FINAL REPORT

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP) FOR THE ESTABLISHMENT OF VOCATIONAL AND ENTREPRENEURSHIP CENTRES IN SOKOTO STATE

BY

SOKOTO STATE GOVERNMENT

SUBMITTED TO

FEDERAL MINISTRY OF ENVIRONMENT
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LIST OF ACRONYMS AND ABBREVIATIONS

AIDS	Acquired Immuno-Deficiency Syndrome
ALARP	As Low as Reasonably Practicable
ASAP	As Soon as Possible
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CCNN	Cement Company of Northern Nigeria
CHSSP	Community Health, Safety and Security Plan
CLO	Community Liaison Officer
COVID 19	Corona Virus Diseases 2019
CSO	Civil Society Organization
dB	Decibel
DO	Dissolved Oxygen
EAu	Environmental Audit
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
ERP	Emergency Response Plan
ESDD	Environmental and Social Due Diligence
FGD	Focused Group Discussions
FGN	Federal Government of Nigeria
FRN	Federal Republic of Nigeria
GDP	Gross Domestic Product
H&S	Health and Safety
HIV	Human Immuno-Deficiency Virus
HSE	Health Safety and Environment
IEE	Initial Environmental Examination
IFC	International Financing Corporation
KII	Key Informant Interview
LFN	Laws of the Federation of Nigeria
LGA	Local Government Area
MDAs	Ministries, Departments & Agencies
MgO	Magnesim oxide
MgO	Magnesium Oxide
MOU	Memorandum of Understanding
NEDEP	National Enterprise Development Programme
NGO	Non-governmental Organization
NH3	Ammonia
NH4+	Ammonium ion
NIMET	Nigerian Meteorological Agency
O_3	Ozone
OSH	Occupational Safety and Health
OSHMS	Occupational Safety and Health Management System
PAP	Project Affected Person

PPE	Personal Protective Equipment
S	Sulphur
S&H	Safety and Health
SMART	Specific, Measurable, Achievable, Relevant and Time-Bound
SME	State Ministry of Environment
SMEDAN	Small and Medium Enterprise Development Agency of Nigeria
SMES	Small and Medium-sized Enterprises
SOSG	Sokoto State Government
STIs	Sexually Transmitted Infections
SWP	Safe Work Procedures
ToR	Terms of Reference
Zn	Zinc

LIST OF ORGANIZATIONS

FEPA	Federal Environmental Protection Agency
FMEnv	Federal Ministry of Environment
NESREA	National Environmental Standards and Regulations Enforcement Agency
SOSMEnv	Sokoto State Ministry of Environment
SEPA	Sokoto Environmental Protection Agency
OSHA	Occupation Safety and Health Administration
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
SOSG	Sokoto State Government

LIST OF KEY EMP PREPARERS

S/No.	Name	Address	Area of specialization	Role played in the EIA
1.	Mr. Philip O. Bankole	ENARMAC Nigeria Ltd	Environment and Natural Resources Management	Administrative Project Management
2.	Mr. Simon O. Adedoyin	ENARMAC Nigeria Ltd	Forest Resources Survey	Technical Project Management
3.	Dr. Lawal Abdurrashid	Department of Geography, Umar Musa Yaradua University (UMYU), Katsina	PhD in Environmental Resources Planning	Waste Management
4.	Dr. B. Y. Abubakar	Department of Biological Sciences A.B.U. Zaria	Ecology	Biodiversity Studies
5.	Dr. Umar Mohammed	Desert Research Centre, Damaturu, Yobe State	Waste Management	Soil and Water Studies
6.	Engr. Abdulkadir Isa	ENARMAC Nigeria Ltd	Chemical Engineering and Environmental Management	Engineering design and Team Leader
7.	Dr. Mubarak Tukur	Department of History, Umar Musa Yaradua University, Katsina	Gender Specialist	Socio-economic Studies
8.	Dr. S. Y. Abubakar	Department of Geophysics, Usman Danfodio University, Sokoto	Geophysicist	Geology and Hydrogeology
9.	Mr.Charles Ntor	ENARMAC Nigeria Ltd	Environmental Laboratory Technologist	Field Work (Physico-chemical Analysis)
10.	Patrick Ebe	ENARMAC Nigeria Limited	Geography and Environmental Management	Project Report Writing

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The Sokoto State Government has embarked on this transformational project for the benefits of all the residents of our dear state and we hereby wish to thank and acknowledge the contributions of our consultants, **Carter Consulting Limited** and **ENARMAC Nigeria Limited** for the successful execution of the Environmental Assessment Study.

We also wish to appreciate the support of the State's Technical Committee for their time and contributions throughout the field data gathering and stakeholders' engagements.

Finally, we would like to express our deep appreciation to the Federal Ministry of Environment and the Sokoto State Ministry of Environment for their regulatory support and guidance throughout the study.

We look forward to the implementation of this project with the expectation that it will significantly improve the livelihoods of millions of people in the State.

EXECUTIVE SUMMARY

BACKGROUND

Nigeria, despite its abundant human and natural resources, is contending with high rate of unemployment. Consequently, a significant population of Nigerians falls below the poverty line. To address the problem of youth unemployment and poverty, the Sokoto State Government of Nigeria plans to establish entrepreneurship and vocational education centres aimed at boosting employment and wealth generation towards socio-economic development of the State.

Based on the existing arrangement, the Sokoto State Government, which is the beneficiary, is to provide suitable land location and secure all permits for the smooth execution of the project while AfDB is to provide the technical expertise, funding and operation of the entire project.

The proposed initiative will to a very large extent facilitate entrepreneurship and Vocational development as well as increase socio-economic activities in this part of Sokoto State well known for its economic and entrepreneurial activities of the State.

However, development projects of this nature and scale, when not handled in an environmentally sustainable manner, tend to degrade the environment and pose environmental challenges. To ensure environmental protection and sustainability in Nigeria, the Environmental Impact Assessment (EIA) Act CAP E12, LFN 2004, was enacted. The Act makes carrying out Environmental Impact Assessment mandatory for major development projects and stipulates the various categories of EIAs and their statutory requirements. EIAs are carried out in order to identify potential impacts in the planning process and to make provisions, through an Environmental Management Plan (EMP), to adequately handle negative impacts by out rightly avoiding, mitigating or compensating for them while enhancing positive ones.

In compliance with EIA Act 2004 therefore, an EIA has to be carried out before the implementation of the proposed project. In this regard Enarmac Nigeria Limited was commissioned, as an Environmental Consultant, to design an Environmental and Social Management Plan (ESMP) for the proposed project, which is the subject of this report.

The EIA Study

The Environmental and Social Impacts Assessment (EIA) for the proposed project was therefore undertaken so as to identify environmental and socio-economic impacts associated with the project and offer preventive and mitigation measures which will lead to a design of an

appropriate Environmental and Social Management Plan (ESMP) for the various phases of the project.

The objectives of the ESMP are to:

- Determine the beneficial and adverse impacts of the proposed project;
- Propose effective measures to mitigate the adverse (negative) impacts and enhance beneficial (positive) ones;
- Outline management clauses and enforcement mechanisms to be included in the contract for the implementation of the mitigation measures; and
- Prepare management and monitoring plans indicating responsibilities and outputs.

The Proponent

Sokoto State Government is the proponent for the proposed project. The environmental consultant, Enarmac Nigeria Limited, has been appointed to apply for environmental approval of the project and is therefore the applicant for the process.

EIA Terms of Reference (TOR)

The Terms of Reference (TOR) used in guiding production of the ESMP of the proposed project are as follows:

- Define relevant framework of legal and administrative requirements for the project.
- Carry out a detailed one season Environmental baseline studies of the ambient environment;
- Identification and assess the associated and potential impacts of the proposed project;
- Design appropriate mitigation measures for such impacts and develop an effective Environmental and Social Management Plan for the project; and
- Define framework for interaction and integration of views of a multidisciplinary project team with regulators, host communities and other stakeholders.

Policy and Legal Frameworks

ESIA studies are carried out within the frameworks of both local and international policies, laws as well as environmental guidelines and regulations. The following policies, laws, principles, guidelines and regulations were specifically considered.

- The 1999 Constitution of the Federal Republic of Nigeria;
- The National Policy on Environment, NPE (1989, revised 1999);
- The National Environmental Standards and Regulation Enforcement Agency Act (No. 25 of 2007) (NESREA);
- Harmful Waste Act No. 42 of 25 November 1988;
- Land Use Act 1978;
- Environmental Impact Assessment Sectorial Guideline for Infrastructure development projects (1995) of the Federal Ministry of Environment;
- National Environmental Protection (Effluent Limitation) Regulations S.I.8 (1991)
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulation S.I. 15; and
- Other national legislations such as Penal Code.

International Standards, Treaties and Conventions

- At the international level, Nigeria is party to a number of Conventions that are relevant to the proposed development project. The more relevant ones are as follows:
- Vienna Convention for the Protection of the Ozone Layer, including the Montreal Protocol and the London Amendment;
- The Framework Convention on Climate Change, Kyoto Protocol, 1995; and
- The Convention on Biological Diversity, 1992;

EIA Procedure in Nigeria

The procedure indicates the steps to be followed from project conception to commissioning in order to ensure that the project is implemented with maximum consideration for the environment. The procedure for EIA involves the project proposal stage where the project proponent notifies FMEnv of the proposed project in writing.

This stage is followed by the screening phase, during which the Ministry will carry out, an Initial Environmental Examination (IEE) and assign the project into a category based on some of its characteristics. There are three categories (I, II, III) in FMEnv's EIA/EsMP Procedural Guideline. Category 1 projects are subjected to full-scale EIA/EMP. Projects listed in Category II may not require a full-scale ESIA/ESMP except when such a project is located in an Environmentally Sensitive Area (ESA) and in this case the project will be automatically assigned to Category I. Category III projects are those expected to have essentially beneficial impacts on the environment. The next stage is scoping stage, the main feature of which is that the proponent will be required to submit a Terms of Reference (TOR) for the proposed EIA study. This stage is followed by actual implementation of the ESIA/ESMP study, preparation of Draft Final and Final Reports, review process and approval/certification.

Need for the Project

For Nigeria to become self-sufficient, it needs to be self-reliant in terms of goods and services needed by its citizens so that its hard-earned foreign exchange can be conserved.

It is therefore imperative to implement this project so that the teeming youth in Sokoto State can acquire entrepreneurial and vocational skills for job and wealth creation leading to local and national industrial development.

Project Objectives

The overall objectives of the project are to create both direct and in-direct employment opportunities for the unemployed citizens of Sokoto State and other Nigerians.

Benefits of the project

- The key benefits associated with the project are thus as follows:
- Increased potential for local and national self –sufficiency;
- Making vocational skills accessible to all in the project area;
- Creation of job opportunities for people in the project area and the country at large;
- Creation of wealth in the project area and the country at large; and
- Boosting socio-economic activities in the project area and the country.

PROJECT DESCRIPTION

The project consists of the development of six (6) Entrepreneurship Centers one in each of the Three Senatorial Zones covering 20,000m^2 in each of the locations. At the Eastern Senatorial Zone, the centre will be situated at Government Secondary School Isa, Isa Local Government. While that of Western Zone is to be situated at GDSS, Tambuwal in Tambuwal Local Government. And that of Central Zone will be at Sultan Abubakar College, Sokoto in Sokoto South Local Government.

Similarly, one in Shehu Shagari College of Education, another one in Sokoto State University as well as One in Umaru Ali Shinkafi Polytechnic in Sokoto State. The approach would be to establish the Entrepreneurial Centers in the State for maximum impact on contributing to the elimination of rural poverty, promoting skills and jobs creation and provide decent employment to a large number of people.

Moreover, other schools and institutions within the catchment areas will also be trained by the centres. And the state government will also scaled up the project by establishing similar Entrepreneurship Centres in areas not covered by the project.

This intention is in line with prevailing African Development Bank and Federal Government policies that guarantee safeguarding lives and properties. It is also in compliance with the Federal Ministry of Environment (FMEnv) Environmental Impact Assessment Act 86 of

1992 (codified as EIA Act CAP E12 LFN2004) and Sectoral Guideline on Infrastructure (1995) and the requirement of the extant laws for any development approval.

Preconstruction activities

Preconstruction activities for this project include feasibility/technical design and environmental planning, as well as establishment of site offices.

Source of Construction Equipment

It is expected that the construction company to be awarded the contract would own all or most of the construction equipment to be utilized in executing the project.

Estimated Project Workforce

In the construction phase, the proposed project will directly employ about one hundred and twenty(120) skilled professionals as well as about eighty to a hundred unskilled employees; in the operational phase, the project will employ over a hundred skilled professionals and about fifty-seventy five (50-75) unskilled labourers depending on the number of shifts to be operated.

However, during employee recruitment, priority will be given to qualified persons from the host community, followed by those from nearby communities. This will be in accordance with a Local Content Plan to be designed by the contractor and vetted by FMEnv and Sokoto State Ministry of Environment.

Construction phase activities

The Construction Phase of this project will begin with surveying and clearing of the proposed land. Building of perimeter fence will follow and then building of workshop blocks (to house the equipment for the various vocations), office blocks, stores/warehouses and security gate houses. All buildings will be made of concrete blocks.

Laboratory and workshop equipment will then be procured and installed according to manufacturer's specifications. Afterwards, installed equipment will be test-run to ensure they have been successfully installed.

Operational Activities

Operational phase of the project will succeed the construction phase and would be characterized by training of student/trainee artisans/craftsmen and technicians. The installed equipment would also require routine maintenance in the operational phase.

Decommissioning Activities

However, in the event of, general good practice guidelines for decommissioning of infrastructure as well as the existing environmental legislation of the time would guide appropriate decommissioning. At the end of the construction phase the construction site will be rehabilitated according to recommended plans before abandonment.

ENVIRONMENTAL BASELINE DESCRIPTION

Baseline Data Acquisition Method

Environmental baseline data for this project was acquired through desktop research, field observations, sampling and measurements as well as laboratory analysis of collected samples. Prior to field investigations, background and design information on the project were obtained from the project. Wet season field work was then used to verify and complement information gathered from desktop research. The fieldwork, which took place from 20th to 25th September 2021, covered all relevant elements of the ecological and socio-economic environment.

Public consultations were held with different stakeholders on issues relating to the potential bio-physical, ecological and socio-economic impacts of the proposed project.

In situ Measurements

As recommended by FEPA (1991), in situ measurements were carried out on some physical parameters of the project environment. These parameters included: Air quality (Suspended particulate matter, SPM, COx, SOx, NOx, NH_3, H_2S, HC) Noise; and water quality (pH, temperature, dissolved oxygen concentration, total dissolved solids, conductivity, turbidity and salinity).

Sampling Criteria

Wet season sampling of flora, fauna, soil and ground water was carried out during the field work. Based on the objectives, soil and groundwater samples and as well as control samples were taken from the proposed project sites.

Soils Sampling

Surface soil was investigated through visual observation and sampling. Composite soil samples were obtained from designated sampling stations on the sites. Samples for microbiological analysis were collected in sterile McCarthey bottles and kept under 4^0C in a refrigerated container. Physico-chemical analysis of soil samples was carried out using the analytical methods recommended by FEPA (1991) in Giolee Laboratories Limited, Port-harcourt, Rivers State.

Water Quality and Hydro-biological Studies

In-situ measurements for pH, temperature, conductivity and dissolved oxygen were conducted with Pye Unicam meter on groundwater samples and their control samples. For physiochemical and microbial analysis, duplicate water samples were collected in two 1-litre plastic containers for each site, labelled and stored in an insulated refrigerated container.

All samples for laboratory analysis were taken to Lab **ANALYTICAL CONCEPT LTD**, Elelenwo District Rivers State Port Harcourt, accredited by the Federal Ministry of Environment, (see attached appendix II), this was because, according to available information, there was no any accredited environmental laboratory in Sokoto State. However, the consultant made sure that all samples for microbial analysis were appropriately preserved at 4^0C.

Socio-Economic Studies

The primary data for the study was obtained from structured questionnaires; Focus Group Discussions (FGDs), and Key Informant Interviews (KII). The questionnaire was designed to generate information on demographic structure and socio-cultural and economic characteristics of the project area.

A simplified spatial boundary considered for the socio-economic studies in this EIA comprised of communities living or carrying out business activities in locations within a two-kilometer (2km) radius from the proposed site.

The project area

Three of the proposed entrepreneurship centres will be located in Sokoto State University, Umar Ali Shinkafi Polytechnic and Shehu Shagari College of Education, all in Wamakko LGA. One centre will be located in Sultan Abubakar College of Minanata District of Sokoto South LGA. One centre will be located each of Government Day Secondary School Tambuwal and Government Secondary School Isa in Tambuwal LGA and Isa LGA respectively.

Climate

The climate of the study area is characterized by a long dry season (October/November-April/May) with a short rainy season (May-September/October), (Singh, 1995). The study area experiences harmattan wind (N-E Trade winds), which are dry, cold, and dusty blowing between the months of November to February.

Vegetation

The vegetation of the area falls within the Sudan Savannah vegetation zone characterized by soils that are mostly sandy to loamy in texture with some patches of clayey subsoil. An assortment of various species of grasses and legumes, patches of bushes and sparsely distributed indigenous tree species majority of which are thorny tree species, such trees include Acacia nilotica, Faidherbia albida, Zizipus spp, Tamarindus indica, Balanites aegyptiaca, etc, (Ango, et al., 2014).

Relief

The relief of the proposed areas for the construction of the entrepreneural and vocational centres falls within the Sokoto Basin which lies in northwestern Nigeria between latitudes 10°20' and 14°00' N and longitudes 3°30'and 6°58' E occupying about 6.4 x 104 km2 of land area (Figure 1). It falls within a region where rainfall distribution is irregular in time and space and characterized by a prolonged dry season and a short rainy season. The Sokoto sedimentary basin in northwestern Nigeria consists predominantly of a gentle undulating plain with an average elevation varying from 250 to 400 m above sea level. This monotonous plain (according to Kogbe, 1979) is occasionally interrupted by steep-sided, flat-topped hills with a low escarpment, called the "Dange Scarp" as the most prominent feature in the basin. The escarpment itself is closely related to the geology of the area and has undergone intensive erosion to the extent that the Dange Scarp is no longer recognizable today (Udoh, 1970).

The climate is semi-arid with a zone of savannah-type vegetation as part of the sub-Saharan Sudan belt of West Africa. Rainfall in the Sokoto Basin shows a marked variation, with annual mean precipitation varying from 350 mm (at Kalmalo in the extreme north) to 670 mm (at Sokoto Airport). Rainfall is concentrated in a short wet season, which extends from mid-May to mid-September whilst the dry season (with no single rain) lasts more than 7 months. Mean annual temperatures are from 21.5 to 34.9°C. The highest temperature occurs between April and July, the lowest in August (during the rainy season).

The LGA's are generally composed of undulating plains which generally rise up to about 300 m above sea level.

Geology

Sokoto State is within the Sokoto Basin, which is in the northwestern part of Nigeria, covering a surface area of about 111,925 km^2, bounded between longitudes 3.50° N to 7.00° N and latitudes 10.0°N to 14.0° N, predominantly spanning between Sokoto, Kebbi and Zamfara states. The basin

is believed to have developed by tectonic epeirogenic movements or stretching and rifting of tectonically stabilized crust during the Paleozoic era (Kogbe, 1981; Wright *et al*., 1985). The basin is underlain by crystalline basement rocks and overlying sediments. The crystalline basement rocks consist of (i) dominant crystalline complex of migmatites and gneises, (ii) N-S trending schist belt, and (iii) older granites. Overlying the basement complex rocks are successions of sediments deposited under different conditions ranging from continental to marine events (Wright *et al*., 1985; Kogbe, 1989; Obaje 2009).

Soil Physico-chemical Characteristics

The baseline concentrations of key potential pollutants from the project sites showed that all potential pollutant concentrations were below the regulatory limits stipulated by FMEnv.

Physico-Chemical Properties of Groundwater in the Project Area

Relevant physico-chemical parameters of groundwater from the project area were analyzed and the results showed that their concentrations were below the regulatory limits set by FMEnv.

Air Quality Studies

Air quality characteristics were monitored in eight (8) locations on the proposed project sites. Overall, results from the air quality monitoring exercise showed that the concentrations of gaseous pollutants were lower than the limits set by FMEnv.

Noise Level Studies

Noise level measurements were carried out directly at selected points on the respective project sites by using a very sensitive noise level meter. Noise levels recorded were all within the regulatory limits stipulated by FMEnv.

Public Consultation

Consultations were carried out with the communities in the proposed project areas and with other relevant institutional stakeholders.

Objectives of Consultation

The main objectives of these consultations were to:

- To inform stakeholders about the proposed project and its potential benefits as well as discuss environmental and social issues associated with the project and solicit for their views and concerns.
- Collect relevant information for the project design;

- To identify and mitigate impacts before the project gets underway;
- To avoid conflicts by addressing issues of concern early and continuously in the life of the project; and
- To ensure that any fears or apprehension about the nature, scale and impacts of the project have been fully addressed.

The primary institutional stakeholders consulted include FMEnv, SEPA/SOSME and LGA Councils in the respective project areas. Other stakeholders consulted include communities in Wamakko, Dogon-Daji and Isa towns and Sarkin Zamfara District in Sokoto South LGA and youth groups as well as traditional councils.

The stakeholders were consulted through visitations, KIIs and Focused Group Discussions.

Highlights from the consultation process in the project communities include the following:

- Attendance at all the consultation meetings was appreciable and cut across the different strata of the communities;
- The communities want the proponent consider some of their youths for employment in both the constructional and operational phases of the project;
- The communities also want complimentary infrastructure such as roads and drainage system; and
- Community leaders assured the meetings that they would give their moral support in the implementation of the project.

Traditional Administration

The emirate system of traditional governance is practiced in Sokoto State, with the Sultan as Head of all emirs and the leader of all Muslims in Nigeria. The District Heads of Wamakko, districts are the highest-ranking traditional rulers in the project area. They report to the Sultan of Sokoto who appointed them. They run local traditional councils that assist them in running the daily affairs of their respective districts.

Ethnic Groups.

The predominant ethnic groups in the project area are the Hausas and the Fulanis. Other ethnic groups, such as the Igbo and Yoruba and other minority tribes also reside in the area in small populations.

Population

The current population was obtained by projecting the 2006 population figure, using a conservative 2.5% population growth rate, as follows:

The population of Isa LGA (149,513), Tambuwal LGA (224,931) Sokoto South (194,914) LGA (based on the 2006 Census). The LGA's has an average of (10) district each.

Adding the population of the three LGA's = 569,358

A basic equation for getting a projection of a given population is Nt=P e (r * t); where "Nt" represents the number of people at a future time;

$Nt = P\ e^{(r * t)} = 569,358 \text{ X } 2.71828^{(0.025*14)} = 569,358 \text{ X } 1.4191 = 807,975$

Age Profile

The age distribution of respondent household heads at various locations in the study area showed a predominance of the working-age population (21 to 60 years), which is cumulatively much higher than 50% of the entire respondents in all the three districts.

Marital Status

In Wamakko 33 household heads (about 83%) are married. On the other hand, four (4) household heads (10%) are widowed while three (3) are single. In Sokoto South, Isa and Tambuwal LGAs the ratio of married to single household heads are about 82.5%, 96% and 92.3% respectively.

Educational Background

27.5% of respondents in Wamakko, Sokoto South and Isa have secondary school education, while those with primary education and Islamic/Quranic education constitute 20% each. Respondents with tertiary education and those with postgraduate level of education constitute 15% and 17.5% respectively. Wamakko LGA, being a major LGA has a larger number of both public and private educational institutions, than the other LGAs in Sokoto State as a whole.

Social Infrastructure

Wamakko, Sokoto South and Isa LGA is supplied with water by boreholes provided by both the three tiers of Government as well as by International Donor Agencies and similar organizations. Other sources of water in the project area include pipe-borne water, wells and surface water in seasonal ponds and rivers in remote parts of the project area.

Electricity in the settlement is provided by Kaduna Electricity Distribution Company (KEDCO). However, as in other parts of the country, a number of reasons have combined to impede a constant

supply of electricity in the project area which led many people to be using private electricity generating sets.

Private telecommunication companies that provide telecommunication services in form of mobile phone (GSM) and digital data services (Internet) in the project area include MTN, 9Mobile, Airtel and Glo.

Means of transportation in the study area include automobiles and bicycles, as well as animals and animal-driven carts in the rural areas.

Wamakko and Sokoto South LGA enjoys a fairly good tarred road networks. However, the network is more prominent at the city centres, while the road networks in Isa and Tambuwal LGAs are mostly occupied by untarred roads within the local communities and districts.

The project area is threatened by the activities of criminals such as kidnappers and armed bandits.

Social vices like drug abuse and prostitution take place in the project area in a very limited extent. People in the area normally frown at such vices which mainly take place in hidden or isolated areas at night.

Most people in the study area dispose of their domestic waste by open dumping. Sometimes they openly burn such refuse after gathering it over a long period of time.

Housing and Settlement Pattern

Settlements in the project area are a mixture of urban and rural with low and high residential densities. Types of houses in the study area are both modern and traditional. In major streets, houses made of cement and concrete blocks predominate, while in other smaller settlements in the outskirts and neighbouring villages, houses are mostly made of mud.

Land use

Major land use observed in the project area is agricultural, followed by residential, institutional and commercial and to a much lesser extent recreational. Agricultural land use in the project area is in form of farming and rearing of animals, while institutional land use is mostly in form of schools and administrative and office accommodation.

Economic Activities

People in the project area are predominantly peasant farmers. Other occupations in the project area include traditional crafts, petty trading, transportation services, hawking, masonry, civil service, etc. However, some respondents have multiple streams of income.

People in the project area make use of government hospitals, private clinics, off-the-shelf self-medication and also resort to consulting herbal and traditional alternative health practitioners. Primary Health Centres are owned and operated by Wamakko, Sokoto South, Isa and Tambuwal Local Government Areas in their major wards. There are also numerous private clinics in the study area, although they charge relatively higher prices for their services. According to the survey, most people prefer to use government health services in the project area.

Biological Features

Vegetation in the project area mainly composes of bushes and farm lands and is characterized by the coexistence of trees, shrubs and grasses. The vegetation zone in the area can be described as Sahel Savanna type which combines the characteristics and species of Sahel Savanna. Extensive farming is practiced in this zone and agricultural produce in the zone include vegetable, fruits and cereals. In particular, guinea corn, rice, cowpea, groundnut, onion, watermelon, soy beans, etc. are grown in the region.

The invertebrates documented in the area include gastropoda such millipedes (*Pochybolus* sp), dragon flies and butterflies were observed visiting flowers for pollination

The reptiles documented in the study area include snakes, African Chameleon (*Chameleo senegalensis*), Rainbow Lizard (*Agama agama*) etc.

The avifauna of the project area represents the diverse habitat types in the region as birds inhabit vegetation areas that are most suitable for their feeding and nesting habits. Seed and insect eating birds such as barn swallow, doves, pied crows, common thrush.

The mammals documented in the area are mostly rats, rabbit and African giant rat.

BENEFICIAL AND ADVERSE IMPACTS

The following potential and associated impacts of the proposed project were identified.

Positive Impacts in the construction phase

Significant positive impacts identified in the construction phase include surveying and clearing of the proposed lands. It will also involve provision of additional fill material for improvement of the low-lying sections of the land through provision of naturally occurring lateritic material as fill. Building of perimeter fence will follow and then building of class room blocks/warehouses (to house the trainees equipment), office blocks, power tools facilities and security gate post. All buildings will be made of concrete blocks.

All equipment will then be procured and installed according to manufacturer's specifications. Afterwards, installed equipment will then be test-run to ensure they have been successfully installed.

Positive Impacts in the operational phase

The most significant positive impact of the proposed project in this phase is capacity building and skills acquisition by the local communities, job and wealth creation that will boost socio-economic activities in the project area and lead to industrial and economic development at both the State and national levels. This phase of the project may also significantly witness increased penetration of renewable energy usage in the communities which will lead to climate change mitigation. Also in this phase provision of skill acquisition trainings, local employment and procurement opportunities to the host communities as well as a slight boost in local trading activities.

Negative Impacts in the construction phase

Negative impacts in the Construction Phase include the risks of occupational accidents and spread of Covid 19, HIV/AIDS and other communicable diseases that may be consequent upon employee social interactions with local communities.

Negative impacts in the Operational phase

Significant negative impacts identified in the Operations Phase include occupational and fire hazards as well as HSE hazards due to non-compliance with safety instructions and regulations. Another significant impact in this phase of the project is risk of kidnapping and banditry attacks.

MITIGATION AND ENHANCEMENT MEASURES

Mitigation measures have been designed for identified negative impacts. Some of these measures against the negative impacts in the construction phase include regular maintenance of construction equipment to reduce emission and soil and water pollution as well as appropriate planning of noisy

operations and provision and enforcement of use of appropriate HSE kits. As mitigation measures against Covid-19 and occupational accidents in the construction phase, employees and communities shall be sensitized on good HSE practices, PPE usage as well as HIV/AIDs/STDs protection and prevention measures.

Enhancement measures for positive impacts in construction phase of the project will include giving project host communities' procurement opportunities whenever possible as well as employing them as construction employees and developing their capacity through on-the-job training.

Mitigation measures in the Operations Phase include ensuring strict use of PPEs, good house-keeping and appropriate waste management as well as robust emergency preparedness, including having effective fire-fighting equipment as well as standby emergency medical ambulance and First Aid Kits. As mitigation against terrorist attack, a fortified perimeter fence and gate post with a round-the-clock armed security guards will be provided.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The Environmental Management Plan has been designed to provide details of management measures including actions to be taken, stakeholder roles and responsibilities, time frames and monitoring schedule for ensuring that all potential impacts are effectively managed.

The Environmental Management Plan aims at ensuring the following:

- That Environmental, Health and Safety factors are carefully managed throughout the project cycle.
- That the project complies with regulatory provisions and guidelines;
- That environmental performance is verified through information on impacts as they occur;
- That project implementation responds to unforeseen events and to changes not considered in this ESMP;
- That there is provision of feedback for continuous improvement in environmental performance;
- That institutional arrangements required to implement the environmental impact mitigation and enhancement measures are specified and include a monitoring program, for appropriate environmental parameters, to assess the success of the mitigating and enhancement measures, as well as their timely execution; and
- That an implementation schedule for the mitigation measures is provided.

The project contractor shall be responsible for the implementation of the ESMP falling under the scope of his contract. An environmental consultant shall undertake the monitoring of the ESMP for all the phases of the project, in close collaboration with FMEnv and SEPA/SOSMENV.

To ensure the success of environmental management of the project, the entire project team and other relevant stakeholders would be properly mobilized and oriented on the necessity and methods for sound and environmentally responsible project operations and delivery. The project host communities are also expected to be part of the monitoring plan to be carried out under the ESMP. Good relations and interactions between the contractor and the other stakeholders and exchange of timely information and project scheduling, duration of construction works, and minimizing potential interference with public services and business and social activities will go a long way in avoiding social conflicts. Communication channels between the contractor, host communities and other stakeholders should always be open to ensure proper and timely responses to any complaints that may arise during project execution.

CONCLUSIONS

The Environmental Impact Assessment for the proposed entrepreneurial centres was carried out in compliance with existing national and international guidelines and regulations. Relevant stakeholders were also duly consulted during the study to ensure the success of the implementation of the environmental and socio-economic management framework for the project. The study has identified the potential environmental impacts of the project and proffered appropriate mitigation measures to be carried out under this Environmental and Management Plan.

Although the project is expected to produce some negative impacts, most of which are expected to occur in the constructional phase, these impacts can be effectively mitigated by implementing the stipulated actions in the ESMP.

In conclusion, the proposed skill acquisition and entrepreneurial project is environmentally and socially justified and acceptable to the entire project stakeholders, if the Environmental and Social Management Plan is strictly implemented. The project is therefore recommended for an integrated implementation with the Environmental and Social Management Plan.

CHAPTER ONE: INTRODUCTION

1.0 BACKGROUND

Nigeria, despite its abundant human and natural resources, is contending with high rate of unemployment. Consequently, a significant population of Nigerians falls below the poverty line. To address the problem of youth unemployment and poverty, the Sokoto State Government of Nigeria plans to establish entrepreneurship and vocational education centres aimed at boosting employment and wealth generation towards socio-economic development of the State. Specifically, the Sokoto State Government intends to establish Entrepreneurship Centres at Sokoto state university, Shehu Shagari College of Education, Umar Ali Shinkafi Polytechnic and Sultan Abubakar College, which are all within Sokoto metropolis. The entrepreneurship centres will also serve as integrated facilities for skill acquisition and learning centres to other Northwestern States including Zamfara, Kebbi and Katsina States.

