2	3.2	3.2
8	Oxygen	Mg/Nm ³	NS	20.8	20.8	20.8	20.9	20.8	20.8	20.8	20.8	20.8

BDL = Below detectable limit.

MGA = M40 Gas Analyser

Ppm = Parts per million.

3.3.1.4 Noise and Vibration:

The proposed Mokwa project area runs generally along several areas of high density residential neighborhoods. Noise levels were measured using the Digital Sound Level Meter (BAFX Products), Type BAFX3370. Ambient noise exposure levels were taken at four locations along the drainage corridor. The recorded minimum and maximum ambient levels ranged from 44.1dB to 87.1dB. These noise levels may be considered moderate ambient levels but are below the FMEnv regulatory standard of 90dB. The baseline noise levels are shown in Table 3.9. The baseline particulate matter levels are shown in Table 3.10.

Table 3.20: Mokwa Project Site Noise Readings

S/N	LOCATIONS	COORDINATES	MIN READING (dB)	MAX READING (dB)
1.	THE RAILWAY TRACK	N 09 18. 032; E005 02.989	37.2	67.5
2.	BRIDGE UNDER CONSTRUCTION	N 09 16. 881; E 005 02. 936	36.7	62.9
3.	BRIDGE UNDER CONSTRUCTION	N 09 16. 935; E005 02.961	38.0	67.7
4.	DUMMI AREA	N 09 17. 102; E 005 02. 955	34.7	65.6
5	BACK OF KPEGE PRIMARY SCHOOL	N 09 17. 921; E 005 03. 209	43.9	69.3
6	CULVERT CLOSE TO ALH. MAHMUD KOLO HOUSE	N 09 17. 803; E 005 03. 083	37.8	72.2
7	MANGORORI BLACKSMITH CLOSE TO THE CULVERT	N 09 17. 746; E 005 03. 064	52.8	73.8
8	FORMER GBASTEFF GLOBAL ACADEMY (WELL)	N 09 17. 302; E 005 03. 215	64.3	77.6
9	MALLAM ISA KOKO ISLAMIC SCHOOL (WELL)	N 09 17. 794; E 005 02. 930	50.7	78.4
10	MBB FURNITURE (WELL)	N 09 17. 502; E 005 03. 535	59.3	71.5

Table 3.22: Mokwa Project Site Particulate Matter Readings

S/N	LOCATIONS	COORDINATES	PM 2.5 READING	PM 10 READING
1.	MANGORORI BLACKSMITH CLOSE TO THE CULVERT	N 09 17. 746; E 005 03. 064	6.0	6.5
2.	FORMER GBASTEFF GLOBAL ACADEMY	N 09 17. 324; E 005 03. 211	10.0	16.0
3.	MALLAM NDABISAN AREA	N 09 17. 344; E 005 03. 347	5.0	5.7
4.	MBB FURNITURE	N 09 17. 515; E 005 03. 539	7.0	8.0
5	ALHAJI KUMIGI COMPOUND	N 09 17. 792; E005 02. 994	4.1	4.5
6	MALLAM ISA KOKO AREA BY TRANSFORMER	N 09 17. 816; E 005 02. 881	8.0	11.0
7	MALLAM ISA KOKO AREA	N 09 17. 785; E 005 02. 927	10.0	19.0
8	MALLAM DAN-KANO HOUSE (HEAD OF VIGILANTE)	N 09 17. 834; E 005 03. 017	1.0	17.0
9	GENERAL HOSPITAL MOKWA	N 09 16. 977; E 005 02. 977	4.0	15.0
10	BAPTIST SCHOOL	N 09 17. 484; E 005 03. 674	2.5	5.4

3.3.2 Evaluation of Baseline Analytical Results

Soil Condition

Environmental contaminants in soil generally can be of concern to human health. Heavy metals are a class of elements that include Lead, Copper, Arsenic, and Cadmium, and can be toxic to humans and plants if ingested in high enough quantities. Soils have often been the landing spot for heavy metals, chemicals, and wastes as byproducts of industrial and agricultural pollutants. Many of these metals are present in soils naturally, usually in small amounts, although the natural level may vary. (Saunders & Buob, 2018).

Lead poses the greatest concern because it is the most common contaminant and is most likely to exceed health based guidance values (McBride et al., 2014). Lead does not degrade and can remain in the soil for thousands of years. Lead accumulates on the top 1-2 inches of the soil as it binds tightly to soil particles and organic matter. In addition to Lead, Cadmium and Mercury are the most likely to pose the greatest health risk to humans. Elevated levels of Copper, Nickel, and Zinc can cause plant toxicity, while cadmium and arsenic can be of concern to human health.

The project location of Mokwa is considered high density population community. People, particularly children are likely to go to or wander into the construction zones thus increasing exposures to the health hazards associated with dusts and emissions from equipment and vehicles.

It is envisaged that during project implementation, construction activities such as soil excavation, stockpiling and haulage of soil materials, equipment and vehicular movements will result in site soil dusts. These activities will essentially increase exposure of and bring residents, workers, passersby in contact with soil as well as inhalation of dusts.

Baseline soil parameters indicate the state of soil ecosystem characteristics, which especially reflect productive, buffering, filtering and other soil functions. Soil quality is significantly affected by physical, chemical, biological and biochemical properties sensitive to changes in the environment and land management. The analytical results of the baseline soil quality indicators show concentrations of key soil quality below the regulatory threshold limits.

Groundwater Quality

Contaminants in groundwater which are relied upon as drinking water source by communities pose serious health risks to the residents. People can suffer acute or chronic health effects from almost any contaminant if they are exposed to extraordinarily high levels (as in the case of a spill). In drinking water, microbes, such as bacteria and viruses, are the contaminants with the greatest chance of reaching levels high enough to cause acute health effects.

The groundwater conditions at the Mokwa site were assessed through laboratory analysis of parameters that affect the quality of water in the environment. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. The analytical results of the baseline water quality indicators within and around the project areas show some concentrations that are higher than the regulatory threshold limits and are considered highly significant.

1. Phosphate (PO_4)

The concentration of Phosphate ranges from 39.58 - 95.39mg/l. This is above the minimum standard of 5.0mg/l permissible limit of phosphate in water as prescribed by WHO and FMEnv/NESREA.

2. Lead (Pb)

The range of lead concentration in groundwater is between 0.09 -3.17mg/l. This is above the 0.01mg/l permissible limit of lead in water as prescribed by WHO and FMEnv.

3. Chromium (Cr)

The concentration of chromium ranges from 0.54 to 1.54 mg/L, which is above the minimum standard of 0.0001mg/L of NESREA.

Air Quality

Air quality assessment was carried out at several locations where active construction operations are anticipated and where human activities are expected to be high. The analytical results of the baseline air quality indicators within and around the Mokwa project corridors show concentrations below the regulatory threshold limits. Field (in-situ) air sampling was carried out using the Dragner CMS Gas Analyzer. Ambient air was drawn into the calibrated equipment at the targeted locations and subsequently the digital readings for the various parameters were read off the instrument.

The parameters measured as part of the air quality assessment included carbon monoxide (CO), Ammonia (NH_3), hydrogen sulphide (H_2S), sulphur dioxide (SO_2), nitrogen oxides (NO_x), hydrogen cyanide (HCN) as well as oxygen (O_2). Analytical results obtained were reviewed against the appropriate regulatory limits to determine any potential health risk levels.

Noise and Vibration

The regulatory threshold limit for noise is 90 dB. All noise readings obtained at the various Mokwa locations within the project areas are below this regulatory limit. During the project construction phase, it is typically expected that noise levels will increase from the use of heavy equipment and project vehicular movements at the site.

CHAPTER 4: SOCIOECONOMIC CHARACTERISTICS AND CONSULTATION WITH STAKEHOLDERS

4.1 Description of Socioeconomic Environment

4.1.1 Introduction:

The overall project study was based on both quantitative data and qualitative inputs collected through research of historical environmental and social data for the Mokwa project areas, and the census/socio-economic survey data (the census questionnaire and socio-economic survey questionnaire was integrated into one basic document to enhance effectiveness). Qualitative inputs through consultations and discussions with potential project affected persons (PAPs), local community members and other stakeholders provided additional information for inclusion in the assessment. The affected Mokwa communities have been mobilized to contribute actively to project implementation and to sustainably maintain the works following implementation.

The socioeconomic elements and characteristics of the project area considered in this study include population, land use and tenure system, social setups, economic activities, education, vulnerability profile, gender, religion, settlement and migration patterns and health services system for Mokwa Communities. Qualitative and quantitative mixed method of assessment was adopted in this project because it offered an effective means of interacting widely with the stakeholder groups, the Niger ACREsAL team, as well as individual stakeholders and affected persons. Participatory community meetings, public discussions as well as discussions with key informants (Community elders, Local leadership, and Niger ACREsAL Officers, among others) were held in the course of study.

4.1.2 Socioeconomic Study

An integrated demographic and socio-economic survey questionnaire was developed and administered to the Mokwa project area communities, particularly households that may be affected directly or indirectly by the project. The questionnaire was administered to provide socio-economic profile of the community, particularly the areas that will potentially be impacted by the project. The data collected included data on age, gender, occupation, income, sources of livelihood of all persons who live on or derive a living from the area of land as well as information on houses, businesses and any structures in use in the affected areas. The specimen of the demographic/socio-economic survey form adopted for the project areas is included as Annexure II.

Besides the quantitative data collection method, a number of other tools were also used for eliciting information. These tools included Focused Group Discussion (FGD); community meetings and key informants' interviews.

Essentially, the comprehensive questionnaire for data collection that was used captured the following information:

- a) Household bio-data (demographic information);
- b) Livelihoods;
- c) Inventory of structural and nonstructural assets including land, common properties, houses, economic trees and cash crops.
- d) Health Impact Assessment

4.1.3 Public/Stakeholder Consultation

This was conducted as part of the participatory approach aimed at gaining good knowledge of the social issues/risks associated with the project as perceived by the communities. Public meetings were held at the respective community facilities located within the project immediate impact areas. Minutes of, and attendance to, the meetings are included in Annexure IV.

4.1.4 Use of Drone, Maps and GIS

Survey maps as well as high resolution imagery were used to identify and map out the project area identifying any locations of structures relative to the project corridor. Additionally, drone

imageries of the gully corridors and other areas of particular environmental and social interest were procured and used to evaluate, at a close range, the characteristics of the various gully corridors.

The qualitative analysis involved an assessment of information obtained during the stakeholders' consultations and public participation forums and discussions. The socioeconomic study provided necessary primary quantitative data for the project assessment. This quantitative data included:

- Household census of the people identified as PAPs;
- Establishing the socioeconomic profile of the project area population including health related status of respondents;
- Establishing the structural assets to be affected by project;
- Establishing area of land to be affected.

4.2 Description of Cultural Environment

4.2.1 Population

Based on the 2006 national population census records and the 3.42% annual population growth factor recommended by the National Population Commission (NPC), Mokwa LGA has a projected population of 430,159 for 2023. A breakdown shows the male population is 218,693 (50.84%) while the female population is 211,466 (49.16%) for Mokwa.

4.2.2 Ethnic Groups

The people of Mokwa consists mainly of Nupe, Hausa and Yoruba ethnic groups. The ethnic groups have their unique cultures, social organizations and traditions. The social and cultural aspects in the project area are closely intertwined with the ethnic groupings. Each ethnic group has elaborate cultural practices that include strong kinship linkages with organizations spanning from localized social groups to strong clan relations. The cultural associations and social interactions are epitomized during cultural and religious ceremonies and festivities. The people generally speak and write mainly their respective languages.

Mokwa town is essentially semi-urban town whose residents are generally trading/business men and women. The local dwellers rear domestic animals such as goats and sheep most of which are carried out within their residential compounds and maintain cows pastorally. Each community traces its origin from genealogical ties. Politics in the town are done within the framework of clanism. Clans are the basic point of cultural and political identity for the citizens. Clanism and kinship are the elemental forces in control of political and cultural institutions as well as service points. As previously stated, the project area, Mokwa is semi-urbanized being located in the ancient commercial southern to northern Nigerian trading routes. As a result of this, the flood/gully area is residential host to many persons from other parts of the country, particularly the south-south/south-west regions of Nigeria.

4.2.3 Religion

The people of Mokwa are predominantly of Islam religion, mostly Muslims. There are however a significant number of Christians and a few traditionalists in the communities.

4.2.4 Cultural Resources

There are no known designated historical, archaeological or cultural resources within the project area.

4.3 Land Use Pattern

4.3.1 Land Tenure System in the Project Area

There are three major types of customary land tenure system in the region – (1) individual land ownership; (2) family land ownership; and. (3) communal land ownership. Individual ownership may be for indigenes or for residents of the community. Family lands (as well as individual lands) are inherited from generational relatives. Communities retain family lands which may never be sold. Such family lands are generally retained for communal development

and sometimes are rotationally shared among the members of the community for agricultural purposes but are not for sale.

The Mokwa flood/gully corridors can be characterized as a predominantly semi-urbanized area with residential and commercial properties occupying significant sections of the communities while the areas close to the outfall are used for agricultural purposes. Land use in Mokwa community is committed to agricultural production of food crops. The crops include rice, groundnut, millet, maize, guinea corn and melon for Mokwa.

A review of the land use pattern within the project areas reveals the following:

- i) The frontal land areas in the vicinity of, and along the Mokwa - Bida Road are predominantly residential and commercial property development areas;
- ii) There are several structures (both residential and commercial) in close proximity to a section of the flood/gully corridor. These structures are proposed to be appropriately protected during the remedial construction phase of the project.
- iii) The land areas closest to the flood/gully corridor towards the hinterland are essentially dominated by agricultural farmlands and are currently erosion and flood prone.

4.3.2 Methods By Which People Acquire Lands

Three different methods of land acquisition were identified: inheritance, government allocation and purchase. Most lands acquired via inheritance method seldom have titles whether customary or statutory while the purchased lands often have. Generally, the community leaders constitute local stamp of approval and a body that certifies land ownership. Hence, those without title to land can provide attestation from the community leaders relating to land ownership. Additionally, the community leaders have the capacity to settle any land dispute that could arise.

4.3.3 Cost of Land and Rentage

According to Mr. Mordecai Gana of the State Ministry, the cost of land varies between locations from ₦250,000 to ₦350,000 for a 100m x 50m plot of land; 100m x 100m plot goes for ₦500,000 – ₦600,000. The rent for a two-bedroom house goes for between ₦150,000 to ₦200,000 per year and one room self-contained apartment is between ₦100,000 – ₦120,000 depending on the location.

The cost of houses in established locations inside Mokwa varies depending on the type of residence. The price range for a two-bedroom house or single unit house is between ₦450,000 and ₦500,000. A single or self-contained unit rents for between ₦45,000 and ₦90,000 while a two-bed room goes for between ₦100,000 and ₦300,000. A three-bed room apartment rents for between ₦300,000 and ₦500,000. House rent in Mokwa's undeveloped sections ranges from ₦25,000 to ₦40,000.

4.4 Analysis of Socioeconomic Survey

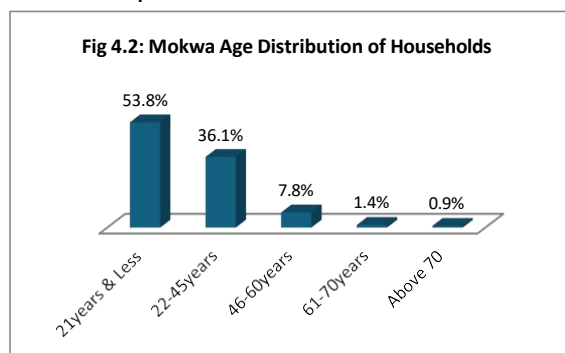
The measurement of precise impacts of the project on persons living or earning their living along the flood/gully corridor cannot be effectively established without appropriate and accurate social and economic baseline data. The socioeconomic study helps to assess the social economic changes that may occur in the living conditions of the project area population as a result of the project impacts.

4.4.1 Objectives of the Socioeconomic Survey

The primary objectives of the socioeconomic survey are as follows:

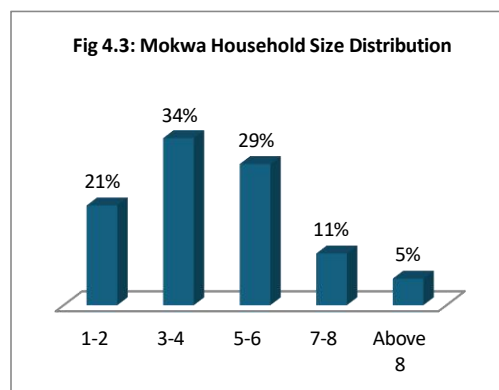
1. To collect information regarding existing socioeconomic conditions of Mokwa project area population;
2. To use the collected socioeconomic information to develop baseline data for the assessment of the social and economic impacts of the project;
3. To analyze the patterns of relationships that exist among various socioeconomic or demographic components of the project area;
4. To obtain perceived views of respondents on the effects of project on the environment and their vulnerability to socioeconomic changes due to the project; and,

5. To provide a benchmark for any further information needed to monitor and evaluate improvements in the future.



The respondents to the socioeconomic survey included the following:

- (1) Owners of any buildings or structures located within 6 meters from the edges of the Mokwa flood/gully corridor.
- (2) Owners of any buildings or structures located in areas to be used as construction staging areas during the construction phase of the project;
- (3) Residents/tenants of the buildings or structures identified in items (1) and (2) above whether the structures are permanent or temporary; residential or commercial;
- (4) Land owners along the proposed flood/flood/gully rehabilitation corridor whose lands would be required for the purpose of the project as project ROW;
- (5) Economic trees/crops owners along the flood/gully Setbacks (ROW) whose lands would be required.



The socioeconomic survey was conducted in conjunction with the census of the project affected persons to profile the impacted project area and provide baseline data against which mitigations measures and support will be measured. The analysis is based on respondents to the questionnaire administered to residents of Mokwa communities who are most likely to be impacted by the project. On the basis of the responses obtained in the exercise, the following determinations were made

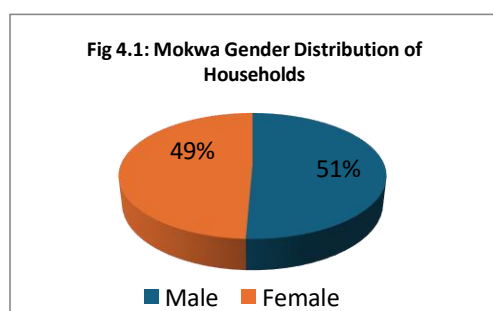
4.4.2 Respondent and Household Distribution in Project Area

The following Sections show how the residents of the project area responded to the socioeconomic survey administered to them. A total of 658 questionnaires were administered in Mokwa with a 100% return. The 658 respondents have a total of 2921 household members were documented for Mokwa. The percentage of the sample size disaggregated according to gender for Mokwa communities are male/female 59%/41%.