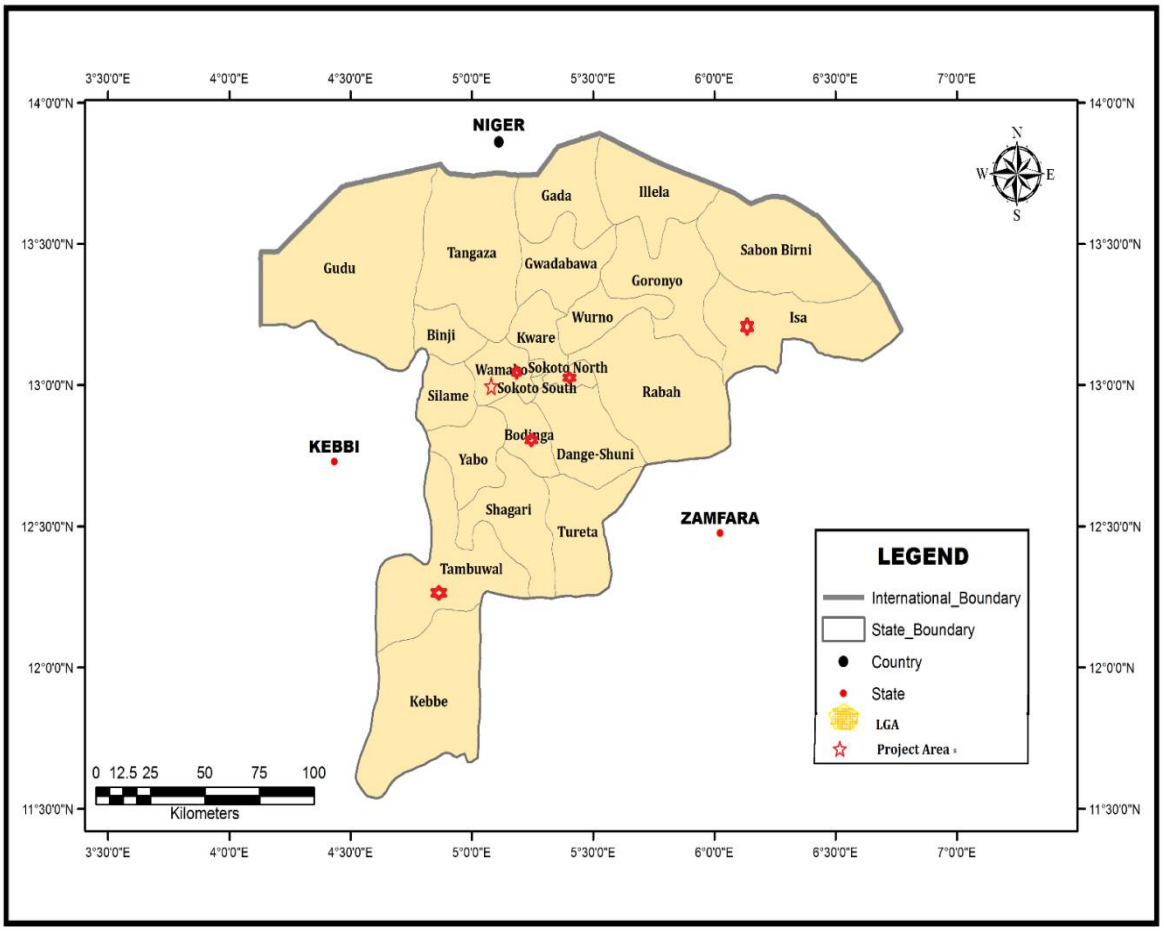


Figure 1. 1: Map of Sokoto State showing the project areas

However, development projects of this nature, if not executed in an environmentally friendly manner, tend to degrade the environment and generate adverse impacts. Consequently, the Nigerian Environmental Impact Assessment Act (Cap E12 LFN 2004) makes it mandatory for an EIA to be carried out (or an EMP be designed) before the implementation of projects with tendency to produce significant adverse environmental impacts. Similarly, the African Development Bank (AfDB) has in place an Environmental and Social Assessment Procedure (ESAP) to be followed in executing projects being funded by the Bank. In this regard, the Sokoto State Government commissioned ENARMAC Nigeria Limited to design an ESMP in line with the provisions of both the Nigerian EIA Act and the AfDB Integrated Safeguards System, for the establishment of the proposed entrepreneurship centres at the selected institutions, which is the subject of this report.

1.1 OBJECTIVES OF THE ESMP

The main aim of the ESMP is to ensure that the project complies with applicable national, environmental, social and legal requirements.

The ESMP is to specifically provide the following:

- Identify, and evaluate the impact of the proposed project on the ecological and socio-economic settings with adequate interfacing and project interaction;
- Identify the existing and expected environmental regulations that will affect the project construction and operation and advise on standards, concepts and targets;
- Identify any environmental issues and concerns that may affect the successful construction and operation of the project;
- Develop control strategies with a view to mitigating and ameliorating significant negative impacts, while enhancing positive ones;

Develop an effective Environmental and Social Management Plan (ESMP) to last the life-span of the proposed project including compliance-monitoring, auditing and contingency planning.

1.1.1 Project Objectives

The main objectives of the project include equipping youth in the state with entrepreneurship education thereby making them graduates with adequate skills for the man power need of the State which will in turn stimulate industrial and economic growth of rural and less developed areas and the State in general. Furthermore, the entrepreneurship education centres will:

- Offer functional education for self-reliance;

- Provide adequate training for discovering novel business ideas; and
- Serve as a catalyst for economic growth and development among others.

The project is aligned with the federal government of Nigeria's initiative known as the Entrepreneurship Education Program (EEP) which aims to inculcate in youth trainees the ability to identify and solve problems using critical and creative thinking, work effectively with others as proactive team members and cultivate the ability to resolve conflict, communicate and negotiate effectively and reflect on experience and explore various strategies for effective learning at all times. In the short and long terms, the project will provide employment opportunities (direct and in-direct) for substantial number of the inhabitants of the affected host communities in the State.

1.1.2 SCOPE OF WORK

The scope of work undertaken by the Consultant included the preparation of the ESMP whose purpose was to define and reach an agreement with project sponsors concerning the following:

- Comprehensive literature reviews to generate background information on the environmental characteristics of the study area of the associated substation;
- Review of National and International Environmental regulations on and substations' construction;
- One wet season detailed environmental baseline data collection and laboratory analysis to fill information/data gaps;
- Identification of potential and associated impacts;
- Development of effective mitigation, enhancement and control measures; and
- Preparation of a robust Environmental and Social Management Plan (ESMP).

1.1.3 METHODOLOGY

Generally, the study involved desktop studies, field research, consultation, impact assessment and proffering of mitigation measures and the development of an Environmental and Social Management Plan (ESMP). The approach used involved the use of a blend of multidisciplinary standard methods used in obtaining basic data for impact prediction/identification which was followed up with designing of appropriate mitigation measures.

The ESMP Methodology adopted for this study is shown in Figure 1.3 below.

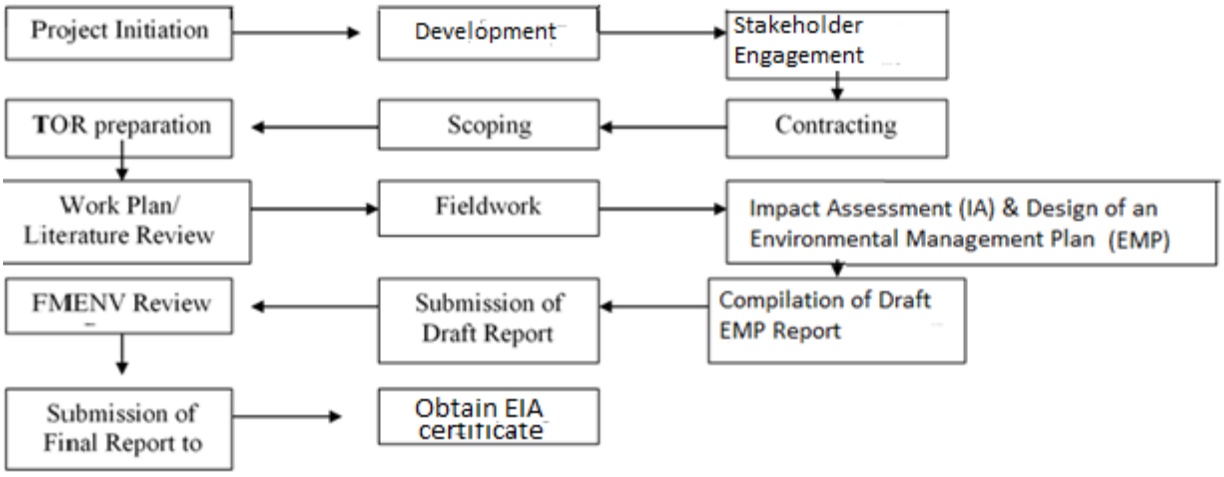


Figure 1. 2: EIA design methodology

1.1.3.1 Desktop Studies

Desktop study was undertaken to acquire information on climate, geology, soil, groundwater, socio-economics characteristics of the project area, proposed interventions, legal, institutional and organizational framework, entrepreneurship sector and the historical background, Nigerian legislations and the World Bank safeguard policies related to the project, environmental and social standards and guidelines for related environmental and social issues and web based resources which help in environmental components of the proposed project area. The materials consulted included textbooks, articles, maps and previous EIA reports, such as the Proposed 3rd Line Cement Production Expansion and 48MW Gas Fired Power Plant in KM 10 Kalambaina Road Wamakko LGA, Sokoto State by Cement Company of Northern Nigeria and that of Kalambaina Fertilizer Blending Plant in Sokot State.

1.1.3.2 Impact Identification and Evaluation

The potential adverse and beneficial impacts of the proposed project were identified by considering and studying the interactions of the environmental components with the existing environment at the mobilization/site preparation, civil works/construction, and maintenance phases. The EIA Sectoral Guidelines for Infrastructure Projects (FEPA 1995), the World Bank Environmental Assessment Source Book (1991), and the conceptual project description among other sources/references were used in the process. Evaluation of the identified impacts was carried out using such criteria as legal/regulatory requirements in respect of planned activities, magnitude of impact, risk posed by impacts, public perception and importance of affected environmental components.

1.1.3.3 Impact Mitigation

In proffering mitigation measures to prevent, reduce or control the adverse impacts of the proposed project, professional judgment (based on scientific deduction), project experience, knowledge of the ecosystem in which the proposed project shall be located and consensus of opinions among others were considered.

1.1.3.4 Terms of Reference

The Terms of Reference (TOR) used in guiding the execution and implementing the ESMP of the proposed entrepreneurship and vocational education centres is as detailed below:

- To define relevant framework of legal and administrative requirements for the project;
- To carry out a detailed one season environmental baseline studies of the project environment;
- To identify and assess the associated and potential impacts of the proposed project; and
- To identify appropriate mitigation measures for such impacts; and
- To develop an effective Environmental and Social Management Plan for the project.

1.1.3.5 National EIA Procedure

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

The procedure for EIA involves the project proposal stage where the project proponent notifies FMEnv of the proposed project in writing.

This stage is followed by the screening phase, during which the Ministry will carry out, an Initial Environmental Examination (IEE) and assign the project into a category based on some of its characteristics such as magnitude, environmental risks and their significance, etc. The location of the project if in Environmentally Sensitive Areas (ESAs) is also an important criterion in project categorization. There are three categories (I, II, III) in FMEnv's EIA/ESMP Procedural Guideline. Category 1 projects are subjected to full-scale EIA/EMP. Projects listed in Category II may not require a full-scale EIA/ESMP except when such a project is located in an Environmentally Sensitive Area (ESA) and in this case the project will be automatically assigned to Category I. The requirement for Category II projects is a partial EIA/ESMP. Category III projects are those expected to have essentially beneficial impacts on the environment. For projects in this category,

the Ministry will issue an Environmental Impact Statement (EIS). Projects in this category include family planning programme, environmental awareness projects, etc.

Another stage of FMEnv's EIA/ESMP procedure which comes up after the project proposal stage in the scoping stage, the main feature of which is that the proponent will be required to submit a Terms of Reference (TOR) for the proposed EIA study. This stage is followed by actual implementation of the EIA/ESMP study, preparation of Draft Final and Final EIA/ESMP Reports, review process and approval/certification.

Figure 1.3 below is a schematic summary of the national EIA process.

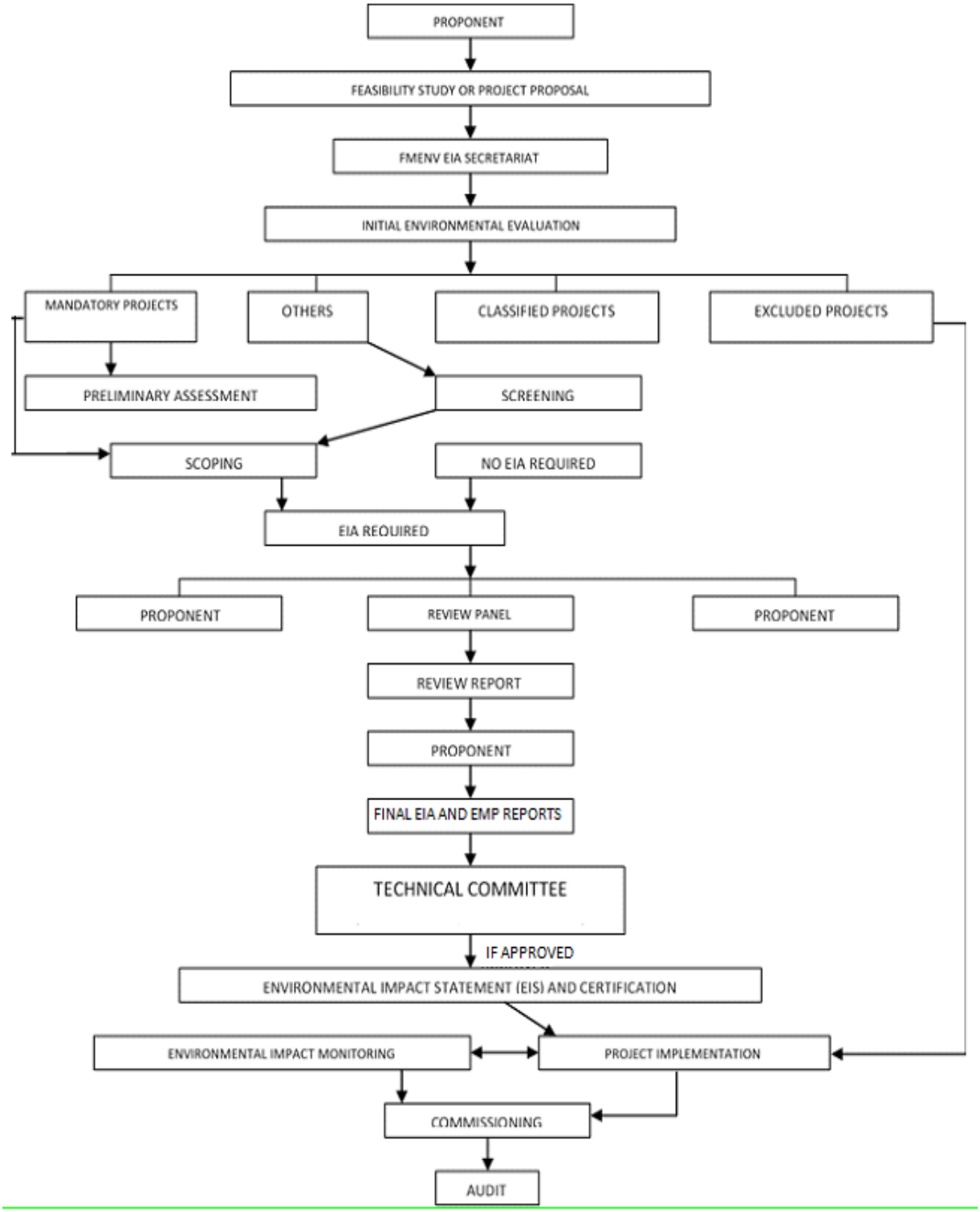


Figure 1. 3: Nigerian EIA procedure

The following procedures/phases were followed in the preparation of this ESMP:

In addition to a literature review, structured site visits were undertaken to collect primary data and to get stakeholders perceptions about some issues, especially social issues, such as:

- The current environmental situation on site and surrounding the project area as well as the natural condition of the project area;
- Ideas for maximizing the positive benefits especially on people's livelihoods and the economic development of the project;
- A reconnaissance survey was first undertaken to familiarize the ESMP Team with the proposed project area and to facilitate concept design of field work execution. Baseline data gathering and laboratory analysis were then carried out to verify and complement information obtained from literature search. The fieldwork was undertaken in September 2021 and it covered all the relevant aspects of the ecological and socio-economic environment.
- Stakeholder consultation is a very important aspect of the ESMP study. The result of the process, forms the basis for consultation with key stakeholder

1.2.0 Relevant National Environmental Policies and Regulations

1.2.1 Relevant Nigerian Government Policies

The Government of Nigeria has a number of policies, which have come into existence over the years, for the safeguard of the Nigerian environment. The following policies are worthy of being presented here.

1.2.2 National Policy on Environment, 1989 (revised 1999)

The National Policy on Environment was formulated in 1989 and revised in 1999. The ultimate aim of the National Environmental Policy of Nigeria is the achievement of Sustainable Development of the country as stated in Section 20 of its 1999 Constitution which provides that ''the State shall protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria'' . In addition, Nigeria is a signatory to a number of international treaties and conventions governing environmental issues.

In the Policy, guidelines and strategies are defined for securing for all Nigerians a quality of environment adequate for their health and well-being; conserving and using the natural resources for the benefit of present and future generations; raising public awareness and promoting understanding of the essential linkages between the environment, resources and development;

and cooperation with other countries, international organizations and agencies to achieve optimal use of trans-boundary spaces in order to protect environmental resources.

Environmental protection policy framework in Nigeria is guided by the following environmental concepts:

- Public Trust Doctrine
- Environmental Offsetting Principle
- Polluter Pays Principle
- User Pays Principle
- Precautionary Principle
- Pollution Prevention Pays Principle
- Inter-generational Equity Principle
- Intra-generational Equity Principle
- Participation Principle

1.2.3 National Climate Change Policy and Strategy

Nigeria is serious about converting the challenge of climate change. In this regard, it now has a National Adaptation Strategy and Response Plan (NASPA) as well as a Climate Change Department in its Federal Ministry of Environment. Among its other mandates, the Department is to implement the Climate Change Convention and the Kyoto Protocol activities. Nigeria has several policies and strategic initiatives which when properly implemented can mitigate climate change and serve as adaptive measures. Many of the policy initiatives are anticipatory adaptation measures and plans which can be further developed into policy options for climate change response in the country.

1.3. Guiding Principles

The Nigerian climate change policy is guided by a number of principles including the following:

- The strategic climate change response is consistent with national development priorities;
- Climate change is addressed within the framework of sustainable development which ensures that response is sensitive to issues of equity, gender, youth, children and other vulnerable groups;
- National energy use is pursued within the broad context of sustainable development;

- The policy is integrated with other interrelated policies that promote economic and environmental efficiency;
- Climate change is cross-cutting and demands application across various governmental, communal, industrial, business and concerned stakeholder sectors;
- Climate change response provides viable entrepreneurial opportunities.

1.3.1 Strategic Objectives of the Policy

The strategic goal of response to climate change policy in Nigeria is to foster low-carbon, high growth economic development path and build a climate resilient society through the attainment of the following objectives:

- Implement mitigation measures that will promote low carbon, sustainable and high economic growth;
- Strengthen national capacity to adapt to climate change;
- Promote climate change-related technology and R&D that will enable the country to better participate in international cooperation on climate change;
- Significantly increase public awareness and involve private sector participation in addressing the challenges of climate change;
- Strengthen national institutions and mechanisms to create a suitable and functional framework for climate change governance.

1.3.1.2 Policy Response Approaches

Key policy approaches to be used in providing a framework for development and implementation of sectored strategies for effective response to climate change include:

- Generating adequate non GHG energy mix for rapid socio-economic development;
- Continuously reducing GHG emissions in all sectors, especially in the oil and gas and transportation sectors;
- Enhancing food security , reducing poverty and promoting healthy living for all Nigerians;
- Integrating disaster risk management of climate-related hazards into development.

1.3.1.3 Sectoral adaptation and Mitigation Measures

The Climate Change Policy and Response Strategy has identified adaptation and mitigation interventions in key sectors that include energy, agriculture, water, coastal areas, forestry, land-use, transport, health, culture/tourism, population/human settlement, ICT, etc.

1.4. Legal and Institutional Framework

Generally, there are a number of national and international laws and regulations dealing with development, health and environmental matters. The major laws applicable to this project include:

1.4.1.1 Environmental Impact Assessment (EIA) ACT 86, CAP E12, LFN 2004

This deals with considerations of environmental impact in respect of public and private projects.

Section 2 (1) requires an assessment of public or private projects likely to have a significant (negative) impact on the environment.

Section 2 (4) requires an application in writing to the FMEnv before embarking on projects for their environmental assessment to determine approval.

Section 13 establishes cases where an EIA is required and

Section 60 creates a legal liability for contravention of any provision

1.4.1.2 Factory Act CAP F1, LFN 2004

The Act enjoins the contractor to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions, and is further obliged to provide necessary information, instructions, training and supervision to ensure the health and safety at work of those other workers engaged in a particular work.

1.4.1.3 Land Use Act Cap. L5, 2004

The Land Use Act of 1978 vests all land situated in the territory of each State (except land vested in the Federal Government or its agencies) solely in the Governor of the State, who would hold such land in trust for the people and would henceforth be responsible for allocation of land in all urban areas to individual residing in the State and to organizations for residential, agriculture, commercial and other purposes. Similar powers with respect to non-urban areas are conferred on Local Governments. The Law commenced from 27th March 1978.

The above act guided the acquisition of farmlands to be used for the proposed project.

1.4.1.4 Nigerian Urban and Regional Planning Act Cap N138, LFN 2004

The Urban and Regional Planning Act is aimed at overseeing a realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions. In this regard, the following sections become instructive:

Section 30 (3) requires a building plan to be drawn by a registered architect or town planner.

Section 39 (7) establishes that an application for land development would be rejected if such development would harm the environment or constitute a nuisance to the community.

Section 59 makes it an offence to disobey a stop-work order. The punishment under this section, is a fine not exceeding N10, 000 (Ten thousand naira) and in the case of a company, a fine not exceeding N50, 000.

Section 72 provides for the preservation and planting of trees for environmental conservation. The above provisions would be respected in obtaining building approval and permits from relevant authorities.

1.4.1.5 Workers Compensation Act 1987

An Act to provide for the compensation and rehabilitation of workers in respect of work related injuries This Act works with the Workplace Injury Management and Workers Compensation Act 1998 and associated regulations in the provision of the Workers Compensation Scheme.
Essentially the Act:
- establishes that where a worker is injured during the course of employment, the employer has liability for such injury.
- seeks to ensure that a worker, suffering such an injury, should receive appropriate compensation arising from the employers liability.
Under the Act, employers has a duty to appropriately insure its employees for injuries incurred during the course of employment and further, has a duty to disclose relevant information that would affect the calculation of the premium payable.

1.4.1.6 Public Health Law Cap 103 LFN 1990

Public Health Law examines the authority of the government at various jurisdictional levels to improve the health of the general population within societal limits and norms. The State is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. The law prohibits the public or private sector of the economy not to undertake or embark on or authorize projects or activities without prior consideration of the effect on the environment.

1.4.1.7 Harmful Wastes (Special Criminal Provisions etc.) Act CAP HI LFN 2004.

An Act to prohibit the carrying, depositing and dumping of harmful waste on any land, territorial waters and matters relating thereto. Specifically, Section 1 of the Act prohibits all activities relating to the purchase, sale, importation, transit, transportation, deposit, storage of harmful wastes. Section 6 of the Act spells out the penalty for offences under the Act to include life imprisonment for individual and appropriate punishment for corporate bodies.

1.4.1.8 Labour Act (Cap L1 LFN 2004)

Provides comprehensive legislation on conditions of work and employment. Part I sets out general provisions relating to wages, contracts and terms of employment. Employers shall not advance more than one month's wages to an employee (s. 4). Section 8 requires that workers entering a contract be medically examined at the employer's expense. Section 20 governs redundancy. Part II regulates recruiting, including the licensing of recruiters (s. 25), and the right to be accompanied by family (not exceeding 2 wives) (s. 34). Part III relates to special classes of workers, including apprentices (ss. 49-53), women (ss. 54-58), and young persons (ss. 59-64). In general, women and young persons are prohibited from performing underground and night work. Section 73 prohibits forced labour. Part IV contains supplemental provisions relating to administration and the settlement of disputes. Section 90 repeals the Labour Code Act.

1.4.1.9 National Policy on Occupational Safety and Health (2016)

The National Policy on Occupational Safety and Health, a guide to Occupational Safety and Health in Nigeria is the government approach for achieving a National development philosophy of building a united, self-reliant and egalitarian economy through minimising so far as is reasonably practicable, the causes and effects of hazards inherent in the working environment in response to her ratification of Convention 155 on Occupational Safety, Health and Working Environment. The Policy came into force in November, 2016.

1.4.1.10 Endangered Species Act

The Nigeria Endangered Species (Control of International Trade and Traffic) Act Decree No. 11 Of 1985: Nigeria's endangered species act provides for the conservation and management of ***Nigeria's*** wildlife and the protection of some of her ***endangered species*** in danger of extinction as a result of over-exploitation, as required under certain international treaties to which ***Nigeria*** is a signatory.

These laws prohibit and spell out some degrees of punishment for the endanger laws breakers. The law clearly states that:

- Prohibition of hunting of or trading in wild animals, this means that no person shall hunt, capture, trade-in, or otherwise deal with an animal species specified to be endangered

species, being animals which, though not necessarily now threatened with extinction, may become so threatened unless trade in respect of such species is controlled

- Regulation of export and import of species specified as endangered species animals, this states that no person shall trade in any animal specified under the Endangered Species act of 2014 as amended.

1.4.1.11 NATIONAL BUILDING CODE

National Building Code will open a new vista in the Building Industry and eliminate or reduce to the bare minimum the incidents of collapsed building syndrome in Nigeria; promote safety and qualitative housing for every Nigerian. To achieve these laudable objectives, every tier of government, (federal, state and local) must imbibe the spirit and intent of this Code. To this end, State Governments are implored to integrate the provisions of this Code into their local laws particularly those relating to Design, Construction and Maintenance (Post Construction) and efficiently monitor the implementation of the Code. I also charge the relevant professional bodies who have participated in producing this Code not to rest on their oars. They should encourage their members to religiously observe the provisions of this Code.

1.4.1.12 Environmental Audit (EA)

Many different definitions are reflecting different emphases and objectives of environmental audit, but the critical elements are that the audit should be objective, systematic, and based on defined criteria. EA is a management tool comprising a systematic, documented, periodic, and objective evaluation of how the environmental organization, management, and equipment are performing with the aim of helping to safeguard the environment.

In an industrial context, the main objective of the Environmental Audit is to understand the scale and sources of the pollution problems at a facility or in a defined area and to set out the option available for dealing with the problems.

EA is applied to an existing project rather than new development as required by the Environmental Impact Assessment (EIA) Act. EA is but one of many environmental management tools that are used to assess, evaluate, and manage environmental and sustainability issues. This tool can be used in various ways but also has its limitations.

Environmental Audit is designed to protect the environment with the aim of:

- assessing performance against a set of requirements or targets, related to specific issues;
- evaluating compliance with environmental legislation and corporate policies;

- measuring performance against the requirements of an environmental management system standard; and
- exploring the potential economic, social, and environmental benefits that improved performance can achieve.

1.4.1.13 Pollution Abatement in Industries and Facilities Generating Wastes (Regulations, 1991)

The Regulations prohibit industry or facility from release of hazardous or toxic substances into the air, water of Nigeria's ecosystems beyond the permissible limits of FMEnv. The Regulations further charge any industry or facility to:

- Establish and maintain a pollution monitoring unit within their premises;
- Ensure on site pollution control; and
- Assign the responsibility for pollution control to a person or body accredited by the FMEnv. Section 5 of the Regulations mandate industry or facility to submit to the nearest office of FMEnv a list of chemicals used in the manufacture of its products, details of stored chemicals and storage conditions and where these chemicals were obtained, bought or sold.

1.4.1.14 State Legislations

In order to protect public health and safety, and to restore and enhance environmental quality, and sustain economic vitality through effective and efficient implementation of environmental programmes, Sokoto State has a State Ministry which is empowered by the State Government to give direction to all issues concerning the environment, monitor and control pollution and the disposal of solid, gaseous and liquid wastes generated by various facilities in the states.

Some of the functions of the Sokoto State Ministry of Environment include:

- Liaising with the Federal Ministry of Environment, FMEnv to achieve a healthy or better management of the environment via development of National Policy on Environment;
- Co-operating with FMEnv and other National Directorates/Agencies in the performance of environmental functions including environmental education/awareness to the citizenry;
- Responsibility for monitoring waste management standards;
- Responsibility for general environmental matters in the State; and
- Monitoring the implementation of EIA/ESMP studies and other environmental studies for all development projects in the State.

Generally, State laws on environment are still in the evolving stages. Specifically, for EA, the States rely on that of the Federal Government, the EIA Act 86.

Sokoto State Ministry of Lands and Housing

The Ministry ensures efficient and effective land resource management which promotes equitable access, enabling environment for land delivery, land information and ability to contribute to sustainable socio-economic development of the state.

Sokoto State Environmental Protection Agency (SEPA)

The SEPA is mandated to set environmental quality standards and ensure compliance with pollution control. It is responsible for the implementation of environmental policies towards protection, sustenance and development of the environment.

SEPA was established by an edict No 10 of 1994 as amended by Edict No. 3 of 1997. Its objectives include:

- Implementation of environmental policies towards protection, sustenance and development of the environment.
- Identifying detecting and evolving environmental problems such as pollution, desertification, soil degradation, bush burning, indiscriminate felling of trees, protection of water and air among others.

Sokoto State Local Government Area (LGA's)

Decree No 12, 1989 of the Federal Republic of Nigeria, vested the statutory function of refuse management in the local council under its primary health care department. The LGAs being the third tier of government also ensures economic planning and development of the communities under their area of influence. The common interest of these communities, traditional association and administrative convenience of the communities is equally administered by the local government councils.

1.5 Applicable International Legal and Administrative Instruments

Some of the relevant international instruments to which Nigeria is a signatory include:

- Convention Concerning the Protection of the World Cultural and Natural Heritage Sites (World Heritage Convention) 1975;

- United Nations Framework Convention on Climate Change (1992);
- African Convention on the Conservation of Nature and Natural Resources (1969);
- Convention on the Conservation of Migratory Species of Wild Animals (1979); and
- Agenda 21 – United Nations Conference on Environment and Development.

1.5.1.1 AfDB's Safeguard Policies and Procedures:

1.5.1.2 Integrated Safeguard System (ISS)

African Development Bank has established an Integrated Safeguard System (ISS) for a comprehensive project review and ensuring across the board perspective of environmental and social linkages. The ISS comprises of four components, that existed separately but with identifiable operational weakness. The components include;

- Integrated Safeguard Policy Statement (ISPS)
- Operational Safeguards(OS)
- Environmental and Social Assessment Procedures (ESAPs)
- Environmental and Social Impact Assessments (ESIAs)

Integrated Safeguard System (ISS) comprises five operational safeguards addressing the following fields;

- Environment
- Involuntary Resettlement
- Gender
- Climate risk management and adaptation
- Civil society engagement framework
- Health
- Integrated water Resources management
- Agriculture and rural development
- Poverty reduction

The five specific Operational Safeguards are briefly described below:

Operational Safeguard 1 (OS 1)

This is the main safeguard that guides environment and social assessment as well as climate issues. The safeguard governs the process of determining the environmental and social assessment

requirements of a project. OS1 is designed to identify, assess and manage potential environmental and social risks and impacts including climate change issues. More specifically, OS1 achieves the following;

- Identify and assess risks and impacts,
- Avoid and/or minimize, risks and impact,
- Provide for stakeholders' participation.
- Ensure effective management of risks and impacts
- Contribute to capacity building elements.

In the categorization requirements OS 1-5 are also considered as support safeguards. Environmental and Social Impact Assessments (ESIA) studies are undertaken on clearly defined projects while Environmental and Social Management Framework (ESMF) is prepared for programmes or plans with a multiplicity of uncertain projects.

Operational Safeguard 2(OS 2)

This safeguard focuses on involuntary resettlements, land acquisition, population displacements and requirements and compensation. It consolidates the policy commitment and requirements on involuntary resettlements and incorporates improvements operational effectiveness.

Operational Safeguards 3 (OS 3)

This safeguard is designed to govern biodiversity and ecosystem services for the conservation and promotion of sustainable use of natural resources. Among the focus is on the integrated water resources management where commitments translated into operational requirements.

Operational Safeguard 4(OS 4)

OS4 governs pollution prevention and control, hazardous materials and resource efficiently. It covers a wide range of impacts arising from pollution, wastes and hazardous materials and particularly those under international conventions and regional standards. This also includes greenhouse accounting. The OS4 principles also support OS1 described above.

Operational safeguard 5 (OS 5)

Labour conditions, health and safety are a major concern in projects. The Bank therefore, has established OS5 to address requirements concerning works conditions, rights and protection from abuse and/or exploitation.

1.6. Project Categorization

Project screening through OS1 and supported by OS1-5 leads to categorization of projects. The project categories are guided by considered linkage levels as follows;

Category 1: Bank Operations Likely To Cause Significant Environmental and Social Impacts

Category 1 projects are those that are likely to induce significant and/or irreversible adverse environmental and/or social impacts, or to significantly affect environmental or social components that the Bank or the borrowing country considers sensitive. Some operations or other regional and sector programme loans that have significant adverse environmental or social risks are deemed to be Category 1. In some cases, projects are included in Category 1 because of their potential cumulative impacts or the potential impacts of associated facilities.

Any project requiring a Full Resettlement Action Plan (FRAP) under the provisions of the Bank's policy on involuntary resettlement is also deemed to be Category 1. Category 1 programme-based operations or regional and sector loans require a SESA, and Category 1 investment projects require an ESIA, both leading to the preparation of an ESMP. For a project requiring a FRAP, the ESIA includes, and if there are no other issues requiring assessment may be limited to, the social assessment needed to prepare the FRAP.

Category 2: Bank Operations Likely To Cause Less Adverse Environmental and Social Impacts than Category 1.

Category 2 projects are likely to have detrimental site-specific environmental and/or social impacts that are less adverse than those of Category 1 projects. Likely impacts are few in number, site-specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating intentionally recognized design criteria and standards. An operation that involves resettlement activity for which an Abbreviated Resettlement Action Plan (ARAP) is required under the ESAPs is classified as category 2.

Most programme based operations and regional or sector programme loans designed to finance a set of subprojects approved and implemented by the borrower or client are included in this category unless the nature, scale or sensitivity of the intended pipeline of subprojects involves either a high level of environmental and social risk or no such risk. Category 2 projects require an appropriate level of environmental and social assessment (SESA for programme operations, investment loans,

and some corporate loans, or ESIA for investment projects) tailored to the expected environmental and social risk so that the borrower can prepare and implement an adequate ESMP (for an investment project) or ESMF (for a programme operation) to manage the environmental and social risks of subprojects in compliance with the Bank's safeguards.

Category 3: Bank Operations with Negligible Adverse Environmental and Social Risks

Projects in this category do not directly or indirectly affect the environment adversely and are unlikely to induce adverse social impacts. They do not require an environmental and social assessment. Beyond categorization, no action is required. Nonetheless, to design a Category 3 project properly, it may be necessary to carry out gender analysis, institutional analysis, or other studies on specific, critical social considerations to anticipate and manage unintended impacts on the affected communities.

Category 4: Bank operations involving lending to financial intermediaries

Projects in this category involve Bank lending to financial intermediaries that on-lend or invest in subprojects that may produce adverse environmental and social impacts. Financial intermediaries include banks, insurance, reinsurance and leasing companies, microfinance providers, private equity funds and investment funds that use the Bank's funds to lend or provide equity finance to their clients. Financial intermediaries also include private or public sector companies that receive corporate loans or loans for investment plans from the Bank that are used to finance a set of subprojects. Financial intermediary subprojects equivalent to Category 1 and Category 2 are subject to the relevant OS requirements, as if they were directly financed Category 1 or Category 2 projects. However, if a client will use a Bank corporate loan to finance high-risk investment projects known at the time of loan approval, the loan can be considered Category 1.

1.6.1.1 Key Environmental and Social Components

While assessment contents depend on the nature and scope of the project, plan or programme, there are typical environmental and social components in the human and natural environments that should be considered.

1.6.1.2 Human Environment

The components to consider in the human environment include the elements and characteristics of the social, cultural and economic environments as well as infrastructures and services and land use patterns in the project area and its zone of influence.

(i) Under the social environment, the proponent must consider issues related to: population, gender, health, civil society, and societal framework.

(ii) Under the cultural environment, consideration should be given to issues such as: cultural heritage, customs and traditions, traditional activities, fundamental values, religious and/or ancestral beliefs, ethnic dialects, leisure, etc.; right and use of natural resources related to cultural practices (religious sacrifices, traditional medication, etc.); Cultural factors contributing to excluding some groups from development benefits; Major concerns, opinions, interests, and aspirations of local populations; Environmental problem awareness, attitude towards nature; architectural, archaeological and landscape heritage, as well as any other heritage element protected or not by laws or regulations.

(iii) Under economic environment, issues to consider include major economic activities at the local and regional levels and growth trends; right, use and dependence on renewable natural resources; inequality patterns, economic differences and poverty determinants; Working conditions and employment situation in the region; infrastructure and services; and land use patterns.

1.6.1.3 Natural Environment

The components to consider in the natural environment include:

(i) Climate, weather conditions and air quality and regional conditions (microclimate, meso-climate or macroclimate), emphasizing aspects that may affect the project's activities.

(ii) Geology, topography and soil issue the local and regional levels, emphasizing vulnerable or problematic aspects of land and soils, as well as topographic characteristics which may be modified by the project.

(iii) Water and hydrologic cycle including surface water, ground water, near-shore waters, coastal shores and seas.

(iv) Ecosystem types, functions, protected areas and sensitive zones, integrity, interactions, conservation and protection measures.

(v) Vegetation types, characteristics, biodiversity, threats, conservation and protection measures.

(vi) Wildlife biodiversity ecological and behavioural characteristics, threats, conservation and protection measures.

1.6.1.4 Environment and Social Impact Assessments

The following provides a summary of the objectives of an ESIA in accordance with the AfDB guidelines; it presents the scope of work to be carried out and the key tasks to be undertaken during

the study. Major tasks that shall be highlighted in this section because of their importance in the preparation of an ESIA include among others.

(i) Describing the proposed project by providing a synthetic description of the project relevant components and presenting plans, maps, figures and tables.

(ii) Identifying the policy, legal and administrative framework relevant to the project.

(iii) Defining and justifying the project study area for the assessment of environmental and social impacts.

(iv) Describing and analyzing the physical, biological and human environment conditions in the study area before project implementation. This analysis shall include the interrelations between environmental and social components and the importance that the society and local populations attach to these components, in order to identify the environmental and social components of high value or representing a particular interest.

(v) Presenting and analyzing alternatives to the proposed project, including the "without project" option, by identifying and comparing the alternatives on the basis of technical, economic, environmental and social criteria.

(vi) Identifying and assessing potential importance of beneficial and adverse environmental and social, direct and indirect, short and long-term, temporary and permanent impacts for the selected alternative on the basis of a rigorous method.

(vii) Defining appropriate mitigation/enhancement measures to prevent, minimize, mitigate, or compensate for adverse impacts or to enhance the project environmental and social benefits, including responsibilities and associated costs.

(viii) Developing an environmental and social monitoring program, including indicators, institutional responsibilities and associated costs.

(ix) Preparing a resettlement plan, if required.

(x) Carrying out consultations with primary and secondary stakeholders in order to obtain their views on and preoccupations about the project. These consultations shall occur during the preparation of the ESIA Report to identify key environmental and social issues and impacts, and after completion of the draft ESIA Report to obtain comments from stakeholders on the proposed mitigation/enhancement measures.

(xi) Preparing an Environmental and Social Management Plan (ESMP). This management plan shall be presented as a distinct document from the ESIA Report.

1.6.1.5 AfDB Guidelines on Cooperation with Civil Society Organization

The AfDB considers the African civil society as a primary stakeholder and help to enhance transparency and accountability due to the need to change information disclosure policies and enhance participation of stakeholders in the bank operations. The civil society includes groups such as the; non- governmental Organization (NGO's), community Based Organizations (CBO's), people's organization, trade unions and religion groups among others. The civil society organizations are central to the banks efforts to implement the participatory approaches especially in reaching to the poor people and women which are the priority target groups who have little influence and control over decisions and actions that affect their lives.

Africa Development Bank (AfDB) has adopted an integrated approach to environmental assessment in the so-called Integrated Environmental and Social Impact Assessment (IESIA) guidelines. The Guidelines' major objective is to provide reference material on how to adequately consider cross-cutting themes while assessing the environmental and social impacts of a project. The IESIA Guidelines assist in the project design, as many potential adverse impacts can be avoided or mitigated by modifying or adding certain project components to the initial design. They also provide guidance on how to adequately consider cross-cutting themes in both the preparation and assessment phases. The cross-cutting themes prioritized by the Bank are the following: poverty, environment, population, gender and participation. In addition, the Bank has recently adopted health priorities that are transversal issues by nature: HIV/AIDS and Malaria control. Consequently, health outcomes are also considered as a cross-cutting theme in the IESIA Guidelines. There are several operational principles discussed in the guidelines;

(i) Gaining and providing information: The bank is expected to make available information to the public and also draw knowledge, information from them. The regional member country authorities are expected to be responsive to the civil societies' requests, issues and concerns on bank supported programmes and projects,

(ii) Involvement of the civil society organizations (CSO) in policy making: The bank collaborates with the civil society organizations and the regional member country to factor in the interest of the stakeholders in both policy and project activities. The bank takes deliberate measures to remove barriers such as gender biases and other inequalities to allow effective participation,

(iii) Civil Society Participation in operation: It's the responsibility of the region member country to give responsibility to the CSO in programs financed by the bank loans,

(iv) To foster effective CSO involvement the AfDB request the regional member country to provide institutional support to CSO for capacity building purposes,

(v) The AfDB remains optimistic and committed to effective engagement with the CSO in the future.

1.6.1.6 AfDB Policy on Poverty Reduction

Poverty is not limited to the lack of the physical resources for development but also rooted in the inability of poor people to influence forces and decisions that shape their lives. AfDB considers the empowering of the poor people to actively participate in the development interventions for sustainable poverty reduction. The main objective of this policy is to provide a framework for action by putting poverty reduction at the centre of bank lending and non-lending activities for the regional member country.

There are several guiding principles highlighted in the policy. These include:

(i) The bank focuses in the analysis of incidences and in-depth causes of poverty in Africa and these consequently results in formulation of policies and intervention mechanisms;

(ii) Support for national capacity building, promotion of participatory approach, development on the new forms of partnership and establishment of poverty monitoring systems;

(iii) Internal policy coherence to strengthen the existing sector policy and fill gaps in specific areas from poverty reduction;

(iv) Requires a strong partnership that facilitates the consistence between the bank poverty policy and poverty reduction strategies;

(v) Handles the new conceptual framework that expands the concept of poverty beyond income measures and its causes; addresses the economic and non-economic causes of poverty;

1.6.1.7 Operational Safeguard (OS) Triggered and Project Categorization

Sokoto State entrepreneurship centres will trigger the entire (OS 1-5) Operational Safeguards in the AfDB's ISS, although to varying degrees.

Therefore, this project requires an appropriate level of environmental and social assessment, ESIA, tailored to the expected environmental and social risk so that the borrower can prepare and implement an adequate ESMP to manage the environmental and social risks of subprojects in compliance with the Bank's safeguards.

The Nigerian Constitution allows States to make legislations, laws and edicts on the Environment. The FEPA Amended Act No. 58 of 1988 also recommends the setting up of State Environmental Protection Agencies (SEPA), to participate in regulating the consequences of project development on the environment in their area of jurisdiction. SEPA's thus have the responsibility for environmental protection at the state level within their states. The functions of the SEPA include:

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

In accordance with the provisions of Section 24 of FEPA Act 58 of 1988 (Cap 131 LFN 1990), State Environmental Protection Agency was formed in Sokoto State. The State Environmental protection Agency and Ministry of Environment are important stakeholders in the proposed project.

Specifically, this Ministry was set up to protect and develop the general environment of the State. Other duties as outlined include:

- Monitor the Implementation of ESMPs guidelines and procedures on all developmental projects in the State;
- Monitor and regulate disposal of solid, gaseous, and liquid wastes from facilities; Monitor air, water, land and soil in the State to determine pollution levels; and
- Establish penalties for persons obstructing personnel of the ministry in the performance of their duties.

CHAPTER TWO: PROJECT DESCRIPTION

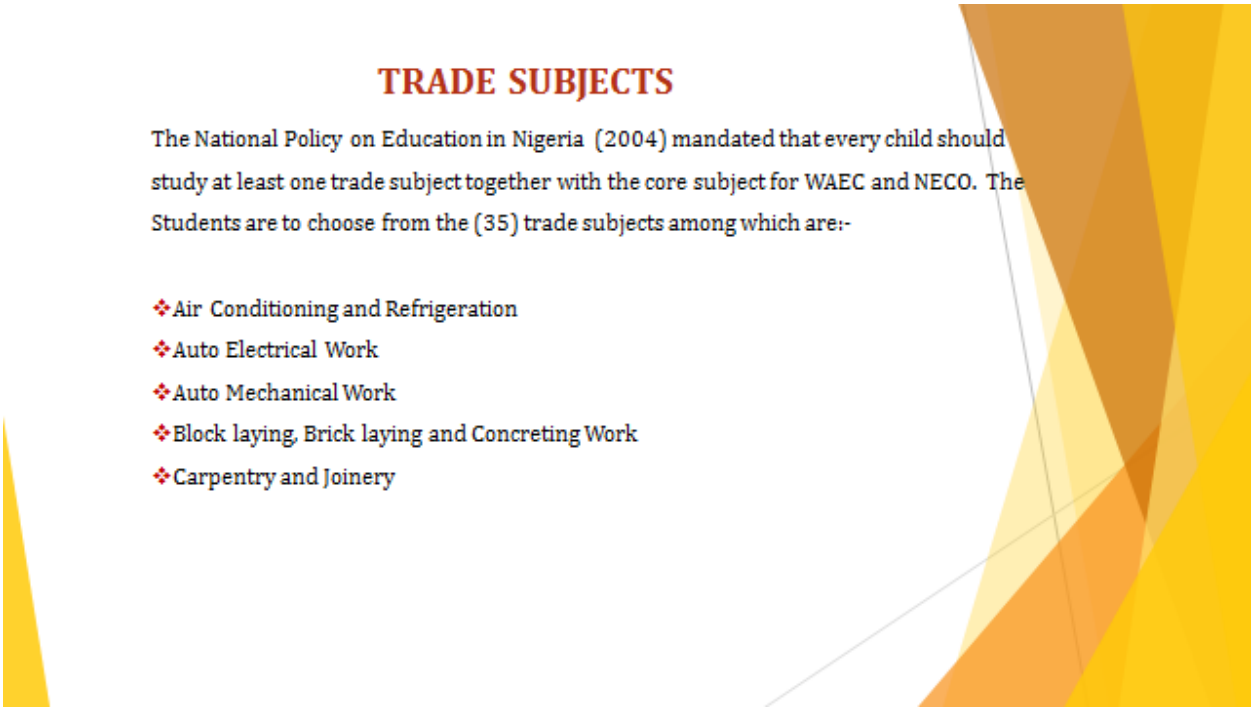
2.1 Project Description

Sokoto State Government's drive to ensure access to skills acquisition and entrepreneurship education by the citizens of the State as well as the emphasis by the National Council on Education (NCE) on popularization of Innovation Enterprises Institutions (IEIS) is a pointer to need and importance of establishing entrepreneurship education centers across the state.

Based on the existing arrangement, the Sokoto State Government is to provide the appropriate project sites and secure all permits for the smooth execution of the project, while AfDB is to provide the technical expertise and funding for the implementation of the entire project.

The justification would be to establish the centres in the State in order to facilitate the elimination of poverty through the promotion of skills acquisition and job creation.

It is part of the project planning that other schools and institutions within the catchment areas will also participate in training at the centres, while the State Government will also scale up the project by establishing similar Entrepreneurship Centres in areas not covered by the project.



AUTO MECHANICAL WORKS

COMPUTER/GSM REPAIRS & WOODWORKING WORKS

FASHION DESIGN WORKSHOP

ELECTRICAL AND ELECTRONICS WORKSHOP

- Catering Craft Practice
- Cosmetology
- Dyeing and Bleaching

- Electrical Installation and Maintenance Works
- Fisheries
- GSM Phone Maintenance and Repair
- Garment Making
- Leather Goods Manufacturing and Repairs
- Machine Woodworking
- Marketing
- Painting and Decoration
- Photography
- Plumbing and Pipe Fitting
- Printing Craft Practice
- Welding and Fabrication Engineering Craft Practice

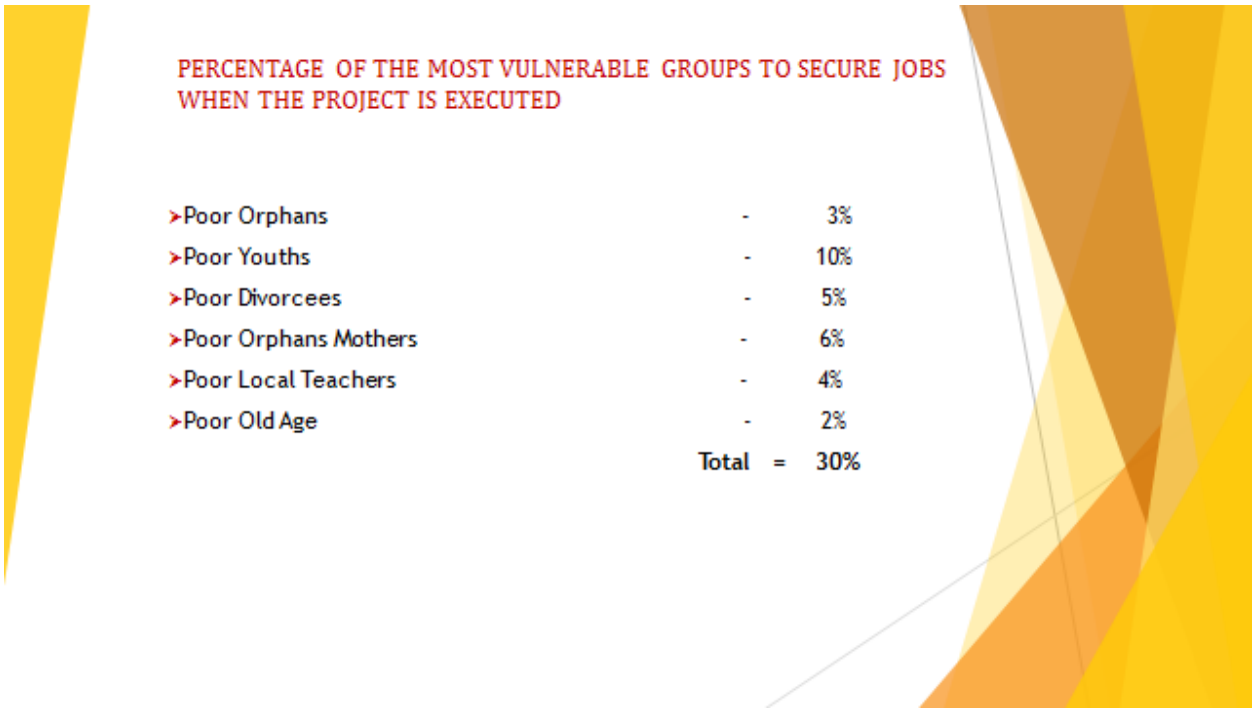
Thus, the establishment of Entrepreneurship Centres that will cater for the trade subjects is a welcome development and will go a long way in preparing the students to be self-reliant after graduation.

TARGETED JOBS TO BE CREATED

Electrical and Electronics	-	19,000	Jobs
Fashion Designers	-	20, 000	Jobs
Auto Mechanics	-	17,000	Jobs
Carpenters	-	19,000	Jobs
Fish Farming	-	19,000	Jobs
Catering Crafts	-	21,000	Jobs
Cosmetics Producers	-	20,000	Jobs
GSM Maintenance and Repairers	-	19,000	Jobs
Leather Goods Manufacturers	-	19,000	Jobs
Plumbers	-	22,000	Jobs
Photographers	-	19,000	Jobs
Welders and Fabricators	-	15,000	Jobs
Marketers	-	9,000	Jobs
Painters and Decorators	-	5,000	Jobs
Printers	-	6,000	Jobs
Poultry Farming	-	25,000	Jobs
Livestock Farming	-	26,000	Jobs

Total Jobs to be Created by the Project = 300,000

- The targeted jobs in the project are currently more attractive and very prone to employment opportunities as evidently suggested and established through consultations with major stake-holders in both formal and non-formal sectors.



The Project has four broad components as follows:

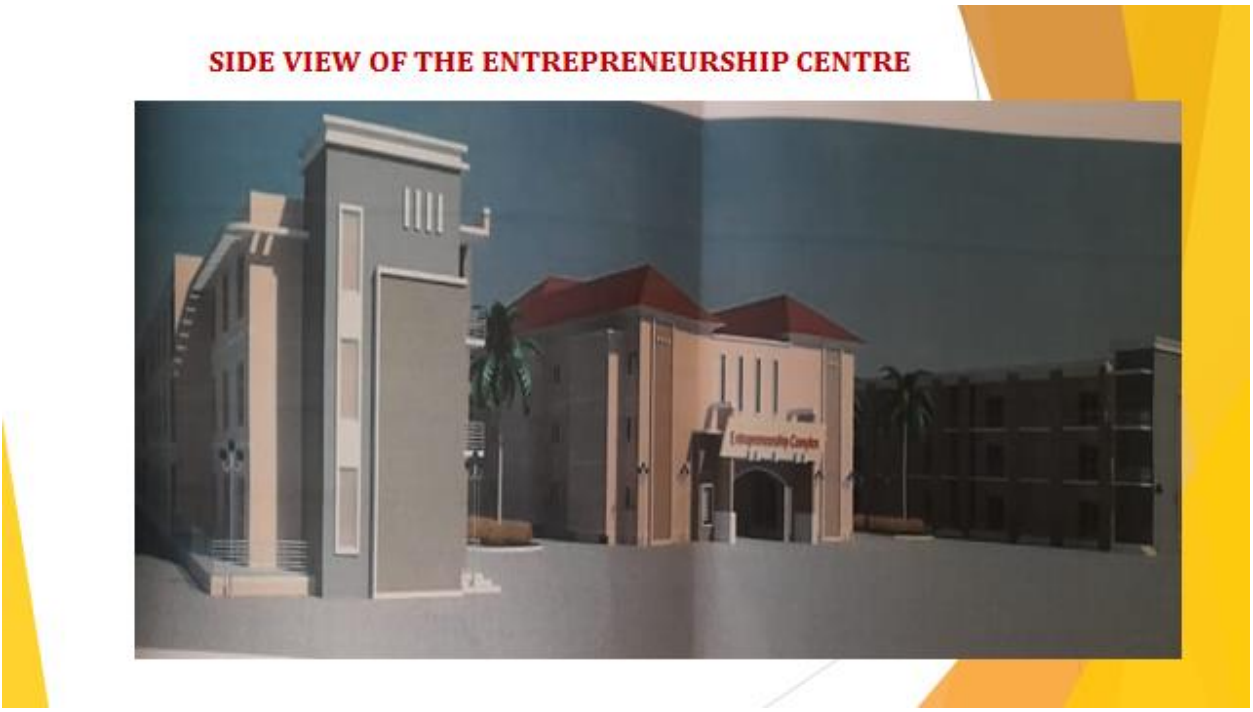
Component 1– Construction and Equipping of the Entrepreneurship Centres

This includes activities such as:

i. Identifying Schools for rehabilitation, renovation and equipping.

ii. Expansion of learning Centres and improvement of facilities for special need education.

iii. School environment be provided (e.g. more female teachers) with the determination of these activities are in line with the project to establish entrepreneurship centres and provide conducive learning atmosphere so as to promote and sustain innovations for skills acquisition.



Component 2 - Strengthening human capacity

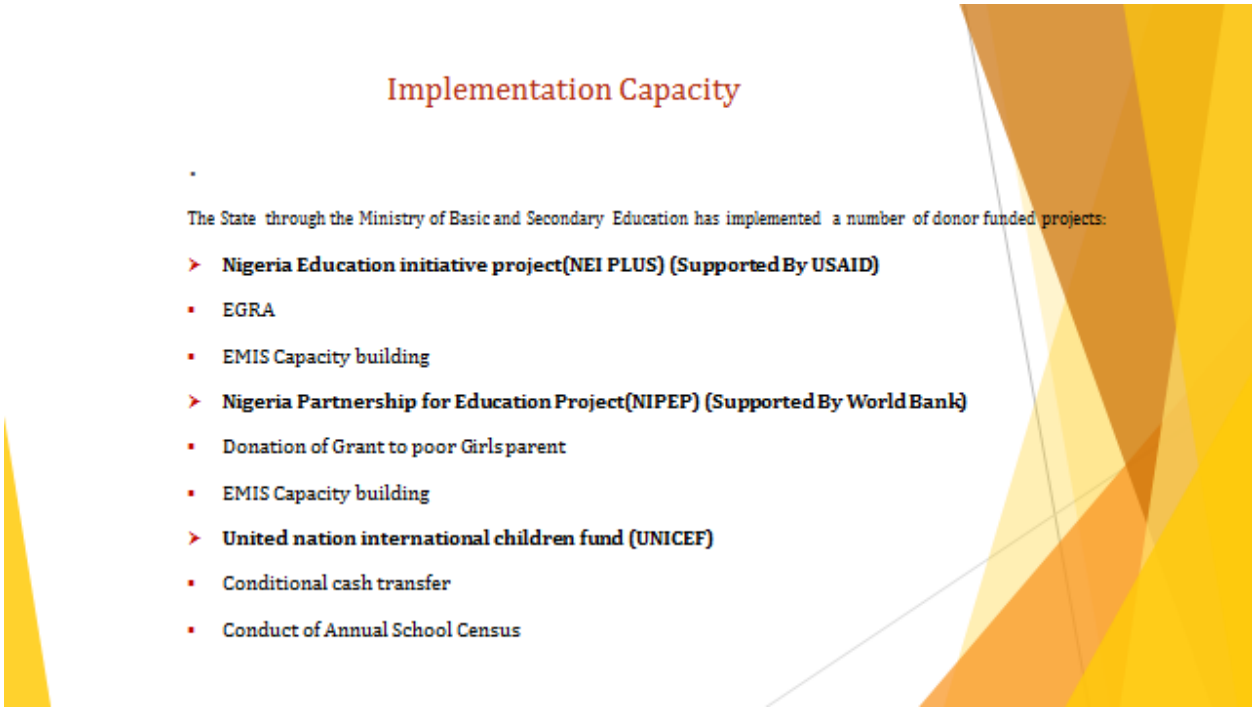
The much-needed manpower to implement the project will be strengthened for the implementation of the project. This includes activities such as:

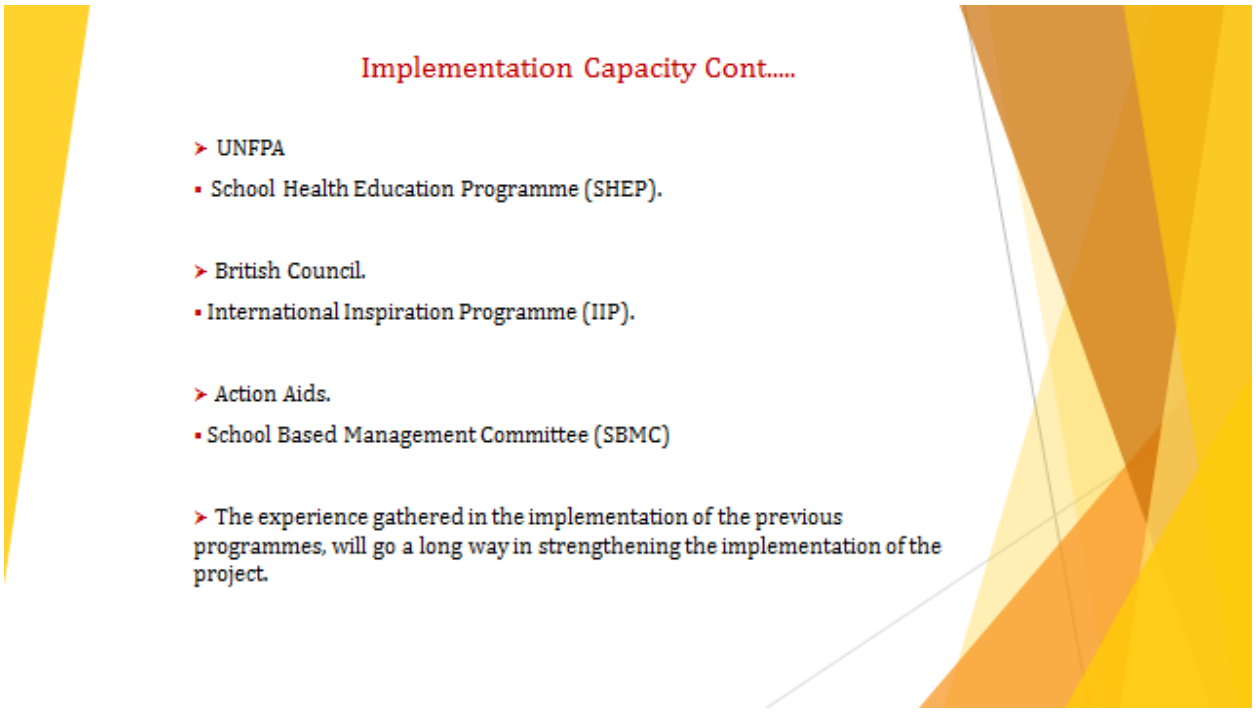
- Training to teachers in modern vocational facilities.
- Training of teachers in entrepreneurship education towards socio-economic development.
- Capacity building training for staff of the project management unit.

Component 3 – Strengthening System of Secondary and Higher Education

- Support the development/Strengthening of enabling policy legislation and regulations for secondary and higher education.

- Provide technical assistance and capacity building for staff of relevant public institutions (State Polytechnic, State University and State College of Education.
- Provide enabling environment and relevant incentives to learning centres as well as traditional institutions.





Component 4 – Project Management

- Monitoring and Evaluation
- Personnel Management

Financing Information

- Total Project Amount will cost USD 27.5 Million

  And the Project Implementation Period is for

  Four (4) Years from the date of Project Effectiveness.

Implementation Capacity

The State through the Ministry of Basic and Secondary Education has implemented a number of donor funded projects:

- **Nigeria Education initiative project(NEI PLUS) (Supported By USAID)**
  - EGRA
  - EMIS Capacity building
- **Nigeria Partnership for Education Project(NIPEP) (Supported By World Bank)**
  - Donation of Grant to poor Girls parent
  - EMIS Capacity building
- **United nation international children fund (UNICEF)**
  - Conditional cash transfer
  - Conduct of Annual School Census

2.1.2 Project Locations

Sokoto State is situated in the North-western part of Nigeria. It is located between latitudes 11° 30" to 13 ° 50" N and longitudes 4° 00'' to 6° 00''E. The State shares common boundaries with the republic of Niger to the North and West, Zamfara State to the East and Kebbi State to the South. The proposed sites for the Centres are located in Wamakko Town, Isa Town and Sokoto Town, all of which are within of Sokoto State. The sizes of the lands are approximately 10 hectares each.

In this regard, the State Government intends to establish one of the centres in the Eastern Senatorial Zone at Government Secondary School Isa in Isa Local Government Area, while that of the Western Zone is to be situated at GDSS Tambuwal, in Tambuwal Local Government Area of the State. The entrepreneurship and skills acquisition centre to be established in the Central Zone will be situated at Sultan Abubakar College, Sokoto, in Sokoto South Local Government Area.

Similarly, each of Sokoto State Polytechnic, State College of Education and Sokoto State University will house one Entrepreneurship Education Center. .

The entrepreneurship centres will be located at six centres across Sokoto State as summarized below:

Table2. 1: Summary of project location information

S/No	Institution	Location	Geo location (northing)	Geo location (easting)	LGA
1.	Sokoto State University	kasarawa	$12^0$56'33"N	$5^0$11'25"E	Wamakko
2.	Umar Ali Shinkafi Polytechnic	Gwiwa	$13^0$02'02"N	$5^0$08'56"E	Wamakko
3.	Shehu Shagari College of Education	Farfaru	$12^0$59.671'	$005^0$13.173'	Wamakko
4.	Sultan Abubakar College	Minanata	$13^0$03.051'	$005^0$13.638'	Sokoto South
5.	Government Day Secondary School,	Tambuwal	$12^0$25'34"N	$4^0$50'35"E	Tambuwal
6.	Government Secondary School,	Isa	$13^0$12'18"N	$6^0$08'41"E	Isa

Sokoto State University, located in Sokoto state along Sokoto-Jega High way. It was establish in 2009, at Kasarawa district of Wammako Local Government Area. Its central Geographic coordinates is $12^0$56'33"N and $5^0$11'25"E. The topography of the area is generally flat with few undulations over large areas.

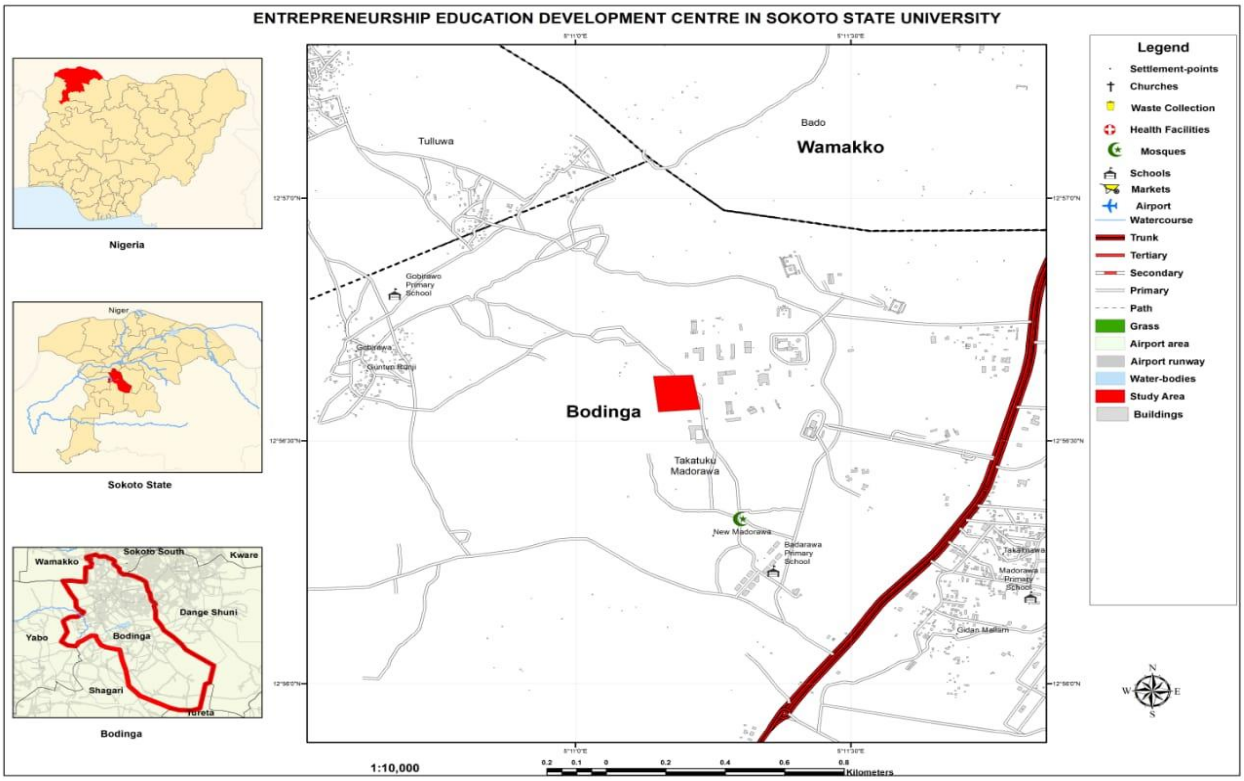


Figure 2. 1: Location of the project site at Sokoto State University.

Shehu Shagari College of Education

Shehu Shagari College of Education is located in Sokoto town, along Birnin Kebbi Road, at Farfaru District of Wamako Local government Area of the State. It was establish in 1970 and has central Geographic coordinates is $12^{0}59'46"$N and $5^{0}13'16"$E. The topography of the area is generally flat with few undulations over large areas.

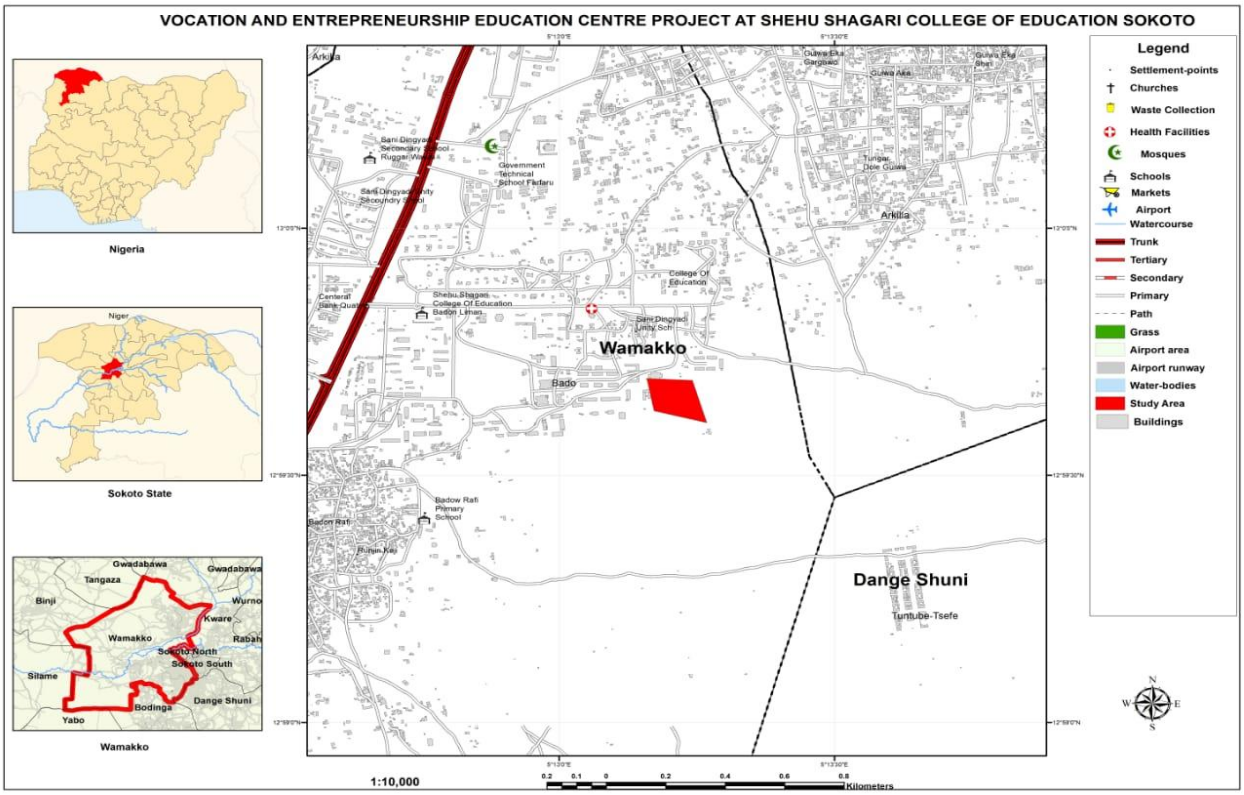


Figure 2. 2: Location of the project site in Shehu Shagari College of Education.