4.4.3 Gender, Age and Household Size Distribution

The survey data indicated male/female distribution of 50.7/49.3% for households in Mokwa. This is shown in Figure 4-1. Women in the project area are mainly involved in petty trading and home-keeping. Both men and women are significantly involved in the general pursuits to provide for the family.

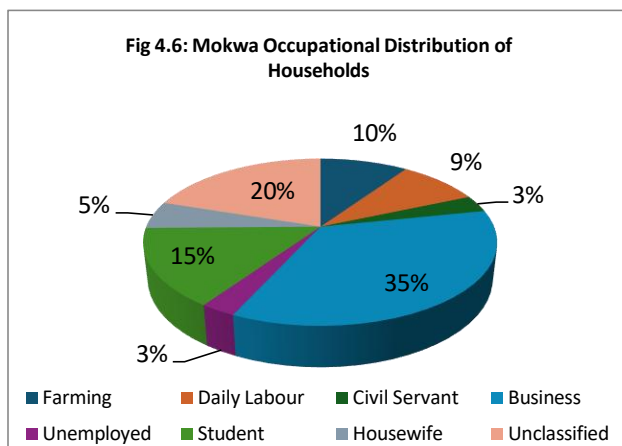
The age distribution data (Figure 4-2) of Mokwa community indicate that 53.8% of the households in the Mokwa communities are 21 years of age and below, while 2.3% of the households are 61years and above for the communities. The survey further showed that 36.1% of households in Mokwa are within the youthful ages of between 22 and 45 years. 7.8% of households in the communities are between the ages of 46 and 60 years (Figure 4-2).



The household sizes in Mokwa ranged from a minimum of one person to a maximum of 18 persons in the Mokwa. The household average size is 6

persons for both communities.

Mokwa has 21% of their households at the lowest end of the household sizes (one or two persons) and 5% of their households at the highest end (above 8 persons). For Mokwa, 34%, 29% and 11% of their households, respectively have 3-4 persons, 5-6 persons and 7-8 persons as their household sizes (Figure 4-3).



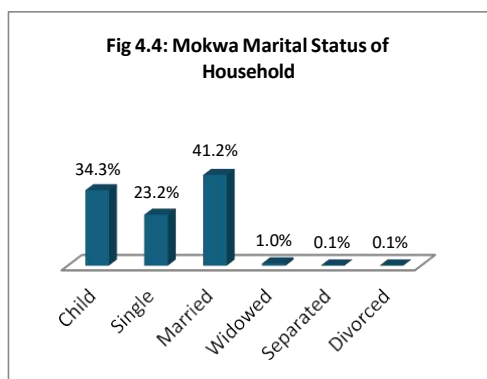
4.4.4 Marital Status of Respondents

The survey data showed that 41.2% of household members in Mokwa are married. 34.3% are children of non-marriageable age in the households. 23.2% of the households are single in Mokwa. The data showed 1% of the households in Mokwa are widowed and 0.1% in Mokwa are divorced and separated (Figure 4-4).

4.4.5 Access to Education

The survey indicated that the population of schooling age who never attended school is 32.5%. 16.9% are children attending preschool in Mokwa communities. 19.9% have basic primary school education (FSLC); 20.8% have attended Secondary school (SSCE); 4.2% are undergraduates; there are 5.4% graduates in Mokwa while 0.3% attended post graduates (Figure 4-5). The low literacy level within the Mokwa communities is reflective of the significantly low number of existing educational infrastructure support within the project area.

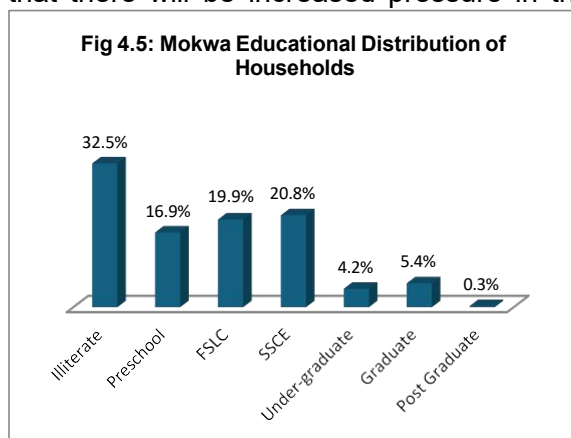
4.4.6 Access to Health Infrastructure



The commonly treated diseases within Mokwa communities include diarrhea, malaria, typhoid, pneumonia, cough, skin diseases, deficiency diseases and waterborne diseases resulting mainly from malnutrition and lack of hygiene. Due to poverty, access to quality health care services in the areas is generally poor with most residents patronizing quacks and medicine shops for their medical treatment.

4.4.7 Access to Socioeconomic Infrastructure

The socioeconomic infrastructures (roads system, electric power and access to water) in the project communities are generally in poor state. Public access to potable water is poor and power is generally not steady. It should be anticipated that there will be increased pressure in the demand for social services and amenities in the communities resulting from influx of persons during the implementation of the projects. The influx of persons will inevitably put pressures on existing social service resources like water, electricity, transportation, etc. in Mokwa community. The use of existing facilities will be on the rise.



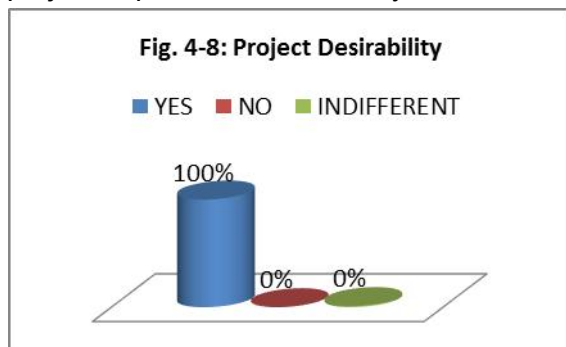
4.4.8 Occupational and Income Distribution of Households

The occupational distribution data from the questionnaires indicate that of the surveyed households in the Mokwa, 10% are farmers; about 9% are employed in the private sector; 15% are students. The data further showed that 5% are housewives in Mokwa; 3% are civil servants; while 3% are unemployed; 19.9% are unclassified. (Persons of school age but not in school and not employed) (Figure 4-6).

The main source of income for the households surveyed came from trading/business across Mokwa communities. Based on the household income data obtained, 32% of the households in Mokwa earned less than N21,000 monthly; 10% earned between N21,000-30,000 monthly; 11% earned N31,000-45,000 monthly, 17% earned N46,000-60,000 monthly, 22% earned N60,000-N120,000 monthly while 9% earned above N120,000, respectively (Figure 4-7). The margin of error in the information provided on incomes may be significant considering that some of the respondents may have grossly inflated data provided with the intent to receive compensations in accordance with incomes indicated in the survey. The data provided could not be independently verified.

4.4.9 Desirability of the Project

All the respondents in the survey (100%) for Mokwa indicated immense desirability for the project to proceed as shown in Figure 4-8. Many of them expressed a clear wish for the project to proceed immediately before the next round of rainfall.



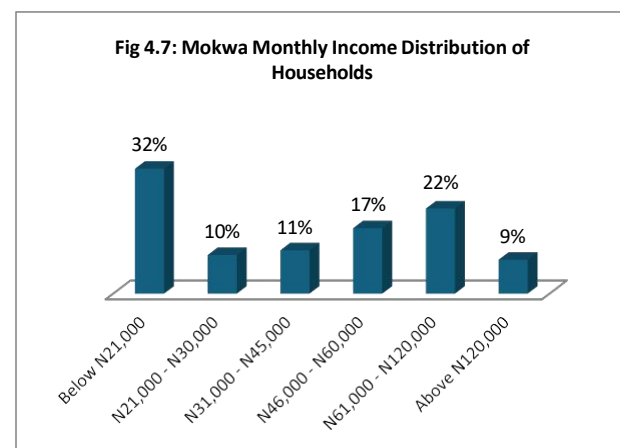
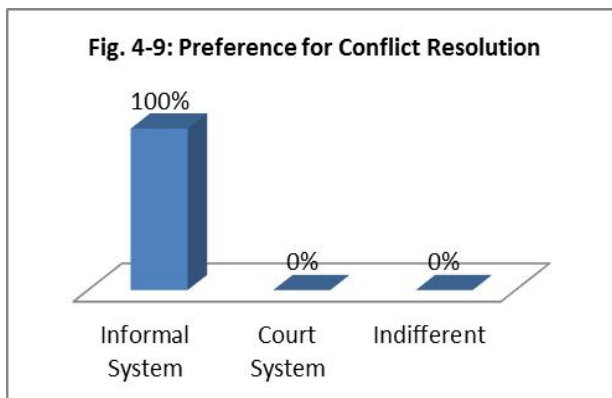
4.4.10 Potential Security Risk Challenges

As previously indicated, implementation of the Mokwa subprojects will result in an influx of persons seeking gainful employment with the project contractors or providing social services of various types or to gain any social privileges within the project communities. Different types of persons, including criminals of sorts, may be expected to find their ways into the project communities during this time. Such movement

of persons will inevitably increase the potential for criminal activities within the Mokwa communities. It should therefore be anticipated that there will be increased pressure in the demand for police services and other security issues in the project area. Additionally, the cumulative unemployment levels in Mokwa communities resulting from the influx of employment seeking persons to the area will pose its own security risks for both the communities and the security institutions.

4.4.11 Conflict Resolution

All respondents in the survey (100%) for both Mokwa prefer and find it most convenient to have conflicts resolved through their informal traditional modes of conflict resolution which currently exist within the communities. The court system is seen as an alternative means to resolve issues but no respondent favored it as a means of resolving conflict. None of the respondents was indifferent to the preferred approach as shown in Figure 4-9.



4.5 Public/Stakeholders' Consultation and Participation

The public participation process is a critical component of this ESIA development and required identifying and working with all stakeholders and the project communities, including the potential affected individuals or group of persons, from the beginning of the process. The direct involvement and active participation of relevant stakeholders and the local people in the planning and management processes of the project assures that any potential disharmonious issues within the community are resolved speedily. There will also be maximization of resource use and increased benefits and expanded opportunities for the communities in the project areas.

The consultation process with the people of Mokwa was driven in a manner that encouraged active and sustained participation of the community members, particularly the communities through which the active gully traversed. This was to promote community ownership of the project and to enhance sustainability. Consultations and stakeholder involvement in the project gave the villages and the PAPs the opportunity to make contributions aimed at strengthening the subproject while avoiding any negative impacts and reducing possible conflicts. The consultations will remain an ongoing exercise throughout the entire project to minimize chances of possible conflicts. This consultation phase also included the administration of pre-defined socio-economic questionnaires at the household level for the project affected areas along the gully corridors.

Information and data gathering involved a broad spectrum of activities that included interviews and discussions with community members who have historical knowledge of the site and the history of flooding and erosion problems in the affected areas. It also involved other physical and intrusive study of the natural, social, economic and cultural environments of the subproject areas. Table 4.3 gives the list of identified stakeholders with their areas of interest and responsibilities in the subproject. The list includes government functionaries, NGOs, FBOs and CBOs among others.

4.5.1 Community Participation

Community participation improves understanding of the project and communication between the SPMU, the consultants or contractors and the community. The decision-making process for the project will also be enhanced by actively involving relevant stakeholders, especially the project affected persons and organizations with a stake in the project.

4.5.2 Objectives of the Community Consultations

The aims of the public participation and consultation process are:

- Solicit inputs, views and concerns from the each affected community as they relate to the project and obtain local and traditional knowledge that may be useful for decision-making;
- Facilitate consideration of alternatives, mitigation measures and trade-offs, and ensure that important impacts are not overlooked and that benefits are maximized;
- Reduce conflict through the early identification of contentious issues; and increase public confidence in the project.
- Provide opportunity for the public to influence the project designs and implementation in a positive manner and improve transparency and accountability in decision-making.

4.5.3 Public Consultation Methodology

The methodology adopted in this ESIA for carrying out the consultation process include a qualitative and quantitative mixed method that offers an effective means to interact widely with the project communities and stakeholder groups. Essentially, the approach is based on a participatory approach that included community meetings, public discussions as well as discussions with key informants (District Heads, Village Heads, Council members, Local Authorities, and Niger ACRESAL Officers, among others). A brief description of these methods is as follows:

1. Rapid Assessment Technique:

This involved a quick professional assessment of the subproject potential impacts based on nearness of residential/commercial assets to the drainage alignment along the gully corridors. It also involved anticipated nature and intensity of impacts, and the significance of the impacts within the proposed subproject areas. Any affected property owner is directly engaged in discussions to create and gain better understanding between the parties.

2. Socioeconomic Survey:

This involved the administration of structured questionnaire designed to provide socioeconomic profile of households/families resident or doing business within the subproject area as well as formal and informal discussions with focus groups, including the community traditional and administrative leadership.

3. Public Meetings:

This was conducted as part of the participatory approach aimed at gaining good knowledge of the social issues/risks associated with the subproject as perceived by the communities. Public meetings were held at different locations within the subproject immediate impact areas.

4.5.4 Stakeholders' Identification

Consistent with recommendations in the ESMF for ACRReSAL, five broad categories of stakeholders were identified by the Consultant for this project based on the degree to which the project activities affected or involved such persons or group of persons. These stakeholders are grouped as shown in Table 4-2.

The adopted process consists of:

- i) Identification of any parties whose line of duties whether officially, socially, economically or culturally have direct or indirect bearing on any aspects of the project activities. These parties may include individuals, groups, institutions or organizations that may be affected by the flood/gully remedial activities;
- ii) Establishment of the stakeholders list and identification of specific stakeholder interests in relation to the project. The issues considered include: (a) the project's benefit(s) to the stakeholders; (b) potential changes to the routine activities of the stakeholders that may occur due to the project; and, (c) the project activities that may cause damage or conflict for the stakeholder;

Table 4-2: Identified Stakeholders' Groups and Their Responsibilities

GROUP	DESCRIPTION	ROLE IN COMMUNITY AND AREAS OF INTEREST IN SUBPROJECT
Group-1	Individuals or group of persons whose day-to-day lives/livelihoods may be directly affected by subproject activities. These are people who either reside or carry out their daily livelihood activities within the proposed flood/gully corridor plus 6 meters on either side of the flood/gully for Mokwa	The identified persons or group of persons in this category represent the potential project affected persons (PAPs) or households (PAHs)
Group-2	Individuals or group of persons whose day-to-day traditional or administrative functions include oversight of developmental activities and welfare of people within the subproject areas. This includes community District Heads, Mai Aungwas and other community leaders.	This category of persons serves as mobilization points around which the Consultant will reach out to the other members of the community.
Group-3	Individuals or group of persons whose daily activities (including farming) bring them in close proximity to the subproject corridors. These are people who either reside or carry out their daily livelihood activities outside the project corridors but within the community in which the subproject is located.	This category of persons may or may not be affected by the subproject but may be significant contributors to the long term sustainability of the subproject areas. This includes institutions of higher learning, etc.
Group-4	Organizations that provide frequent interface with the community members who may be directly or indirectly affected by the subproject	This group of organizations essentially provides on a continuous basis spiritual

GROUP	DESCRIPTION	ROLE IN COMMUNITY AND AREAS OF INTEREST IN SUBPROJECT
	activities. This group includes Community-based Organizations (CBOs), Faith-based Organizations (FBOs) in the Community (Mosques, Churches, etc), and Non-governmental Organizations (NGOs).	and physical welfare as well as environmental health of the community.
Group-5	Individuals or group of persons who are political office holders and have significant responsibilities toward community members and developments within the subproject areas. This includes the Chairmen of Mokwa LGA, Hon. Members of State House of Assembly, Members of Federal Constituencies representing Mokwa and Distinguished Senator representing Mokwa communities.	This group of individuals is collectively responsible for the political and general socio-economic development of the communities that are within their respective political zones.

4.5.5 Project Neighborhood Reconnaissance

Prior to the meeting with the subproject communities, the ESIA Consultant met with members of the Project Site Committee in Mokwa. The committee members in the company of the engineering design consultant Surveyor then conducted a walk-through of all the flood- and gully-affected areas along the project corridors with the Consultant. A close inspection of critical areas along the corridors and other key infrastructure within the project areas were also carried out. The Surveyor identified and conducted the Consultant team through the gully corridors including those that existed before the Mokwa flash flood event and the additional gully fingers that resulted from the flash flood.

4.5.6 Community Meetings

The ESIA Consultant team held a consultation meeting with the Community Leadership and Stakeholders on September 20, 2025 to gain knowledge of the community/stakeholders' perspectives on the issues associated with the gully erosion and flood problems in the communities. This meeting was held at the Palace of the District Head/Traditional Ruler. The meeting involved the direct participation of those individuals and groups of persons identified in Table 4.2. Other meetings with the enlarged community members were held on September 26, 2025 at convenient public assembly places for each community. The community/stakeholders' meeting for Mokwa was attended by 60 persons, including the principal LGA and community leaders as well as members of the communities. Additionally, focus group discussions (FGD) with the men, women and youths of Mokwa communities were also held. The attendance at the various community meetings are as shown in Table 4.3 below.

Table 4.3: Community Consultations And Documentation

COMMUNITY	TYPES OF CONSULTATION	COMMUNITY LOCATION	DATE HELD	NUMBER OF ATTENDEES
Mokwa	Community leadership and stakeholders consultation	Ndalile Aliyu Palace	20/09/2025	60 (male 40, female 20)
	Community sensitization & consultation	Anguwan Hausawa/ kpege	26/09/2025	126 (males 116, females 10)
		Etisheshi/ Takowangwa/ Yaffu	26/09/2025	63 All males
	Men Focused Group Discussion	Anguwan Hausawa/ kpege	26/09/2025	15
		Etisheshi/ Takowangwa/ Yaffu	26/09/2025	13
	Youth Focused Group Discussion	Anguwan Hausawa/ Mangorori	26/09/2025	75 All males

		Etisheshi/ Takowangwa/ Yaffu	26/09/2025	74 All males
	Women Focused Group Discussion	Anguwan Hausawa/ Mangorori	26/09/2025	60
		Etisheshi/ Takowangwa/ Yaffu	26/09/2025	105 All females

At each of the community meetings, the Consultant explained the purpose of the meeting and formally introduced members of the ESIA study team to the community. An overview of the ESIA assignment was explained to the communities and the subproject objectives, activities, outputs and work schedule of the assignment were also highlighted. Sustained support by the community members was solicited by the Consultant, particularly in respect of providing any necessary information/data that may be associated with the problem history and subproject implementation. The Consultant further called for questions, comments, observations or suggestions from the respective communities to which answers and necessary responses were provided. Summaries of the meetings with each community and the list of participants are provided in Annexure VIII - X.

4.5.7 Participants' Feedback – Comments and Concerns

During the community/stakeholders' meeting, the District Head expressed the appreciation and gratitude of the community to ACRReSAL, the Niger State Government, the Federal Government and the World Bank for the proposed intervention works. Several other participants expressed their views, and made comments and suggestions relating to the subproject. All the speakers promised to give full cooperation and support to the activities of the Consultant and the subproject at large. Photos and the attendance taken at the various meetings are included in Annexure VIII - X.