Umar Ali Shinkafi Polytechnic is located in Sokoto State, located at Gwiwa, district of Wamako Local government Area of the State. It was establish in 2002 and has central Geographic coordinates is $13^{0}02'02"$N and $5^{0}08'56"$E. The topography of the area is generally flat with few undulations over large areas

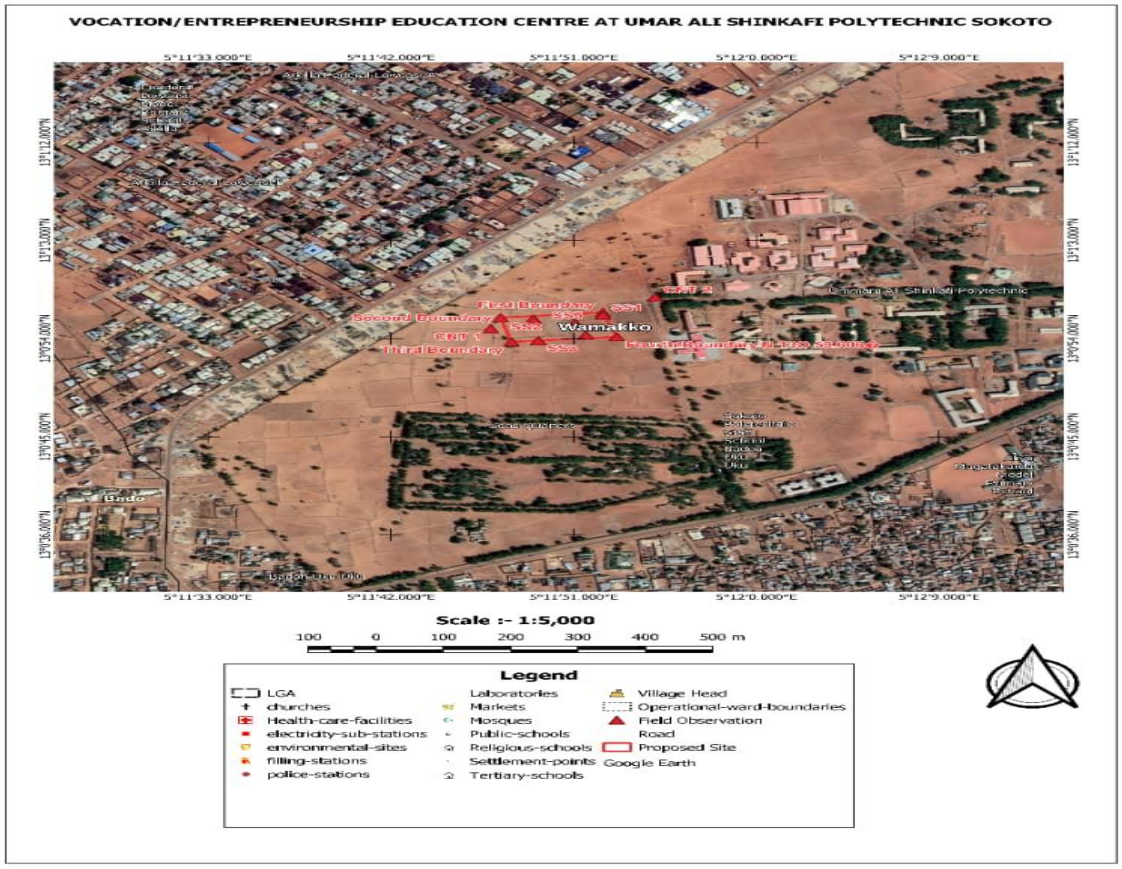


Figure 2. 3: Location of the project site in Umar Ali Shinkafi Polytechnic.

Sultan Abubakar College, located in Sokoto State, located at Minanata, district of Sokoto South Local government Area of the State. It has central Geographic coordinates is $13^{0}03'10"$N and $5^{0}13'44"$E. The topography of the area is generally flat with few undulations over large areas.

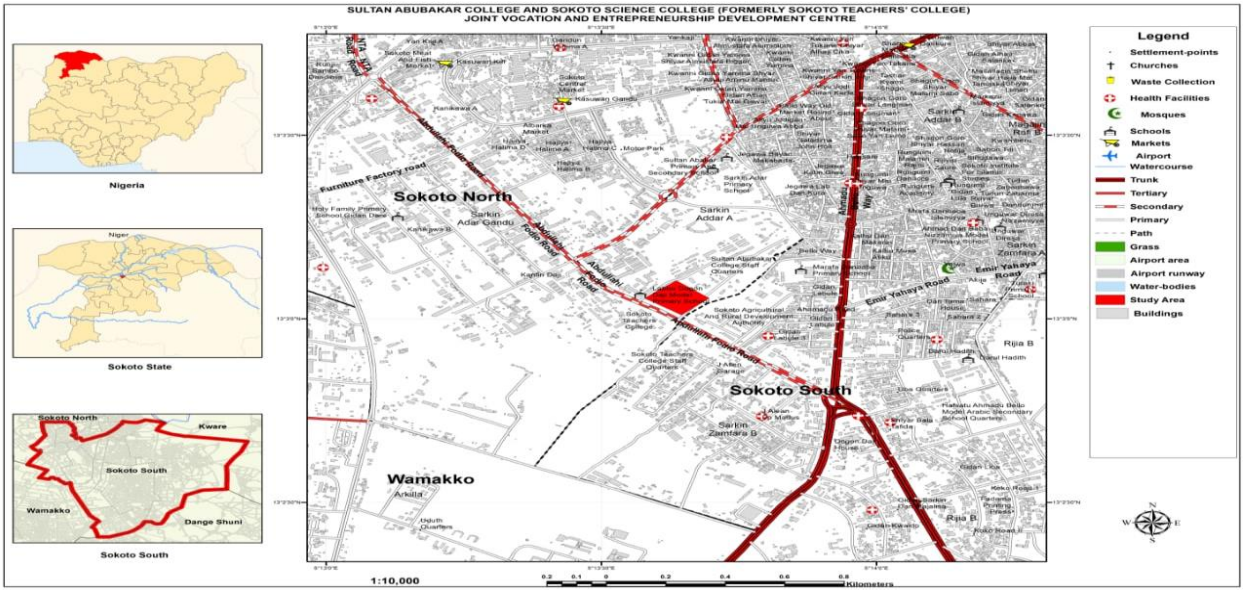


Figure 2. 4: Location of the project site in Sultan Abubakar College

Government Day Secondary School, located in Sokoto State, located at Gidan Dare, district of Tambuwal Local government Area of the State. It has central Geographic coordinates is $12^0$25'34"N and $4^0$50'35"E. The topography of the area is generally flat with few undulations over large areas.

Government Secondary School, located in Sokoto State, located at Isa, in Isa Local government Area of the State. It has central Geographic coordinates is $13^0$12'18"N and $6^0$08'41"E. The topography of the area is generally flat with few undulations over large areas.

Plate A. 1: Showing Sokoto State University School Gate

Plate A. 2: Showing Sultan Abubakar Entrance Gate

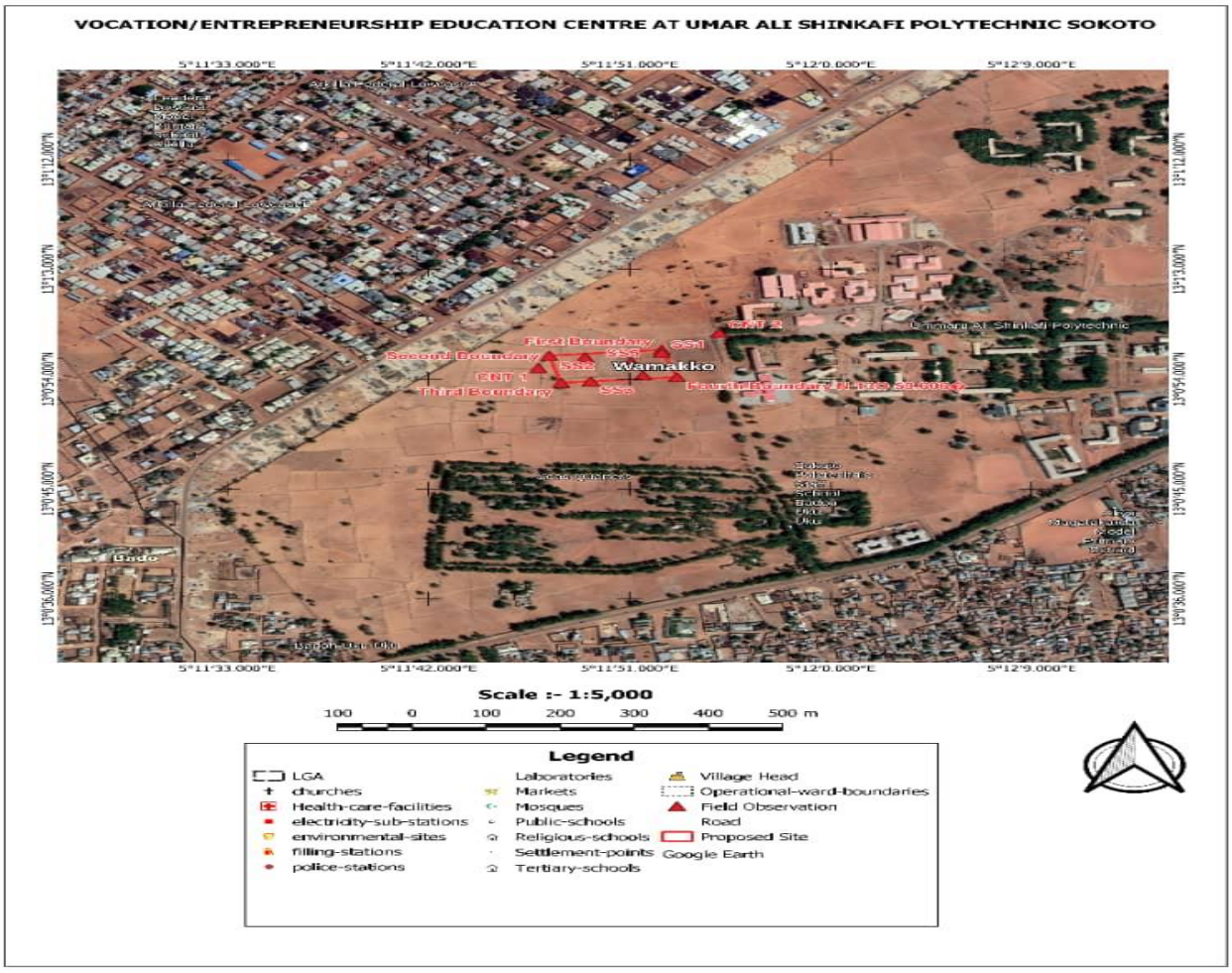


Figure 2. 5. Google Earth images of the Propose locations.

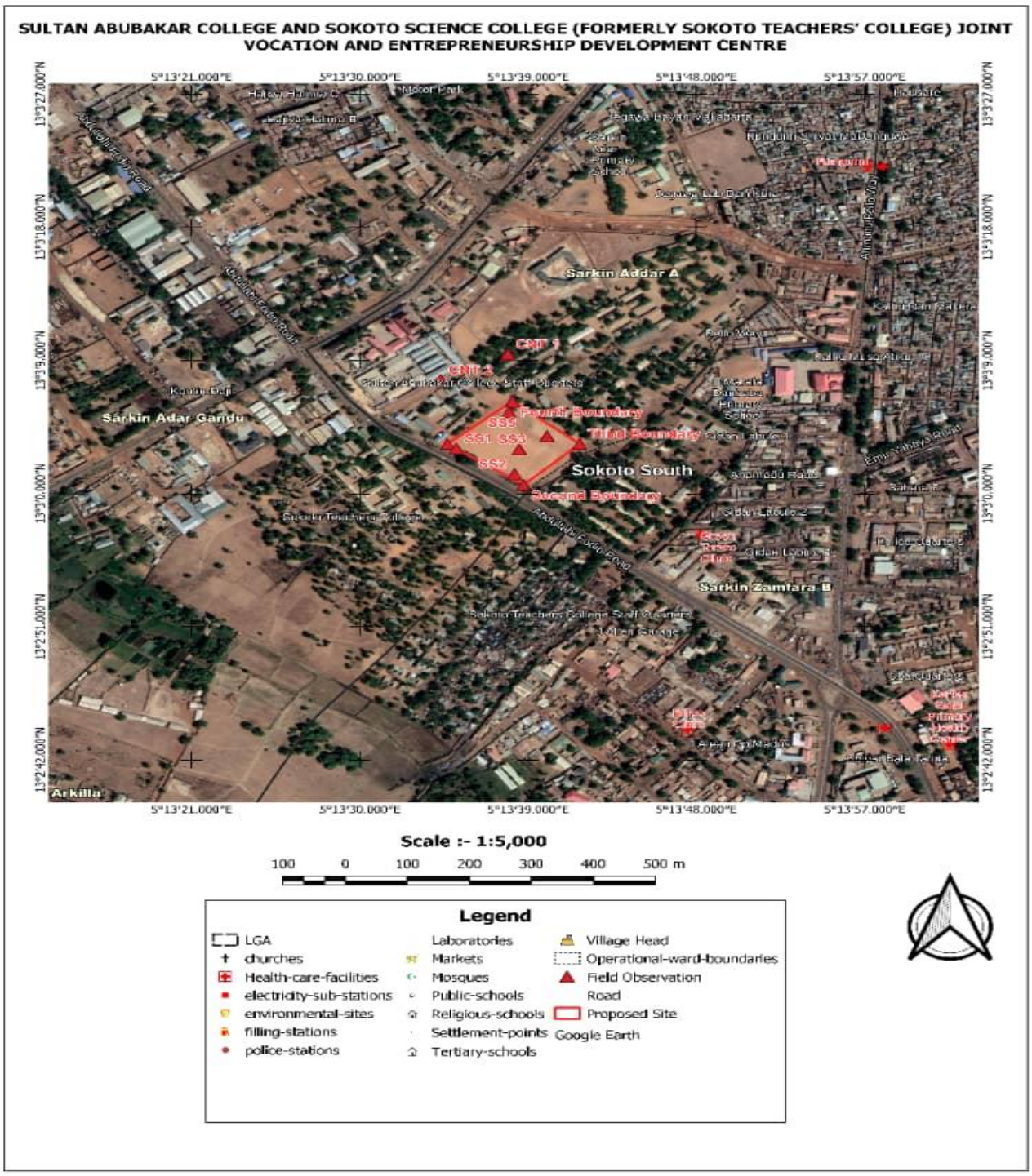


Figure 2. 6. Google Earth images of the Propose locations

2.1.3 The project's Direct Area of Influence

The project's direct area of influence is, by definition, that part of the project area that may be affected directly by any impact resulting from implementation of the proposed projects. In the

context of bio-physical and ecological environmental impacts, this area can be defined as the premises of the proposed centres and all areas located not more than five hundred metres (500m) radius from it. In terms of socio-economic impacts, the project's direct area of influence will be restricted to the entire Communities within Wammako, Sokoto South, Isa town and parts of Dogon Daji in Tambuwal Local Government Areas.

2.1.4 The project's Extended Area of influence

The project's extended areas of influence include the entire Wamakko town, Sarkin Zamfara, Isa town and Tambuwal town, while the extended socio-economic area of influence comprises of Wamakko LGA, Sokoto South LGA and Tambuwal LGA of Sokoto State.

2.3 SCOPE OF WORKS

The proposed project involves the following broad key activities:

- Project Design
- Permitting and licensing including this ESMP
- Site Preparation
- Civil construction
- Installation of machineries
- Commissioning of the centres
- Demobilization from construction
- Operational activities

2.4 ACTIVITIES WITHIN PROJECT PHASES

2.4.1 Pre-construction activities

Preconstruction activities for this project broadly include feasibility/technical design and environmental planning.

2.4.2 Construction Phase

2.4.2.1 Site Preparation

The Construction Phase of this project will begin with surveying and clearing of the proposed lands. This may involve provision of additional fill material for improvement of the low-lying sections of the land through provision of naturally occurring lateritic material as fill.

2.4.2.2 Civil and Steel Structures

The civil and steel structure necessary for the realization of the proposed project includes the following works:

- Foundations of the blocks of building.
- Warehouses for Storage of goods.
- Stairs access, walkways, roofing, siding, and railings.
- Access platforms and support for equipment.
- Other ancillary facilities include: Administrative building, locker-room, maintenance and vocational training workshops, generator room, canteen, gate-house, car park, drainage and road infrastructures as well as land scaping.

2.4.2.2.1 Project Design Criteria

The design stage of all projects is of great significance to the operations, lifespan and integrity of infrastructures to be installed. The structures and ancillary facilities shall be 'fit-for-purpose'. This implies that the design and materials from which they are fabricated shall be of high standard and industry specified quality that will meet expected/ designed purpose. Failure to consider detailed design criteria could ultimately result in significant failure of part or all the buildings, leading to incidents and injuries to occupants, loss of assets and occupational hazards. Therefore, to ensure that proper construction is undertaken, the following design criteria should be taken into consideration during the execution of this project:

- Location compatibility;
- Proposed population density and pressure on facilities;
- Safety and environmental safeguard measures;
- Improved indoor air quality;
- Low maintenance; and cost efficiency.

2.4.2.2.3 Facilities

These will include all foundation works, paving, columns, beams, tile, masonry, plaster and ceilings, finishing work, painting, flooring and walls, plumbing, air conditioning as well as all works necessary for the operation of buildings.

The assumptions for the estimation of the surfaces of the buildings that will receive the personnel, is as presented in table 2.2 and 2.3 respectively.

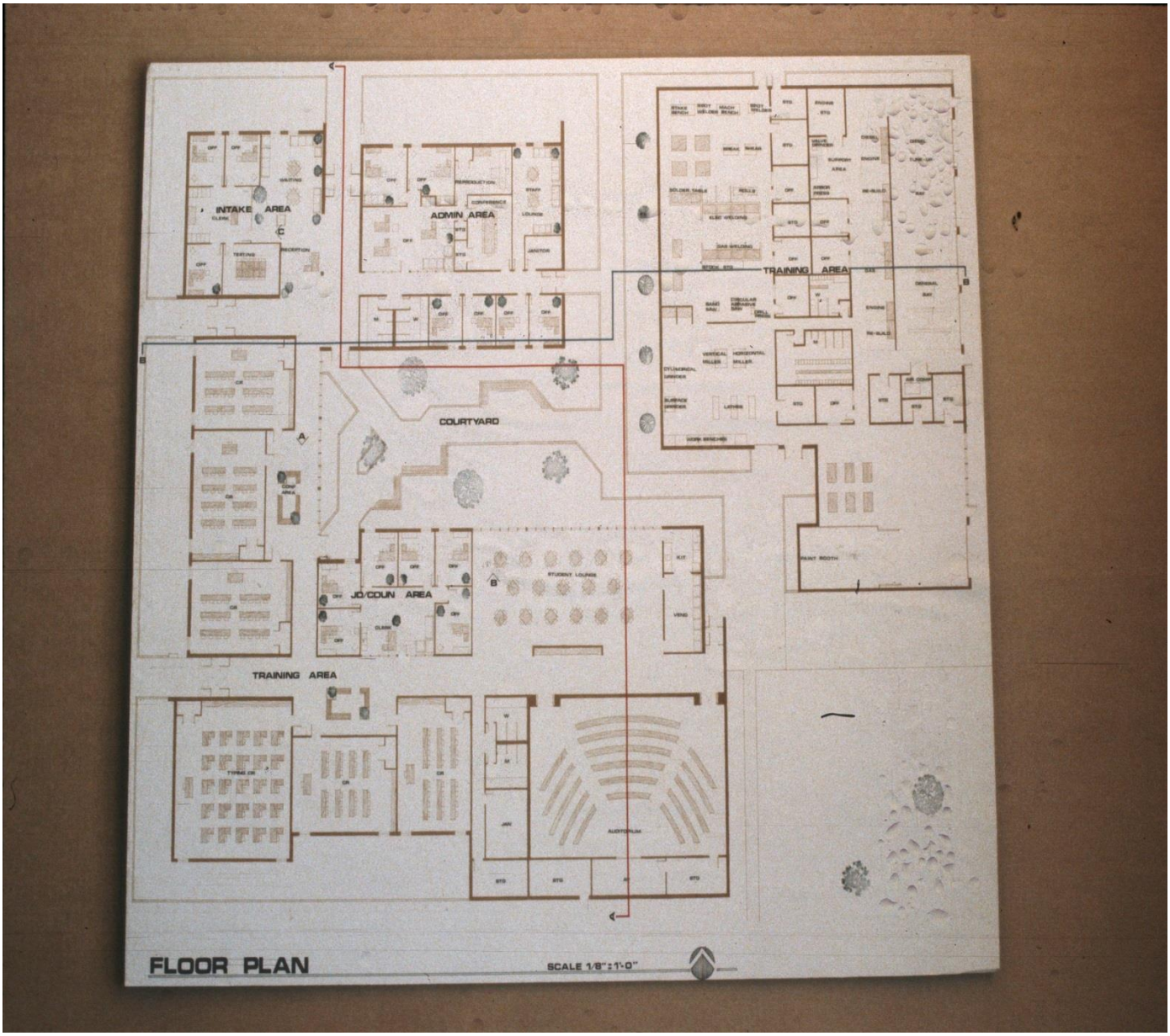


Figure 2. 7: Floor plan layout of proposed entrepreneurship centres

2.4.2.2.5 Sewage

The sewage of the entire platform against precipitation or rainwater will be via a network of water collection channels which will surround the storage halls. These channels will be connected to an underground pipeline system that connects to a cesspool. For building and storage, the downspouts are provided on the roofs to collect water. The threshold side must be at a level higher than that of the sewerage system with a minimum slope of 3%.

2.4.2.2.6 Roads and Parking

A road network is required for the movement of motor vehicles.

2.4.2.2.9 Firefighting plan

The objectives of firefighting plan for the proposed project are:

i. To define the general philosophy for application of Active Fire Protection (AFP) and Passive Fire Protection (PFP).
ii. To define areas where passive fire protection is required.
iii. To establish criteria to be used for deciding which equipment needs to be protected by AFP and/or PFP in the areas where it is required;
iv. To define type of fire against which they have to be protected and required duration of protection; and
v. To clearly delineate a muster point

2.4.3. Operational Activities

Operational phase of the project will succeed the construction phase and would be characterized by installation of equipment's and routine maintenance.

2.5 GENERAL

2.5.1 Estimated Project Workforce

In the construction phase, the proposed project will directly employ about eighty skilled professionals as well as about a hundred to two hundred unskilled employees; in the operational phase, the project will employ about twenty (20) skilled professionals and about one hundred (100) unskilled workers per project site.

However, during employee recruitment, priority will be given to qualified persons from the host community, followed by those from nearby communities. This will be in accordance with a Local Content Plan to be designed by the contractor and vetted by, Federal Ministry of Environment and Sokoto State Ministry of Environment. The Local Content Plan will ensure that whenever possible

qualified skilled and non-skilled positions are reserved strictly for people from the project host communities and that on-the-job training is made an integral part of the recruitment policy of the contractor.

2.5.2 Land Requirement

The total land requirement for this project is 10.0 hectares each for a centre, for current development and future possible expansion which will be a subject of another ESMP report.
The government of Sokoto State, as a form of encouragement, provided the 10-hectare parcel of land each for the construction of the centres.

2.5.3 Corporate Social Responsibility (CSR)

As part of its Corporate Social Responsibility (CSR), Carter Consultants has set out its broad objectives on its corporate social responsibility in a Memorandum of Understanding (MOU) that will be signed with the Host Community in the project area in relation to its peaceful co-existence with the community.
During its operations within the Host Community, Carter Consultants, to the best of its abilities, having due regard to compliance with its internal policies and projections, endeavour to:

i. Embark on corporate social responsibility projects that will have positive impact on the members of the Host Community particularly in areas such as educational assistance, social development, entrepreneurial training, and infrastructural development.

ii. Provide employment opportunities for the indigenes of the Host Community subject to availability of positions and adequate professional and technical qualification of such indigenes.

iii. Perform any other acts or projects which in its opinion will be beneficial to the Host Community.

However, nothing in the above provisions shall oblige the company to execute any of the above-mentioned intervention CSR projects within a particular timeframe and such projects will be executed at any time during the operational phase of the Company.

2.6 DECOMMISSIONING PHASE

The design life of the proposed entrepreneur centres will be 25 years, depending on proper maintenance. Therefore, it is unlikely that the centres would be decommissioned early. In future, the centres may even be upgraded or rehabilitated, if this is found to be necessary. However, should

decommissioning be decided in the long run, the general good practice guidelines for decommissioning of infrastructure as well as the existing environmental legislation of the time would guide appropriate decommissioning.

Nonetheless, at the end of the construction phase the construction area will be rehabilitated according to recommended plans before abandonment.

2.7 PROJECT IMPLEMENTATION SCHEDULE

The Gantt chart of figure 2.8 is self-explanatory and briefly summarizes the project scheduling.

According to the proposed schedule, preconstruction phase of the proposed project will last for twelve months, i.e., from June 2021 to May 2022, culminating with obtaining all relevant permits including building development permit, environmental permit, etc.

The construction phase, which will include physical building construction activities and developing related infrastructure as well as installation of vocational training equipment and accessories, is expected to begin in June 2022 and lasts for another twelve months.

The operational phase of the project during which operations and periodic building and vocational training workshops maintenance activities will be carried out is scheduled to commence in July 2023 and lasts for at least twenty-five years.

S/N	Activity	Preconstruction Phase	Construction Phase	Operations Phase
		Duration (timeframe)		
		June 2021-May 2022	June 2022-May 2023	June 2023-July 2048
1.	Preconstruction activities, including site acquisition centre design, permits/approvals			
2.	Construction of buildings and associated structures			
3.	Installation of power tools equipment and test-running			
4.	Demobilization from construction site			
5.	Operations and periodic maintenance			

Figure 2. 8: Project implementation schedule

2.8 VALUE OF THE PROJECT

The proposed project cost includes the costs of feasibility/technical studies and ESMP/, mobilization and construction activities as well as installation of associated equipment.

The project intends to employ, directly and indirectly, over two hundred people in both its constructional and operational phases. Priority will be given to qualified persons from the host community, followed by those from nearby communities. The project would also contribute an overall net positive economic benefit to the nation when its overall potentials for boosting socio-economic activities in the country are considered.

2.9 ENVISAGED SUSTAINABILITY

For any form of development to be environmentally sustainable, it should give due regard to the likely environmental impacts of the proposed activities. It should incorporate mitigation and enhancement measures that will lead to preservation of the existing project environment.

The proposed project shall therefore be undertaken according to an environmentally sound industry practice, which employs standard and time-tested designs, standard construction methods, and standard operational procedures and fully trained, qualified and environmentally conscious personnel. The environmental sustainability of the project is therefore based on the following specific considerations:

- Time-tested standard engineering designs which will improve the life cycle costs, environmental performance and project economics;
- All other works shall follow standard and environmentally sound construction methods so as to keep disruption to the environment at acceptable levels;
- The use of best available technology and effective waste management shall be carried out to enhance environmental protection;
- Project management shall be carried out by fully trained and qualified personnel who are conversant with general HSE guidelines;
- Environmental sustainability of the project is predicated on the fact that not much interference is expected with the physical setting of the project area as a result of the project, because the project site has been acquired from existing lands which had already

been cleared for farming activities. In addition, adequate Environmental and Social Management Plan, ESMP, is to be put in place to ensure minimum environmental disruption and mitigation of significant negative environmental impacts. A good housekeeping practice will also be maintained and the contractor and other stakeholders are expected to implement all the measures stipulated in the ESMP.

Envisaged economic sustainability of the project is based on the economic feasibility study conducted for the project, which shows a potentially high return on investment. Social sustainability of the project is hinged on the policy of ensuring cordial relationship with stakeholders and communities by the contractor and the proponent through consultation throughout the various phases of the project. It has also been planned that local people will be given priority in terms of employment in the construction phase.

To further strengthen the social sustainability of the project, a Grievance Redress Mechanism (GRM) shall also be developed and deployed as part of the ESMP.

2.10 PROJECT LIFE SPAN

It is expected that the proposed entrepreneurship and vocational centres will remain operational, viable and sustained with periodic maintenance by the proponent for at least twenty five years.

CHAPTER THREE: ENVIRONMENTAL BASELINE CONDITION

A general description of the methodology employed and the environmental data generated during the field work as well as the environmental conditions around the project area is presented in the following subsections.

3.1 METHODOLOGY FOR FIELD WORK

In order to effectively characterize the bio-physical environment of the study area, a wet season field data gathering exercise was approved by Federal Ministry of Environment. The field work was carried from the 20th to 26th of September 2021. The specific objectives of the field sampling were to:

- Determine the ambient air quality and noise level of the study area;
- Determine the physio-chemical and microbiological characteristics of the soil within the study area;
- Determine the physico-chemical and biological characteristics of groundwater within the study area;
- Determine the vegetation characteristics of the area; and
- Establish the socio-economic and health status of the host communities in the project area.

3.1.2 Soils Sampling

Surface soil was investigated through visual observation and sampling. Composite soil samples were obtained from designated sampling points in four (4) locations on the project sites. Hand Auger of uniform cross section was used to ensure that reproducible composite soil samples were collected from depths of 0-15cm and 15-30cm. This ensured high quality representative data collection. Surface litter of un-decomposed plant materials were removed to ensure that uncontaminated soil samples were collected. Soil samples were collected in appropriately labeled and sealed polythene bags.

Samples for microbiological analysis were collected in sterile McCarthey bottles and kept under 4^0C in a refrigerated container (cooler). Samples for physico-chemical analysis were air-dried in a dust-free environment while those for microbiological analysis were stored in ice-packed container in the field and transferred to the refrigerator at 4^0C. Physico-chemical analysis of soil samples were carried out using the analytical methods recommended by defunct FEPA.

3.1.3 Soil Organisms

Tulgren and Floatation methods were used for the extraction of soil organisms. Surface soil macroscopic organisms from leaf or top soil were picked with forceps and preserved in 4% Formalin prior to identification with Edmonson (1959), Pennak (1978) and Species Diversity Index (Margalef 1975).

3.1.4 Water Quality and Hydro-biological Studies

In-situ measurements for pH, temperature, conductivity and dissolved oxygen were conducted with Pye Unicam meter in the field. For other physiochemical analysis, duplicate water samples were collected in two 1-litre plastic containers, labeled and stored in an insulated refrigerated container and later analyzed in the laboratory according to Lind (1979) and APHA (1985). All samples for laboratory analysis were flown from Sokoto to Giolee Laboratory in Rivers State, Port Harcourt for Analysis within 24 hours.

3.1.5 Microbiological Studies

Water samples for microbiological studies were collected in 100ml plastic containers which were covered with Aluminum foil and kept in ice-cool container prior to culturing in the laboratory. The water was then analyzed for coliforms using the multiple tube fermentation technique. EC broth was the medium used and MPN Index was determined with MPN Table. The heterotrophic count was determined using the Plate Count Agar upon which aliquots of 0.5ml of serially diluted samples were plated.

3.1.6 Air Quality and Noise Level Studies

3.1.6.1 Air Quality

The air pollutants from industrial activities that are of greatest concern are Sulphur Oxides (SOx), Nitrogen Oxides (NOx), Particulate Matter (PM), Hydrocarbon (HC) gases, Volatile Organic Compounds (VOCs), Carbondioxide and Carbon Monoxide (CO).

For the proposed project, air quality characteristics were monitored in four (4) centres on the proposed sites for the project. The results are tabulated in Table 3.9.

Plate A. 3: Soil Sampling and Air quality /Noise level measurements

3.1.6.2 Sample Handling/Preservation and Transportation

After sampling, each sample was properly labeled, arranged and preserved. The sample label contained the following information:

- Sample Code/I.D
- Name and Location of Site;
- Date and Time of Sampling;
- Name and Signature of Sampler;
- Type of Sample, and
- Type of Preservative used.

3.1.6.3 Chain of Custody Management

All samples collected on site were recorded in a field notebook or field log. Inventory of samples collected and all necessary information including parameters to analyse, type of sample, date of sampling, etc were recorded in the chain of custody form.

3.1.6.4 Quality Assurance/ Quality Control

In order to ensure the integrity of collected samples, the following measures were taken to avoid cross contamination, deterioration and pollution of samples from the point of collection on the site till the collation of the laboratory results.

- It was ensured that the samples collected were representative of the materials to be examined by collecting adequate volumes and from points of target as determined;

- It was ensured that there was no contamination or cross-contamination of the samples or equipment by keeping all materials in contaminant-free spaces and decontaminating equipment in-between sampling stations with ninety-five (95) Percent Ethanol;
- It was ensured that adequate volumes of samples were collected for laboratory examinations;
- All samples were collected with the appropriate containers and preservatives;
- All field observations and data were captured and logged in the field logs as timely as required;
- All samples were timely, properly and completely identified/coded;
- All samples were duly preserved in a cool box fitted with frozen ice packs and delivered to the laboratory same day of collection; and
- All samples were properly analyzed in line with required methods and standards.

3.1.6.5 Analytical Methods

Samples collected from the field were analysed in Giolee laboratory, an FMEnv Accredited laboratory located in Port Harcourt, Rivers State, Nigeria. The methods presented in **Table 3.1** were employed in the samples analyses**.** Also shown on the table are the equipment detection limits for the different parameters analyzed.

Table 3. 1: Laboratory Analytical Methods

Parameters for Water Analysis	Methods	Detection Limits
Temperature (^{o}C)	APHA 2110B	-
Ph	APHA 4500H^{+}B	-
Turbidity (NTU)	APHA 2130B	1.0
Salinity (mg/l)	APHA 2520B	0.01
TSS (mg/l)	APHA 2540D	1
TDS (mg/l)	APHA 2510A	-
Conductivity (µS/cm)	APHA 2510A	-
THC (mg/l)	ASTM D3921	1.0
DO (mg/l)	APHA 4500-O G	-
BOD (mg/l)	APHA 5210A	0.5
COD (mg/l)	APHA 5220D	0.8
Reactive Silica (mg/l)	APHA 4500-SiO_2	0.1
Nitrate (mg/l)	EPA 352.1	0.02
Phosphate (mg/l)	APHA4500-P D	0.002
Ammonium (mg/l)	APHA 4500-NH_3	0.02
Calcium (mg/l)	APHA 3111B/ASTM D3561	0. 1
Magnesium (mg/l)	APHA 3111B/ASTM D3561	0.1
Potassium (mg/l)	APHA 3111B/ASTM D3561	0. 1
Sodium (mg/l)	APHA 3111B/ASTM D3561	0.1

3.1.6.6 Biodiversity studies across the study area.

The vegetation study of the proposed Project area and adjacent environment were made by taking separate sample quadrants (25m x 25m for herbs and shrubs and 4m x 4m for grasses and undergrowth) were measured in the sampling locations, which were selected using stratified random sampling procedures, considering plant species diversity, density and dominance. Homogenous habitats were identified and sampled. The vegetation of the proposed Project location was characterized in terms of types, density, and profile of the vegetation, economic benefits, regional characteristics, and distribution of ecological zones, environmental sensitivity, and reserve areas. Plant specimens were randomly collected from proposed project location and the communities. The plants were tagged, pressed, and labelled. Initial identification of the plant samples was done using Flora of West Tropical Africa (Hutchinson and Dalziel, 1954, 1958) and Nigerian Trees (Keay et al., 1960, 1964). The scientific names of the identified plants were recorded in the table below. Locals were engaged for the local nomenclature of all identified plant species and their local use.

Lead (mg/l)	APHA 3111B	0.20
Total Iron (mg/l)	APHA 3111B	0.05
Copper (mg/l)	APHA 3111B	0.05
Zinc (mg/l)	APHA 3111B	0.05
Manganese (mg/l)	APHA 3111B	0.10
Cadmium (mg/l)	APHA 3111B	0.02
Total Chromium (mg/l)	APHA 3111B	0.10
Mercury (mg/l)	APHA 3112B	0.0002
Arsenic (mg/l)	APHA 3030B/3114B	0.001
Parameters for Soil Analysis		
pH (H_2O)	ASTM D4972	-
TOC/TOM (mg/kg)	BS 1377	-
Conductivity (mg/kg)	APHA 2510B	-
THC (mg/kg)	ASTM D3921	10.0
Nitrate (mg/kg)	EPA 352.1	0.02
Phosphate (mg/kg)	APHA 4500-P D/CAEM	0.002
PSD (mg/kg)	ASTM D422	-
Calcium (mg/kg)	APHA 3111D	0.1
Magnesium (mg/kg)	APHA 3111B/ASTM D3561	0.1
Potassium (mg/kg)	APHA 3111B/ASTM D3561	0.1
Sodium (mg/kg)	APHA 3111B/ASTM D3561	0.1
Zinc (mg/kg)	ASTM D5198/APHA	0.05
Lead (mg/kg)	ASTM D3111B /D5198	0.20
Mercury (mg/kg)	APHA 3112B/ASTM D	0.0002
Arsenic (mg/kg)	APHA 3030F/3114B	0.001
Total Iron (mg/kg)	APHA 3111B/ASTM D5198	0.05
Copper (mg/kg)	APHA 3111B/ASTM D5198	0.05
Cadmium (mg/kg)	APHA 3111D/ASTM D5198	0.02
Total Chromium (mg/kg)	APHA 3111B/ASTM D5198	0.10

Data were collected along the established quadrant by using the Line Intercept Methods of Cook and Bonham (1977) at pre-selected points. Each study location (plot) covered an area of 25m x 25m along the direction of transect for assessments. The procedure for the Line Intercept Method consists of recording the plants bisected by the line sometimes referred to as horizontal linear distance for each plant under the line. The total linear measurements for the total intercepts along the line represent the percentage ground covers which were converted to percent species composition as intercepts were recorded by species. However, unidentified plant species and species whose identification were doubted, were collected, given sample location coded numbers and pressed for identification in a herbarium.

3.1.6.7 Methods used in Collecting the Baseline Samples

Flora (Vegetation): Transects, Informal interviews, Questionnaires and direct observations.

Fauna (Wildlife): Direct observations and informal interviews

3.2. Socio-Economic Studies

The primary data for the study was obtained from structured questionnaires; Focus Group Discussions (FGDs) and Key Informant Interviews (KII). The questionnaire was designed to generate information on demographic structure and socio-cultural characteristics of the inhabitants as well as local economy and available infrastructure among others. The objective of the group discussions was to identify community's perceptions on the proposed project, problems associated with it, and how such problems may be mitigated. Information from such discussions was used to confirm/cross check the veracity of some of the answers provided in the questionnaires.

3.3. Spatial boundary for the socio-economic studies

A simplified spatial boundary considered for the socio-economic studies in this EIA comprised of households located not more than two kilometers away from the proposed project sites. This was because settlements within this boundary may be impacted more severely and more directly than those in other locations in the extended project area.

3.4 BASELINE CHARACTERISTICS OF THE PROJECT AREA

3.4.1.1 Meteorology/Climate

The climate of the project areas is a Local Steppe climate, classified as BSh according to Köppen and Geiger Classification system. There is little rainfall throughout the year. The average annual temperature is 28.4 °C. Relative humidity is generally low especially in the dry season and high in the wet season.

The area is characterized by tropical continental climate with a very fragile ecosystem. Temperatures are high throughout the year while rainfall, low and erratic which barely lasts for more than five months in a year. Average annual rainfall barely exceeds 629 mm while temperatures could be as high as 39° C or even higher, particularly during the month of April which usually records the highest of temperature. The area is also characterized by Sudan Savannah type of vegetation dominated by short grasses interspaced by short woody trees and shrubs.

3.4.1.2 Rainfall/Relative Humidity

Much of the rain in Sokoto State falls between June and September in the north during which showers are a daily occurrence while it's from April to October in other parts of the country. The showers rarely last long and are by far less than the regular torrential rain known in wet tropical regions.

The annual rainfall is between 500mm in the north and 1300mm in the south; its relative humidity is 18.0 – 74.0% with an average of 40.7% at 15:00 hrs as can be seen from the Figures 3.1 and 3.2 Below:

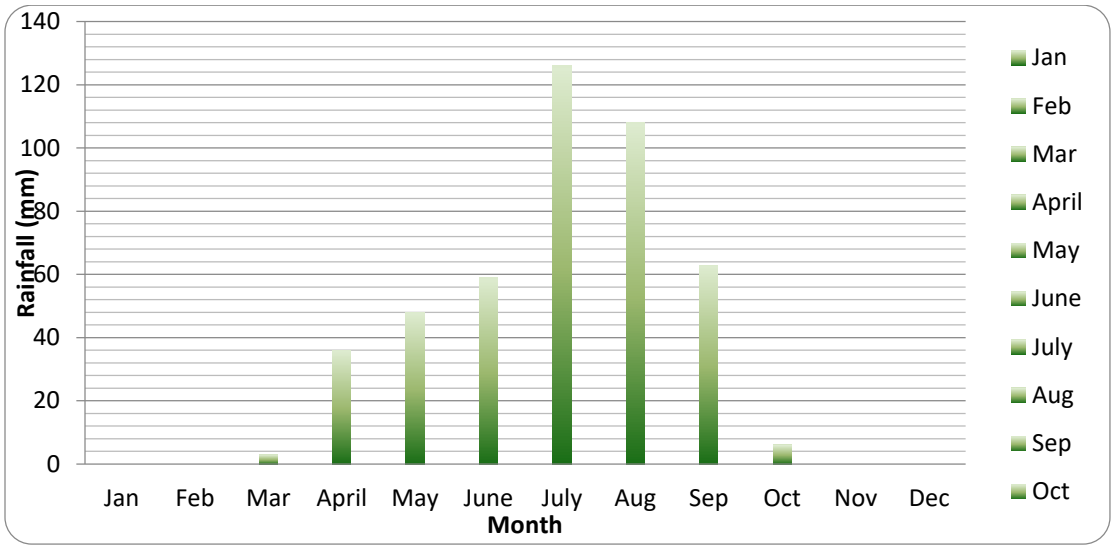


Figure 3. 1: Twenty-Year Monthly Rainfall within Sokoto State (NIMET, 2021)

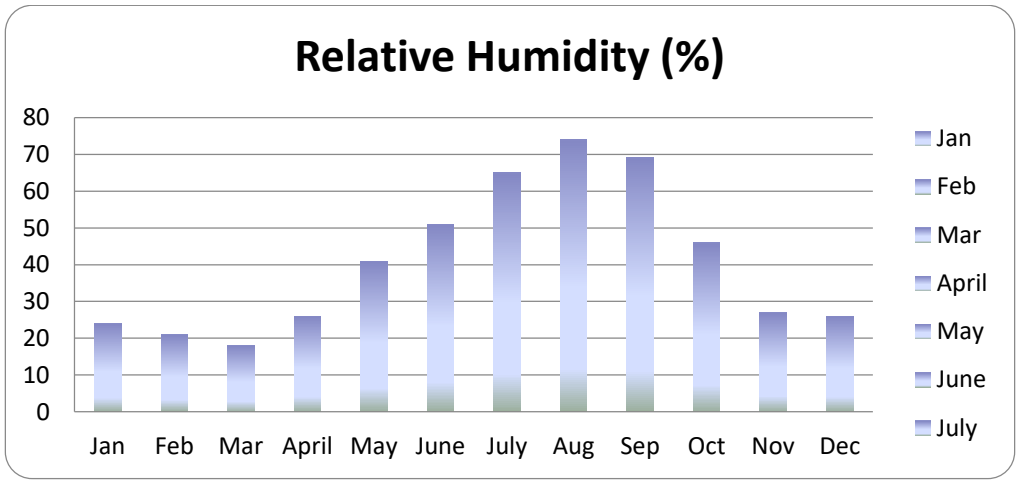


Figure 3. 2: Twenty-Year Monthly Relative Humidity within Sokoto State (NIMET, 2021)

3.4.1.3 Temperature

Sokoto is characterized by two extreme temperatures relative to its tropical location; hot and cold seasons. Highest temperatures are recorded during the hot season between the months of March and May. From November through to February, there is prevalence of harmattan characterized by very cold temperatures and dust laden winds often accompanied by thick fog of alarming intensity. With an annual average temperature of 28.3 °C (82.9 °F), Sokoto State is a very hot area. However, maximum daytime temperatures are for most of the year generally under 40°C (104.0 °F) and the dryness makes the heat bearable. The warmest months are February to May when daytime

temperatures can exceed 45 °C (113.0 °F). Measured air temperatures of 32.1 – 45.2 obtained in the study during the sampling agree with the climatic data (Figure 2.7).

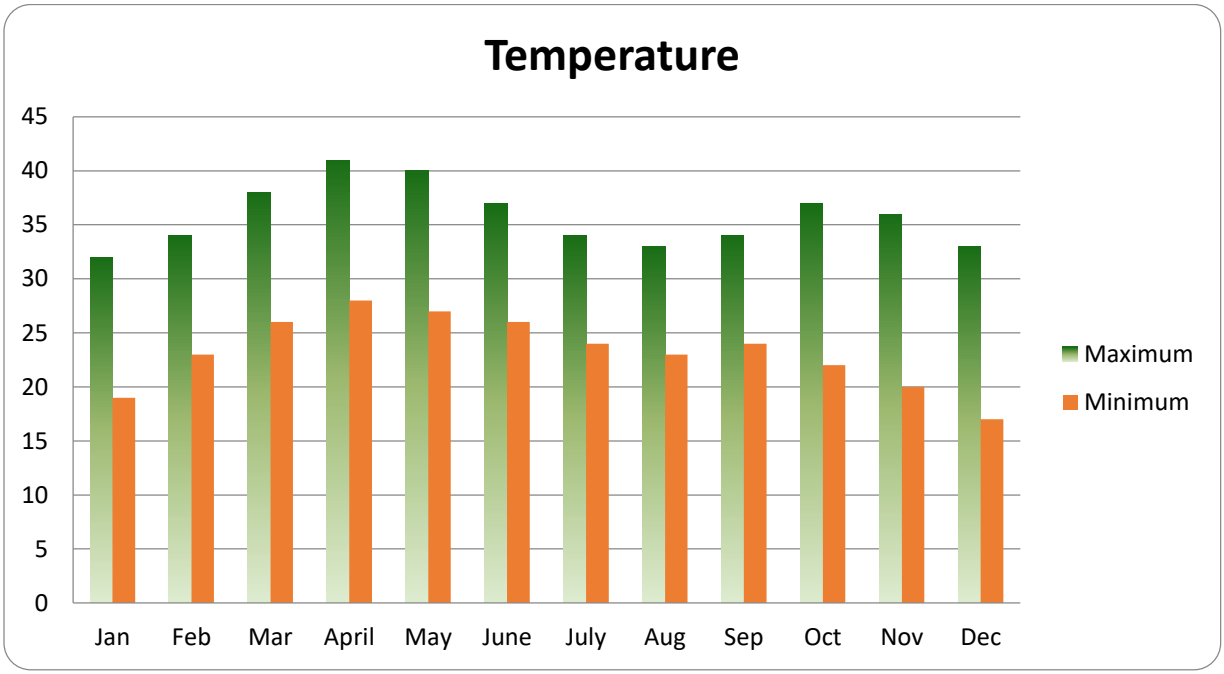


Figure 3. 3: 20-Year Air Temperature Distribution in the Area (NIMET, 2021)

3.4.1.4 Sunshine

The length of the day in Sokoto does not vary substantially over the course of the year, staying within *53 minutes* of *12 hours* throughout. In 2021, the shortest day is *December 21*, with *11 hours, 22 minutes* of daylight; the longest day is *June 21*, with *12 hours, 54 minutes* of daylight.

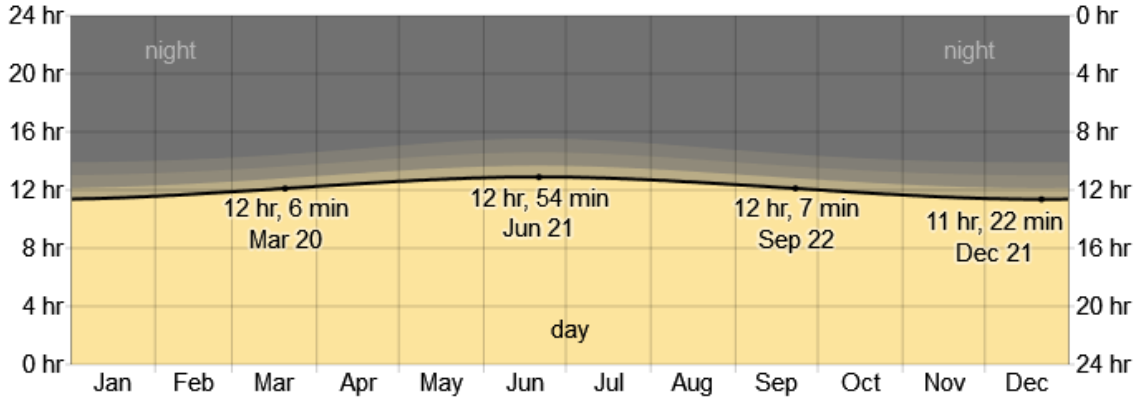


Figure 3. 4: 20-Year Sunshine Distribution in the Area (NIMET, 2021).
The number of hours during which the Sun is visible (black line), From bottom (most yellow) to top (most gray), the color bands indicate: full daylight, twilight (civil, nautical, and astronomical), and full night.

Hours of	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Daylight	11.5h	11.7h	12.1h	12.4h	12.7h	12.9h	12.8h	12.5h	12.2h	11.8h	11.5h	11.4h

The *earliest sunrise* is at *6:11 AM* on *June 2*, and the *latest sunrise* is *54 minutes* later at *7:05 AM* on *January 24*. The *earliest sunset* is at *6:09 PM* on *November 20*, and the *latest sunset* is *1 hour, 1 minute* later at *7:09 PM* on *July 9*.

3.4.1.5 Geology and Hydrogeology of Sokoto

Sokoto State is within the Sokoto Basin, which is in the northwestern part of Nigeria, covering a surface area of about 111,925 km^2, bounded between longitudes 3.50° N to 7.00° N and latitudes 10.0°N to 14.0° N, predominantly spanning between Sokoto, Kebbi and Zamfara states. The basin is believed to have developed by tectonic epeirogenic movements or stretching and rifting of tectonically stabilized crust during the Paleozoic era (Kogbe, 1981; Wright *et al*., 1985).

The basin is underlain by crystalline basement rocks and overlying sediments. The crystalline basement rocks consist of (i) dominant crystalline complex of migmatites and gneises, (ii) N-S trending schist belt, and (iii) older granites. Overlying the basement complex rocks are successions of sediments deposited under different conditions ranging from continental to marine events (Wright *et al*., 1985; Kogbe, 1989; Obaje 2009).

Sedimentation began with the deposition of the Illo and Gundumi Formations uncomfortably over the basement complex. The Gundumi Formation consists of gravel with sand intercalations, sandstone and variegated clays, while the Illo Formation consists of interbeded clays and grits (Kogbe 1989; Obaje 1989). Overlying the Gundumi/Illo Formations is the Rima Group consisting of three distinct marine sedimeents, known as the Taloka, Dukamaje and Wurno Formations (Kogbe 1989; Obaje 2009). The Taloka Formation is the oldest Formation in the Rima Group, which consist of multiple layers of sandstone and shakes, with the sandstone containing a lot of water. The Dukaaje Formation overlies the Taloka Formation and is shaley with limestone and

mudstone intercalations (Kogbe 1989; Obaje 2009), while the Wurno Formation consists of sandstone containing carbonaceous material making it to have dark appearance (Kogbe, 1989; Obaje, 2009). The Sokoto group, consisting of D age and Kalambaina Formation, overlies the Rima Group. The Dange Formation cosists of clays and shales, while the Kalambaina Formation, which overlies the former, consisits of limestone and shale. The Gwandu Formation, which consists of clay. Limestone and sandstone are the youngest series and overlies the Sokoto Group; which is of Tertiary age attributed to a lacustrine environment (Kogbe, 1989).

3.4.1.6 Hydrogeology of Sokoto Area

The water resources of Sokoto State can be categorized into surface and underground groups. The surface sources emanate from streams and rivers, lakes and ponds. Major rivers of hydrogeological importance in the State are the Sokoto, Rima and Goronyo rivers, as discharges from these rivers recharge the Rima group and to a less extent the Kalambaina limestone. Other lakes of importance are the Kalmalo, Kware and Bodinga lakes. Overflow from these lakes, contribute immensely to the recharge of Rima in the Sokoto area during intense dry season and Dange clays.

The sedimentary formations which contain aquifers in the Sokoto basin are listed below:

(i) Recent (Alluvium, laterite),
(ii) (ii) Tertiary (Gwandu Formation, Kalambaina Formation), and
(iii) (iii) Cretaceous (Wurno Formation, Taloka Formation, Gundumi Formation and Illo Formation) (Oteze, 1989).

All the Formations that serve as good aquifers are found in Sokoto state except the Illo Formation. For better characterization of the hydrogeology of the Sokoto area, it will be described in terms of different geographic zones (Fig. 3.5), which are classified as (i) Sokoto metropolis, (ii) Southern part of Sokoto State, (iii) Eastern part of Sokoto State, and (iv) Northern part of Sokoto State.

3.4.1.7 Sokoto Metropolis

The Sokoto metropolis is presently partitioned into Sokoto North, Sokoto South and Wamakko Local Government areas. Information obtained from drilled boreholes in the Sokoto North, which comprises of the northern part of the Sokoto metropolis reveals that the prolific aquifers, with high yield (≥ 250 Lpm), were found at moderate and high depth values. Prolific aquifers at moderate

depth between 60 to 70 meters were found around Bazza, Dutse Assada and Sokoto Television Station areas. The static water level in these areas generally ranges between 18 to 24 meters. Also, such aquifers were found at high depths ranging between 104 to 130 m around Sultan Palace, Filin Idi, Kofar Kware, Mabera Jelani, Dutsin Assada and Bi-water Company. The static water level in these areas ranges from 40 to 45 meters. The aquifers constitute of limestone, of Kalambaina Formation, which is interpreted to be hard and fractures which enables it to store enough underground water.

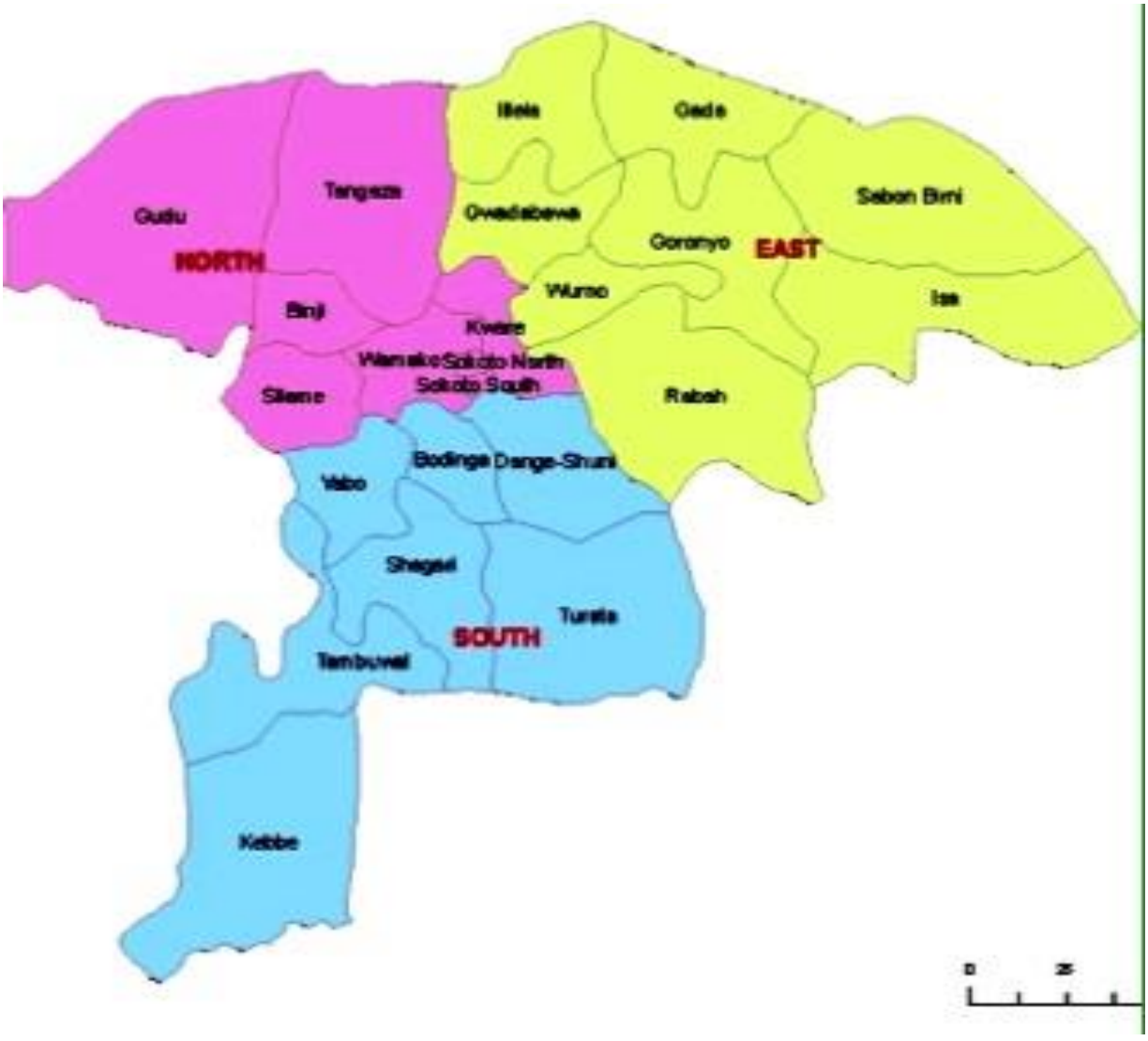


Figure 3. 5 Map of Sokoto State showing different zones and local governments

In the Sokoto south local government, which covers the southern portion of the metropolis, the prolific aquifers are found to be shallow within areas around Civil Service Club, at depth of about 30 meters and static water level of 13.5 meters. Moderate aquifers were found at moderate depths ranging between 52 to 72 meters around Tudun Wada and Yar Akija areas, with static water levels between 27 to 43 meters respectively. Hence, these areas are prolific for groundwater survey. The aquifers constitute of limestone, of Kalambaina Formation, which is interpreted to be hard and fractures which enables it to store enough underground water.

In other parts of the metropolis, which falls within the Wamakko Local Government area, prolific aquifers at shallow, moderate and high depths were found. The shallow aquifers were found at depths ranging between 28 to 43 meters with static water levels ranging between 6 to 17 meters, around Sokoto Guest Inn, Arkilla, Kasarawa, Kontagora Road, Bado Village and Yawuri Secretariat. Such aquifers are not expected to be prolific during the intense dry season. Aquifers at high depths ranging between 96 to 150 meters with static water levels between 45 to 58 meters, were equally found around Bubare, Gwiwa, Bado Quarters, Farfaru and Talata Mafara Road. These aquifers are expected to be prolific throughout the year, especially during intense dry season when water is generally scarce. The aquifers constitute of limestone, of Kalambaina Formation, which is interpreted to be hard and fractures which enables it to store enough underground water.

3.4.1.8 Southern part of Sokoto state

This portion of the state contains seven local governments namely, Yabo, Shagari, Bodinga, Dange/Shuni, Tureta, Tambuwal and Kebbe. Information from borehole data shows that prolific aquifers, with high yield ranging from 250 to 400 Lpm and moderate yield ranging between 100 to 250 Lpm were found in all the areas of the local governments.

In Tambuwal Local Government, the area has high prolific aquifers at depth ranging from 11.1 to 123.7 meters with static water level ranging from 5 to 80 meters, except few areas where moderate and low prolific aquifers were found. Areas of moderate prolific aquifers were found in Bilom and Iloji areas at depths ranging from 89 to 127 meters. The low prolific areas were found in Saida, Garam, Tungar Makera, Tungar Dorowa, Ruggar Rumbu, Samo, Rakuma, Gwangar Makera and Gesalode. The aquifer in the area consists of clayey sand and limestone, contained in Gwandu and Kalmbaina Formations.

In Bodinga Local Government, the high prolific aquifers were found in the predominant part of the area at depths ranging from 11.0 to 122.5 meters, except few areas where aquifers of moderate and low yield were found. The areas of moderate prolific aquifers, which are at depths of between 57.5 to 92.5 meters are Tauma, Bagauwan Dan Ajiwe, Zonzoro, Darhela and Tuntube areas. Further, areas of low prolific aquifers are in Tudun Buba, Lukuyawa,Guntun Gida Gidan KokaniDwrko, Kwaciyar Lalle, Badu, Darhela, Gugari, , KabawaKauri Haiya, Kaura Miyo and Kulodo areas at depths ranging between 13.0 to 134.0 meters.

3.4.1.9 Eastern part of Sokoto state

This portion of the state contains seven local governments namely, Wurno, Gwadabawa, Illela, Gada, Goronyo, Rabah, Isa and Sabon Birni. Information from borehole data shows that prolific aquifers, with high yield ranging from 250 to 400 Lpm and moderate yield ranging between 100 to 250 Lpm were found in all the areas of the local governments.

In Isa Local Government, considerable high prolific aquifers were found in the area. These areas include Janunu, Kwanar Isa, Malamawa,Gidan Katau, Batamawa, Kayaye,Dan Amma, Gidan Kadau, Gomoroji,Tagirke, Tungar Gobirawa, Kagara Bugaje, Ashabanza, Gyangyadi, Yarfakko, Awulkitti, Talokan Fili The depth to the aquifers in these areas range from 20.5 to 76.5 meters, while the static water level ranges from 3.9 to 67.5 meters. Aquifers in these areas which are confined/semi-confined constitute coarse sand and gravel. Apart from these areas, borehole information from other portions of the local government shows low prolific aquifers which do not store sufficient underground water.

3.4.1.10 Hydrology of the Project Area

The project area is drain by River Sokoto. River Sokoto is a tributary of the River Niger and originates from a place close to Funtua in the south of Katsina State about 300 kilometres away from Sokoto. River Sokoto flows north-west passing through Gusau and eventually enters Sokoto where it is joined by River Rima and further down turns south flowing through Birnin Kebbi Town in Kebbi State before reaching its confluence with the River Niger.

The plains around River Sokoto are widely cultivated using its water for irrigation. The river is also an important means of transport.

Flow in streams of the Sokoto Basin is mostly overland runoff. Only few streams are perennial. Near Sokoto Town, the Rima River flows throughout the year sustained by spring discharge from perched ground water in limestone of the Kalambaina Formation.

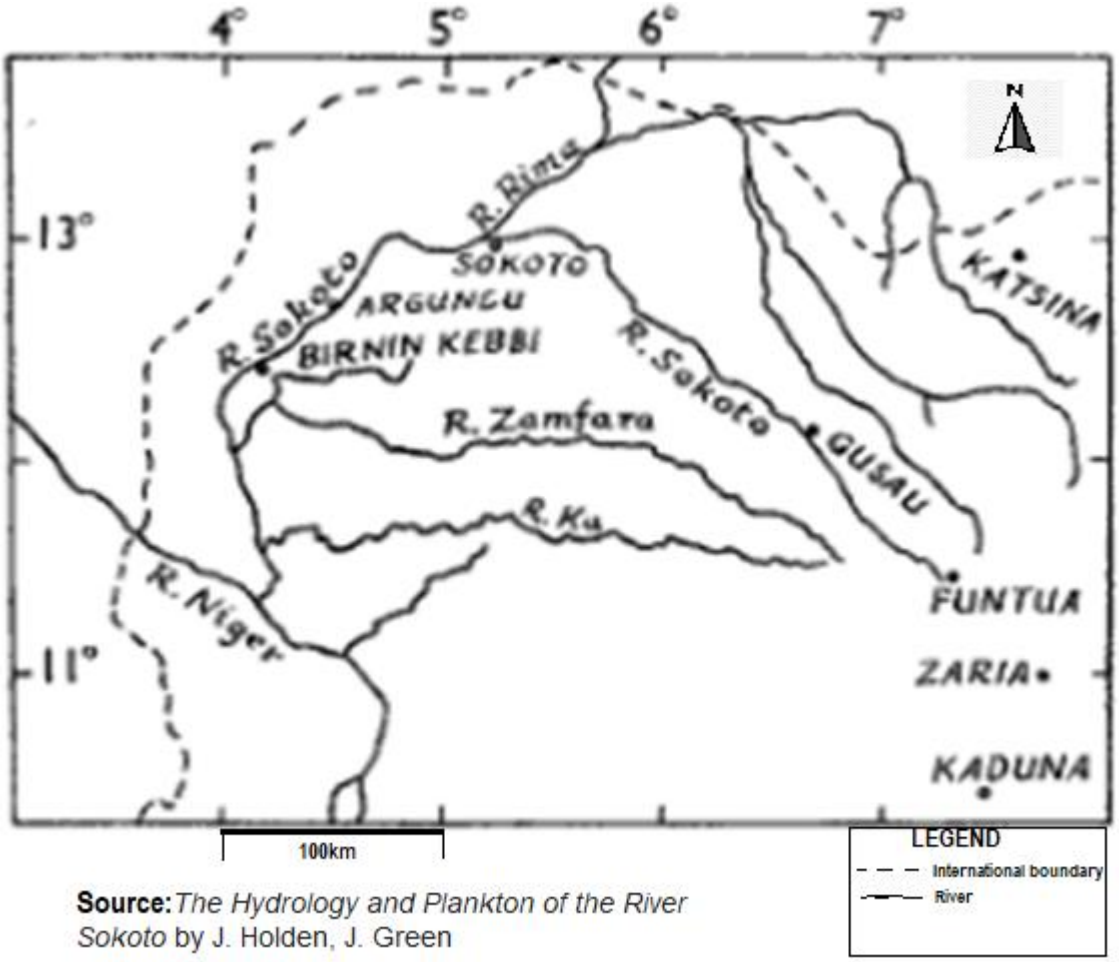


Figure 3. 6: Hydrology and Geology of Sokoto State

3.5.1 Ecological Baseline

3.5.1.1 Vegetation

The vegetation of the project area falls within the Sudan Savannah agro-ecological zone characterized by sandy soil, loamy soil and some patches of Fadama land. Grasses look green during the rainy season, but eventually withered and die during the dry season (Adamu, 2007). Ecosystem services provided by plants include protection of soil loss against wind and water erosion, humus accumulation, nitrogen fixation, and nutrient supply from deeper layers. Moreover,

plants stabilise regional and global climate, provides for pollution control and act as carbon sink (Botkin and Keller, 1998; Alonso *et al.*, 2001; Adamu, 2007). Vegetation patches also yield utilitarian products/services such as fuel-wood, nuts vegetable, gum, spices, dyes, medicinal products, fodder for grazing and browsing by wildlife and livestock. They also serve as avenues for recreation while crown of trees and shrubs offer shade (in hot weather) (GFA, 2001; Adamu, 2007). Hence, these environmental and utilitarian services underscore the importance of vegetation patches not only in Sokoto metropolis but in all cities and towns in Nigeria. The dryland ecosystem of Sokoto state, in the North-western part of Nigeria has been witnessing gradual loss of vegetation cover in the recent decades caused by natural and human induced drivers of ecosystem change. This negative trend poses great challenges to both the physical environment and the people of the area, particularly due to the fragile nature of the ecosystems in the region and the peoples' over dependence on it for their livelihoods.

Plate A. 4: *Hyphaene thebiaca* stands

Plant and bird species identified at the respective project sites are presented in the following tables.