The key environmental and social issues and concerns that were raised during the stakeholders'/community meetings include:

1. Community safety with the next cycle of the rainy season. The community was quite apprehensive of the worsening flood and gully situation particularly in relation to safety risks posed to existing homes and human lives;
2. Continued flooding in the area would lead to additional damages and loss of crops and livestock, personal possessions, spread of diseases such as typhoid, cholera, diarrhea, and malaria;
3. Loss of access to roadways and crop lands.
4. Physical displacement of vulnerable persons during subproject implementation.

These issues and other concerns raised were addressed during the community meetings as are contained in Table 4.4.

Table 4.4: Community Consultation and Issues of Concern

TYPES OF CONSULTATION	KEY ISSUES RAISED	HOW ISSUES WERE ADDRESSED
Community leadership and stakeholders' consultation held on 25/9/2025	Safety concerns relating to community movement along the gully corridor to avoid injury due to the soil caving in	Community was informed that protective barriers will be placed at the necessary areas to ensure safety of persons moving near the gully corridors.
	Concerns were expressed about the aggravated damage to Takwanga Primary School (new gully finger created within the school).	Schools are considered sensitive receptors and given serious attention in this ESIA. The new gully finger will be stabilized during construction in accordance with the engineering design.
	The stakeholders cautioned against use of non-Mokwa indigenes as guides to the consulting team.	Advice was noted. The stakeholders were however informed that non-indigenes are also legitimate stakeholders whose views are also important for success of project.

Community sensitization and consultation held on 26/9/2025	What will be the fate of those not previously affected, but now affected due to May 2025 flash flood?	Any persons or issues not previously affected by the project but now impacted will be identified and appropriately documented in this ESIA.
	Concerns about flood water entering and damaging New Era Primary School.	It is expected that based on engineering design for this project, flooding concerns within the project areas including the New Era school will be resolved.
	Attention was again drawn to damage to Takwanga Primary School due to flood water.	Same as above.
Men Focused Group Discussions held on 26/9/2025	Concerns were raised about impostors who might claim other people's property.	The use of native guides and witnesses from neighbours will help to checkmate this.
	Will socioeconomic survey exercise apply to only one person in each household?	Yes, the socioeconomic survey applies to only the head of household. But all legitimate asset owners along the corridors will be verified.
	What is the setback distance for determining project affected assets?	Assets located within 6m from each side of the gully edge may be damaged and therefore considered for compensation to the owners.
	Will palliatives of May 2025 flash flood be accounted as compensation to PAPs?	No. The palliatives will not be counted as part of compensation in the current exercise. This is a standalone activity.
Women Focused Group Discussion held on 26/9/2025	Concerns were expressed about damages to their properties and possible compensations for affected persons.	Identified project affected persons, including women and vulnerable persons will be appropriately compensated. No person is expected to be worse-off due to the project.
	Who are the beneficiaries of the project?	All residents of the community including women and vulnerable persons shall benefit directly or indirectly.
	What are the chances of women being hired for works during construction.	Women will have chances of being hired as skilled or unskilled laborers just like men, subject to necessary safeguards against GBV, SEA etc.
Youth Focused Group Discussion held on 26/9/2025	Prospects of hiring the youths for labour work.	Given the availability of skilled and unskilled labour in the community, an advisory will be issued for the use of community labour during the construction phase.
	What is the commencement date for project implementation? There was skepticism about timing of civil works implementation.	Civil works will commence as soon as the environmental and social safeguard issues (ESMP and RAP, etc) are cleared. The State Government and the World Bank are eager to implement the project. May 2025 flash flood and its impacts are the reasons for the delay in take-off.

Consultations and stakeholder involvement in the subproject will continue in a manner that gives the communities and the subproject affected persons (PAPs) the opportunity to make contributions aimed at strengthening the development subproject while avoiding negative impacts as well as reducing possible conflicts. The consultations will also remain an ongoing exercise throughout the entire subproject, particularly with the potentially affected individuals and households relating to resettlements and compensations to minimize chances of every possible conflict.

CHAPTER 5: ASSESSMENT OF POTENTIAL IMPACTS AND ANALYSIS OF ALTERNATIVES

5.1 Introduction

This chapter discusses the methods/techniques used in assessing and analyzing the potential social and environmental impacts of the project and, also discusses the alternatives to the proposed project and reasons for their rejection. The likely future scenario without the project is also considered. The details of method used in arriving at the significant potential social and environmental impacts of the project are included in Annexure XX and the impact assessment process is depicted in Figure 5.1.

The beneficial and adverse potential environmental, economic, social and cultural impacts are identified based on professional judgment and the use of unranked pair-wise comparison approach (Canter, L and Sadler, B; 1997). Other factors in predicting the potential impacts include the results of public consultations. The potentially significant environmental and social impacts of the project as well as the suitable mitigation measures are discussed.

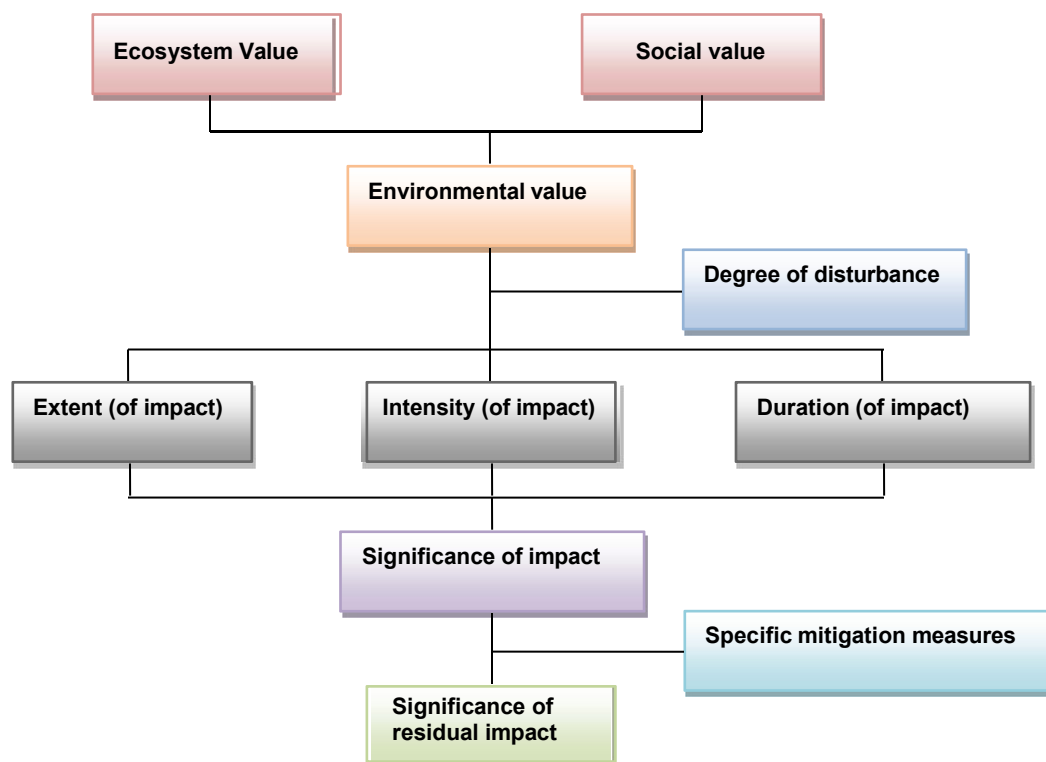


Figure 5-1 : Standard Flowchart for a Systematic Approach to Impact Assessment
(Source: Consultant)

The assignment of responsibilities for implementation of the ESMP and the associated costs are presented in Chapter 6.

As previously indicated under Chapter 1, the envisaged project activities will include:

1. Civil Construction Works:
 - cutting and filling for percentage recovery
 - compaction of soils
 - concrete casting
 - assembling of structures
 - Slope stabilization
 - Digging of the foundations of the lattice structures
 - Vegetation clearing
 - Deployment and movement of transport vehicles and power equipment on site.

- Use of earth moving equipment such as excavators, compactors, bulldozers and pay loaders;

2. Bio-Engineering Remedial Works:

- Terracing;
- Structured vegetation;
- Specific trees planting with known root strength
- Economic trees planting

Overall, this project is aimed at halting or minimizing the environmental and social damage being caused by gullies and the incidence of flooding in the project area and beyond. This is, overall, a positive impact. The envisaged areas of potential impacts (positive and negative) on the socioeconomic, cultural and biophysical environments which could result from the proposed project are shown in Table 5.1.

The evaluation of the social impacts require assessment of the need for land for the project as proposed and the remedial alternatives by conducting the following:

- Analysis of watershed to determine drainage corridors and the consequential storm water flow path resulting from anthropogenic activities for each of the gully sites;
- Development of conceptual remedial alternatives based on the field surveys and the analysis of the watershed for each of the gully sites;
- Evaluation of the availability of land for proposed project or alternatives.

Following the collection of primary socio-economic data on the communities, a qualitative and quantitative analysis of the data was conducted to assess direct impacts on project population. Existing environmental conditions that impact on human health and safety were evaluated to ascertain imminent risks that may be associated with the project. Specifically, analytical data on the ambient air and surface water quality was used to assess potential health risk concerns to workers and residents along the gully corridors.

Potential environmental impacts along the Mokwa gully corridors were developed in accordance with the grouped and project-phased impact identifiers contained in the ESMF for ACRESAL. The project phases are pre-construction, construction, and operation and maintenance phases. The potential impacts that arise from all the subproject activities and information/data sources identified were developed and presented in matrix/table format for the gully site. The identified impacts and mitigation of the impacts are shown in Table 5-1.

Table 5.1: Potential Environmental and Social Impacts and Mitigation Measures

Project Phase	Activities	Potential and Associated Impacts	Mitigation Measures
PRE-CONSTRUCTION	Land acquisition and demolition of existing buildings/hydraulic structures	• Reduction in access to land resources and anxiety on the part of the communities. • Opportunities for income generation • Economic activities may thrive in the affected communities. • Grievance /conflict due to resettlement and compensation issues • Work related accidents leading to injury /death of workers. • Accidents and injuries to scavengers or community members during demolition and removal of structures	Stakeholder Engagement Plan. Implementation of RAP/GRM Occupational Health and Safety Management Plan. Demolition Management Plan Community Health and Safety

Project Phase	Activities	Potential and Associated Impacts	Mitigation Measures
	Mobilization of equipment and personnel	• Increase traffic and delays. • Noise from heavy duty vehicles all through the working hours from morning to early evening except break hour • Gas emission from vehicles and machines	Traffic and Vehicle Management Plan. Noise and Vibration Control Management Plan. Air Quality and Dust Control Management Plan
	Site clearing and preparation	• Loss of species diversity and abundance • Potential increase in erosion of area(s) cleared. • Increased generation of solid and liquid waste • Noise from heavy duty vehicles during working hours of the day from morning to early evening except break hour • Dust generation and emissions from vehicles and machines	Vegetation Clearing and Biomass Management Plan. Waste and Chemical Management Plan. Air Quality and Dust Control Management Plan Noise and Vibration Control Management Plan
	Recruitment of local labour	• Employment opportunities for the local populace • Increase in economic activities. • Increase in the price of commodities (High demand for food, fuel etc.) • Influx of people in search of jobs, which may lead to population / demographic change. • Influx of people searching for jobs may lead to increase in crime. • Increase in the spread of communicable and sexually transmitted diseases (e.g., HIV, Hepatitis) • Cultural conflict between migrants and local people. • Increase demand for housing	Occupational/Public Health and Safety Management Plan. Labour Management Plan. GRM and Stakeholder Engagement Plan
CONSTRUCTION	Excavation for drainage/gully route	• Change to local topography of the area. • Work related accidents leading to injury /death of workers. • Soil and surface water pollution because of accidental spill of fuel and lubricant • Noise and ground vibration from heavy	Occupational Health and Safety Storage of fuel and hazardous material management plan. Control of Noise and Vibration Management Plan

Project Phase	Activities	Potential and Associated Impacts	Mitigation Measures
		equipment through the working hours of the day from morning to early evening except break hour Respiratory effects on the health of the workers because of dust	Waste Management Plan.
	Blasting of rocks for drainage/gully route	- Flying rock fragments causing injuries to workers, residents and passersby - Vibration causing cracks on nearby structures and possible collapse - Noise from blasting causing injuries to the ear drums during blasting operations - Respiratory effects on the health of the workers and residents because of dust	Occupational Health and Safety Control of Noise and Vibration Management Plan Air Quality and Dust Control Management Plan. Rock Blasting Management Plan
	Construction of drain canal	- Creation of deviation/diversion routes that will likely take up land and cause traffic delay. - Hinder access to homestead during drainage construction due to depth of ditches created along the gully route. - Noise pollution from equipment and workers may create nuisance in the communities from morning till early evening during working hours except break hour - Concerns over oil/fuel spills from fuel dump areas and workshop at the project sites. - Generation of waste from camp sites and sites where works are undertaken. - Work related accidents leading to injury /death of workers.	Traffic and Vehicle Management Plan. Control of Noise and Vibration Management Plan. Storage of fuel and hazardous material management plan. Waste Management Plan. Occupational Health and Safety
	Backfilling	- Noise and vibrations from heavy machineries through morning till closing in the evening except break hour - Alteration of soil profile / gully bathymetry	Control of Noise and Vibration Management Plan. Air Quality and Dust Control Management Plan.

Project Phase	Activities	Potential and Associated Impacts	Mitigation Measures
		- Fugitive emission of hazardous dusts with potential impact on human health and the ecosystems - Work related accidents leading to injury /death of workers.	Occupational Health and Safety
OPERATIONS	Flow of storm water	Possibility of flooding from blocked drain channel or poorly constructed drain.	Flash flood Emergency Preparedness Plan.
	De-silting	- Exposure of workers, motorist, and nearby community residents to odour - Waste nuisance within the community work area and material transport route - Traffic obstruction around the desilting work area - Work related accidents leading to injury /death of workers.	Waste Management Plan Traffic and Vehicle Management Plan Occupational Health and Safety (OHS). Community Health and Safety (CHS)
DEMOBILIZATION	Dismantling and Removal of Equipment and vehicles	- Noise and vibration - Traffic congestions	Control of Noise and Vibration Management Plan. Traffic and Vehicle Management Plan
	Land Restoration	- Restoration of aesthetic value to the environment. - Leisure and social activities may resume in the affected communities	Bioremediation and establishment of green area on 5m buffer of both sides of the rehabilitated channel.

Based on the potential impacts identified for the proposed intervention activities (Table 5.1), mitigation measures were developed for each identified impact. The evaluation of the level of significance of each identified environmental and social impact was done within the current value system. The tools which were used to define the boundaries for, or regulate every intervention activity and their impacts comprise relevant laws, policies, plans, standards, objectives, limits of acceptable change, performance targets or other environmental quality goals which have a bearing on the proposed activity and its associated impacts.

In assessing the social impacts, the measureable changes in human population, communities and social relationships resulting from the intervention project were identified. The social variables were evaluated under the following general headings:

1. Population characteristics;
2. Community and institutional structures;
3. Political and social resources;
4. Individual and family changes; and,
5. Community resources.

5.2 Analysis of Potential Impacts Triggered by Mokwa Subproject

The potential impacts areas as listed in section 5.1 are organized considering the critical phases of the project from the construction phase to the operation (post-construction) phase and summarized based on whether the envisaged project impact area will result in positive or negative impacts. Impact emphasis is placed particularly on the construction and operation phases of the project.

5.2.1 Potential Positive Impacts

The subproject is envisaged to have a range of positive environmental and social impacts. Some of these are a function of the objectives of the subproject, while others are a function of the way in which the project is designed to meet its objectives. Some of the beneficial impacts associated with the project are as shown in Table 5.2.

Table 5.2: Summary of Potential Positive Impacts Triggered by Subproject

S/No	Potential Positive Impact	
	Impact	Aspects of Project that Cause Impact
PROJECT CONSTRUCTION PHASE		
1	Reduced fear of perceptive loss of property, inhabitation and ancestral origins of the communities.	Construction activities will result in destruction of some buildings/structures along the gully corridors within the project communities. PAPs will be compensated for temporary displacement and inconveniences.
2	Safety of lives and properties; Erosion and flood control capacities, maintenance of infrastructure	Many properties and assets have been lost to the erosion gullies over time. The gullies also continue to be a major threat to the lives of the people living in the area. The project will promptly provide needed safety to the peoples' lives and properties. Members of the community will gain knowledge on the maintenance of infrastructures and flood control capacities.
3	Employment Generation	Project will provide short term, local employment opportunities for community members in the areas of site clearance, excavation, loading and offloading of materials and delivery services; drivers, security services, provision of goods and services to construction workers e.g. food kiosks and other shops.
4	Enhanced community leadership	Project will enhance community/local leadership with formation of various committees to facilitate sustainable post-construction monitoring and maintenance.
5	Local employment	Women as well as men will benefit from the short-term local employment opportunities to be created during construction phase.
6	Income generation for women	There will also be income generating activities for women in catering/restaurants for workers on construction sites and from sale of local products to construction workers.
7	Protection to existing buildings/structures	The buildings or structural assets within the project corridor are not expected to be damaged during construction. The buildings/structures will become stabilized with the project completion.
PROJECT OPERATIONS PHASE (POST-CONSTRUCTION)		
9	Increased community awareness and enhancement of local capacity	The effective implementation of the project will require the active involvement of the project communities through awareness campaigns and capacity building. Health, safety and environmental training and awareness will be extended to respective community members and local residents.
10	Improved and Sustained infrastructure (drainages, electric poles, etc).	Gully erosion control infrastructure as proposed are expected to remain for a long time and sustainably maintained for continued effectiveness.
12	Erosion and flood control capacity	Project will lead to improved community knowledge of causes of erosion and flooding, and capacity to prevent and control flooding and erosion throughout the watershed.
13	Restoration of vegetation and other vital trees	There will be loss of natural and planted vegetation during construction due to vegetation clearing. All de-vegetated areas will be replanted after construction and maintained by the community post-construction.
14	Improved site access roadways	Proposed project will require site access roads to be rehabilitated before and/or after construction to allow for movement of machinery and for the delivery of materials. These roads shall be reinstated to good condition at the conclusion construction works. The improved roads would be of

S/No	Potential Positive Impact	
	Impact	Aspects of Project that Cause Impact
		long term benefit to the community since the roads are essential trading links with the neighboring villages and communities.
15	Maintenance of erosion control structures post construction	Erosion control structures and bio-remediated areas are expected to be continuously maintained for continued effectiveness. Poorly constructed structures including concrete channels and check dams tend to fail after some time and if not properly maintained.
16	Creation of community public recreation areas through land use restrictions	The gully setback land shall be altered through bio-remediation and adapted for a long term use of the community. Structures may never be erected on this portion of land but economic trees could be planted. The community shall be required to sustainably maintain all erosion control structures after the construction of works.