Table 3. 2: Plant species at the Sokoto State University Entrepreneurship Center, Sokoto

Location: Plants from Sokoto State University Entrepreneurship Center, Sokoto Transect 25m x 25m Latitude: 12°.55.599'N Longitude: 005°.11.241'E Date: 21st September, 2021 Time: 10:30am						
S/N	Scientific Name	Plant Common Name	Abundance/population/CS	Family Name	Economic potential	Plant Habit
1	*Acacia senegal*	Gum Arabic	High/unknown/LC	Fabaceae	Gum Arabic	Tree
2	*Azadirachta indica*	Neem tree	Low/stable/LC	Meliaceae	Insecticidal	Tree
3	*Combretum micranthum*	Kinkeliba	High/na	Combretaceae	Herbal tea	Shrub
4	*Andropogon gayanus*	Gamba grass	High/na	Poaceae	Thatch	Grass
5	*Crotalaria retusa*	Crotalaria	Low/LC	Fabaceae	Fodder	Shrub
6	*Ziziphus abbysinica*	Jujube	High/na	Rhamnaceae	Medicine	Shrub
7	*Adansonia digitata*	Baobab tree	Low/na	Bombacaceae	Kidney	Tree
8	*Fhaiderbia albida*	Apple ring acacia	High/unknown/LC	Fabaceae	Fodder	Tree
9	*Vitellaria paradoxum*	Shea butter	High/na	Sapotaceae	Pasteur (oil)	Tree
10	*Acacia nilotica*	Fodder tree	High/Unknown/LC	Fabceae	Fodder	Tree
11	*Hyphaene thebiaca*	Dum palm	Low/na	Palmae	Source of timber	Tree
12	*Diospyros mespiliformis*	Ebony tree	High/na	Ebenaceae	Source of wood	Tree
13	*Urena lobata*	Caesar weed	High/na	Malvaceae	Fibre	Shrub
14	*Senna occidentalis*	Coffea senna	Low/NT	Fabaceae	Anti rabbies	Shrub
15	*Balanites aegyptiaca*	Desert date	High/LC	Balanitaceae	Fruit plant	Tree
16	*Leptadenia hastate*	Leptadenia	High/na	Asclepiadaceae	For food	Shrub

17	*Guiera senegalensis*		High/LC	Combretaceae	Medicinal	Tree

Table 3. 3: Birds Species at Sokoto State University Entrepreneurship Center, Sokoto

Location: Plants from Sokoto State University Entrepreneurship Center, Sokoto **Latitude: 12°.55.599'N Longitude: 005°.11.241'E Date: 21st September, 2021 Time: 10:30am**					
S/N	Birds Scientific Name	Birds Common Name	Family Name	Conservation Status (Borrow & Demey, 2013)	Population Estimate
1.	*Elamus coeruleus*	Black shoulder kite	Acciptridae	M/P/R* c	3
2.	*Falco tinnunculus*	Common Kestrel	Falconidae	R/P/V* f/c LC	
3.	*Polyboroides typus*	African harrier hawk	Acciptridae	R c LC	1
4.	*Milvus migrans*	Yellow billed kite	Acciptridae	M/P/R* c LC	4
5.	*Circus macrourus*	Pallid Harrier	Acciptridae	Pu/s NT	2
6.	*Bubulcus ibis*	Cattle Egret	Ardeidae	R/M+ c LC	5
7.	*Egretta garzetta*	Little Egret	Ardeidae	R+/M/Pc LC	2

Table 3. 4: Plant species at the Shehu Shagari COE Entrepreneurship Center, Sokoto

Location: Plants from Shehu Shagari COE Entrepreneurship Center, Sokoto Transect 25m x 25m **Latitude: 12°.55.599'N Longitude: 005°.11.241'E Date: 22nd September, 2021 Time: 10:30am**						
S/N	Scientific Name	Plant Common Name	Abundance/population/CS	Family Name	Economic potential	Plant Habit
1	*Calotropis procera*	Soddom apple	Low/na	Asclepiadaceae	Medicinal/Indicator of environmental disturbnce	Shrub
2	*Azadirachta indica*	Neem tree	Low/stable/LC	Meliaceae	Insecticidal	Tree
3	*Combretum micranthum*	Kinkeliba	High/na	Combretaceae	Herbal tea	Shrub
4	*Andropogon gayanus*	Gamba grass	High/na	Poaceae	Thatch	Grass
5	*Crotalaria retusa*	Crotalaria	Low/LC	Fabaceae	Fodder	Shrub
6	*Ziziphus abbysinica*	Jujube	High/na	Rhamnaceae	Medicine	Shrub
7	*Adansonia digitata*	Baobab tree	Low/na	Bombacaceae	Kidney	Tree

8	*Fhaiderbia albida*	Apple ring acacia	High/unknown/LC	Fabaceae	Fodder	Tree
10	*Acacia nilotica*	Fodder tree	High/Unknown/LC	Fabceae	Fodder	Tree
11	*Hyphaene thebiaca*	Dum palm	Low/na	Palmae	Source of timber	Tree
12	*Diospyros mespiliformis*	Ebony tree	High/na	Ebenaceae	Source of wood	Tree
13	*Urena lobata*	Caesar weed	High/na	Malvaceae	Fibre	Shrub
14	*Senna occidentalis*	Coffea senna	Low/NT	Fabaceae	Anti rabbies	Shrub
15	*Balanites aegyptiaca*	Desert date	High/LC	Balanitaceae	Fruit plant	Tree

Table 3. 5: Birds Species at Shehu Shagari COE Entrepreneurship Center, Sokoto

Location: Plants from Shehu Shagari COE Entrepreneurship Center, Sokoto Latitude: 12°.55.599'N Longitude: 005°.11.241'E Date: 22nd September, 2021 Time: 10:30am					
S/N	Birds Scientific Name	Birds Common Name	Family Name	Conservation Status (Borrow & Demey, 2013)	Population Estimate
1.	*Elamus coeruleus*	Black shoulder kite	Acciptridae	M/P/R* c	1
2.	*Falco tinnunculus*	Common Kestrel	Falconidae	R/P/V* f/c LC	1
3.	*Polyboroides typus*	African harrier hawk	Acciptridae	R c LC	2
4.	*Milvus migrans*	Yellow billed kite	Acciptridae	M/P/R* c LC	3
5.	*Circus macrourus*	Pallid Harrier	Acciptridae	Pu/s NT	4
8.	*Bubulcus ibis*	Cattle Egret	Ardeidae	R/M+ c LC	1
9.	*Egretta garzetta*	Little Egret	Ardeidae	R+/M/Pc LC	1

Table 3. 6: Plant species at Umaru Ali Shinkafi Polytechnic Entrepreneurship Center, Sokoto

Location: Plants from Umaru Ali Shikafi Polytechnic COE Entrepreneurship Center, Sokoto Transect 25m x 25m Latitude: 13°.00.936'N Longitude: 005°.11.874'E Date: 22nd September, 2021 Time: 1:30pm						
S/N	Scientific Name	Plant Common Name	Abundance/population/CS	Family Name	Economic potential	Plant Habit
1	*Calotropis procera*	Soddom apple	Low/na	Asclepiadaceae	Medicinal/Indicator of environmental disturbnce	Shrub
2	*Azadirachta indica*	Neem tree	Low/stable/LC	Meliaceae	Insecticidal	Tree
3	*Adansonia digitata*	Baobab tree	Low/na	Bombacaceae	Kidney	Tree
4	*Balanites aegyptiaca*	Desert date	High/LC	Balanitaceae	Fruit plant	Tree
5	*Crotalaria retusa*	Crotalaria	Low/LC	Fabaceae	Fodder	Shrub
6	*Ziziphus abbysinica*	Jujube	High/na	Rhamnaceae	Medicine	Shrub

Table 3. 7: Birds Species at Umaru Ali Shinkafi Polytechnic Entrepreneurship Center, Sokoto

Location: Plants from Umaru Ali Shinkafi Polytechnic Entrepreneurship Center, Sokoto Transect 25mx25mLatitude: 12°.55.599'N Longitude: 005°.11.241'E Date: 22nd September, 2021 Time: 10:30am					
S/N	Birds Scientific Name	Birds Common Name	Family Name	Conservation Status (Borrow & Demey, 2013)	Population Estimate
1.	*Elamus coeruleus*	Black shoulder kite	Acciptridae	M/P/R* c	2
2.	*Falco tinnunculus*	Common Kestrel	Falconidae	R/P/V* f/c LC	1
3.	*Polyboroides typus*	African harrier hawk	Acciptridae	R c LC	2
4.	*Milvus migrans*	Yellow billed kite	Acciptridae	M/P/R* c LC	2
5.	*Circus macrourus*	Pallid Harrier	Acciptridae	Pu/s NT	2

Table 3. 8: Plant species at Sultan Abubakar College Entrepreneurship Center, Sokoto

Location: Plants from Sultan Abubakar College Entrepreneurship Center, Sokoto Transect 25m x 25m **Latitude: 13°.03.051'N Longitude: 005°.13.586'E Date: 22nd September, 2021 Time: 3:30pm**						
S/N	Scientific Name	Plant Common Name	Abundance/population/CS	Family Name	Economic potential	Plant Habit
1	*Balanites aegyptiaca*	Desert date	Low/LC	Balanitaceae	Fruit plant	Tree
2	*Azadirachta indica*	Neem tree	Low/stable/LC	Meliaceae	Insecticidal	Tree
3	*Amaranthus spinosus*	Pig weed	High/na	Amaranthaceae	Medicinal	Shrub
4	*Fhaiderbia albida*	Apple ring acacia	Very low/unknown/LC	Fabaceae	Fodder	Tree

Conservation status key:

Status:

R Resident
M Intra-African migrant
P Palearctic migrant (including few species of Nearctic origin)
V Vagrant
* Cape Verde only
+ also Cape Verde

Abundance categories

c common
f fairly common (=frequent; the category 'not uncommon 'in *BOWA* 2001)
u uncommon
s scarce
r rare
l local (e.g. 'lc' = locally common)
* indicates abundance in Cape Verde only (if very different from elsewhere)

Threat categories

CR Critically endangered
EN Endangered
VU Vulnerable
NT Near Threatened
DD Data Deficient
LC Least concern
NA Not available

3.5.1.2 Impacts on the vegetation cover:

The impacts of structure developments of the entrepreneurship centers on biodiversity may fall into 4 main types: habitat loss, habitat fragmentation, direct and indirect impacts on habitat quality and species, and cumulative impacts. Based on these, the following impacts are envisaged to affect the biodiversity in all the proposed centers viz:

1. Most of these projects on entrepreneurship will inevitably lead to some loss of biodiversity through tree/vegetation clearance but, this can be minimised by full use of impact avoidance, mitigation and in some cases compensation measures.
2. Specific plant species like *A. digitata,* stands etc would be cleared during the construction activities of the centers.
3. Similarly, species like *B. aegyptiaca, Fhaiderbia albida* stands etc will also be affected through total clearance during the construction activities.

3.5.1.3 Wildlife

The wild life species documented in the Project area include some members of the invertebrate, reptiles, birds and mammals. Major threats to wildlife in the area include uncontrolled poaching and clearance of land for pasture.

- ***Invertebrates***

  The invertebrates documented in the area include gastropoda such millipedes (*Pochybolus* sp), dragon flies and butterflies were observed visiting flowers for pollination

- ***Reptiles***

  The published works of Nigerian reptiles include works of Child (1974), Dunger (1973), and Grandison (1968). The reptiles documented in the study area include snakes, African Chameleon (*Chameleo senegalensis*), Rainbow Lizard (*Agama agama*) etc.

- **Birds**

  The avifauna of the project area represents the diverse habitat types in the region as birds inhabit vegetation areas that are most suitable for their feeding and nesting habits. Seed and insect eating birds such as barn swallow, doves, pied crows, common thrush.

- **Mammals**

The mammals documented in the area are mostly rats, rabbit and African giant rat.

3.5.1.4 Ambient Air Quality and Noise Level

The mean concentrations of the air pollutants (CO2, SOx, SPM, NH3, VOC, NOx, CH4, H2S) and noise levels were measured in the study area within a radius of 1.5km (zone of influence) from the centre of the project site. Measurements were taken during the study period. Generally, measurements indicated that the ambient air was free from pollution by these measured parameters as at time of study. The quality of air as tested within the proposed Entrepreneurship Centres study area are presented in Table 2.3 while Table 2.4 presents the quality of air as tested within the proposed College of Education Centre study area. While detailed analytical results are included in Appendix 4. (See attached A3 map for spatial distribution of sample stations).

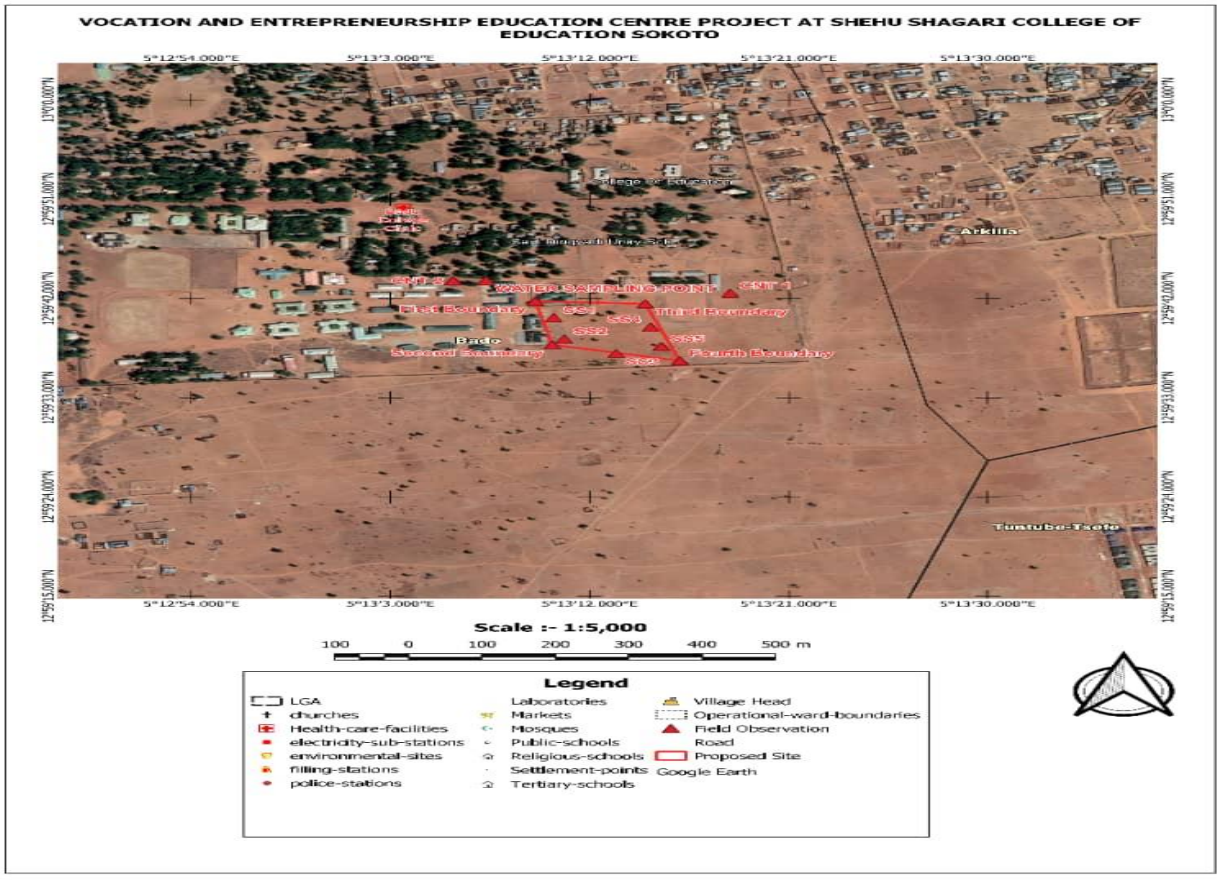


Figure 3. 2: Air Quality samples at Shehu Shagari College

Table 3. 9: Summary for Construction of Entrepreneurship Centre, College of Education

Parameter/unit									Fertilizer Blending Plant Project EIA, 2021	FMEnv Limits (Daily Average) **
	min	max	mean	Control	min	max	mean	Control		
Noise level, d(B) A	43.1	46.1	45.04	41	42.1	46.1	44.04	41	47.34	90
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.89	26
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NA	75-113
SPM µg/m3	8	12	10.4	12	9	11	10.9	12	50	250
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.7	0.13
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NA	0.01
CO µg/m3	0.01	0.09	0.047	0.015	0.01	0.08	0.046	0.015	2.13	11.4
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	35.01	36.04	35.254	35.525	35.02	35.04	35.254	34.24	NA	NA
Wind Speed (m/s)	0.01	0.07	0.03	0.025	0.01	0.07	0.03	0.025	NA	NA
Relative Humidity (%)	34.2	52.9	34.92	43.55	32.9	42.9	39.22	43.55	NA	NA

Source: Field work, 2021. NA: Not Applicable

Suspended Particulate Matter

The SPM levels in the proposed Entrepreneurship Centres study area ranged from 8.0µg/m3 to 12.0 µg/m3 with a mean value of 10.04 µg/m3 during the sampling period which compared well with the control. The SPM levels in the proposed College of Education Centre study area ranged from 9.0µg/m3 to 11.0 µg/m3 with a mean value of 10.9 µg/m3 during the sampling period which also compared well with the control. Values were also below the regulatory limit of 250µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

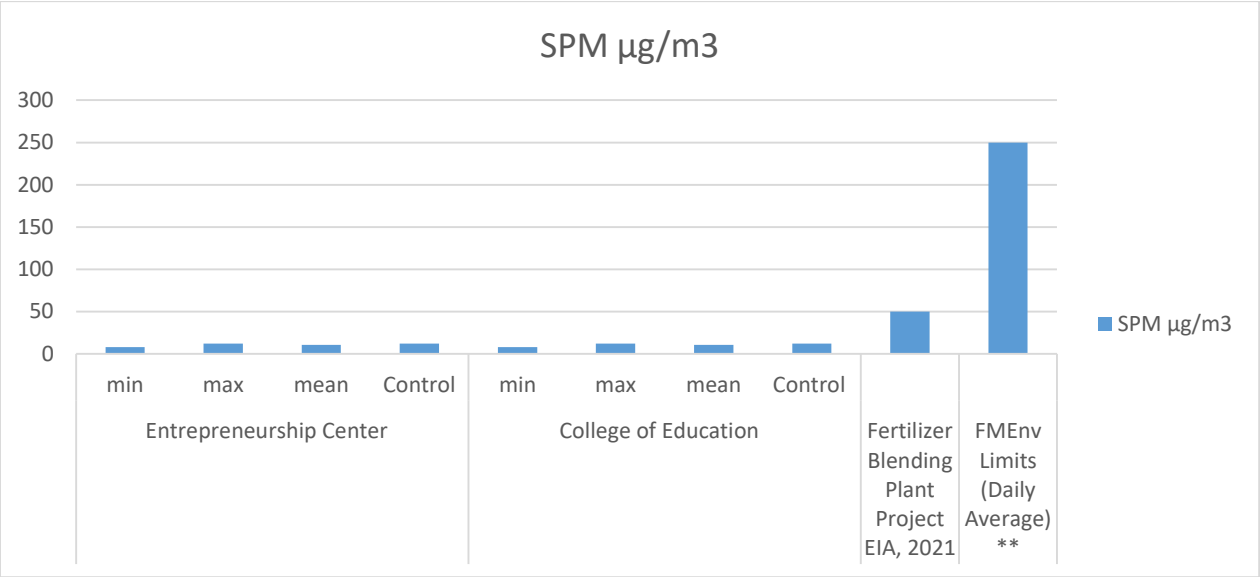


Figure 3. 3: Suspended Particulate Matter in Air. Source: Enarmac Fieldwork, 2021.

Carbon Monoxide

The recorded level of CO ranged from 0.01µg/m3 to 0.09µg/m3 with a mean value of 0.047 µg/m3 during sampling period in the proposed Entrepreneurship Centres study area. These obtained values compared well with control readings. In the proposed College of Education Centre study area the CO level ranged from 0.01µg/m3 to 0.08µg/m3 with a mean value of 0.046 µg/m3 during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 11.4µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Hydrogen Sulphide

H2S was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.01µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Sulphur Oxides

SOx was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 26µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Nitrogen Oxides

NOx was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 75µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA 2021).

Methane

Methane gas was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.01µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Ammonia

NH3 was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.13µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Noise Level

Noise levels in the proposed Entrepreneurship Centres study area ranged from 43.1 d(B) to 46.1 d(B) with a mean value of 45.04d(B) during the sampling period which compared well with the control. In the proposed College of Education Centre study area it ranged from 42.1 d(B) to 46.1 d(B) with a mean value of 44.04d(B) during the sampling period which compared well with the control. Values were also below the regulatory limit of 90 d(B) and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

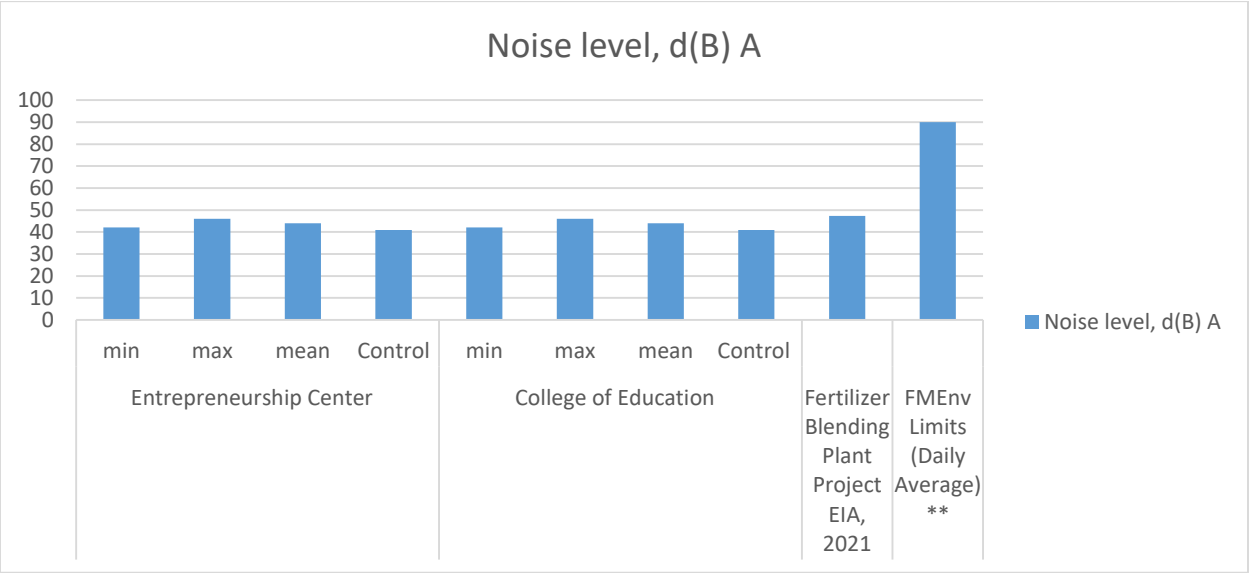


Figure 3. 4: Noise Level. Source: Enarmac Fieldwork, 2021.

Polytechnic Centre and Secondary School Centre Ambient Air Quality and Noise Level

The mean concentrations of the air pollutants (CO2, SOx, SPM, NH3, VOC, NOx, CH4, H2S) and noise levels were measured in the study area within a radius of 1.5km (zone of influence) from the centre of the project site. Measurements were taken during the study period. Generally, measurements indicated that the ambient air was free from pollution by these measured parameters as at time of study. The quality of air as tested within the Polytechnic Centre study area are presented in Table 4.1 while Table 4.2 presents the quality of air as tested within the Secondary School Centre study area. While detailed analytical results are included in Appendix 4. (See attached A3 map for spatial distribution of sample stations).

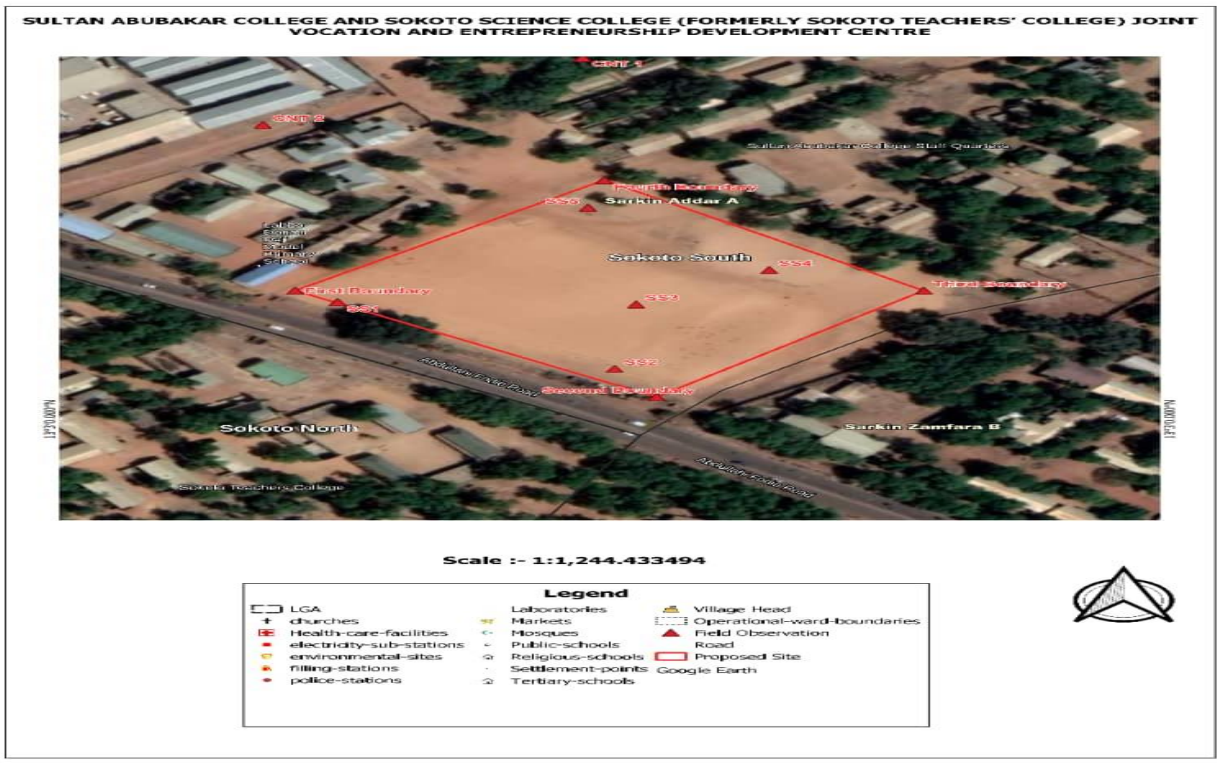


Figure 3. 5: Noise Level. Source at Sultan Abubakar College: Enarmac Fieldwork, 2021.

Table 3. 10: SUMMARY FOR CONSTRUCTION OF:

Parameter/unit	**Polytechnic**				**Secondary School**				Fertilizer Blending Plant Project EIA, 2021	FMEnv Limits (Daily Average) **
	min	max	mean	Control	min	max	mean	Control		
Noise level, d(B) A	42.5	48.4	45.04	41	42.1	46.1	44.04	41	47.34	90
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.89	26
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NA	75-113
SPM µg/m3	8	15	12.4	12	8	12	10.4	12	50	250
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.7	0.13
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NA	0.01
CO µg/m3	0.01	0.09	0.057	0.015	0.01	0.08	0.046	0.015	2.13	11.4
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	36.03	37.04	34.54	35.525	35.01	36.04	35.254	35.525	NA	NA
Wind Speed (m/s)	0.01	0.07	0.03	0.025	0.01	0.07	0.03	0.025	NA	NA
Relative Humidity (%)	33.9	42.9	38.92	43.55	32.9	42.9	39.22	43.55	NA	NA

Source: Field work, 2021. NA: Not Applicable

Suspended Particulate Matter

The SPM levels in the study area ranged from 8.0µg/m3 to 15.0 µg/m3 with a mean value of 12.4 µg/m3 during the sampling period in the Polytechnic Centre study area which compared well with the control. In the Secondary School Centre study area SPM levels in the study area ranged from 8.0µg/m3 to 12.0 µg/m3 with a mean value of 10.4 µg/m3 during the sampling period which also compared well with the control. Values were also below the regulatory limit of 250µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

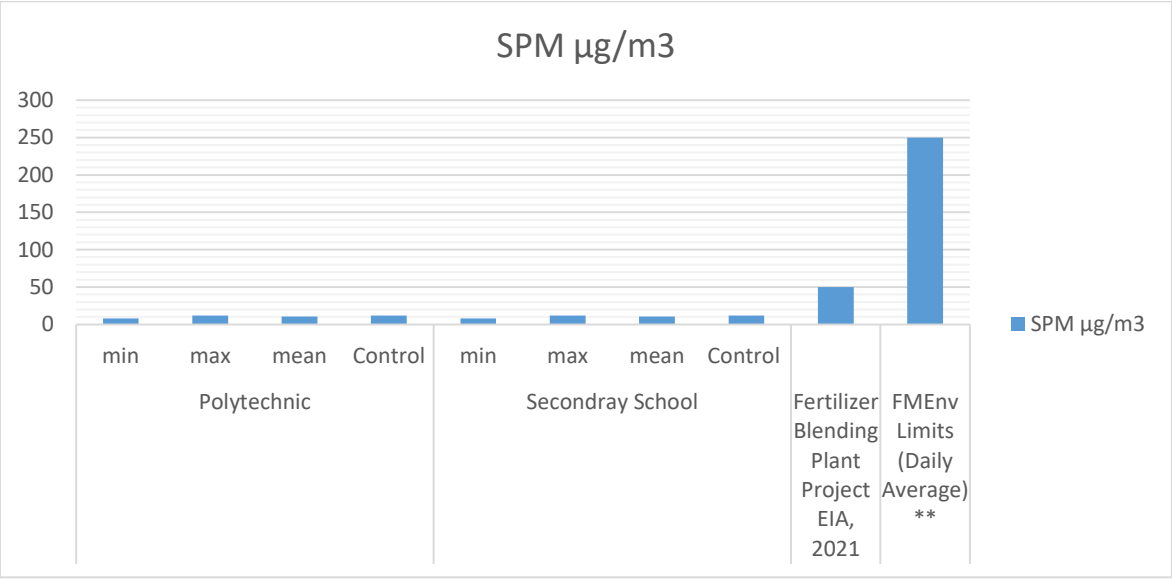


Figure 3. 6: Suspended Particulate Matter in Air. Source: Enarmac Fieldwork, 2021.

Carbon Monoxide

The recorded level of CO ranged from 0.01µg/m3 to 0.09µg/m3 with a mean value of 0.057 µg/m3 during the sampling period in the Polytechnic Centre study area. In the Secondary School Centre study area the recorded level of CO ranged from 0.01µg/m3 to 0.08µg/m3 with a mean value of 0.046 µg/m3 during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 11.4µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Hydrogen Sulphide

H2S was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.01µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Sulphur Oxides

SOx was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 26µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Nitrogen Oxides

NOx was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 75µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Methane

Methane gas was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.01µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Ammonia

NH3 was generally below detectable level of <0.01µg/m3 in the study areas during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 0.13µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Noise Level

Noise levels in the study area ranged from 41.3 d(B) to 44.5 d(B) with a mean value of 44.2 d(B) during the sampling period which compared well with the control. Values were also below the regulatory limit of 90 d(B) and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

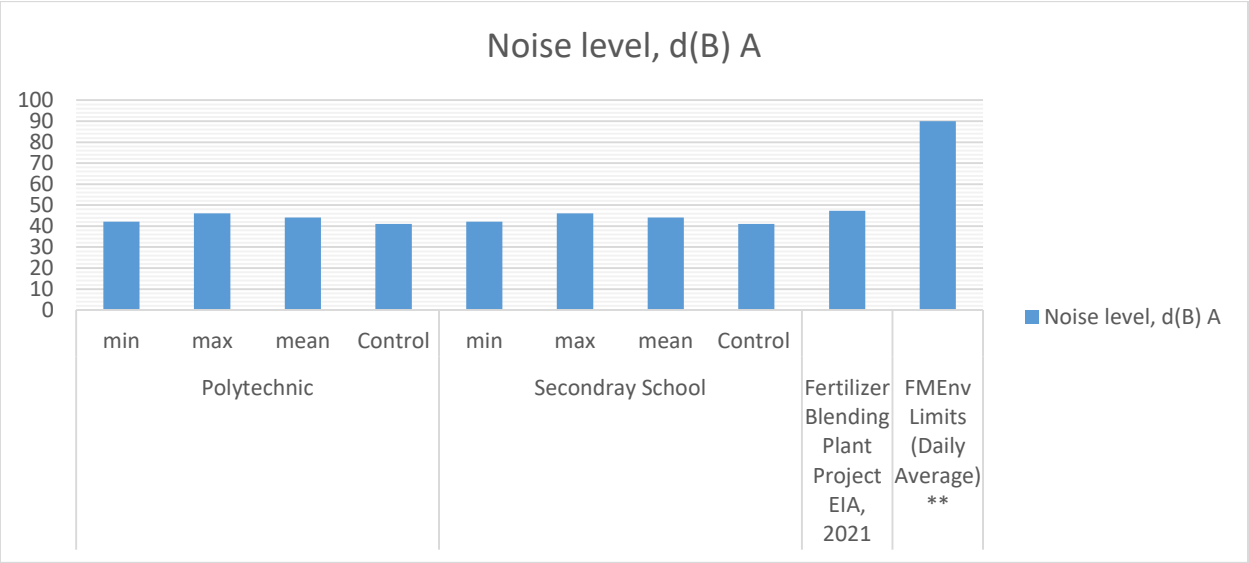


Figure 3. 7: Noise Level. Source: Enarmac Fieldwork, 2021.

3.5.1.5 Water Characteristics

The concentrations of the groundwater parameters were measured in the study area within a radius of 1.5km (zone of influence) from the centre of the project site. Samples for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre were collected within the study area during the wet season. Result from analyses is summarized in **Table 3.11** while detailed analytical results are included in **Appendix 4**. (See attached A3 map for spatial distribution of sample stations).