The Mokwa subproject will create jobs and provide skills that would meaningfully engage the youths within and outside the project influence areas. The project will be a real boost to the economy of the communities by creating direct and indirect employments, create new sources of income and enhance old sources. Thus, improvements through the subproject will allow economies of scale and specialization, widen opportunities, expand trade, integrate markets, strengthen effective competition, enhance social interaction, and eventually increase real income and welfare of the society. These effects will, in general, provide real benefits to most, if not all, socioeconomic groups, particularly the poor.

5.2.2 Potential Negative Impacts

The Mokwa subprojects pose a range of potential negative environmental and social impacts. These impacts are included in Table 5.3.

Table 5.3: Summary of Potential Negative Impacts Triggered by Subproject

S/No	Potential Negative Impact	
	Impact	Aspects of Project that Cause Impact
1	Loss of land and Displacement of people.	As a part of the project, land within 6m of the gully corridors will be taken to ensure effective project implementation. Any structures within the 6m corridors may be damaged to allow for construction works. For such structures, occupants may be required to be temporarily or permanently displaced to allow for safe implementation of the project. Additionally, persons with critical health conditions, including old persons and children, within 15m of the project area may be temporarily relocated during construction phase. PAPs will be compensated for temporary displacement and inconveniences.
2	Loss of means of livelihoods.	Loss of croplands and economic trees along the proposed project corridor. Compensations will be required for the PAPs in accordance with WB policies.
3	Loss of vegetation	Loss of natural and planted vegetation on lands for staging, temporary office, workers camp and gully setback during site clearance. No impacts however, are anticipated on wildlife habitats and migratory birds.
4	Air quality	Air pollution is expected from dust and emissions from construction vehicles, plant and equipment. Dust is generated by excavation and earth moving operations and causes nuisance to residents and other sensitive receptors. Exhaust emissions occur from poor maintenance of plant and equipment or over revving of engines.
5	Damage to archaeological and cultural resources	Proposed project will not pass through or be sited close to any known World Heritage or archaeological sites. Project is also not located within any United Nations (UN) Classified Indigenous Peoples Land. However, there may be shrines or other cultural relics in the vicinity of the gully corridor which could be impacted during construction activities. Relocation of such shrines/ cultural relics or compensation for these may be expected.
6	Surface and ground water quality	Construction works have both short-term and long-term impacts on water resources. Earthworks release suspended particles into watercourses, which can have temporary detrimental effects on water organisms. Spillages of fuel and other petroleum products cause contamination of the soil and water resources.
7	Noise and vibrations	Noise will emanate from moving vehicles, excavators, generators, power tools, and compressors during construction. Permissible human noise levels may be temporarily exceeded during construction and may cause hearing impairment and nuisance to local residents and other sensitive receptors such as schools and hospitals. Vibrations from equipment can also be an issue for residences and other sensitive receptors close to the gully heads where such equipment may be in use.

S/No	Potential Negative Impact	
	Impact	Aspects of Project that Cause Impact
8	Solid and liquid wastes	Proposed project will generate waste during construction including off specification materials such as cement, wood, plastic, paper and domestic waste from construction areas and worker camps. This could result in increased pressure on local waste dump facilities as well as potential for unauthorized disposal and littering if not properly managed.
9	Climate change	Exhaust emissions from construction vehicles, plant and equipment may result in ozone depleting compounds. Emissions occur from poor maintenance of plant and equipment or over revving of engines.
10	Public health and safety	Long term fencing of sensible social infrastructures located near the RoW (schools, health centers, etc...)
11	Earth movements	Construction operations can pose earth movement hazards to people working near the construction areas due to unstable soil profiles from site excavations. Additionally check dams that are not properly constructed may suffer damage that could reduce the structural integrity of the erosion control structures during post-construction phase.
12	Traffic and transportation	Traffic movements associated with site staff, delivery of materials and the removal of waste during the construction is likely. Occasional movement of abnormal vehicular loads on local roads may result in temporary diversions.
13	Gender Based Violence & Disparity	More women are likely to take up employment with the project. Women are generally subjected to societal domestic violence that inadvertently transmits into the work place. Heightened efforts must be made to curtail these unacceptable behaviours.
14	Landscape change	Project involves significant cut and fill and soil movement in most areas of the project corridor. This will result in significant landscape changes across the project area.
15	Degradation of off-site land	Soils for necessary backfills in the project shall be sourced from identified borrow pits. Owners of the borrow pits will be compensated for soil excavated. Excavation at offsite borrow pits may cause land degradation in the vicinity of the borrow pits particularly with respect to erosion and siltation of nearby roads and water courses.
16	Pressures on Off-site Resources	Sourcing construction materials such as sand from river beds or burrow pits may cause adverse environmental impacts if not conducted in a sustainable manner. Project may also lead to increased demand for construction materials and impact on availability of such materials for other projects going on at the same time in the area.

5.3 Potential Impacts Significance Rating

Tables 5-4 summarizes the detailed analysis of the impact significance rating for each of the potential project impact areas associated with the Mokwa gully site.

Table 5-4: Impact Significance Rating for Mokwa Gully Site

S/N	Impact Area	Consequence Rating	Probability Classification	Impact Significance
PROJECT CONSTRUCTION PHASE				
1	Loss of land	Very High	Definite	VERY HIGH
2	Loss of means of livelihood	Very High	Definite	VERY HIGH
3	Loss of physical assets	Very High	Definite	VERY HIGH
4	Displacement of persons	Very High	Definite	VERY HIGH
5	Degradation of land	Medium	Improbable	VERY LOW
6	Occupational Health and safety	High	Definite	VERY HIGH
7	Community/Public Health & Safety	High	Definite	VERY HIGH
8	Air quality	Medium	Definite	HIGH
9	Surface water quality	Low	Definite	MEDIUM

S/N	Impact Area	Consequence Rating	Probability Classification	Impact Significance
10	Ground water quality	Very Low	Possible	INSIGNIFICANT
11	Noise and vibrations	Medium	Definite	HIGH
12	Degradation of arable land in the project area.	Very Low	Improbable	INSIGNIFICANT
13	Loss of vegetation	High	Probable	HIGH
14	Siltation of stream	Low	Possible	VERY LOW
15	Loss of ecological diversity in stream watershed.	Very Low	Improbable	INSIGNIFICANT
16	Disruption of traffic and transportation	Medium	Definite	HIGH
17	Earth movements	Very Low	Definite	LOW
18	Generation of solid and liquid wastes	Very High	Definite	HIGH
19	Soil erosion and flooding vulnerability	Low	Improbable	VERY LOW
20	Climate change	Low	Possible	VERY LOW
21	Landscape change	Medium	Probable	MEDIUM
22	Off-site Resources (backfills)	Very High	Definite	HIGH
23	Sanitation and waste management	Medium	Definite	HIGH
24	Pollution and contamination	High	Definite	HIGH
25	Visual effects.	Medium	Definite	HIGH
26	Displacement of infrastructure (drainages, electric poles, etc).	Low	Definite	MEDIUM
27	Increase in social grievances	High	Definite	HIGH
28	Potential child and forced labor	High	Definite	HIGH
29	Security challenges for workers and equipment	Very High	Definite	VERY HIGH
30	Insecurity risk to others	Very High	Definite	VERY HIGH
31	Increase in vulnerable groups	Medium	Possible	LOW
32	GBV risks (operations)	Very High	Definite	VERY HIGH
33	Damage to archaeological and cultural resource	Very Low	Possible	VERY LOW
34	Labor Influx	Very High	Definite	VERY HIGH
35	Land use restriction	Very High	Definite	VERY HIGH

5.4 Identified Social and Environmental Impacts

The outcome of Table 5.4 indicating the social and environmental impact categories that will suffer medium to very high impact levels during the Construction and Post-construction Phases of the project implementation is presented below. The other environmental and social

impact categories that will suffer low to insignificant impact levels from the project as shown in Table 5.4 are appropriately ignored.

Project Construction Phase:

(a) Significant Social Impacts

- Loss of means of livelihood
- Loss of physical assets
- Displacement of persons (temporary)
- Displacement of infrastructure (utilities, etc)
- Labor influx
- Child and forced labor
- GBV risks
- Increase in social grievances
- Insecurity challenges

(b) Significant Environmental Impacts

- Visual effects
- Vegetation loss
- Dust and air quality
- Surface water quality
- Noise and vibration
- Public/Occupational Health and Safety
- Traffic and Transport
- Solid wastes
- Liquid wastes
- Landscape change
- Off-site Resources
- Sanitation and Waste Management.

Operation & Maintenance (Post Construction) Phase:

- Land use restriction

5.5 Analysis of Alternatives

The consideration of alternatives relates principally to ways of improving the proposed intervention activities and/or attempting to avoid or minimize potential significant negative impacts. Usually there are several alternatives to any project. Different alternatives were evaluated consistent with the various components of the Mokwa project intervention. These alternatives include: demand-based; activity-based; location-based; process-based; sequencing or phasing; material-based; and the “no project” alternatives. The consideration of these alternatives intertwined with the identification of mitigation measures that included strengthening the bioengineering activities, prevention of soil erosion at the drainage outlets and the setup of buffer zones around critical infrastructures such as the check dams to prevent their degradation.

The potentially significant impacts associated with considered discrete alternatives were evaluated to a point of clear emergence of optimum alternative. The process of accomplishing this has been documented as well as the criteria used in the comparison. This section discusses the alternatives to the proposed project and reasons for their rejection. The likely future scenario without the project is also considered. The selection of a particular alternative is premised on several considerations, including the desirability/acceptability of the project, the government’s position or inclinations to the project, the potential environmental and social impacts of the project, the economic viability of the project, etc. For the proposed Mokwa gully erosion project, a number of alternatives were considered and these include: **delayed project alternative**; **a do-nothing alternative**; and **the planned project alternative**. A summary of these alternatives is presented below:

Delayed Project Alternative

This option means that the project will not be implemented at this time; rather, a delay will be in effect until such a time when certain conditions are met or requirements fulfilled. This kind of option is usually adopted when there are regulatory requirements that need to be met, when the political and economic climate is inclement for project implementation or in a period of war. Presently, the country is not at war neither is Niger State. Furthermore, the government of Nigeria is vigorously encouraging and courting foreign direct investment and socio-economic development. The planned project can attract foreign investment, in addition to all the added values indicated earlier. Therefore, delaying the project will in turn delay the realization of the positive benefits expected from the project. In addition, given the very high level of inflation in Nigeria's economy, a delay of one year could potentially cause up to a 25% increase in project costs. Therefore, the option of delaying the project is not considered a viable option.

The Do-Nothing (No-Project) Alternative

This alternative assumes that the entire project concept will be cancelled and scrapped. There will be no improvement or changes in the present state of Mokwa gully erosion corridor as well as the access roads to and from the gully areas. This is an inferior alternative when compared to the option of going ahead with the project. Although if this option is taken, it would mean that the negative environmental and social impacts of the project would be completely avoided; however, not implementing the project will also result in:

- (i) Continued fears and anxiety over potential loss of lives, people's homes, farmlands and ancestral assets, including cultural heritage will persist with each rainy season;
- (ii) Continued lack of rural access and mobility and increased pains in movement within the communities of Mokwa;
- (iii) Continued lack of economic empowerment, development and transformation within the communities of Mokwa.
- (iv) Failure to generate employment opportunities as anticipated;

Therefore, the "Do-Nothing" or No-Project Alternative will worsen the present situation and worsen poverty at the same time. In addition, most of the affected three communities where agricultural activities dominate will still be cut off due to lack of effective road linkages. The "Do-Nothing" or No-Project Alternative is therefore not a viable option.

The Mokwa Gully Erosion Project (Proposed Project) Alternative

The Mokwa gully erosion intervention project Alternative requires the rehabilitation of the existing gully corridor and improving (upgrading, rehabilitation and maintenance) of the existing access roads and drainage channels to an acceptable safety and environment standard. The advantages associated with this alternative far outweigh the disadvantages. Although initial costs would be high; the accrued economic and cultural benefits far outweigh the no-project alternative. The objective of the intervention project is to eliminate gully erosion in the project area while salvaging the agricultural lands of the affected areas and also boost agricultural production through the provision of access roads for easy transportation of products. Moreover, hitherto post-harvest losses will be reduced and thus creating more benefits to the farmers in particular and Niger State in general.

This alternative involves a lot of construction work, along with the associated positive and negative impacts. The essence of a project of this nature is to ensure that activities are undertaken in a way that minimizes the negative impacts of the project while enhancing the positive impacts. To this end, there is a need to ensure any activity that can result in negative impacts on the environment (biophysical and socio-economic) are identified and mitigating measures planned for each negative impact.

CHAPTER 6: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

This Environmental and Social Management Plan (ESMP) is necessary to achieve the health, safety, and environmental regulatory compliance objectives of the project. The environmental and social management systems/procedures are developed to establish sound basis for mitigation, monitoring and management at the project level. The E&S requirements are integrated into existing procedures to ensure that project bottlenecks are not created. To this end, the Plan has focused on specific steps to be taken with respect to implementation of the mitigation measures and monitoring activities for the environmental and social impacts identified in this Chapter 6.

The plan highlights the specific mitigation measures that would be taken and the entities responsible for carrying out the mitigation measures. The ESMP also contains a monitoring plan indicating the responsible parties, the frequency of monitoring, key indicators and the reporting format, and provides for necessary capacity building to facilitate the ESMP implementation. Cost estimates for implementation of the various measures, monitoring plan and capacity building are also given. The projected implementation budget will enable the ESMP to be an integral part of financing for the construction and maintenance works in the project.

6.1 Mitigation Measures for Implementation

Based on the environmental and social impact categories identified in Chapter 5 (see Section 5.4), the ESMP implementation will address measures that cover the following impacts during the construction and the post construction (operation and maintenance) phases of the project implementation:

Social Impacts:

- Loss of Land
- Loss of means of livelihood
- Loss of physical assets
- Displacement of persons (whether temporary or permanent)
- Loss of physical cultural resources
- Land use restriction

These impacts are addressed hereunder as Community and PAPs Issues Management.

Environmental Impacts:

- Dust and air quality
- Surface and ground water quality
- Noise and vibration
- Vegetation loss
- Rock blasting
- Public/Occupational Health and Safety
- Traffic and Transportation
- Earth movement
- Solid and liquid wastes
- Landscape change

These impacts are addressed hereunder as:

- 1) Dust control and air quality management;
- 2) Water resources, erosion control and flood prevention management;
- 3) Noise and vibration exposure management;
- 4) Flora and fauna removal management;
- 5) Public and occupational health and safety management;
- 6) Construction operation and slope stabilization;
- 7) Road diversion and accident prevention;
- 8) Waste management;
- 9) Temporary project office site management; and,
- 10) Post construction management.

The mitigation measures to address the above environmental and social impact categories as well as the monitoring and responsibility roles for the different phases of the project implementation are discussed under Section 6.2 below.

6.2 Environmental and Social Impact Mitigation Measures

The impacts mitigation measures to address the identified environmental and social impact categories for the project site (Mokwa Gully Site) are presented in Table .6-1. These mitigation measures will be implemented by the Contractor who shall be solely responsible through the course of the project and shall be contractually required to develop all the necessary specific management plans associated with the mitigation of each impact area. The monitoring aspects of the project implementation shall be carried out by other identified Agencies and organizations including the SPMU-ESO, SMeEnv., SMOw, SMLS, Community leaders, Site Committee, NGOs/CBOs, etc in accordance with the provisions and requirements of this ESMP.

Table 6.1: Summary of Impacts and Mitigation Measures for Mokwa Gully Sites

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
PRE CONSTRUCTION				
1	<u>Impacts on Community and PAP Management (Loss of physical assets; Loss of means of livelihood; Displacement of persons (temporary/permanent)</u> - Possible damage to building structures and other structural elements along the Mokwa gully corridor; - Permanent acquisition of land for gully setback to be used for gully wall stabilization; - Temporary use of land for project staging areas, erection of workers' camp and temporary offices (Agreement between Mokwa and Contractor). - Croplands and economic trees along Mokwa gully setback may be destroyed during gully wall stabilization. - Construction activities may affect persons with critical	- Based on the evaluated impact significant ratings associated with this impact, a site-specific Resettlement Action Plan is required for this project to address impacts on Mokwa communities and the PAP management. The SPMU shall be required to implement the RAP in accordance with the provisions therein. - Appropriate compensations shall be paid for structural damages; project acquired lands; temporary use of lands; destroyed crops and economic trees. - Compensation to persons (PAPs) within Mokwa gully project area who will need to be temporarily relocated prior to beginning of construction activities. - Create awareness among Mokwa community members and sensitize the people to all project activities - Seek the consent of Mokwa Communities and landowners to erect the site office for the specified duration of the project; - Sign Agreement with Community and for the temporary acquisition of land;	- No. of public complaints recorded in Mokwa; - Level of awareness and understanding of Mokwa community members; - No of Mokwa community members that attend trainings; - Level of satisfaction among Mokwa PAPs; - No of women gainfully employed by project; - No of other businesses induced by project in Mokwa - Questionnaires, direct observations and interviews.	SPMU-SLO ; Focal NGO SMeEnv.; SMLS.; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	health conditions, including old persons, children and other vulnerable persons, such persons may be temporarily relocated for the construction phase. Possible disagreement over siting of staging areas and temporary facilities between community and contractor	- Agree on other measures to render the site safe and usable to the satisfaction of the landowners at completion of project. - Implement Community Health and Safety Plan - To be resolved in accordance with provisions in the Agreement by the Mokwa Communities and landowners and the Contractor.		
2	<u>Community Cultural Heritage</u> There may be shrines or other cultural relics in the vicinity of the gully corridor which could be impacted during construction activities.	- Relocation of identified shrines/cultural relics; - Compensation for any damaged cultural relic or for relocation issues. - The Contractor shall be required to prepare and submit a Cultural Heritage Management Plan to the SPMU for approval and adoption for the contractor's implementation	Protection of all identified treasure finds	SPMU-SLO ; Focal NGO SMEnv.; SMLS.; Mokwa Community Leaders; Site Committee
3	<u>Public/Stakeholders Participation</u> Effective project implementation requires active involvement and cooperation of the project community.	- Build capacities within Mokwa communities - Incorporate community feedback into project implementation process - Disseminate project ESIA study findings to Mokwa Communities; - Ensure that period of inaccessibility to land is as short as possible - Awareness campaigns and capacity building. - The Contractor shall be required to prepare and submit a Stakeholders' Engagement Plan to the SPMU for approval and adoption for the contractor's implementation	No of active participants from Mokwa communities and other stakeholders	SPMU-SLO, ESO; Focal NGO; SMOW; SMEnv; SMOH; Mokwa Community Leaders; Site Committee
4	<u>Vegetation and Biomass Removal Management</u> Damage to the natural and planted vegetation on acquired Mokwa gully setback lands	- Mark out areas for clearance & where possible use manual method of vegetation clearing; - Undertake selective clearance by removing tall woody species leaving	- Areas of stressed vegetation; - Size of cleared vegetation areas	SPMU-ESO, NRO; Focal NGO; SMOW; SMEnv; SMOH; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	during site clearance, areas for siting of temporary office and workers camp. • Impact on flora and fauna. • Impact on wild life.	saplings for quick regeneration of vegetation; • Prevent colonization by invasive species. • Prevent damage to critical ecosystems and habitats. • Prevent destruction of flora and fauna. • The Contractor shall be required to prepare and submit a Vegetation and Biomass Management Plan to the SPMU for approval and adoption for the contractor's implementation		
CONSTRUCTION PHASE				
5	<u>Dust and Air Quality Management</u> • Air pollution is expected from dust and emissions from construction vehicles, plant and equipment. • Dust is generated by excavation and earth moving operations and causes nuisance to residents and other sensitive receptors. • Exhaust emissions occur from poor maintenance of plant and equipment or over revving of engines.	• Dust generation will be controlled mainly by the use of water, especially in the dry season. • Use of water tanker for purposes of water dousing to control dust emission. • Erection of speed control signals and ramps mounted in communities; • Covering of hauling trucks carrying sand and other aggregates; • Covering of heaped material e.g. sand will be covered; • Use of nose masks by all workers at road maintenance/works sites. • Surfaces of vegetation along the maintenance road will be monitored to verify the effectiveness of dust suppression method. • The Contractor shall be required to prepare and submit an Air Quality Management Plan to the SPMU for approval and adoption for the contractor's implementation.	• No. of public complaints; • Level of particulates in air • Level of other air pollutants • Vegetation surfaces free of dusts • Ambient air monitoring using standard methods	SPMU-ESO; Focal NGO SMOH.; Mokwa Community Leaders; Site Committee
6	<u>Water Resources, Erosion and Sedimentation, Run-off Control Management</u> • Increased sedimentation and runoff may result	• Location for heaping construction material (e.g. sand and other aggregates) not less than 50m from water bodies and drainage channels (i.e. a separation distance of 50m will be observed); • Site for fueling of machinery and servicing of	• No of complaints from Mokwa community members; • Absence of sediment build up around project areas; • Absence of flooding in construction areas; • No of spills & repairs made;	SPMU-ESO, PE; Focal NGO; SMOW; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	from activities during the construction works. • Earthworks release suspended particles into watercourses, which can have temporary detrimental effects on water organisms. Spillages of fuel and other petroleum products cause contamination of the soil and water resources. • Rock blasting creates elevated noise and vibration levels • Excavation at the borrow pits may cause land degradation in the vicinity of the borrow pits; may cause soil erosion and siltation of nearby roads.	equipment will be located at a minimum distance of 100m from any water bodies, wetlands and drainage channels; • Embankment erection around fueling and other liquid or spill-able storage sites in order to limit or contain such material from escape to potentially pollute water resources; • Side drains (where appropriate) will be provided with settling basins near water bodies to remove silt and debris from road surface and construction site run-off, before discharge to adjoining streams or rivers; • Adequate side drains provided to carry run-off into drainage channels to prevent erosion; • Implement approved noise and vibration management plan. • Culverts of suitable capacity constructed to contain and direct flow, especially at peak flow and run-off; • Road maintenance works to be carried out off peak rainy season; • Provision of toilets and urinal at locations not less than 50m away from water bodies; and • Adequate worker awareness on sanitation and measures to avoid water resource contamination. • The Contractor shall be required to prepare and submit a Water management Plan and an Erosion and Sedimentation Management Plan to the SPMU for approval and adoption for the contractor's implementation.	• Use of standard monitoring methods	
7	<u>Noise and Vibration Exposure Management</u>	• Equipment servicing plan will be prepared and strictly followed to ensure efficient machinery performance and optimum noise generation.	• No of complaints from Mokwa community members; • Absence of structural failures;	SPMU-ESO; Focal NGO; SMOW; SMOH; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	- Noise will emanate from moving vehicles, excavators, generators, power tools (e.g. for vegetation clearing), and compressors during construction. - Vibrations may come from soil compaction equipment and other vibroequipment to be used at the gully heads.	- Stationary equipment shall be sited at safe distances from sensitive areas to minimize noise impacts - Workers operating noisy equipment will not be exposed continuously for more than 3 hours a day. - Workers will be provided with ear plugs. - Workers handling vibrating equipment or parts will be given pads to absorb the vibrations and will not be exposed continuously for longer than 3 hours a day. - Sanctions (ranging from a warning to dismissal) will be instituted by the contractor against workers who do not observe the use of appropriate PPEs	- Absence of debris accumulation; - No of debris removals & repairs made; - Sensor measurements around workplace	
8	<u>Occupational/Public Health and Safety Management</u> - Occupational accident during construction. - Construction operations pose hazards to people living or working near construction areas or employed to work on site. - Excavations, construction traffic and stockpiled materials pose particular threats to children and livestock. - Children may be inadvertently recruited to work on construction sites.	- Health, safety and environmental training and awareness will be extended to Mokwa community members and local residents; - Erection of warning signals and use of reflective tapes at approaches to excavations, heaped materials, stationary equipment, etc. - Posting of speed limits of 25km/hr at approaches to construction sites; - Safety meetings held twice a week and documented accordingly; - Inductions and awareness programmes held for all employees on occupational health and safety practices; - A First Aid team formed to provide first aid services to workers and where appropriate make referrals to the nearest Health Centre or hospital; - First Aid team to be trained by a medical team from the Health Centre; - Accident records at construction site and neighbourhoods to be maintained both for workers and the public; - Stocks of PPEs to be maintained and supplied to	- No. of sanitary facilities provided at start of project; - Adherence to stipulated speed limit - Records and No of incidents; - Use of PPEs by workers; - Records of appropriate workers' training; - Record of reinstatement plan for burrow pits; - Record of health and safety meetings - Record of first aid exercises - Hazards assessment	SPMU-ESO; Focal NGO; SMOH; Mokwa Community Leaders; Site Committee;

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
		involved in criminal behaviours and a provision of substance abuse prevention and management program. Preparation and implementation of a traffic management plan; construction of additional or separate access roads to project and workers' camp site, conduct road safety training for workers and inclusion of sanctions or fines for reckless driving by workers.		
10	<u>HIV/AIDS and STIs Management</u> Construction workers camp give rise to health risks associated with poor sexual practices and prostitution.	- Provide quarterly HIV/AIDS and STIs awareness programmes for workers and nearby communities; - Health and HIV awareness team arranged from the State Health Ministry for the quarterly programmes; - Sponsored educational package put together by the team to be implemented to enlighten both workers and communities; - Training of peer educators within the work force and in communities by the team; and - The contractor to provide free condom supplies and encourage free discussions, counseling and testing.	- No. of HIV/AIDS workshops held; - Level of awareness of workers & others; - Records of peer educators' training; - Records of condoms distributed	Focal NGO; SPMU-ESO; SMEnv; SMOH; Mokwa Community Leaders; Site Committee
11	<u>Construction Operation and Slope Stabilization</u> - Construction operations will result in topographic alterations. - Construction operations may result in landslides, rock cave-ins, and mudflow/flooding. - Construction operations can pose earth movement hazards to people working near the construction areas due to unstable soil	- Maximize local employment (including women) on construction works (there should be a contractual requirement to hire a percentage of local workforce including women) - Provide occupational health and safety awareness training and workshops, - Use of child labor shall be strictly prohibited - Routinely Monitor and maintain construction work for continued stability and quality - Shortcomings in the control structures including	- No. of accidents/incidents; - No. of visible warning signs; - Level of public awareness; - Record of safety meetings held;	SPMU-ESO, PE; Focal NGO; SMOW; SMEnv; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	profiles from site excavations.	the check dams (retention basins) along the gully corridor should be corrected before they develop into serious problems. The Contractor shall be required to prepare and submit an Emergency Response and Incident Plan to the SPMU for approval and adoption for the contractor's implementation		
12	<u>Traffic and Transportation Hazards</u> - Traffic movements associated with site staff transportation, delivery of materials and the removal of waste during the construction is likely. - Occasional movement of abnormal vehicular loads on local roads may result in temporary diversions.	- A temporary structure to be constructed on one lane to allow for traffic flow while work is on-going on the other lane; - Traffic wardens to be posted at positions 100m from the construction points on either side of the road to ensure orderly traffic flow; - Actual working areas to be secured with barricades; - Adequate road warning signs to be posted at vantage points to warn and direct traffic; - Traffic and transport associated with project will adhere to existing roads or follow specified routes as established. - All measures shall be effectively monitored by Contractor to ensure their implementation. - The Contractor shall be required to prepare and submit a Traffic and Vehicle Management Plan to the SPMU for approval and adoption for the contractor's implementation	- Effective traffic flow with vehicular & worker safety; - Appropriate positioning of road signs, reflectors, speed ramps, control limits, traffic wardens; - Records of accidents and near misses - No of public complaints.	SPMU-ESO, PE; Focal NGO; SMOW; SMeEnv; Mokwa Community Leaders; Site Committee
13	<u>Waste Management (solid and liquid waste)</u> Proposed project will generate waste during construction including off specification materials such as cement, wood,	- Waste bins to be provided for the disposal of waste generated; - Waste will be segregated into three at source - organic (food residues), recyclables (woods, metals) and non-recyclables (plastic and glass wastes);	- Waste segregation and littering; - Emptying of bins at waste dump sites; - Waste composting; - Indiscriminate defecation; - Toilets decommissioning	SPMU-ESO; Focal NGO; SMOW; SMeEnv; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
	plastic, paper and domestic waste from construction areas and worker camps. This could result in increased pressure on local waste dump facilities as well as potential for unauthorized disposal and littering if not properly managed.	- Organic waste to be composted near the site office to enrich the soil, while plastics and glass are taken to the district dump-sites; - Topsoil removed from the right of way for maintenance work to be spread on the land to avoid disrupting drainage network; and - Toilets and urinals to be sited at least 100m from any stream or drainage channel and decommissioned at the end of project. - The Contractor shall be required to prepare and submit a Waste Management Plan to the SPMU for approval and adoption for the contractor's implementation		
OPERATIONS & MAINTENANCE PHASE (POST CONSTRUCTION)				
14	<u>Land use restriction</u> Use of the acquired land associated with Mokwa gully setback will be altered and restricted to community recreational uses. Structures may never be erected on this portion of land but economic trees could be planted.	- Create awareness among community members; - Build capacities within community; - Incorporate community feedback mechanism into process - Ensure periodic monitoring of restricted areas - Continuous maintenance of erosion control structures including concrete channels and check dams, and bio-remediated areas for continued effectiveness.	Sustained treated gully healing process	SPMU-ESO; SLO SMEnv; Focal NGO; Mokwa Community Leaders; Site Committee
15	<u>Closure of temporary office, staging areas and decommissioning of project</u> Damage to land forms and vegetation including the borrow pits and quarries.	- Ensure that agreements with the community and landowners on post construction hand-over are kept. - Enforce agreed measures to render the site safe and usable post construction to the satisfaction of the	- Agreements entered with community and landowners for use of land; - Terms of Agreement fulfilled with community and landowners; - Handover of office site as agreed	SPMU-ESO, PE, NRO; Focal NGO; Mokwa Community Leaders; Site Committee

Item No	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	Environmental and Social Impact Source	Mitigation Measures	Monitoring	Responsibility
		community and landowners.		
16	<u>Erosion control system failure management</u> Check dams that are not properly constructed may suffer damage that could reduce the structural integrity of the erosion control structures during post-construction phase.	- Any treated gullies should be checked regularly and the healing process monitored closely. - Structures built in the channelization for stabilization purpose should be observed for damage especially during rainy seasons and after heavy storms. Any damage observed should be repaired immediately to avoid further damage and the eventual collapse.	Sustained gully healing process	SPMU – PE Mokwa Community Leaders; Site Committee CBOs/CDOs

6.3 Institutional Responsibilities and Accountabilities

The structure and reporting arrangements for the implementation of the ESMP are integrated into the overall project monitoring and evaluation program for the gully site. The key actors as well as the roles and responsibilities of the various institutions in the ESMP implementation are as shown in Table 6.2. The matrix includes listing of all entities (public and private) responsible for designing and implementing the various aspects of the plan. The need for additional capacity building for the involved institutions and actors, including long-term consultation and training program for the implementing agency are also built into the structure.

Table 6.2: Institutional Responsibilities

Institutional Category	Project Implementation Phase	Roles & Responsibilities
Niger State Ministry of Environment (SMENV)	All Phases (Preconstruction, Construction and Post Construction)	- Lead role to ensure adherence to the ESMP and applicable standards, environmental and social liability investigations, Monitoring and evaluation process and criteria - Executing agency with overall responsibility for ACRReSAL implementation in the State. - Ensure that sufficient funds are made available to the SPMU - Ensure that SPMU, regardless of financing source, complies with the provisions of the ESMP and WB safeguard policy. - Ensure that SPMU complies with NGSG environmental policies and regulations. - Ensure that the SPMU retain dedicated Technical Support for the project duration including safeguard specialists to oversee ESMP implementation. - Ensure that SPMU monitor environmental protection and mitigation measures in the ESMP and those activities that are embodied in the detailed designs - Ensure that SPMU has secured environmental clearances certification from FMENV and WB prior to award and/or commencement of civil works contracts - Ensure that SPMU establishes and implements an environmental grievance redress mechanism, as described in the ESMP, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance - Ensure that the bidding and contract documents include the ESMP. - Ensure that SPMU submits semi-annual monitoring reports on the ESMP implementation to WB and FPMU.

Institutional Category	Project Implementation Phase	Roles & Responsibilities
SPMU (Safeguard Officers, NRO, Project Engineer)	Pre-Construction Phase	• Ensure that bidding and contract documents include the ESMP; • Review and approve all required management plans necessary for the pre-construction, construction and post construction phases of the project; • Undertake monitoring of the implementation of the ESMP (mitigation and monitoring measures) with support from the appointed Focal NGO, the Site Committee, the Contractor and other stakeholders. • Report to WB and FPMU on all aspects of social and environmental management and monitoring at required frequency • Submit monthly and quarterly or semi-annual monitoring reports on ESMP implementation to FPMU and WB • Participate in grievance redress mechanism, as described in the this document, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the sub-project's environmental performance • Based on the results of the ESMP monitoring, identify environmental corrective actions and prepare a corrective action plan • Maintain and manage all funds effectively and efficiently for the project; • Coordinate all policies, programmes and actions associated with the intervention construction works; • Ensure the smooth and efficient implementation of the preconstruction phase of project's various programmes; • Have custody of a copy of the ESMP and disseminate information contained therein accordingly.
	Construction Phase	• Cooperate with the Steering/Technical Committees to provide guidance to the technical aspects of all project activities; • Provide oversight of contractors work plan and E&S implementation schedule; • Conduct weekly or routine site inspection and monitor implementation of E&S safeguards; • Receive and review reports from the contractor; • Prepare and submit weekly/monthly and subsequent quarterly and annual reports to the SPMU Project Coordinator, FPMU and the WB.
	Post Construction Phase	• Ensure proper closures of all contractor's temporary facilities; • Ensure that the terms of Agreement between the Contractor and the community and land owners are fulfilled.
FPMU	All Phases (Pre-construction, Construction and Post Construction)	• Project assessment and monitoring of the ESMP implementation and the construction activities. • Review the TORs/ESMPs and recommend for Bank's clearance • Facilitate trainings/workshops on HSE/OHS/CHS; GRM and other Safeguards related issues
World Bank	All Phases (Pre-Construction, Construction and Post Construction)	• Assessment of specific and general project implementation; • Recommend additional measures for strengthening the management framework and implementation performance.
State Ministry of Works	Pre-Construction and Construction Phases	• Provide necessary preconstruction and construction support to the SPMU • Site assessment and monitoring of construction works and engineering activities;
State Ministry of Lands & Survey (SMLS)	Pre-Construction Phase	• Compliance overseer at State Level, on matters of land acquisition, compensation and other resettlement issues
Other MDAs	Pre-Construction and Construction Phases	• Intervene in areas under their jurisdiction as and when project demands
Contractor (Site Manager, Site Engineers/ Supervisors)	Pre-Construction Phase	• Recruit qualified environmental safeguard specialist to ensure compliance with environmental statutory and contractual obligations and proper implementation of the ESMP • Implement all the provisions of the ESMP in coordination with the SPMU and other relevant authorities • Develop and submit for SPMU and FPMU approvals specific management plans as provided in the ESMP. • Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the ESMP • Implement additional environmental mitigation measures for unexpected impacts, as necessary • Develop a work plan which incorporates schedule for E&S safeguards implementation;

Institutional Category	Project Implementation Phase	Roles & Responsibilities
		• Submit the work plan and schedule of E&S safeguard implementation to the SPMU; • Train/create awareness of all personnel/workers on relevant E&S safeguard measures and their obligations; • Ensure land disturbance activities are conducted in accordance with relevant legislation and the ESMP; • Communicate content of ESMP to all employees and contractor agents; • Provide oversight function during mobilization to ensure adherence to good practice and the ESMP
	Construction Phase	• Implement all E&S safeguards and other mitigation measures as planned; • Submit monthly and quarterly implementation reports on E&S safeguards to SPMU; • Comply with BEME specification in procurement of material and construction, and adherence to the ESMP and good construction practices; • Ensure land disturbance activities are conducted in accordance with relevant legislation and the ESMP; • Provide adequate onsite waste collection bins, ensure proper disposal, not to litter and not to create environmental nuisance; • Provide oversight function during construction to ensure adherence to good practice and the ESMP
	Post Construction Phase	• Provide oversight function during decommissioning to ensure adherence to good practice and the ESMP
Site Committee	All Phases (Preconstruction, Construction and Post Construction)	• Monitor and ensure compliance to ESMP provisions as well as contractor implementation quality
Local government	All Phases (Preconstruction, Construction and Post Construction)	• Provide support in monitoring project execution within their domains to ensure compliance with the ESMP and other relevant requirements
Local Community	All Phases (Preconstruction, Construction and Post Construction)	• Promote environmental awareness • Assist and liaise with other stakeholders to ensure proper siting and provision of approval for such sites • Support with provision of necessary infrastructures and engage/encourage carrying out comprehensive and practical awareness campaign for the proposed projects, amongst the various relevant grass roots interest groups.
CDOs	All Phases (Preconstruction, Construction and Post Construction)	• Ensure community participation by mobilizing, sensitizing community members;
Focal NGO	All Phases (Preconstruction, Construction and Post Construction)	• Assist to ensure effective response actions, to evolve and devise sustainable environmental strategies and rehabilitation techniques, organize, coordinate and ensure safe use of volunteers in a response action, & provide wide support in management planning, institutional/governance issues and other livelihood related matter, awareness campaigns
General Public	All Phases (Preconstruction, Construction and Post Construction)	• Identify issues that could derail the project • Support project impacts mitigation measures as well as awareness campaigns

6.4 Capacity of Niger ACRESAL to Implement the ESMP

6.4.1 Capacity and Training Needs

In order to achieve effective ESMP implementation, there is need to strengthen relevant competencies on environmental and social management at particularly the State level and secondarily, the LGA and community levels including contractors. This will stimulate the required collaboration among the key actors. Experience shows that strengthening capacity involves more than improving technical skills, developing new systems or establishing quality

assurance and improvement standards. While these are important, strengthening capacity is however, essentially about changing behavior.