Table 3. 11: Summary of Physico-Chemical and Microbiology Result of Groundwater Samples

Parameters	Entrepreneurship center	College of education	Polytechnic	Secondary school	Fertilizer Blending Plant Project EIA, 2021	FMEnv. Standard
pH	7.50	6.85	6.70	8.53	7.70	6-9
TEMP (^{0}c)	27.18	28.60	28.10	27.18	28.55	<40
COND (µs/cm)	85.00	66.00	92.00	85.00	252.00	1000
TDS (mg/l)	42.00	31.00	47.00	42.00	84.00	2000
DO (mg/l)	4.17	4.55	4.07	4.17	8.29	2-8
TSS mg/l	0.41	0.33	0.27	0.41	0.006	30
Turbidity, NTU	1.10	2.00	3.01	2.10	0.65	5
BOD (mg/l)	0.45	0.56	0.58	0.45	21.2	7.5
COD (mg/l)	1.161	1.16	1.16	1.16	106.45	30
Petroleum Hydrocarbons						
THC (mg/l)	<0.001	<0.001	<0.001	<0.001	NA	NA

Nutrient						
Nitrate (mg/l)	0.17	0.20	0.15	0.17	4.63	<1
Sulphate (mg/l)	35.01	55.00	51.7	35.01	11.75	500
Ammonium (mg/l)	<0.01	<0.01	<0.01	<0.01	0.005	10
Phophate (mg/l)	0.41	0.27	0.35	0.41	0.112	5
Heavy Metals						
Nickel (mg/l)	<0.001	<0.001	<0.001	<0.001	0.05	<1
Iron (mg/l)	0.015	0.021	<0.001	0.015	0.82	1.5
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001	0.006	<1
Copper (mg/l)	<0.001	<0.001	<0.001	<0.001	0.171	<1
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<1
Zinc (mg/l)	<0.001	<0.001	<0.001	<0.001	1.562	3
Cadmium (mg/l)	<0.001	<0.001	<0.001	<0.001	0.046	<1
Barium (mg/l)	<0.001	<0.001	<0.001	<0.001	NA	NA
Cobalt (mg/l)	<0.001	<0.001	<0.001	<0.001	NA	NA
Arsenic (mg/l)	<0.001	<0.001	<0.001	<0.001	NA	NA
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001	NA	NA
Cations						
Potassium (mg/l)	0.003	0.01	0.006	0.003	NA	NA
Sodium (mg/l)	0.22	0.25	0.23	0.22	NA	NA
Magnesium (mg/l)	0.01	0.01	0.01	0.01	119.84	NA
Calcium (mg/l)	0.02	0.03	0.02	0.02	308.16	NA
Microbiology						
Coliforms	10	12	8	10	6.6	<1
E. coli	0	0	0	0	NA	absent
Faecalstreptacocci	--	--	--	--	NA	absent
Straphylococcciaureus	Absent	absent	absent	Absent	NA	absent

Source: **Enarmac Fieldwork, 2021**.Field work, 2021. NA: Not Applicable

Physico-Chemical Characteristics

pH values were 7.50, 6.85, 6.70 and 8.53 for the underground water samples collected for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre. These values are mostly tending towards alkalinity and are below the stipulated limits by FMEnv. Conductivity and TDS values respectively were 85.00µS/cm and 42.00mg/l, 66.00µS/cm and 31.00mg/l, 92.00µS/cm and 47.00mg/l; and 85.00µS/cm and 42.00mg/l respectively for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre. These values complied well with stipulated limits by FMEnv. The values recorded for Total Suspended Solids were respectively 0.41mg/l, 0.33mg/l, 0.27mg/l and 0.41mg/l while those recorded for turbidity were respectively 1.10NTU, 2.00NTU, 3.01NTU and 2.10NTU in the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre underground water samples collected which complied well with stipulated limits by FMEnv. Obtained values were also within the range of those obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

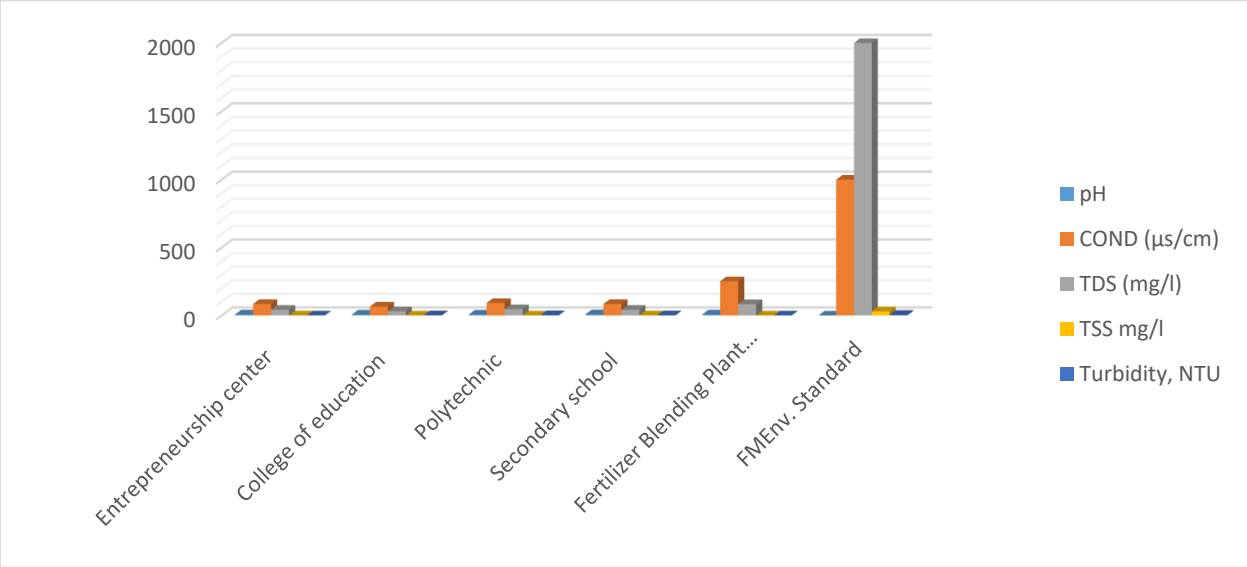


Figure 3. 8: pH, Conductivity, Total Dissolved Solids, Total Suspended Solids and Turbidity Levels in Ground water. Source: Enarmac Fieldwork, 2021**.**

DO, BOD and COD

The Dissolved Oxygen values obtained in samples collected for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre study areas were 4.17mg/l, 4.55mg/l, 4.07mg/l and 4.17mg/l respectively. The Biological Oxygen Demend values obtained in samples collected for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre study areas were 0.45mg/l, 0.56mg/l, 0.58mg/l and 0.45mg/l respectively. The Chemical Oxygen Demend values obtained in samples collected for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre study areas were 1.16mg/l in all the samples. These values complied well with stipulated limits by FMEnv and were lower than range of values obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

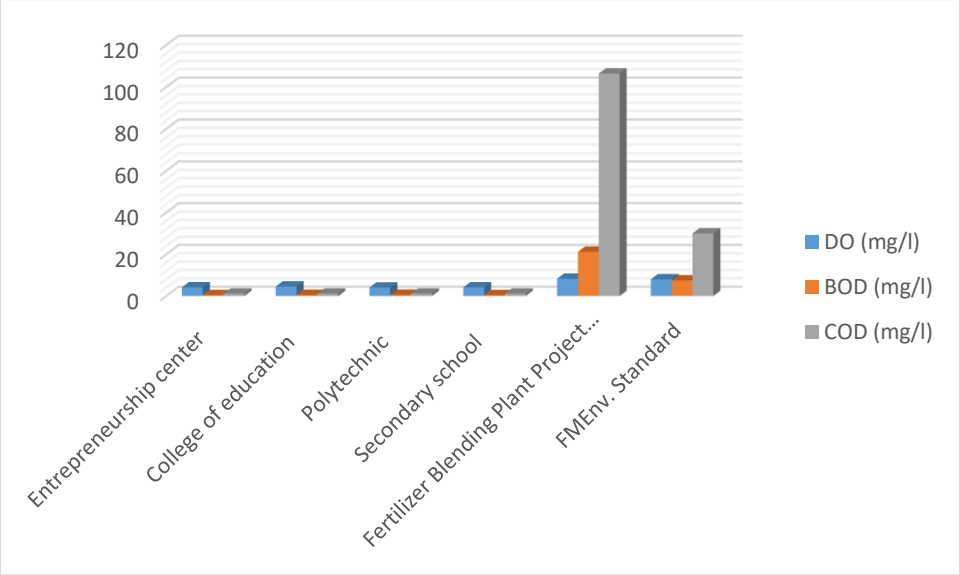


Figure 3. 9: DO, BOD and COD Levels in Ground water. Source: Enarmac Fieldwork, 2021.

Total Hydrocarbon Content (THC)

The THC analysed from the ground water samples in the facility areas were below equipment detection limit of <0.001mg/l in all stations. Obtained values complied with the range of those obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

Nutrients

From the **Table 2.5** the concentration of sulphate accounted for the larger part of the nutrient content with values of 35.01mg/l, 55.00mg/l, 51.70mg/l and 35.01mg/L for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre respectively. The order of nutrient concentration present in the samples for the facilities are Sulphate>Phosphate>Nitrate>Ammonium.

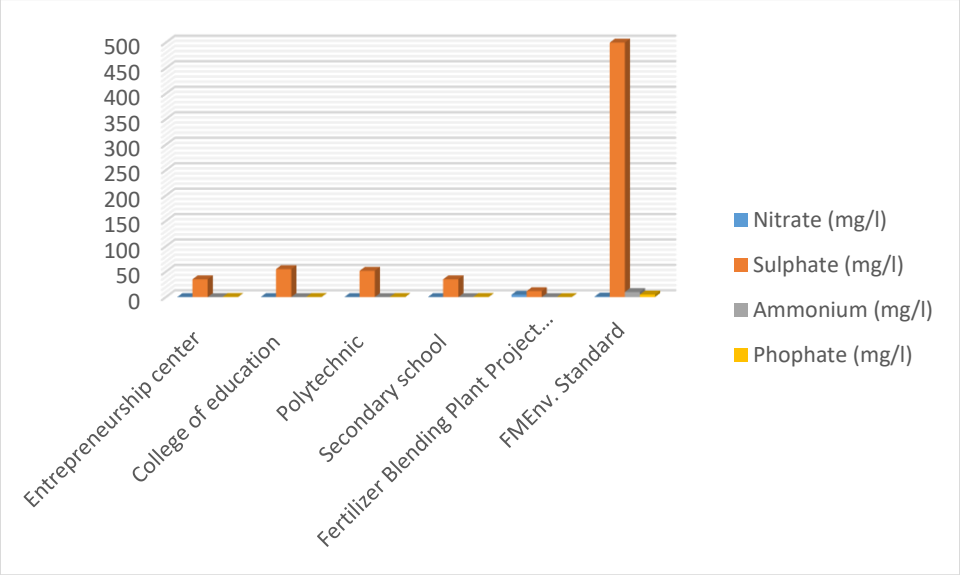


Figure 3. 10: Nutrients Levels in Ground water. Source: Enarmac Fieldwork, 2021.

Cations

From the **Table 2.5.** The concentration of sodium accounted for the larger part of the cations content with values of 0.234mg/l and 0.233mg/L for the cargo terminal and ware house facilities respectively. The order of cations concentration present in the samples for the facilities are Sodium>Calcium>Magnesium>Potassium.

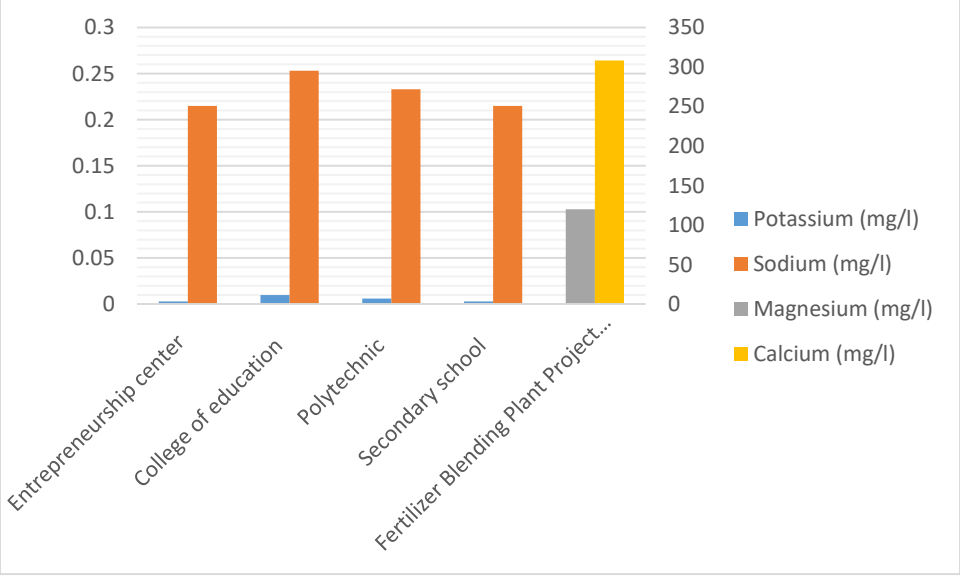


Figure 3. 11: Cations Levels in Ground water. Source: Enarmac Fieldwork, 2021.

Heavy Metals

The heavy metals concentration of the groundwater was generally low and mostly below the detection limit of the atomic absorption spectrophotometer used for the analysis except for Iron which was detected at a concentration of 0.015mg/l, 0.021mg/l, <0.001mg/l and 0.015mg/l in samples collected for the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre respectively. In all, the heavy metals results were below FMEnv limits for heavy metals and were also below values obtained from a previous study.

Ground Water Microbiology

The results of microbial counts in underground water samples collected in the project area are presented in **Table 2.6** Where values were all below equipment detection limit except for coliforms count where a count of 10, 12, 8 and 10 were obtained in the proposed Entrepreneurship Centres, College of Education Centre, Polytechnic Centre and Secondary School Centre respectively.

35.1.6 Soil Studies

Soil Physico-Chemical Characteristics

Entrepreneurship Centres and College of Education Centre Soil Physico-Chemical Characteristics

Soil samples of the proposed project sites were collected for the proposed construction of the Entrepreneurship Centres and College of Education Centre. Samples were collected within a radius of 1.5km (zone of influence) from the centre of the project sites. At each station, soil samples were collected from two depth levels: 0 – 15cm, and 15 – 30cm. Result from analyses is summarized in **Table 2.6** while detailed analytical results are included in **Appendix xxxx..**

pH

Soil pH or soil reaction is an indication of the acidity or alkalinity of soil and is measured in pH units. Soil pH is defined as the negative logarithm of the hydrogen ion concentration. The pH scale goes from 0 to 14 with pH 7 as the neutral point. As the amount of hydrogen ions in the soil increases, the soil pH decreases thus becoming more acidic. From pH 7 to 0 the soil is increasingly more acidic and from pH 7 to 14 the soil is increasingly more alkaline or basic.

pH of the soil sampled were generally varying from basic to moderately acidic. At the proposed Entrepreneurship Centres study area, it ranged from 7.1 to 8.38 with a mean value of 7.70 at the

top soil and between 6.79 and 7.82 with a mean value of 7.24 at sub soil. At the proposed College of Education Centre study area it ranged from 7.21 to 8.05 with a mean of 7.56 at the top soil and between 6.79 and 7.82 with a mean value of 7.24. All obtained values compared well with values from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Total Organic Carbon

The principal factors responsible for high organic matter in soil include vegetative cover and decay of plant residue. These factors are significantly absent in the proposed project areas. Hence, return of organic matter to the soil is poor. Total organic carbon content in the entire soils was generally low. The result, see (**Table 2.6.**),indicates that at the proposed construction of the Entrepreneurship Centres study area, the soil had a mean total organic content of 1.12% and 1.07% in top and sub soil respectively. Meanwhile at proposed College of Education Centre study area, TOC had a mean value of 1.06% and 1.07% respectively in top and sub soil.

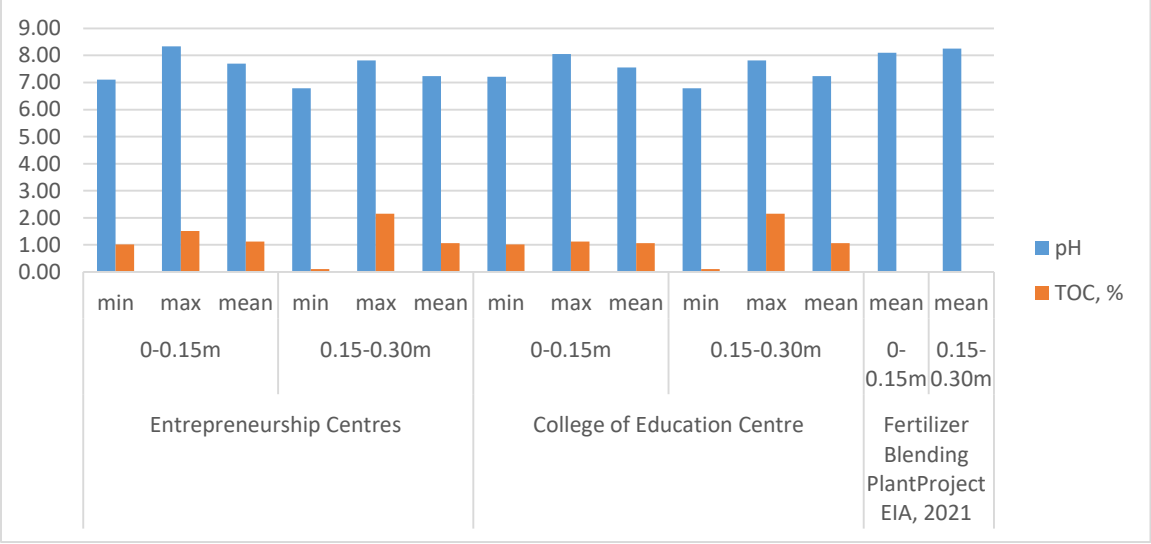


Figure 3. 12: pH and Total Organic Carbon in Soil. Source: Enarmac Fieldwork, 2021.

Total Hydrocarbon Content (THC)

Hydrocarbons are a common and natural occurrence in the environment and varying concentrations in soils are not unusual. Microbes in the soils and water have a natural ability to breakdown many of these compounds and any hydrocarbon which is exposed to the air will also have an affinity to volatilize. As well, reactions including photochemistry and the various transformations of the hydrocarbon through these reactions can enhance the hydrocarbon

decomposition. Industrial processes and man induced activities often result in the increased loading of hydrocarbons in soil. The natural abilities of the soil to decompose the hydrocarbons become overwhelmed.

The THC analyzed from the soil samples during the study were below equipment detection limit of <0.01mg/kg in all stations. These values were lower than the natural background concentration of 50mg/kg for standard soils (SIEP, 1995).

PSD

Particle-size distributions (PSDs) of soils are often used to estimate other soil properties, such as soil moisture characteristics and hydraulic conductivities. Prediction of hydraulic properties from soil texture requires an accurate characterization of PSDs. The textural composition of soil samples collected from the area was dominantly sand with an admixture of silt and clay. Mean particle size of 65.94% sand, 17.00% silt and 13.20% clay were recorded for top soil and 79.93% sand, 9.84% silt and 15.23% clay for sub soil for the proposed construction of the Entrepreneurship Centres study area. On the other hand, mean particle size of 65.94% sand, 17.06% silt and 13.14% clay were recorded for top soil and 74.93% sand, 9.84% silt and 15.23% clay for sub soil at proposed College of Education Centre study area. These findings did not corroborate the previous study as the soil was silty (Fertilizer Blending Plant Project EIA, 2021).

Anions Concentration of the Soils

Sulphate: At the proposed construction of the Entrepreneurship Centres study area, sulphate values were low with values ranging from 1.12 to 3.92mgk/g and from 0.21 to 2.13mg/kg respectively for top and sub soil. At proposed College of Education Centre study area, sulphate concentration ranged from 0.92 to 2.15mg/kg and 0.21 to 2.13mg/kg respectively for top and sub soil. Values were lower than those obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Ammonia: At the proposed construction of the Entrepreneurship Centres study area, ammonia values were low with values ranging from 0.01 to 0.18mg/kg and from 0.11 to 1.01mg/kg respectively for top and sub soil. At proposed College of Education Centre study area, ammonia

concentration ranged from 0.11 to 1.04mg/g and 0.11 to 1.01mg/g respectively for top and sub soil respectively.

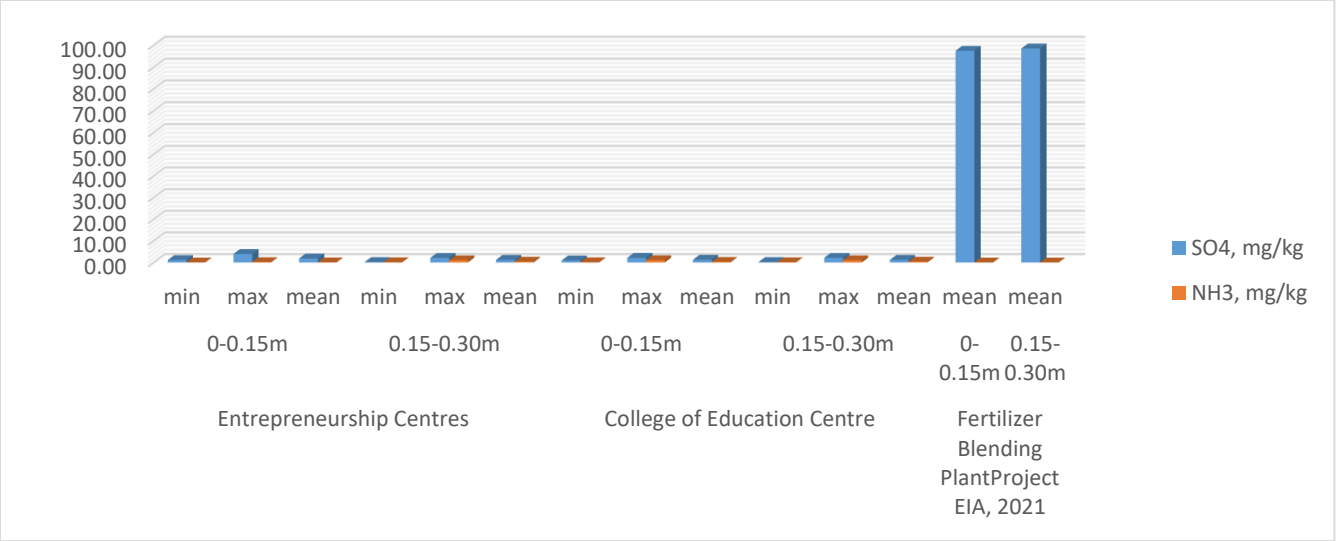


Figure 3. 13: Sulphate and Ammonia in Soil. Source: Enarmac Fieldwork, 2021.

Table 3. 12: Summary of Physico-Chemical and Microbiology Result of Soil Samples

	Entrepreneurship Centres						College of Education Centre						Fertilizer Blending Plant Project EIA, 2021		FMEnv. Standard
	0-0.15m			0.15-0.30m			0-0.15m			0.15-0.30m			0-0.15m	0.15-0.30m	
Parameters	**min**	**max**	**mean**	**min**	**max**	**mean**	**min**	**max**	**mean**	**min**	**max**	**mean**	**mean**	**mean**	
pH	7.11	8.34	7.70	6.79	7.82	7.24	7.21	8.05	7.56	6.79	7.82	7.24	8.1	8.25	
TOC, %	1.01	1.51	1.12	0.10	2.15	1.07	1.01	1.12	1.06	0.10	2.15	1.07	NA	NA	NA
THC, mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
SO4, mg/kg	1.12	3.92	1.82	0.21	2.13	1.20	0.92	2.15	1.27	0.21	2.13	1.20	97.5	98.55	500
NH3, mg/kg	0.01	0.18	0.05	0.11	1.01	0.40	0.11	1.04	0.29	0.11	1.01	0.40	NA	NA	NA
% Sand	29.80	93.40	65.94	48.30	92.30	74.93	29.80	93.40	65.94	48.30	92.30	74.93	10.36	14.195	NA
% Silt	5.00	44.30	17.00	2.60	19.00	9.84	5.00	44.30	17.06	2.60	19.00	9.84	53.89	44.77	NA
% Clay	1.60	25.90	13.20	5.10	46.60	15.23	1.60	25.90	13.14	5.10	46.60	15.23	35.73	41.11	NA
Calcium, mg/kg	11.15	17.11	13.46	11.01	18.06	13.70	11.05	19.18	16.39	11.01	18.06	13.70	3.65	3.91	NA
Magnesium, mg/kg	12.21	23.60	16.97	12.11	24.92	20.99	21.10	24.12	22.59	12.11	24.92	20.99	5.73	5.17	NA
Sodium, mg/kg	10.61	18.51	14.38	11.47	24.52	18.37	11.13	22.52	15.23	11.47	24.52	18.37	NA	NA	NA
Potassium, mg/kg	10.41	28.53	16.85	10.15	13.18	12.24	10.41	28.54	15.55	10.15	13.18	12.24	NA	NA	NA
Copper, mg/kg	1.03	2.48	1.60	1.03	14.34	3.33	1.01	2.43	1.47	1.03	14.34	3.33	1.11	1.17	NA
Lead, mg/kg	0.37	1.75	1.07	0.44	1.56	1.16	0.34	1.41	0.98	0.44	1.56	1.16	0.018	0.27	<1
Iron, mg/kg	18.67	24.88	20.93	18.07	27.72	21.62	18.57	24.58	20.81	18.07	27.72	21.62	6.59	2.31	NA
Nickel, mg/kg	6.94	224.00	39.52	2.76	8.57	6.58	6.84	224.00	39.44	2.76	8.57	6.58	0.015	0.02	NA
Chromium, mg/kg	0.06	0.57	0.15	0.05	2.08	0.37	0.06	0.67	0.23	0.05	2.08	0.37	NA	NA	NA
Cadmium, mg/kg	0.04	0.07	0.06	0.01	0.07	0.03	0.01	0.05	0.02	0.01	0.07	0.03	0.15	0.05	NA
Zinc, mg/kg	1.23	8.37	2.85	0.10	1.10	0.79	0.07	2.00	1.02	0.10	1.10	0.79	2.62	2.67	NA
HUB, CFU/gx104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
HUf, CFU/gx103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
THB, CFU/gx104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
THB, CFU/gx103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
E Coli	0.00	3.02	1.38	0.00	1.04	0.19	0.00	1.49	0.26	0.00	1.04	0.19	Nil	Nil	NA

NA: Not Applicable; Source: **Enarmac Fieldwork, 2021**.

Exchangeable Bases

The exchangeable bases of the soil measured were Na, K, Ca and Mg. In the proposed Entrepreneurship centres study area, magnesium dominated the exchange site with mean values of 16.97mg/kg and 20.99mg/kg respectively in the top and sub soil. While calcium dominated in the proposed College of education centre with mean values of 16.39mg/kg and 13.70mg/kg respectively in the top and sub soil. Two factors which mainly contribute to Exchange Capacity in soil are organic matter content and clay composition. In the assessment these two parameters were relatively and inherently low which will give rise to generally low CEC of the soils.

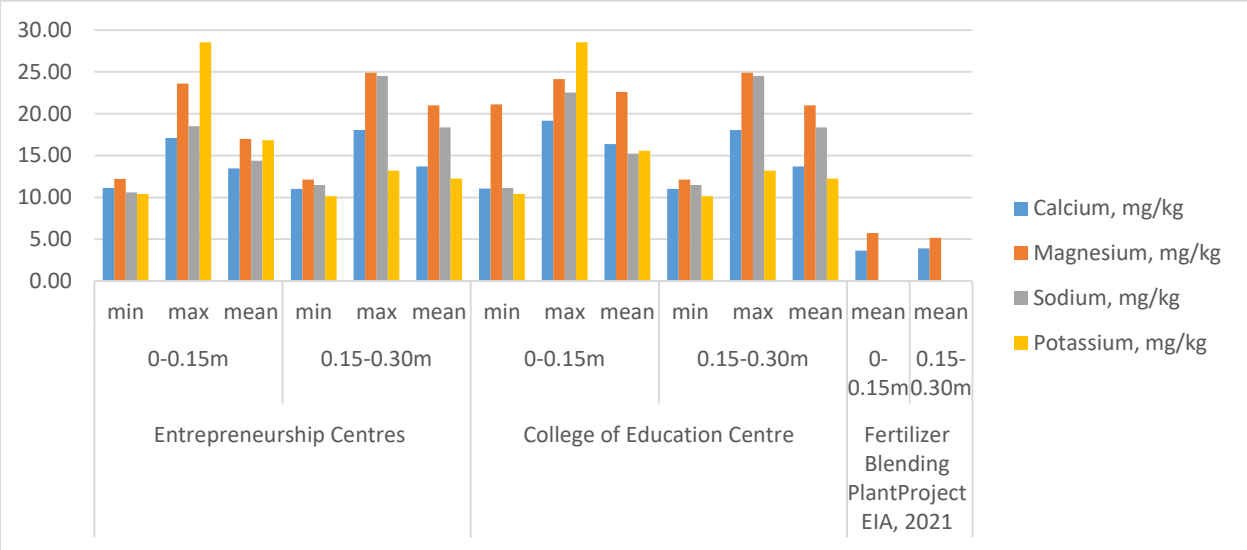


Figure 3. 14: Exchangeable Bases. Source: Enarmac Fieldwork, 2021.

Heavy Metals

Human activities have dramatically changed the composition and organization of soils. Industrial and urban wastes, agricultural application and also mining activities resulted in an increased concentration of heavy metals in soils. Soils normally contain low background levels of heavy metals. Excessive levels of heavy metals can be hazardous to man, animals and plants. Heavy metals of greatest concern are iron (Fe), copper (Cu), lead (Pb), nickel (Ni), Zinc (Zn), Chromium (Cr) and Cadmium (Cd). Ecological soil investigation involved sampling of soil (0-15cm and 15-30cm depth) at the designated stations within the study area.

At the proposed construction of the Entrepreneurship Centres study area, values obtained were between 1.03-2.48mg/kg (top soil) and 1.03-14.34mg/kg (sub soil) for Cu; 0.37-1.75mg/kg (top soil) and 0.44-1.56mg/kg (sub soil) for Pb; 18.67-24.88mg/kg (top soil) and 18.07-27.72mg/kg (sub soil) for Fe; 6.94-224.00mg/kg (top soil) and 2.76-8.57mg/kg (sub soil) for Ni; 0.06-0.57mg/kg (topsoil) and 0.05-2.08mg/kg (subsoil) for Cr; 0.04-0.07mg/kg (top soil) and 0.01-0.07mg/kg (sub soil) for Cd; and 1.23-8.37mg/kg (top soil) and 0.10-1.10mg/kg (sub soil) for Zn.

At proposed College of Education Centre study area, values obtained were between 1.01-2.43mg/kg (top soil) and 1.03-14.34mg/kg (sub soil) for Cu; 0.34-1.41mg/kg (top soil) and 0.44-1.56mg/kg (sub soil) for Pb; 18.57-24.58mg/kg (top soil) and 18.07-27.22mg/kg (sub soil) for Fe; 6.84-224.00mg/kg (top soil) and 2.76-8.57mg/kg (sub soil) for Ni; 0.06-0.67mg/kg (topsoil) and 0.05-2.08mg/kg (subsoil) for Cr; 0.01-0.05mg/kg (top soil) and 0.01-0.07mg/kg (sub soil) for Cd; and 0.07-2.00mg/kg (top soil) and 0.10-1.10mg/kg (sub soil) for Zn.

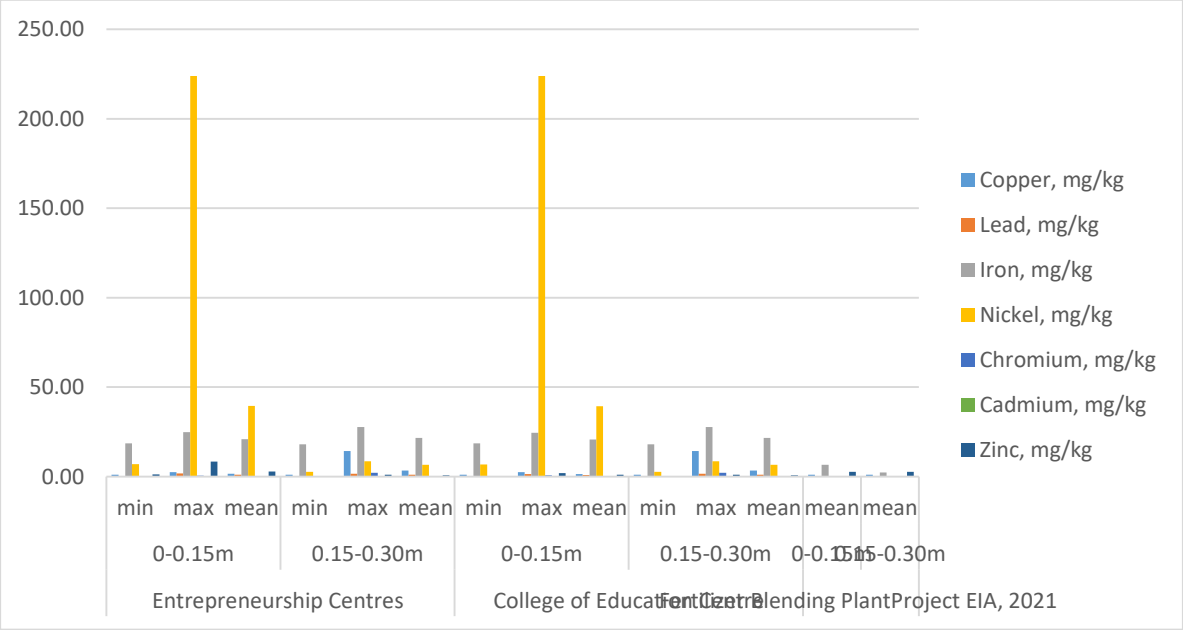


Figure 3. 15: Heavy Metals in Soil. Source: Enarmac Fieldwork, 2021

Soil Microbiological Characteristics

The two groups of microorganisms studied are fungi and bacteria, which are the most important organic matter decomposers in the soil. Bacteria and fungi (microbes) counts provide information on the level of on-going biochemical activities in the soil. Microbial counts under normal circumstances increases with an increase in soil organic matter. About 1g of fertile soil should

contain 1 x 10^6 to 1 x 10^8cfu/g bacteria and fungi (Odu *et al*., 1985). These organisms were not present in the samples collected. However, E Coli in the samples had mean values of 1.38 and 0.19 respectively at the top and sub soil samples for the proposed construction of the Entrepreneurship Centres study area. On the other hand, mean values of 0.26 and 0.19 respectively were obtained at the top and sub soil samples for the proposed College of Education Centre study area.