The capacity building should include equipping individuals with the understanding, skills and access to information and training that enables them to perform effectively. Personnel of the erosion control intervention project need to understand the purpose of the ESMP and their expected roles during its implementation. The target groups for the training will include:

- SPMU E&S Safeguard Officers and Project Engineers;
- Contractor's personnel;
- Construction workers and site personnel; and,
- Select members from the project communities-Mokwa.

The SPMU E&S safeguard officers and contractors will require capacity building in the implementation of the projects' environmental and social safeguards and general project planning and management interfaced with E&S components. Capacity requirements are also necessary in the areas of E&S monitoring and reporting, adherence to the required E&S principles, standards and commitments. The construction workers and select members of the project communities will undergo training on public awareness creation/educational techniques (on environmental, social and health issues) and first aid procedures.

6.4.2 Capacity Building Cost

The capacity building plan for the ESMP with the associated cost implications is shown in Table 6.3 below. To enhance the respective roles and collaboration of the relevant stakeholders, the broad areas for capacity building and effective ESMP implementation are identified and shown in Table 6.3.

Table 6.3: Summary of Institutional Capacity and Training Needs with Costs

Programme Description	Participants	Form of Training	Duration	Training Agency	Estimated Cost In (N) and Project Phase
<u>Understanding the Environment:</u> • Concepts, Regulations & Statutory Requirements; • Environmental Management; • Flood and Erosion Prevention & Control; • Stakeholder & Community Participation	Officials of SMEnv, SMOW, SMLS, SPMU, Contractor, Community Leaders, Focal NGO, CBOs & Other Relevant Groups	Workshop	2 Days	External Agency for capacity building or Environmental & Social Specialist	4,600,000.00 (Pre-Construction Phase)
<u>Scope of Mokwa Intervention Project:</u> • Environmental & Social Impacts; • Engineering Design and Associated ESMP; • Coordination with Other MDAs and the Community	Contractor, SPMU Safeguard Officers and Project Engineers, SMENV, & relevant MDAs, Community Leaders, CDOs, & NGOs	Workshop	2 Days	External Agency for capacity building or Environmental & Social Specialist	5,600,000.00 (Pre-Construction Phase)
<u>Project Implementation:</u> • Civil Works with Bio-remediation in the project; • Roles and Responsibilities of Key Actors; • Environmental Monitoring	SPMU Project Engineers and Safeguard Officers, Contractors, SMEnv,	Lecture and Site Visit	2 Days	External Agency for capacity building or Environmental & Social Specialist	7,200,000.00 (Construction Phase)
<u>Monitoring and Evaluation Gender/GBV and GRM:</u> • ESMP Monitoring and Reporting Strategy; • Stakeholder and Community Participation	Contractor, SPMU Safeguard Officers, Engineers, SMEnv, & relevant MDAs, Community Leaders, CDOs, & Focal NGO	Workshop	2 Days	Environmental & Social Specialists; External Agency engaged for capacity building	15,800,000.00 (Pre-Construction Phase)

Programme Description	Participants	Form of Training	Duration	Training Agency	Estimated Cost In (N) and Project Phase
<u>Watershed Protection and Management:</u> • Alternative income generation programme for stakeholders and skills requirements; • Promotion of Agricultural Methods and Technologies for Improving Farm Production and Erosion Prevention;	Watershed Committee, Community Leaders, LGA Staff, Support Professionals	Workshop	2 Days	World Bank/External Agency Engaged for Capacity Building/ Environmental & Social Specialists	6,400,000.00 (Pre-Construction Phase)
TOTALS					N39,600,000.00

The capacity building and trainings costs shown in Table 6-3 shall be included as part of the overall project construction cost to be funded by the Contractor as part of preparedness for ESMP implementation. The training is to be conducted preparatory to the contractor's mobilization to site. All training courses shall therefore be completed prior to mobilization or latest two weeks after the contractor has mobilized to site.

6.5 E&S Obligations of the Construction Contractor

It is the responsibility of the construction contractor to ensure compliance with all the Engineering Design provisions associated with this project. The SPMU shall not be responsible for any property (whether community, corporate or individual) damaged as a result of actions or activities undertaken or being undertaken by the contractor in the course of executing its contract. In the event of such damage, the contractor shall be fully liable for the cost of such damage.

As part of the construction approval process for the project, a set of environmental and social management plans is needed to address the specific issues identified in this ESMP which may arise in the course of the project. The management plans will need to be developed by the Contractor to address the specific impacts as identified in this ESMP. These management plans are briefly described in the following sections and shall be implemented as part of the overall environmental and social management and monitoring plan for the Mokwa gully sites.

6.6 Required Environmental and Social Management Plans

The construction Contractor for the project shall be required to meet the specific E&S safeguard obligations as provided in this ESMP which shall be incorporated into the contract specifications for the project as provided. The contractor shall also be required to develop a work programme for field work to guide and explain how the mitigation measures recommended in this ESMP will be implemented during the project execution. This is in addition to other contractual provisions for the project. The required specific E&S management plans include the following:

6.6.1 Resettlement Action Plan

One of the significant social impacts identified in this study (Section 6.1) includes the displacement of persons due to loss of land and other physical assets to the project. The WB requires the preparation, in advance of the project implementation, of a Resettlement Action Plan/Abbreviated Resettlement Action Plan (RAP/ARAP) where project impacts are known to displace persons within the project community or affect their social and economic well-being. The RAP/ARAP seeks to specifically identify, evaluate and document the set of mitigation, monitoring and institutional actions to be undertaken for the project to eliminate identified adverse community or individual social and livelihood impacts before commencing the remedial construction and rehabilitation works.

As part of the site-specific subproject preparation for the Mokwa intervention, a Resettlement Action Plan (RAP) was prepared in 2023 and cleared by the WB for the initial Mokwa

subproject design. Since the flash flood event at Mokwa in May 2025, the environmental and social conditions in Mokwa have significantly changed.

In view of the significant level of social impacts and the changes in the number of project affected persons due to structural damages and land acquisition for the revised engineering design, the existing site-specific Resettlement Action Plan is hereby recommended for a review and updated. The provisions of the updated RAP shall be incorporated accordingly into this Environmental and Social Management Plan by reference.

6.6.2 Public/Stakeholder Consultation Plan

A key element of sustaining stakeholders' support in the project is to sustain the consultations and communication process that has already been effectively established in the course of the preparation of this ESMP. Stakeholders' engagement needs to be enhanced and managed through a well-defined strategy. Table 6.4 provides a summary of the stakeholder consultation activities to be considered in the engagement plan. Public sensitization and consultation will continue throughout the project execution.

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Stakeholder Engagement Plan. The Plan will provide the Contractor's specific engagement plan to ensure that all segments of the community and other stakeholders are fully and effectively involved in the project decision process.

Table 6.4: Summary of Stakeholder Consultation Plan

Activity	Stakeholders / Community	Timeline
Pre-Construction / Prior to Project Commencement		
Project briefings, site tours, personal meetings, community sessions, consultation meetings	State Government , Local Government, Site committee, Residents of affected areas/ Community and interest groups	As required, subject to project updates and feedback from the community
Development/dissemination of feedback and complaints mechanism and communications procedures	State Government , Local Government, Site committee, Residents of affected areas/ Community and interest groups	As required, subject to any updates on the project
Briefings, Site Tours and Community Sessions for flood control and intervention works	Government authorities, Local communities, Key/ relevant stakeholders	Prior to Work Plan approval
Construction and Operations		
Responding to issues and inquiries as per feedback and complaints mechanism	All stakeholders	Ongoing / as required
Monthly/Quarterly reporting on status of project	All stakeholders	Monthly/quarterly/as required.
Briefings, site tours and community sessions for flood control and intervention works closure plan	Government authorities, Local communities, Key/ relevant stakeholders	Prior to project completion
Prior to Project Closeout/Post-Construction		
Project briefings, site tours, personal meetings, community sessions, consultation meetings with stakeholders	All stakeholders, State Govt , Local Govt, Site committee, Affected residents/ Community/ interest groups	As required, subject to approvals and feedback from the community

6.6.3 Chance Finds Management/Cultural Heritage Management Plan (CHMP)

The Chance Finds Management/Cultural Heritage Management Plan (CHMP) is required to address the specific impacts that may occur as a result of any "Archaeological Chance Finds" or existence of cultural heritage resources during the planned construction works. It is anticipated that some of the construction activities associated with the project may impact cultural resources such as shrines.

The shrines identified within the project area are considered only of local significance and may not be affected by construction. However, if the shrine needs to be relocated on account of the project, the local people, community leaders, NGOs and others should reach a consensus

and the local people should be involved in the process of relocation. Alternatively, if the shrine is considered of archaeological and historical value, then the Contractor shall develop a strategy for restoration, conservation and management which shall be implemented.

In the event of any "Archaeological Chance Finds", the construction contractor should comply with the following rules as well as the Federal or State archaeological laws:

- notify relevant departments of such findings,
- request a site inspection,
- completely halt work until inspection results are received, and
- decide whether or not to proceed with further work.

The Contractor shall prepare and submit for approval of SPMU and FPMU, the necessary CHMP to be implemented for the project. The CHMP will set out a formal system by which the Contractor will carry out mitigation measures that will reduce any impacts to the Cultural Heritage. Specifically, the CHMP will provide details regarding the implementation of avoidance, mitigation and management measures for impacts related to the possibility of archaeological chance finds or any existing cultural heritage of significance. The scope of the CHMP will cover pre-construction, construction and post construction/closure phases of the Project.

6.6.4 Occupational/Public Health, Safety and Security Management Plan

The Contractor shall be required to develop and implement an occupational and community health and safety plan that contributes to a healthy workforce and local community. The health and safety plan shall be submitted to the SPMU and FPMU for necessary approvals prior to implementation. In developing the Plan, the Contractor shall evaluate possible hazards that may be associated with the project activities such as: (a) imported backfill material; (b) Hazards to the aquatic environment arising from toxic effects of imported material (pH, COD, salinity, dispersed material); (c) Flood hazards due to heavy downpour during the construction period; (d) Physical/mechanical hazards due to the movement of solid material in the event of an accident; (e) Hazards resulting from soil contamination.

The Contractor shall also be required to identify who and what can be affected assuming possible scenarios (such as construction failures). Consideration should be given to issues relating to the environment (water, soil, and biota), humans (life, health and living conditions), and economic losses of the population (damage to infrastructure, property) in the event of the possible scenarios. Cooperation between the Contractor, the SPMU and the local community is recommended for emergency planning.

The Contractor shall fully comply with ESHS standards and bear the cost of implementation. Community Health, Safety and Security assessment will identify potential negative risks related to the different phases of the project. Some of the significant risks to be considered include:

- Possible pressure and/or additional demand on community health services associated with the influx of workers from outside the project area;
- Possible pressure and/or additional demand on utility services including water and wastewater system associated with the influx of workers from outside the project area;
- Possible pressure and/or additional demand for social services as a result of an increased family stress and violence;
- Possible sexual harassment and gender based violence;
- Possible illicit drug use and alcohol;
- Possible crime and criminal activities;
- Possible change in community wellness as a result of alcohol, and substance abuse associated with the influx of workers from outside the project area;
- Possible change in Community Health as a result of sudden spread of communicable and non-communicable diseases including sexually transmitted diseases (STDs) associated with the influx of workers from outside the project area;
- Possible pressure on traffic and transportation network associated with construction and operations activities; and

- Possible change in water and air quality associated with construction and operations activities.
- In addition to the potential negative impacts which would require mitigation, the rehabilitation of the erosion gully also has the potential to improve community health safety and security through the following means:
 - Improved access to medical facilities for communities due to the gully rehabilitation and the restoration of connecting roadways;
 - Improved healthcare infrastructure;
 - Improved workforce health awareness;
 - Improved standards of living of direct and indirect employees due to better income in the employees households; and
 - Improved standards of living of vulnerable groups and their households, including support to the elderly within the respective households.

6.6.5 Gender Based Violence Management Plan

The Gender Based Violence Management Plan (GBVMP) is required to identify and assess key risks, develop mitigation measures to prevent and respond to sexual exploitation, abuse and other forms of Gender Based Violence (GBV). The Contractor shall prepare and submit for approval of SPMU and FPMU, the necessary GBVMP to be implemented for the project. The GBVMP will set out a formal system by which the Contractor will carry out mitigation measures that will reduce any impacts relating to Gender Based Violence matters.

Specifically, the GBVMP will provide details regarding the implementation of avoidance mitigation and management measures for impacts related to the possibility of or any existing risks which may lead to GBV issues. The scope of the GBVMP will cover pre-construction, construction and post construction/closure phases of the Project.

The risk indicators to be considered shall include but not limited to:

- Possible pressure and/or additional demand for social services as a result of an increased family stress and violence;
- Possible sexual harassment (including rape, sexual assault and harassment in all public and private spheres of life);
- Norms, attitudes and stereotypes around gender in general and violence against women in particular;
- Various forms of structural inequality or institutional discrimination on any particular gender.

6.6.6 Vegetation Clearing and Biomass Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Vegetation Clearing and Biomass Management Plan (VCBMP). Together with this ESMP, the VCBMP will provide the specific activities to be carried out to protect the natural biodiversity of the project area as well as maintain appropriate public access.

The specific objectives of the Plan are to:

- Identify appropriate, ecologically sustainable, and spatially-explicit management actions, such as re-vegetation with native plant species, based on biological and hydrological factors, as well as the reasonableness of costs, local community expectations, and other key considerations.
- Develop monitoring methods to evaluate progress toward Plan objectives, to apply adaptive management to enhance the likelihood of achieving those objectives, and to increase understanding of water and ecosystem interactions.
- Prepare for anticipated changes to the system, such as climate change and land-use changes.
- Prepare for implementation of rapid, active ecological restoration and other management strategies for threatened, endangered, and other native wildlife species potentially displaced by construction activities, and to enhance pollinator habitat.
- Provide consideration of proper implementation techniques, implementation costs, short- and long-term maintenance needs, water use/savings, and wildfire control.

The approved Plan shall form part of the construction documents and requirements for Contractor implementation through the project.

6.6.7 Air Quality Management Plan

Air quality plans identify potential control measures and strategies, including rules and regulations that could be implemented to reduce air pollutant emissions from construction equipment, on and off road motor vehicles, and other sources. The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Air Quality Management Plan (AQMP). The Contractor shall implement these strategies through rules and regulations, public education and outreach, and partnerships with other agencies and stakeholders.

6.6.8 Emergency Response and Incident Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Emergency Response and Incident Plan (ERIP). The Plan will describe the set of necessary actions to be taken in response to defined circumstances, across all hazards, and through the phases of mitigation, preparedness, response, and recovery during this project.

The Plan will provide necessary guidance for how to organize assets to respond to an incident (system description) and processes to manage the response through its successive stages (concept of operations). The Plan will document the combination of facilities, equipment, personnel, procedures, and communications existing within the Contractor's organizational structure and designed to help in the management of resources during incident response.

The activities contained in the Plan will address the phases of mitigation, preparedness, response, and recovery and will identify potential hazards, assess their likelihood of occurrence, their potential impact and the organization's vulnerabilities to the impact, and also provide a basis for understanding how the hazard likelihood and organizational vulnerabilities can be addressed.

For the Plan to be effective, the emergency incident must be formally defined so that there is clarity and consistency as to what is being managed. This may be best accomplished by defining the incident response through delineation of response goals and objectives, and by explaining response parameters through the Emergency Response and Incident Plan (ERIP).

6.6.9 Water Management Plan

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a Water Management Plan. The Plan will provide information about current water uses and charts a course for water efficiency improvements, conservation activities, and water-reduction goals.

An important step in creating a water management plan is to establish a water balance for the project. It is necessary to ensure that water supply, wastewater, storm water issues, and water efficiency Best Management Practices (BMPs) are taken into account prior to commencement of the construction works. Water emergency and other contingency plans should describe how the construction facility will meet minimum water needs during emergency or other water shortages.

6.6.10 Erosion and Sedimentation Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a comprehensive Erosion and Sedimentation Management Plan. Together with this ESMP, the Plan will provide the specific activities to be carried out to protect the environment from erosion and sedimentation within the project area. It is important that an erosion and sediment control plan is effective in preventing illicit discharge. Appropriate consideration should be given to identify potential problems posed by the project area slopes, drainage patterns, and soil types in preparing an effective erosion and sediment control plan.

The erosion and sediment control plan shall be overlaid on the project grading plan(s) or site plan if there is no grading plan.

- The plan shall show what Best Management Practices (BMPs) will be used, when, and where, specific to the project scope, along with the total disturbance area and installation details and notes for the proposed BMPs. Measures will include those necessary to delineate areas of work, prevent erosion of unstable or denuded areas, plan for construction staging and storage logistics, construction of stabilized access points, and proper containment measures for construction materials and waste.
- The name and contact information for the person responsible for maintaining erosion and sediment control measures throughout the construction work shall be included as Erosion Control Point of Contact.
- Location, width, direction of flow and approximate location of top and toes of banks of any watercourses.
- Location and types of existing vegetation on the site. Within 10 meter of any cut or fill, the plan shall identify the location, diameter, species and appropriate elevation at the base of all trees over 0.3 m in diameter measured at 1.5m above average ground level.
- Existing drainage patterns and direction of flow.
- Limits of disturbed areas.
- Areas not to be disturbed and off-limits to construction activity.
- Location of proposed vegetative erosion control measures (e.g., seeding, landscaping), including type, quantity, planting schedule, and irrigation.
- Location and details of all proposed drainage systems, walls, cribbing or other erosion protection devices to be constructed in connection with, or as a part of, the project.

6.6.11 Traffic and Vehicle Management Plan

Managing traffic at a construction workplace is an important part of ensuring the workplace is without risks to health and safety. Vehicles including powered mobile plant moving in and around a workplace, reversing, loading and unloading are often linked with death and injuries to workers and members of the public. Traffic includes cars, trucks and powered mobile plant like excavators or graders, and pedestrians like workers and visitors. The most effective way to protect pedestrians is to eliminate traffic hazards.

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, a comprehensive Traffic and Vehicle Management Plan (TVMP). Together with this ESMP, the TVMP will provide the specific and general guide to vehicular movements throughout the project area in order to protect the community and workforce from accident and safety hazards during construction.

Key issues to consider for managing traffic at the construction workplace include:

- Keeping pedestrians and vehicles apart including on site and when vehicles enter and exit the workplace;
- Minimizing vehicle movements;
- Eliminating reversing vehicles or minimizing the related risks;
- Ensuring vehicles and pedestrians are visible to each other;
- Using traffic signs, and,
- Developing and implementing a traffic management plan.

The Contractor shall be required to provide appropriate information, training, instruction or supervision necessary to protect all persons from risks to their health and safety. The Contractor must also ensure construction induction training is provided to workers who carry out construction work.

- The Niger State ACRoSAL will place speed limits and appropriate road signage along all Project roads;
- The Niger State ACRoSAL will enforce speed limits for safety, air quality, and noise purposes both on the Project site and beyond;

- All Niger State ACRoSAL drivers should be trained by a road safety specialist; and,
- All vehicles should be properly maintained and undergo periodic safety inspections.
- Observance of speed limits by contractor's vehicles / drivers should be part of the contractual agreements

6.6.12 Waste Management Plan

A waste management plan (WMP) is required to achieve the goals set for managing construction waste. The construction Contractor shall prepare and submit for approval of SPMU and FPMU, a comprehensive Waste Management Plan (WMP). The WMP will provide the specific and general guide to the management of solid and liquid wastes throughout the project area and for the duration of the project. The Contractor shall have responsibility for the implementation of the Plan which will include procedures for salvage, reuse and recycling of materials. The implementation of the WMP will protect the community and workforce from the health hazards of indiscriminate waste disposal during construction.

The waste management plan should cover the following:

- i. Specify who is responsible for managing waste on site.
- ii. Establish goals and objectives.
- iii. Estimate the waste types and amounts involved.
- iv. Set targets for reducing the amount of each waste sent to the waste disposal site;
- v. Describe recycling/reuse methods for each material.
- vi. Identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling.
- vii. Track progress.
- viii. Describe special measures for material use and handling.
- ix. Describe communication and training to support and encourage participation from everyone on site.

6.6.13 Chemical Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a Chemical Management Plan (CMP). The CMP will provide specific and general guidance in the storage, use and disposal of any chemicals or chemical products associated with activities to be carried out as part of the project. Chemicals are an integral part of everyday life, essential to our economy, our communities and our homes. While chemical substances provide benefits, they may also have harmful effects on human health and the environment if not properly managed.

The CMP is aimed at protecting human health and the environment by assessing chemicals used in the project and by taking action on the chemicals found to be harmful. The CMP helps protect the project community and their environment from the harmful effects of chemical substances. The CMP will assess the environmental and human health risks posed by the chemical substances to be used in the project, and also develop measures to be implemented to prevent or manage those risks.

6.6.14 Rock Blasting Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a Rock Blasting Management Plan (RBMP). The RBMP will provide specific and general guidance in the blasting of rocks for use during the project, particularly as associated with gully bed activities.

The RBMP helps protect the project community and their environment from the harmful effects of rocks and other hard materials. The RBMP will assess the environmental and human health risks posed by rocks during blasting in the project, and also develop measures to be implemented to prevent or manage those risks.

6.6.15 Security Management Plan

The Contractor shall prepare and submit for approval of SPMU and FPMU, a Security Management Plan (SMP). The SMP will provide specific and general guidance in attending to all security matters including the identification of all the institutions that will work in the site beside the Constructor

6.7 ESMP Monitoring and Evaluation

The objectives of the monitoring and evaluation program are:

- To ensure that the measures suggested herein are carried out accordingly during project implementation;
- To evaluate the efficiency of the proposed mitigation and enhancement measures;
- To investigate the adequacy of the ESMP as well as suggest improvements to it;
- To generate data that could be incorporated in future ESMPs;
- To evaluate what additional enforcement is required for the effective project implementation.

For effective implementation of the ESMP, a monitoring program has been designed. The monitoring plan indicates the operational links between the impacts identified in this study, indicators to be measured, the methods to be used, frequency of measurements and definition of thresholds indicating the need for corrective actions. The necessary costs and the responsibilities for all aspects of the monitoring arrangements are also identified.

6.7.1 Monitoring and Reporting

Project performance monitoring has the overall objective of achieving the desired outcomes through reporting of as measurable events or parameters or aspects that can be monitored and verified. The following monitoring and reporting sequence is proposed for the ESMP implementation

- The Contractor shall submit to SPMU a monthly monitoring report and the ESMP accomplishments during project implementation,
- The SPMU shall prepare monthly ESMP monitoring and accomplishment reports to be submitted to FPMU and the WB.

This reporting cycle should be repeated as the feedback mechanism scheme to all key players consisting of the affected stakeholders, Site Committee, Focal NGO, CBOs/CDOs, Contractors, SPMU, etc.

6.7.2 Post Construction Monitoring

In the post-construction phase of the project, the Site Committee shall be required to maintain continuous monitoring of the project beyond the decommissioning phase. This will ensure that the Mokwa gully rehabilitation/healing process and the associated livelihood programmes are sustained beyond the project closeout. Since the Site Committee will have a big role in sustaining the post construction (operations and maintenance) phase of the project, necessary capacity building trainings will be required to provide its officers/leaders the needed capabilities for formulating necessary policies, systems and procedures. The SPMU and the SMeNV will be required to ensure that the Site Committee and other CBOs/CDOs are institutionally strengthened.

A summary of the impacts mitigation and monitoring plan for the preconstruction, construction, and post-construction phases for Mokwa gully project site with the associated monitoring frequencies, responsible parties and projected costs are presented in Table 6-5.

6.8 Grievance Mechanism And Procedures

It is for the benefit of the MOE/NGSG, ACRESAL, Mokwa Communities and the PAPs to devise a mechanism through which complaints and disagreements arising from the implementation of the Mokwa gully erosion control project can be resolved. A Grievance Redress Mechanism (GRM) is necessary in order to prevent and address community issues, reduce exposure to risks and also provide the platform for the optimization of environmental and social benefits of the project. The grievance procedures consist of the steps that ensure

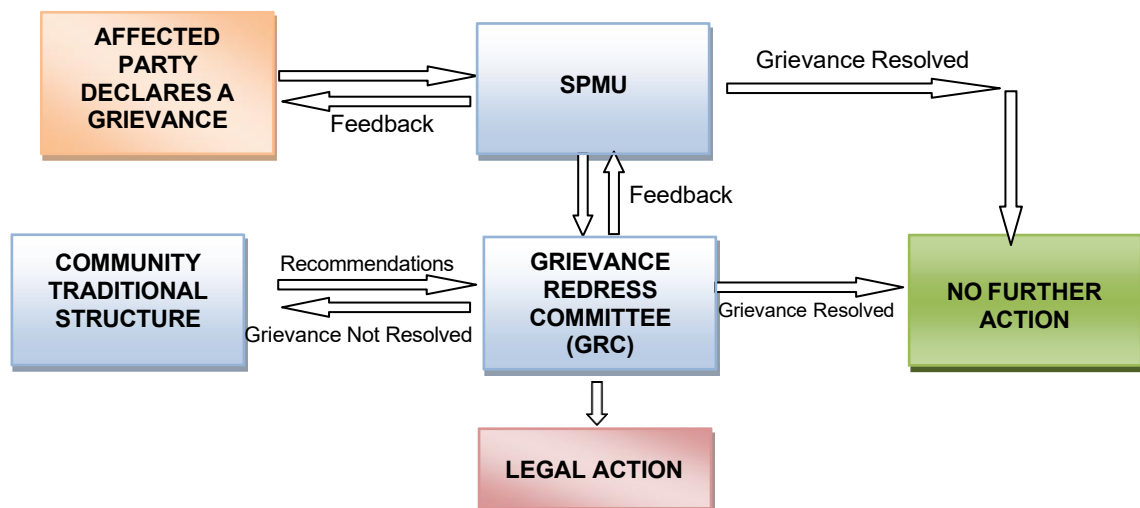
proper documentation of all grievances, a discussion mechanism for hearing and resolving the grievances, and provisions for appeals in the event of dissatisfaction by any affected persons.

The issues considered include: the project's benefit(s) to the stakeholders; potential changes to the routine activities of the stakeholders that might occur due to the project; and the project activities that might cause damage or conflict for the stakeholders. Any issues that may lead to grievances will be addressed through documented grievance mechanism that takes into consideration the cultural and traditional rights of people avoiding as much as possible potential for legal redress mechanism. The specific objective of the mechanism is to facilitate the process and ensure effective and timely grievance resolution thereby reducing the risk of escalation of conflicts and avoiding unnecessary delays. The grievances and remedial actions shall be carefully documented to enhance accountability and reduce liability.

The community traditional land dispute resolution structure currently constitutes the nucleus of traditional resolution of disputes among community members on matters of land. It is therefore wise and advisable that this structure be necessarily retained in the event of any grievance or dispute relating to the ESMP implementation. Inputs from the leadership may also be limited to providing recommendations as to how a specific dispute is to be addressed. Aside from the traditional structure, Figure 6-1 provides a secondary mechanism for grievance resolution using the Grievance Committee (GC). The proposed GRM will also help to achieve the following:

- To serve as the open channel for effective communication together with the identification of emerging environmental and social concerns due to the project;
- To prevent and mitigate any adverse environmental and social impacts as a result of any phase of the project;
- Promote harmonious relationship and respect among stakeholders; and,
- Ensure community acceptance of the project.

Figure 6-1: Grievance Redress Procedure



6.8.1 Levels Of Grievance Mechanism

The levels of grievance redress mechanism as approved by the World Bank are as follows:

First Level: Community Grievance Redress Committee (Com-GRC)

1. Members of Community Grievance Committee as elected
2. Representative of Focal NGO (Coordinator)
3. The Local Government Liaison Officer
4. PAP

Second Level: PMU Grievance Redress Committee (PMU-GRC)

1. PMU Grievance Committee

2. Representative of Focal NGO
3. Chairman of Community Grievance Committee
4. Secretary of Community Grievance Committee
5. Project Coordinator (Coordinator)
6. PAP

Third Level: ACReSAL Steering/Technical Committee (State-GRC)

1. Commissioner or PS (Coordinator)
2. Project Coordinator
3. Chairman of Community Grievance Committee
4. Secretary of Community Grievance Committee
5. Representative of Focal NGO
6. State Safeguards Officers (Social & Environment)
7. PMU Communication Officer
8. PAP

Fourth Level: (Fed-GRC)

1. Umbrella NGO or Ombudsman (Coordinator)
2. National Safeguard Specialists (Social & Environment)
3. State Project Coordinator
4. President General of the Community (PG)
5. Chairman of Community Grievance Committee
6. Secretary of Community Grievance Committee
7. Representative of Focal NGO
8. PMU Communication Officer
9. PAP

6.9 Environmental and Social Management Obligations of the Contractor

The Contractor shall meet the specific E&S obligations provided in this ESMP, which shall be incorporated into the contract specifications for the project. The Contractor shall develop a field work guideline explaining how the recommended mitigation measures in this ESMP will be implemented during the project. The Contractor shall be provided with a copy of this ESMP to guide the preparation of the Contractor Environmental and Social Management Plan (C-ESMP) for safe implementation of the project.

6.9.1 Contractor's Environment and Social Management Plan (C-ESMP)

The contractor shall within six (6) weeks of signing the Contract, prepare a work plan to ensure the adequate management of the E&S aspects of the works, including implementation of the specific requirements of the E&S safeguards. The Contractor's E&S document shall describe:

- i) the procedures and methods for complying with the environmental and social conditions specified in the ESMP,
- ii) the mitigation measures to be implemented against adverse impacts,
- iii) the likely impacts, monitoring activities and reporting; and
- iv) the internal organizational, management and reporting mechanisms put in place for the E&S management.

Thus, before commencement of construction, the Contractor is required to submit a site-specific Contractor's Environmental and Social Management Plan (C-ESMP) for the work, which will be reviewed and approved by the Environment and Safeguard Officer (ESO) of NGS-ACReSAL. The EMSP as a minimum shall have a campsite plan that includes the following:

- a) Workers' accommodation where applicable.
- b) Fuel containment area and refueling locations.
- c) Equipment maintenance area.
- d) Material storage area.
- e) Demolition and Removal of Structure Management Plan
- f) Waste Management Plan.

- g) Noise and Dust Control Plan.
- h) Chemical/Fuel Spill Response Plan.
- i) Gender based Violence (GBV), Sexual Exploitation and Abuse (SEA) Plan etc.
- j) Stakeholder Engagement Plan
- k) Occupational/Community Health Safety Management Plan
- l) Traffic Control and Transport Management Plan
- m) Emergency Preparedness and Response Plan
- n) Flood Risk Management Pan
- o) Flash Flood Emergency Response Preparedness
- p) Rock Blasting Management Plan
- q) Labour and Working Conditions (includes Workers Code of Conduct included on Labour and working conditions and Occupational Health, Safety and Security Management Plans)
- r) Channel /gully Crossing Plan
- s) Biodiversity Management Plan
- t) Hazardous Materials Management Plan
- u) Reinstatement Management Plan
- v) Security Management Plan
- w) Project Corridor (set back) Management Plan

6.9.2 Contractor's HSE Officer

The Health, Safety and Environment (HSE) officer of the Contractor(s) shall be responsible for the overall on-site implementation of this ESMP alongside other environmental and social requirements prepared for the Project for the duration of the contract. The HSE officer must be well equipped and grounded with requisite experience to handle such a high-risk project, in this regard he/she must have the minimum basic HSE training. The Contractor(s) HSE officer shall:

- Make sure that all personnel are informed of the requirements of this ESMP, and the associated responsibilities and implications.
- Produce, provide, and present on request relevant records required to demonstrate compliance with requirements of this ESMP for inspection by relevant officers.
- Consult with the Client's HSE Officer regarding interpretation of the ESMP and any other aspects of the contract that may impact significantly on the environment.
- Ensure that all personnel demonstrate respect and care for the environment in which they are operating.
- Act as point of contact for residents and community members.

It is the responsibility of the construction Contractor(s) to ensure compliance with every provision in the engineering design of the intervention work. Therefore, the Niger State ACRSAL SPMU shall not be liable for any property damaged by the Contractor in the process of executing the gully rehabilitation activities. In the event of such damage occurring, the Contractor shall be liable for the cost of such damage (if the affected asset is not part of the RAP).

6.9.3 Site Establishment

The contractor shall locate the camp away from the communities. A layout plan for construction activities at the camp site shall be developed and approved by the SPMU.

Requirement for Camp Site establishment:

- ❖ The contractor should provide appropriate and safe quarters for the workers.
- ❖ Independent and sufficient toilet facilities (toilet and shower) should be provided on the camping site for male and female workers, respectively.
- ❖ The toilet facilities should be accessible, clean, and indicated with "Male" or "Female."
- ❖ The domestic sewage of the camping site should be treated in the septic tank at least and should not be directly discharged into any waterbody; and
- ❖ The camping site should provide emergency medical facilities. A first-aid box should be provided and managed by specially assigned people who should have full first aid training and qualification and could send the injured or the diseased to local hospital in time.

6.9.4 Labour Employment and Code of Conduct

The Contractor shall adhere to the following on the matters of labour employment:

- Locals should be given preference when it comes to labour employment where possible.
- The contractor should publicize appropriate work positions to the communities along the stretch of the gully.
- The recruited workers and staff members should have a legal contract of employment.
- The contractor is responsible for offering the employees instruction in occupational health and safety, as well as environmental protection.

The establishment of a Code of Conduct for the workforce would prioritize acceptable behavior, abstaining from drug and alcohol misuse, and adhering to pertinent laws and regulations in order to minimize their impact on society. At the time of employment, each employee should be made aware of the Code of Conduct. The local community should also be aware of the worker's code of conduct. If someone violates the code of conduct, disciplinary action should be enforced. A sample of the Code of Conduct is provided in Annex 10.

When visiting the community and interacting with the locals, the workers shall abide by the applicable code of conduct. The following activities shall be prohibited on the construction site and environs:

- Injury to wild animals.
- Capture of protected animals and engendered species.
- Drinking during working hours.
- Mechanical maintenance (replacement of engine oil and lubricant) outside the specified area.
- Dumping of waste outside the specified area.
- Driving dangerously on local road.
- Working without safety clothing.
- Causing interference to people nearby.
- Leakage of pollutants, e.g., oils; and
- Burning of refuse.

Any subcontractor, employee or other staff member found breaking these regulations should be discipline.

Table 6-5: E&S Impact Mitigation and Monitoring Plan for Mokwa Gully Site

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
PRE-CONSTRUCTION PHASE									
Safeguard Instrument (ESIA/ESMP)		Ensure that identified E&S impacts are addressed and mitigation measures are executed properly	Environmental and social management measures as spelled out in this document (details are as enumerated below)	SMEnv, SPMU and contractor	To be included in the overall project construction cost	Approval of ESMP Report by FMEv & WB; Commencement of construction activities; Availability of completed & approved plans	Monitoring parameters as indicated in this ESMP	FPMU & WB	N/A
Impacts on Community and PAP Management (Loss of physical assets; Loss of means of livelihood; Displacement of persons (Temporary/ Permanent))	All those impact sources that are indicated in Table 6.1, Item 1, Column 1	To restore persons affected by the project to a condition equivalent to or better than the pre-project situation	Resettlement Action Plan (RAP) has been prepared as a stand-alone document; All those impact mitigation measures that are indicated in Table 6.1, Item 1, Column 2	SMEnv & SPMU	To be included in the total RAP cost	● No. of public complaints recorded;	Continuous	SPMU-ESO; Focal NGO SMEnv.; SMLS.; Community Leaders; Site Committee	Included in total cost provided in the RAP 2,700,000.00
						● Level of awareness and understanding of community members;	Quarterly		
						● No of community members that attend trainings;	Continuous		
						● Level of satisfaction among PAPs;	Quarterly		
						● No of women gainfully employed by project;	Quarterly;		
						● No of other businesses induced by project	Six months intervals		
● Questionnaires, direct observations and interviews.	Every two years								

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
Community Cultural Heritage	All those impact sources that are indicated in Table 6.1, Item 2, Column 1	Ensure that community's historical, archeological, and cultural treasures are not destroyed during project execution	All those impact mitigation measures that are indicated in Table 6.1, Item 2; Column 2 Develop and submit for SPMU approval a Cultural Heritage Management Plan; Possibility of chance archeological findings	SMEEnv & SPMU Contractor	To be included in the overall project construction cost	Protection of all identified treasure finds	Continuously	Focal NGO; SPMU; SMEEnv; Community Leaders; Site Committee	2,500,000.00
Public/Stakeholders Participation	All those impact sources that are indicated in Table 6.1, Item 3, Column 1	Ensure effective community and stakeholder involvement in the project decision process	Develop and submit for SPMU approval a Stakeholders Engagement Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 3, Column 2	Contractor Contractor	To be included in the overall project construction cost	No of active participants from the community and other stakeholders	Continuously	Focal NGO; SPMU; SMEEnv; Community Leaders; Site Committee	2,600,000.00

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
Vegetation and Biomass Removal Management	All those impact sources that are indicated in Table 6.1, Item 4, Column 1	Prevent damage to critical ecosystems and habitats and destruction of flora and fauna	Develop and submit for SPMU approval a Vegetation and Biomass Removal Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 4, Column 2	Contractor Contractor	To be included in the overall project construction cost	Areas of stressed vegetation; Size of cleared vegetation areas	Monthly Monthly	SPMU-ESO; Focal NGO; SMOW; SMeNV; SMOH; Community Leaders; Site Committee	2,500,000.00
CONSTRUCTION PHASE									
Dust and Air Quality Management	All those impact sources that are indicated in Table 6.1, Item 5, Column 1	To minimize emission of hydrocarbons and generation of dust at the work site and access roads	Develop and submit for SPMU approval an Air Quality Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 5, Column 2	Contractor Contractor	To be included in the overall project construction cost	- No. of public complaints; - Level of particulates - Level of air pollutants - Vegetation surfaces free of dusts - Ambient air monitoring using standard methods	Twice daily Continuous as necessary Continuous as necessary Two month intervals or as required	SPMU-ESO; Focal NGO SMOH.; Community Leaders; Site Committee	2,100,000.00

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
Water Resources, Erosion & Sedimentation Control Management	All those impact sources that are indicated in Table 6.1, Item 6, Column 1	Ensure that project area is adequately protected from development of erosion and sedimentation hazards	Develop and submit for SPMU approval a Water Management Plan and an Erosion and Sedimentation Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 6, Column 2	Contractor Contractor	To be included in the overall project construction cost	- No of complaints from community members; - Absence of sediment build up; - Absence of flooding in construction areas; - No of spills & repairs made; - Use of standard monitoring methods	Daily Daily Daily Three month intervals	SPMU-ESO; Focal NGO; SMOW; Community Leaders; Site Committee;	2,900,000.00
Noise and Vibration Exposure Management Potential for increased noise generation from rock drilling and blasting, construction machinery, earth moving equipment as a result of construction activities.	All those impact sources that are indicated in Table 6.1, Item 7, Column 1	Ensure adequate protection of the workforce and community members from effects of noise and vibrations	All those impact mitigation measures that are indicated in Table 6.1, Item 7, Column 2	Contractor – Site Engineer	To be included in the overall project construction cost	- No of complaints from community members; - Absence of structural failures; - Absence of debris accumulation; - No of debris removals & repairs made; - Sensor measurements around workplace	Daily Daily Daily Daily	SPMU-ESO; Local NGO; SMOW; SMOH; Community Leaders; Site Committee	2,500,000.00
Occupational & Public Health and Safety Management	All those impact sources that are indicated in Table 6.1, Item 8, Column 1	Ensure that identified occupational & public health, safety and security impacts are	Develop and submit for SPMU approval an Occupational and Public Health, Safety	Contractor	To be included in the overall project construction cost	- No. of sanitary facilities provided at start of project; - Adherence to stipulated speed limit - Record of incidents;	At start of project; Twice weekly;	SPMU-ESO; Focal NGO; SMOH; Community Leaders;	3,200,000.00

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
		addressed and mitigation measures are executed properly	and Security Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 8, Column 2	Contractor		• Use of PPEs by workers; • Records of appropriate workers' training; • Record of reinstatement plan for burrow pits; • Record of health and safety meetings • Record of first aid exercises • Hazards assessment	Weekly; Daily; Monthly; At beginning of project Weekly; Monthly At start of project	Site Committee;	
HIV/AIDS and STIs Management	All those impact sources that are indicated in Table 6.1, Item 9, Column 1	Ensure effective HIV/AIDS and STI awareness among community members	• All those impact mitigation measures that are indicated in Table 6.1, Item 9, Column 2	SPMU Safeguard Officers; MOH; NGO; Contractor-Health & Safety Personnel	To be included in the overall project construction cost	• No. of HIV/AIDS workshops held; • Level of awareness of workers & others; • Records of peer educators' training; • Records of condoms distributed	Quarterly Continuous Bi-monthly Monthly	Focal NGO; SPMU-ESO; SMEnv; SMOH; Community Leaders; Site Committee;	3,000,000.00
Construction Operations & Slope Stabilization	All those impact sources that are indicated in Table 6.1, Item 10, Column 1	To ensure that construction activities are carried out without risks to health and safety of the workforce and the community	Develop and submit for SPMU approval an Emergency Response and Incident Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 10, Column 2	Contractor Contractor	To be included in the overall project construction cost	• No of workshops for Gender Based Violence and Child Labour held; • No. of accidents/incidents; • No. of visible warning signs; • Level of public awareness; • Record of safety meetings held;	Daily; Daily; Continuous; Weekly.	SPMU-ESO; Focal NGO; SMOW; SMEnv; Community Leaders; Site Committee	2,700,000.00

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
Traffic and Transportation Hazards	All those impact sources that are indicated in Table 6.1, Item 11, Column 1	To ensure that traffic within the project area is managed so as to assure the workplace and community are without risks to health and safety	Develop and submit for SPMU approval a Traffic and Vehicle Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 11, Column 2	Contractor Contractor	To be included in the overall project construction cost	• Effective traffic flow with vehicular & worker safety; • Appropriate positioning of road signs, reflectors, speed ramps, control limits, traffic wardens; • Records of accidents and near misses	Daily; Daily; Daily.	SPMU-ESO; Focal NGO; SMOW; SMeEnv; Community Leaders; Site Committee	2,700,000.00
Waste Management (Solid and Liquid Wastes)	All those impact sources that are indicated in Table 6.1, Item 12, Column 1	To protect the community and the workforce from health hazards of indiscriminate waste disposal by proper collection and disposal of liquid and solid wastes generated on-site during the project.	Develop and submit for SPMU approval a Waste Management Plan; All those impact mitigation measures that are indicated in Table 6.1, Item 12, Column 2,	Contractor Contractor	To be included in the overall project construction cost	• Waste segregation and littering; • Emptying of bins at waste dump sites; • Waste composting; • Indiscriminate defecation; • Toilets decommissioning	Daily; Weekly; Weekly; Daily; At end of project	SPMU-ESO; Focal NGO; SMOW; SMeEnv; Community Leaders; Site Committee	2,800,000.00
OPERATION AND MAINTENANCE (POST CONSTRUCTION) PHASE									
Land Use Restriction	All those impact sources that are indicated	To ensure that required project areas under	All those impact mitigation measures	SPMU; SMeEnv; Community Leaders;		Sustained treated gully healing process	Routine monitoring of project corridor	SPMU-ESO; SMeEnv; Focal NGO;	3,000,000.00

E&S Impact Category	Source of Impact	Objective	Impact Mitigation			Performance & Impact Monitoring			
			Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)
	in Table 6.1, Item 13, Column 1	restricted use remains as designated	that are indicated in Table 6.1, Item 13, Column 2	Site Committee			(6mos – 12mos)	Community Leaders; Site Committee	
Closure of Temporary Office, Staging Areas and Decommissioning of Project	All those impact sources that are indicated in Table 6.1, Item 14, Column 1	Ensure that agreements with the community and landowners on post construction hand-over are kept.	All those impact mitigation measures that are indicated in Table 6.1, Item 14, Column 2	Contractor Contractor	To be included in the overall project construction cost	Agreements entered with community and landowners for use of land; Terms of Agreement fulfilled with community and landowners; Handover of office site as agreed	Prior to start of project; Quarterly; At completion of project	SPMU-ESO; Focal NGO; Community Leaders; Site Committee	2,900,000.00
System Control Failures Management	All those impact sources that are indicated in Table 6.1, Item 15, Column 1	Ensure sustainable maintenance of erosion prevention and control structures	All those impact mitigation measures that are indicated in Table 6.1, Item 15, Column 2	SPMU; Community Leaders; Site Committee		Sustained gully healing process	Routine monitoring of project corridor (6mos – 12mos)	Community Leaders; Site Committee CBOs/CDOs	2,700,000.00

A summary of the projected ESMP monitoring costs through the preconstruction, construction and post-construction phases of the project are presented in Table 6-7.

Table 6.7: Summary of Monitoring Cost for Mokwa Gully Site

Gully Site	Associated Monitoring Costs (N)		
	Pre-Construction	Construction	Post Construction
TOTAL	N7,300,000.00	N22,650,000.00	N8,550,000.00

6.10 ESMP Management Costs

A summary of the projected ESMP management costs through the preconstruction, construction and post-construction phases of the project are presented in Table 6-8.

Table 6-8: ESMP Management Costs for Mokwa Subproject

Institutional Category	Roles & Responsibilities	Associated Management Costs (N)		
		Pre-Construction	Construction	Post Construction
Niger State Ministry of Environment (SMEEnv)	• Overall oversight, assessment and monitoring of specific and general project implementation ;	2,400,000.00	1,800,000.00	1,400,000.00
SPMU (Safeguard Officers, Project Engineer)	• Oversight of all specific activities associated with the ESMP implementation	4,800,000.00	6,000,000.00	4,800,000.00
FPMU	• Project assessment and monitoring of this ESMP implementation and the construction activities.	N/A	N/A	N/A
World Bank	• Overall assessment and monitoring of specific and general project implementation ;	N/A	N/A	N/A
State Ministry of Works	• Provide necessary preconstruction and construction support to the SPMU	2,400,000.00	1,200,000.00	N/A
State Ministry of Lands & Survey (SMLS)	• Provide necessary support to the SPMU on matters of land acquisition, compensation and other resettlement issues	2,400,000.00	N/A	N/A
Other MDAs	• Intervene in areas under their jurisdiction as and when project demands	1,800,000.00	1,800,000.00	N/A
Contractor (Site Engineers/ Supervisors)	• Provide oversight function during decommissioning to ensure adherence to good practice and the ESMP	N/A	N/A	N/A
Site Committee	• Monitor and ensure compliance with ESMP, BEME and implementation quality	2,400,000.00	1,200,000.00	1,800,000.00
Local government	• Provide support in monitoring project execution within their domains to ensure compliance with this ESMP and other relevant requirements	N/A	N/A	N/A
Local Community	• Support and promote environmental awareness	1,200,000.00	N/A	2,400,000.00
CDOs/CBOs	• Ensure community participation by mobilizing, sensitizing community members;	N/A	N/A	900,000.00
NGOs	• Assist to ensure effective response actions, to evolve and devise sustainable environmental strategies	3,000,000.00	2,400,000.00	1,200,000.00

Institutional Category	Roles & Responsibilities	Associated Management Costs (N)		
		Pre-Construction	Construction	Post Construction
	and rehabilitation techniques, organize, coordinate and ensure safe use of volunteers in a response action, & provide wide support in management planning, institutional/governance issues and other livelihood related matter, awareness campaigns			
General Public	- Identify issues that could derail the project - Support project impacts and mitigation measures as well as awareness campaigns	N/A	N/A	N/A
TOTALs		N20,400,000.00	N14,40,000.00	N18,000,000.00

6.11 Budget to Implement ESMP

Cost projections for implementation of the various measures, monitoring plan and capacity building are given in Table 6.8. The projected implementation budget will enable the ESMP to be an integral part of financing for the rehabilitation/maintenance works in the project.

An indicative budget of **N190,520,000.00** (One Hundred and Ninety Million Five Hundred and Twenty Thousand Naira) only, is shown for the implementation of the ESMP bearing in mind the elements that make up the implementation process. The budget covers:

1. Routine E & S duties of the SPMU;
2. Capacity Building for the SPMU and other stakeholders;
3. Engagement of Environmental and Social Specialists
4. Environmental and Social Due Diligence investigations and/or Audits;
5. Monitoring and evaluation activities of the SPMU

Table 6-9: Breakdown of Cost Estimates

S/No	ITEM	RESPONSIBILI TY	COST BREAKDOWN IN (N)			COST ESTIMATE IN NAIRA (N)	COST ESTIMATE IN (US\$)
			Pre- Construction Phase	Construction Phase	Post- Construction Phase		
1	MITIGATION	SPMU/ Contractor	N41,800,000.00 (To be built into Contractor costs)			N41,800,000.00	\$28,243.24
2	MANAGEMENT	SPMU/ SMeEnv	21,600,000.00	13,700,000.00	18,000,000.00	N53,300,000.00	\$36,013.51
3	MONITORING	SPMU/ FPMU/ FMeEnv/ SMeEnv/ Environmental Consultants/ NGOs	7,300,000.00	22,650,000.00	8,550,000.00	38,500,000.00	26,013.51
4	CAPACITY BUILDING & TRAININGS	SPMU/ MOH/ Consultants/ Contractor	32,400,000.00	7,200,000.00	0.00	39,600,000.00	26,756.76
Sub-total						173,200,000.00	\$117,027.03
5	CONTINGENCY (10%)					17,320,000.00	11,702.70
GRAND TOTAL						N190,520,000.00	\$128,729.73

Assumed exchange rate: US\$1.00 = N1,480.00 (Nigerian Naira)

6.12 ESMP Implementation Schedule

The implementation and management of the ESMP schedule is designed to facilitate any necessary resettlement issues associated with the RAP. The ESMP activities also need to be implemented within an agreed timeframe and budget. Appropriate timing should be adhered to in order to avoid project delays especially if the situation arises where site clearing is to begin before the resettlement end date.

Execution of the ESMP activities is recommended in accordance with the schedule shown in Table 6-10. The period of the first week will be used to develop and set up all structures necessary to support all aspects of the programs.

Table 6-10: Proposed ESMP Implementation Schedule

DESCRIPTION OF ACTIVITY	DURATION IN MONTHS																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Disclosure of ESMP Report	↔																							
Formation of Project Grievance Redress Committee (GRC)	↔																							
Review and Approval of Contractor's ESMP and Health, & Safety Plan		↔																						
Hold Stakeholders Meetings and Consultations	↔																							
Execute Capacity Building Programmes		↔																						
Implementation of Mitigation Measures			↔																					
Supervision of ESMP Implementation	↔																							
Monitoring & Reporting on ESMP Implementation	↔																							
Conduct ESMP Implementation Audit																							↔	
Programme Administration	↔																							

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The proposed Mokwa project, consisting of remediation/rehabilitation of 265.13Ha gully eroded lands within Mokwa communities, is considered to be in line with the development and socio-economic needs of Niger State as a whole. The project will facilitate redevelopment of the gully degraded lands and once again allow unimpeded use of agricultural lands. Indeed, the project have many positive socio-economic impacts both locally and regionally.

In view of positive and negative impacts identified, as well as public consultations conducted in the project area, it is unlikely that the proposed Mokwa project will have overall significant adverse social and environmental impacts to warrant project abandonment. Most adverse impacts will be of a temporary nature during the construction phase and can be managed to acceptable levels with implementation of the recommended mitigation measures for the project such that the overall benefits from the subproject will greatly outweigh the few adverse impacts.

The main social issues for the subproject will revolve around the temporary displacement and relocation of those people along the gully corridors and the permanent acquisition of setback lands for the stabilization of gully walls particularly at the deep sections of the gully corridor. Niger State will compensate the PAPs with respect to the adverse impacts associated with temporary displacement and disturbance, loss of economic trees and crops and loss of lands.

There is a pressing need to rehabilitate the gullied areas of the project site and install effective stormwater management system to reduce the incidence of flooding and gully erosion during periods of heavy rainfall. The quality of life of residents in Mokwa communities is significantly and negatively impacted by the frequent incidence of flooding and gully erosion phenomenon, long-term pools of standing water which encourages the spread of waterborne disease and incidence of malaria.

The public consultations indicate a widespread support for the Mokwa project as people desperately look forward to a relief from the emotional trauma arising from devastating impacts of the erosion gullies as well as the need to improve their quality of life. The most commonly expressed position at the community meetings was that the need to implement an effective maintenance program that ensures: (a) litter and waste is removed before it blocks drains and (b) the structural integrity; thus functional drains/culverts are maintained.

It is concluded that for the Mokwa Project, in essence, a group of mitigation measures are gravely needed to improve the conditions of communities endangered and blighted by the hazards of erosion gulying and living helplessly in the face of perennial severe losses of lives, properties and ancestral lands.

7.2 Recommendations

The current lack of a formal solid waste management system is very apparent as waste and litter are indiscriminately abandoned throughout Mokwa communities. People use a variety of containers for waste disposal (e.g. plastic bags, tins and baskets). However, these are make-shift solutions to a serious waste problem. No collection system means waste is left to rot throughout the study area. The abandoned food waste attracts scavengers such as rats and cats. Once containers are opened by scavengers, waste is scattered widely by wind and animals. The ultimate litter and waste trap tends to be streams and water bodies which net result is a spiral of contamination of water and on-going environmental degradation that promotes the spread of disease.

There is widespread public support for implementing an effective waste collection and disposal system. Many schemes have been instigated in the past but have failed due to a lack of resources including infrastructure. The most commonly made comment, during the public

consultation process, was that a community awareness programme will be key to the success of the waste collection and disposal system. It is therefore imperative that waste collection and disposal system that works on a regular basis is required so that the current problem of waste accumulation in water courses can be eliminated. It is therefore strongly recommended that the volumes of wastes that currently collect in streams should not be allowed to continue as they inhibit the effective flow through water courses thereby reducing the overall capacity of the drainage systems.

CHAPTER 8: DECOMMISSIONING/ABANDONEMENT

This section provides additional specific guidance on prevention and control of community health and safety impacts that may occur during project development and at the end of the project life-cycle. Many of the provisions here have been adopted from the General EHS Guidelines of the World Bank.

Noise and Vibration

During decommissioning activities, noise and vibration may be caused by the earth moving and excavation equipment, the transportation of equipment, materials and people. It is recommended that noise reduction and control strategies be considered in areas close to community areas. These strategies include:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance;
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines; and,
- Avoiding or minimizing project transportation through community areas.

Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters. Recommended soil erosion and water system management approaches include reducing or preventing erosion by:

- Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical
- Contouring and minimizing length and steepness of slopes
- Mulching to stabilize exposed areas
- Re-vegetating areas promptly
- Designing channels and ditches for post-construction flows;
- Lining steep channel and slopes (e.g. use jute matting).

Air Quality

Decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Techniques to consider for the reduction and control of air emissions from construction and decommissioning sites include:

- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone);
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content;
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements;
- Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition;
- Managing emissions from mobile sources;
- Avoiding open burning of solids.

Solid Waste

Non-hazardous solid waste generated at construction and decommissioning sites includes

excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities. Hazardous solid waste includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil, as well as spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling nonhazardous and hazardous construction site solid waste include those already discussed in Section 1.6 of the EHS guidelines.

Hazardous Materials

Decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Techniques for prevention, minimization, and control of these impacts include:

- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids;
- Using impervious surfaces for refueling areas and other fluid transfer areas;
- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills;
- Providing portable spill containment and cleanup equipment on site and training in the equipment deployment;
- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities.

Wastewater Discharges

Decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites. Sanitary wastewater in construction and other sites should be managed as prescribed in Section 1.3 of the EHS guidelines.

Contaminated Land

Land contamination may be encountered in sites under construction or decommissioning due to known or unknown historical releases of hazardous materials or oil, or due to the presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. Actions necessary to manage the risk from contaminated land will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy should include:

- Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning;
- Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities;
- Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6
- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6 of the EHS guidelines.

Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites. Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths;
- Cleaning up excessive waste debris and liquid spills regularly;
- Locating electrical cords and ropes in common areas and marked corridors;
- Use of slip retardant footwear.

Struck By Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels;
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable;
- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap;
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged;
- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures;
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic;
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;
- Ensuring moving equipment is outfitted with audible back-up alarms;
- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Dust

- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements;
- PPE, such as dust masks, should be used where dust levels are excessive

Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of project specific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition;
- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury;
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection.

General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. Risk management strategies may include:

- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community;
- Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials

Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures prescribed for Traffic Safety.

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ANNEXURES