Polytechnic Soil Physico-Chemical Characteristics

Soil samples were collected for the proposed construction of the polytechnic and secondary school Centre. Samples were collected within a radius of 1.5km (zone of influence) from the centre of the project sites. At each station, soil samples were collected from two depth levels: 0 – 15cm, and 15 – 30cm. Result from analyses is summarized in **Table 2.6** while detailed analytical results are included in **Appendix 4.**

(See attached A3 map for spatial distribution of sample stations).

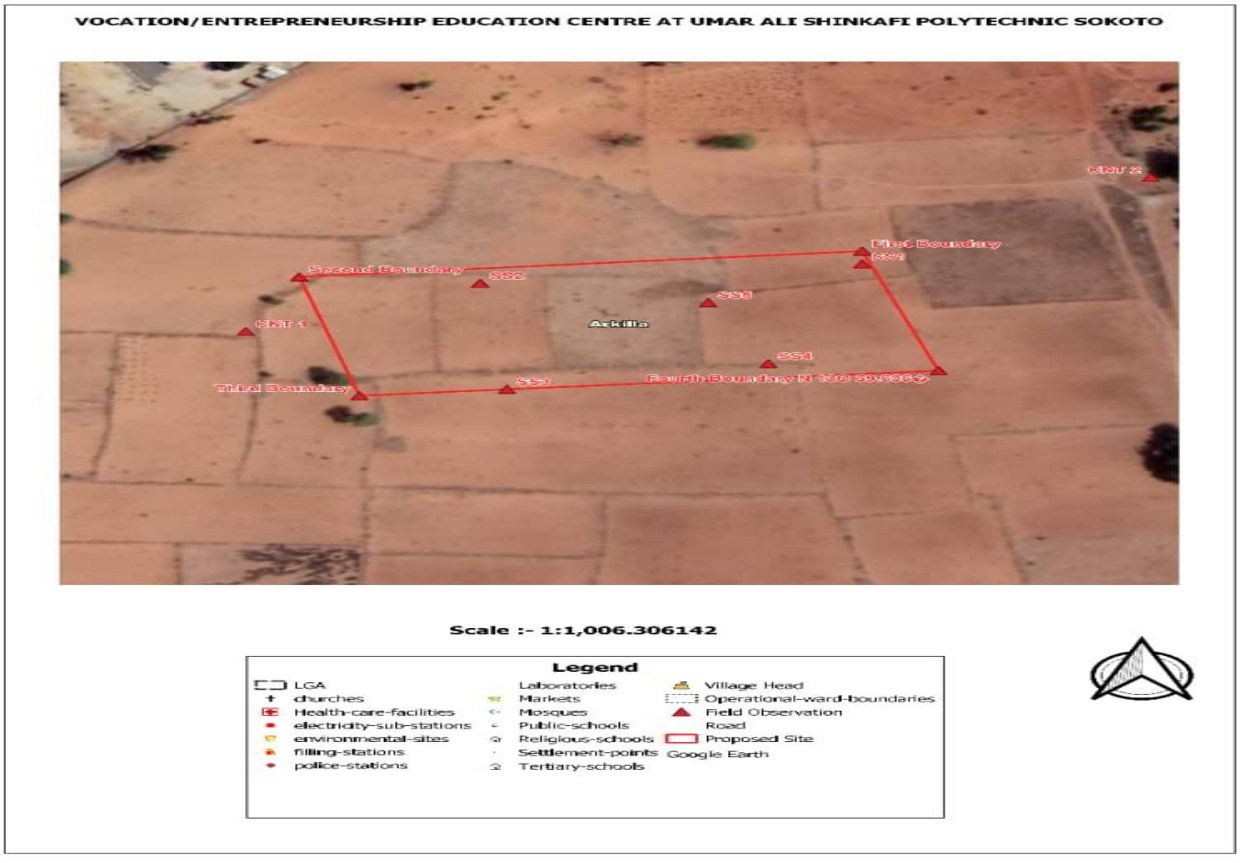


Figure 3. 16:soils physio chemical characteristics at Umar Ali Polytechnic

pH

Soil pH or soil reaction is an indication of the acidity or alkalinity of soil and is measured in pH units. Soil pH is defined as the negative logarithm of the hydrogen ion concentration. The pH scale goes from 0 to 14 with pH 7 as the neutral point. As the amount of hydrogen ions in the soil increases, the soil pH decreases thus becoming more acidic. From pH 7 to 0 the soil is increasingly more acidic and from pH 7 to 14 the soil is increasingly more alkaline or basic.

pH of the soil sampled were generally varying from basic to acidic. At the proposed polytechnic centre study area, it ranged from 1.34 to 8.25 with a mean value of 6.94 at the top soil and between 7.11 and 8.34 with a mean value of 7.40 at sub soil. At the proposed secondary school centre study area it ranged from 6.34 to 8.25 with a mean of 7.29 at the top soil and between 7.21 and 7.44 with a mean value of 7.30. All obtained values compared well with values from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Total Organic Carbon

The principal factors responsible for high organic matter in soil include vegetative cover and decay of plant residue. These factors are significantly absent in the proposed project areas. Hence, return of organic matter to the soil is poor. Total organic carbon content in the entire soils was generally low. The result, see (**Table 2.5.**). Indicates that at the proposed polytechnic centre study area, the soil had a mean total organic content of 1.43% and 1.48% in top and sub soil respectively. Meanwhile at the proposed secondary school centre study area, TOC had a mean value of 1.40% and 1.31% respectively in top and sub soil.

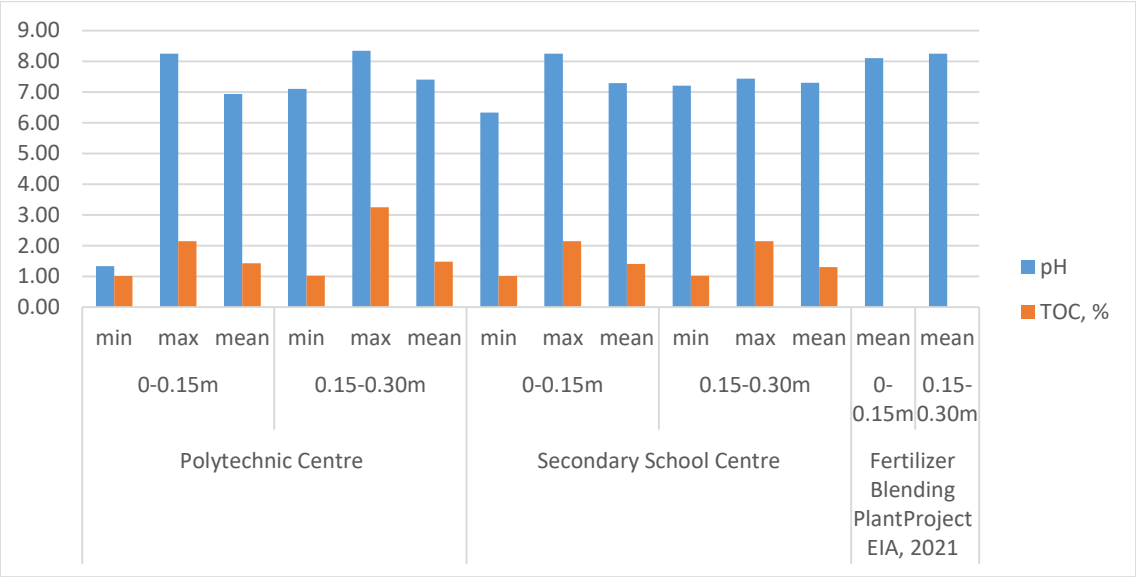


Figure 3. 17: pH and Total Organic Carbon in Soil. Source: Enarmac Field work, 2021

Total Hydrocarbon Content (THC)

Hydrocarbons are a common and natural occurrence in the environment and varying concentrations in soils are not unusual. Microbes in the soils and water have a natural ability to breakdown many of these compounds and any hydrocarbon which is exposed to the air will also have an affinity to volatilize. As well, reactions including photochemistry and the various transformations of the hydrocarbon through these reactions can enhance the hydrocarbon decomposition. Industrial processes and man induced activities often result in the increased loading of hydrocarbons in soil. The natural abilities of the soil to decompose the hydrocarbons become overwhelmed.

The THC analysed from the soil samples during the study were below equipment detection limit of <0.01mg/kg in all stations. These values were below the natural background concentration of 50mg/kg for standard soils (SIEP, 1995).

PSD

Particle-size distributions (PSDs) of soils are often used to estimate other soil properties, such as soil moisture characteristics and hydraulic conductivities. Prediction of hydraulic properties from soil texture requires an accurate characterization of PSDs. The textural composition of soil samples collected from the area was dominantly sand with an admixture of silt and clay. Mean particle size of 72.33% sand, 14.04% silt and 13.34% clay were recorded for top soil and

63.57% sand, 12.06% silt and 24.23% clay for sub soil at the proposed polytechnic centre study area. On the other hand, mean particle size of 73.13% sand, 14.71% silt and 12.01% clay were recorded for top soil and 65.89% sand, 12.63% silt and 21.20% clay for sub soil at the proposed secondary school centre study area. These findings did not corroborate the previous study as the soil was silty (Fertilizer Blending Plant Project EIA, 2021).

Anions Concentration of the Soils

Sulphate: At the proposed polytechnic centre study area, sulphate values were low with values ranging from 0.21 to 1.82mg/kg and from 0.14 to 1.23mg/kg respectively for top and sub soil. At the proposed secondary school centre study area, sulphate concentration ranged from 0.21 to 2.25mg/kg and 0.21 to 3.13mg/kg respectively for top and sub soil. Values were lower than those obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Ammonia: At the proposed polytechnic centre study area, ammonia values were low with values ranging from 0.01 to 0.12mg/kg and from 0.02 to 0.18mg/kg respectively for top and sub soil. At the proposed secondary school centre study area, ammonia concentration ranged from 0.01 to 0.06mg/g and 0.01 to 0.18mg/g respectively for top and sub soil.

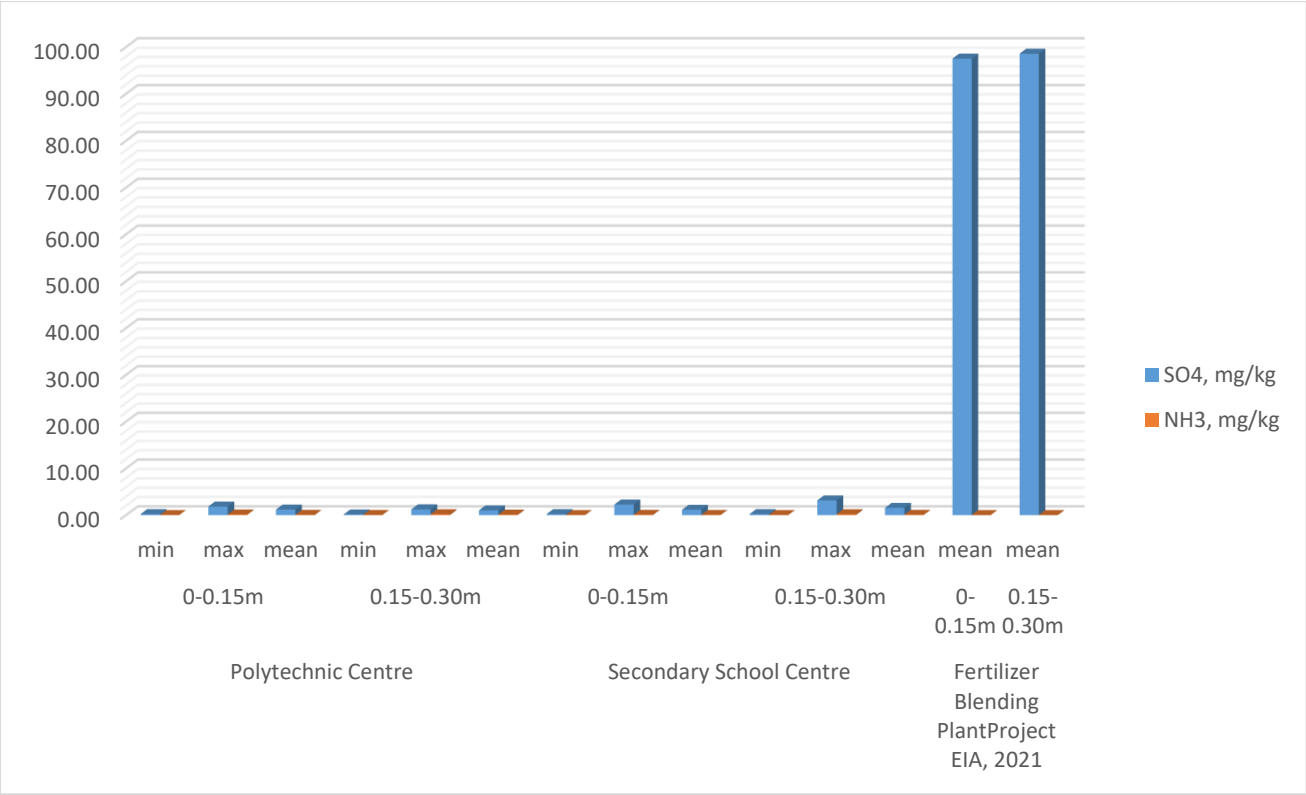


Figure 3. 18: Sulphate and Ammonia in Soil. Source: Enarmac Fieldwork, 2021.

Table 3. 13: Summary of Physico-Chemical and Microbiology Result of Soil Samples

	Polytechnic Centre						Secondary School Centre						Fertilizer Blending PlantProject EIA, 2021		
	0-0.15m			0.15-0.30m			0-0.15m			0.15-0.30m			0-0.15m	0.15-0.30m	FMEnv.
Parameters	**min**	**max**	**mean**	**min**	**max**	**mean**	**min**	**max**	**mean**	**min**	**max**	**mean**	**mean**	**mean**	**Standard**
pH	1.34	8.25	6.94	7.11	8.34	7.40	6.34	8.25	7.29	7.21	7.44	7.30	8.1	8.25	
TOC, %	1.01	2.15	1.43	1.02	3.25	1.48	1.01	2.15	1.40	1.02	2.15	1.31	NA	NA	NA
THC, mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
SO4, mg/kg	0.21	1.82	1.18	0.14	1.23	1.01	0.21	2.25	1.13	0.21	3.13	1.54	97.5	98.55	500
NH3, mg/kg	0.01	0.12	0.04	0.02	0.18	0.09	0.01	0.06	0.03	0.01	0.18	0.05	NA	NA	NA
% Sand	63.00	93.40	72.33	48.30	75.00	63.57	63.00	93.40	73.13	48.30	75.00	65.89	10.36	14.195	NA
% Silt	5.00	19.00	14.04	5.10	19.00	12.06	5.00	19.00	14.71	5.10	19.00	12.63	53.89	44.77	NA
% Clay	1.60	25.80	13.34	10.80	46.60	24.23	1.60	25.80	12.01	9.50	46.60	21.20	35.73	41.11	NA
Calcium, mg/kg	11.15	15.61	13.39	11.31	16.41	13.66	11.15	15.61	13.89	11.31	16.41	13.95	3.65	3.91	NA
Magnesium, mg/kg	9.60	27.60	17.65	9.15	21.60	16.06	9.10	9.92	9.33	7.10	9.92	9.13	5.73	5.17	NA
Sodium, mg/kg	9.23	24.56	14.46	8.33	18.57	12.34	8.21	24.52	12.11	7.17	11.23	9.19	NA	NA	NA
Potassium, mg/kg	10.15	28.53	17.26	9.41	28.53	14.83	8.32	13.02	9.56	7.02	10.15	8.61	NA	NA	NA
Copper, mg/kg	0.03	1.91	1.19	0.14	2.26	1.39	1.11	2.26	1.54	1.11	2.26	1.70	1.11	1.17	NA
Lead, mg/kg	0.17	1.75	1.19	1.12	1.56	1.26	1.01	1.56	1.26	1.01	1.56	1.38	0.018	0.27	<1
Iron, mg/kg	18.17	24.88	20.86	18.19	27.72	21.83	18.19	22.06	21.12	18.19	22.06	19.67	6.59	2.31	NA
Nickel, mg/kg	6.14	224.00	39.36	2.17	8.58	6.64	7.53	9.31	8.27	5.16	8.58	7.85	0.015	0.02	NA
Chromium, mg/kg	0.01	0.17	0.09	0.02	0.18	0.08	0.02	0.10	0.08	0.02	0.09	0.05	NA	NA	NA
Cadmium, mg/kg	0.01	0.07	0.04	0.01	0.07	0.04	0.04	0.07	0.06	0.05	0.07	0.07	0.15	0.05	NA
Zinc, mg/kg	1.00	1.79	1.33	0.12	3.16	1.41	1.79	8.38	4.26	1.79	4.80	3.78	2.62	2.67	NA
HUB, CFU/gx104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
HUf, CFU/gx103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
THB, CFU/gx104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
THB, CFU/gx103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Nil	Nil	NA
E Coli	0.00	2.04	0.95	0.00	1.06	0.74	0.00	3.01	1.11	0.00	1.06	0.74	Nil	Nil	NA

NA: Not Applicable; Source: **Enarmac Fieldwork, 2021**.

Exchangeable Bases

The exchangeable bases of the soil measured were Na, K, Ca and Mg. In the proposed polytechnic centre study area, magnesium dominated the exchange site with concentrations of 17.65mg/kg and 16.06mg/kg in the top and sub soils respectively. While in the proposed secondary school centre study area calcium dominated with mean values of 13.89mg/kg and 13.95mg/kg respectively in top and sub soils. Two factors which mainly contribute to Exchange Capacity in soil are organic matter content and clay composition. In the assessment these two parameters were relatively and inherently low which will give rise to generally low CEC of the soils.

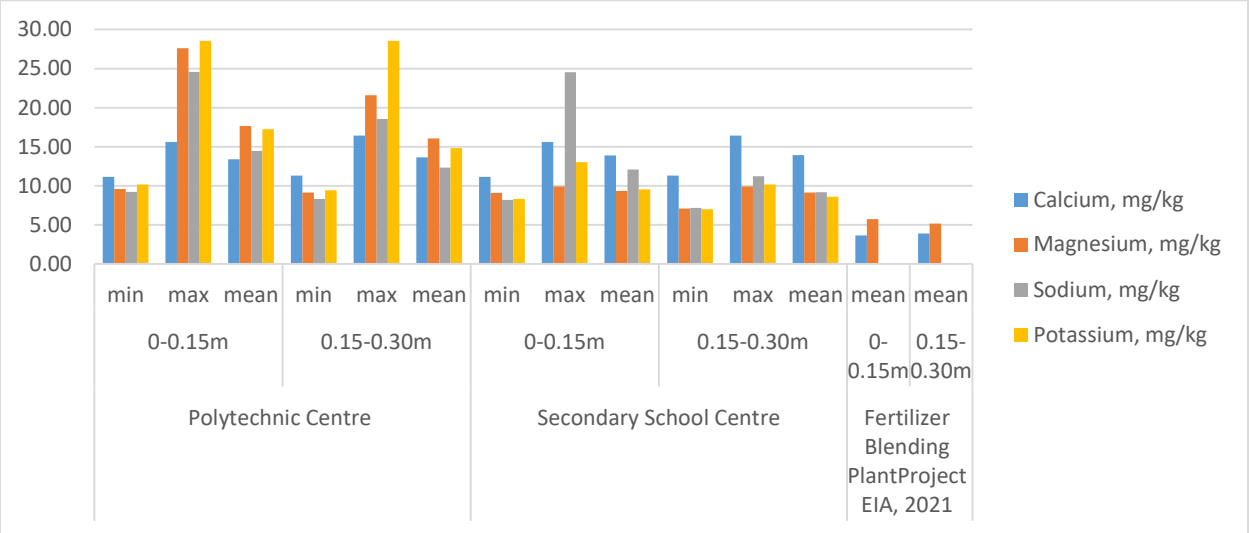


Figure 3. 19: Exchangeable Bases. Source: Enarmac Fieldwork, 2021.

Heavy Metals

Human activities have dramatically changed the composition and organization of soils. Industrial and urban wastes, agricultural application and also mining activities resulted in an increased concentration of heavy metals in soils. Soils normally contain low background levels of heavy metals. Excessive levels of heavy metals can be hazardous to man, animals and plants. Heavy metals of greatest concern are iron (Fe), copper (Cu), lead (Pb), nickel (Ni), Zinc (Zn), Chromium (Cr) and Cadmium (Cd). Ecological soil investigation involved sampling of soil (0-15cm and 15-30cm depth) at the designated stations within the study area.

At the proposed polytechnic centre study area, values obtained were between 0.03-1.91mg/kg (top soil) and 0.14-2.26mg/kg (sub soil) for Cu; 0.17-1.75mg/kg (top soil) and 1.12-1.56mg/kg (sub soil) for Pb; 18.17-24.88mg/kg (top soil) and 18.19-27.72mg/kg (sub soil) for Fe; 6.14-224.00mg/kg (top soil) and 2.17-8.58mg/kg (sub soil) for Ni; 0.01-0.17mg/kg (topsoil) and 0.02-0.18mg/kg (subsoil) for Cr; 0.01-0.07mg/kg (top soil) and 0.01-0.07mg/kg (sub soil) for Cd; and 1.00-1.79mg/kg (top soil) and 0.12-3.16mg/kg (sub soil) for Zn.

At the proposed secondary school centre study area, values obtained were 1.11-2.26mg/kg (top soil) and 1.11-2.26mg/kg (sub soil) for Cu; 1.01-1.56mg/kg (top soil) and 1.01-1.56mg/kg (sub soil) for Pb; 18.19-22.06mg/kg (top soil) and 18.19-22.06mg/kg (sub soil) for Fe; 7.53-9.31mg/kg (top soil) and 5.16-8.58mg/kg (sub soil) for Ni; 0.02-0.10mg/kg (topsoil) and 0.02-0.09mg/kg (subsoil) for Cr; 0.04-0.07mg/kg (top soil) and 0.05-0.07mg/kg (sub soil) for Cd; and 1.79-8.38mg/kg (top soil) and 1.79-4.80mg/kg (sub soil) for Zn.

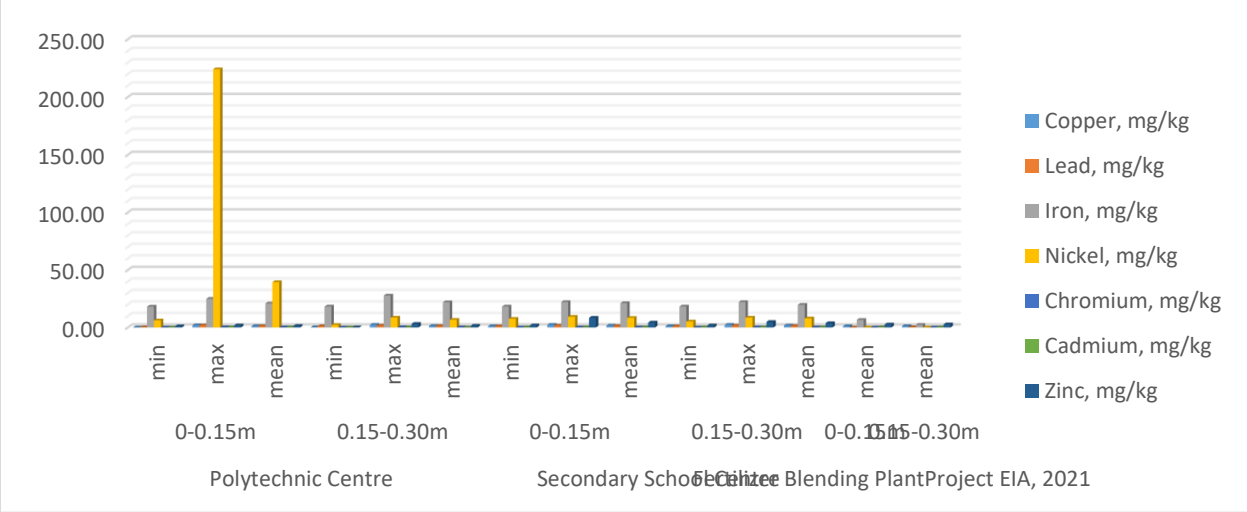


Figure 3. 20: Heavy Metals in Soil. Source: Enarmac Fieldwork, 2021.

Soil Microbiological Characteristics

The two groups of microorganisms studied are fungi and bacteria, which are the most important organic matter decomposers in the soil. Bacteria and fungi (microbes) counts provide information on the level of on-going biochemical activities in the soil. Microbial counts under normal circumstances increases with an increase in soil organic matter. About 1g of fertile soil should contain 1 x 10^6 to 1 x 10^8cfu/g bacteria and fungi (Odu *et al*., 1985). These organisms were not present in the samples collected. However, E Coli in the samples had mean values of 0.95 and 0.74

respectively at the top and sub soil samples for the proposed polytechnic centre study area. On the other hand, mean values of 1.11 and 0.74 respectively were obtained at the top and sub soil samples for the proposed secondary school centre study area

3.6 SOCIO-ECONOMIC STUDIES

WAMMAKO LGA

Results of a comprehensive questionnaire designed to capture the socio-economics of the project area (Wammako LGA) inhabitants is presented below:

3.6.1 Traditional Hierarchy/ Leadership in Sokoto State

The project area is governed at the apex by the Emir who has jurisdiction over an emirate. The Emir (first-class traditional ruler) is the paramount traditional authority in Sokoto State. The administrative hierarchy begins with the Ward Heads at the lowest level. The Ward Heads have social and political jurisdiction over the ward under them. The Ward Head reports to the Village Head. The village Head reports to the District Head who is answerable to the Emir. This order of administrative governance is followed in addressing civil and sometimes legal disputes.

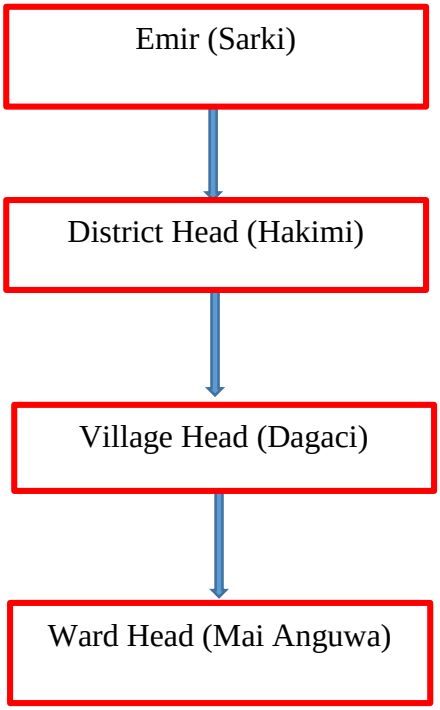


Figure 3. 21: Traditional Hierarchy of Authority in the study area – Enarmac study, 2021

Table 3. 14: **Villages/communities within Project area of influence**

S/no	Village/Settlement/community
1.	KOFARAWA
2.	RUGA BUSAU
3.	GWIWA
4.	MINNAMANTA

Source: ENARMAC's field study, 2021

These settlements/communities are all situated within 2 km radius of the project area.

3.6.2 Population

The current population was obtained by projecting the 2006 population figure, using a conservative 2.5% population growth rate, as follows:

The population of Isa LGA (149,513), Tambuwal LGA (224,931) Sokoto South (194,914) LGA (based on the 2006 Census). The LGA's has an average of (10) district each.

Adding the population of the three LGA's = 569,358

Using the Geometric Method:

A basic equation for getting a projection of a given population is Nt=P e (r * t); where "Nt" represents the number of people at a future time;

"P" is the population at the beginning time;

"e" is the base of the natural logarithms (2.71828);

"r" is the rate of increase (natural increase divided by 100); and

"t" represents the time period involved.

$Nt = P\ e^{(r * t)} = 569,358\ X\ 2.71828^{(0.025*14)} = 569,358\ X\ 1.4191 = 807,975$

This population belongs to 10 wards of the LGA. However, the LGA has 10 wards and the socio-economic studies were restricted to just about 1/3rd of the wards located within the municipality of the LGA.

Assuming the wards have equal population, this means about 3/10 of the LGA population will have 3/10X807,975 = 242393 people.

Thus, assuming an average family size of 9, an approximate number of households in the project area is 242393/9 = 26,932

Now to determine the sample size for the questionnaire to be administered in these wards, we use Glenn's Formula, which is:

$n=N/(1+Ne^2)$;

Where n = sample size, N = Population and e = Margin of error

The estimated population of the settlements /communities within the study area built from 2006 census (with 3% growth rate projection) is shown in the table below:

Table 3. 15: **Estimated Population of the study area**

Community	Population
wamako	10,000
Sokoto south	8,000
kofarwa	7000
Gwiwa	6000

Source: NPC, 2006 projected to 2021

The population distribution of the study area is shown in figure below:

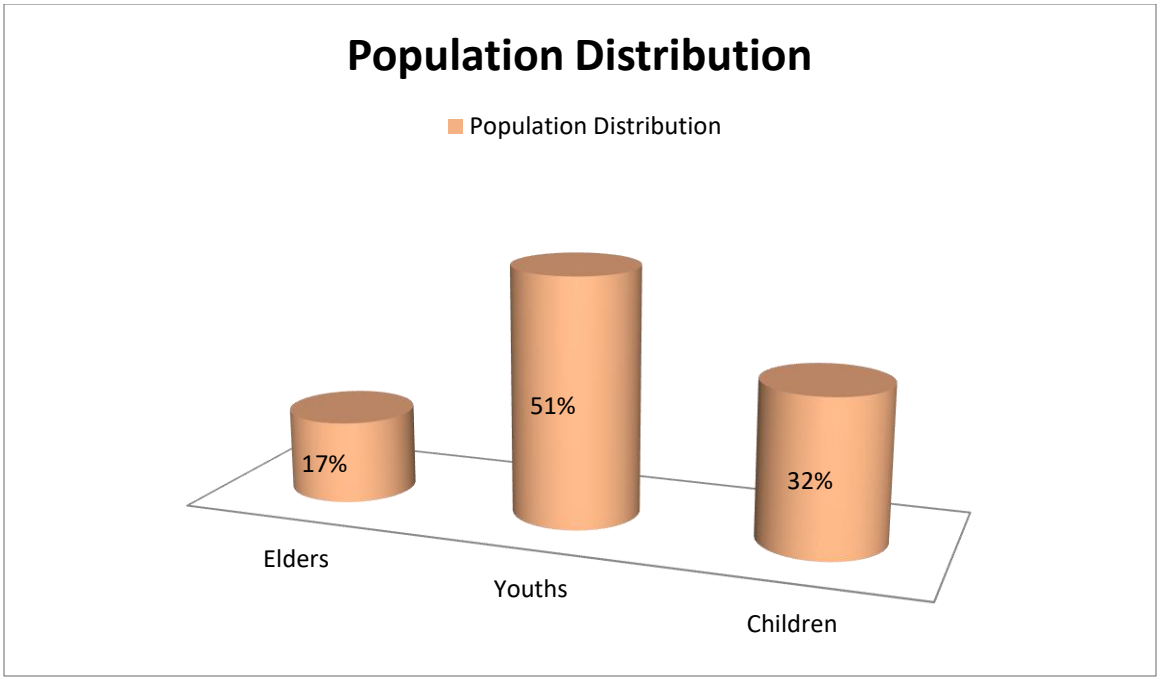


Figure 3. 22: Population Distribution of the study areas - Enarmac field study, 2021

3.6.3 Gender

The Study area had a male to female population ratio of 48.8: 51.2 as seen in figure 2.30. The female population size was observed to be more than their male counter parts due to several factors such as increased hospital attendance and less hazardous job undertaken by women. The population ratio did not conform to the 1991 and 2006 population census figure of Sokoto State which had fewer women when compared with the male population.

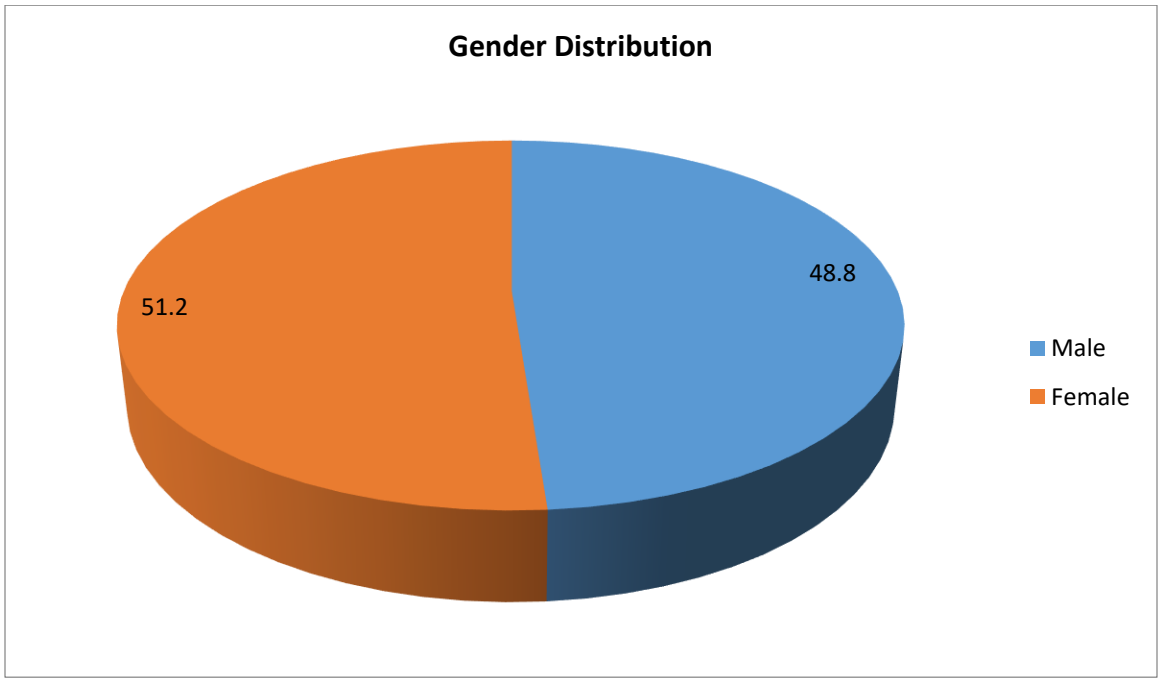


Figure 3. 23: Gender distribution of the study area - Enarmac field study, 2021

3.6.4 Ethnic Composition

The ethnic composition of the study area is heterogeneous, with Hausa and Fulani being the predominant tribes constituting 98% of inhabitants of the study area, while other ethnic group accounts for about 2% as shown in the table 2.16 and figure 2.31

Table 3. 16: Ethnic composition

Ethnicity	**Percentage (%)**
Fulani	23
Hausa	75
Others	2

Source: Enarmac field study, 2021

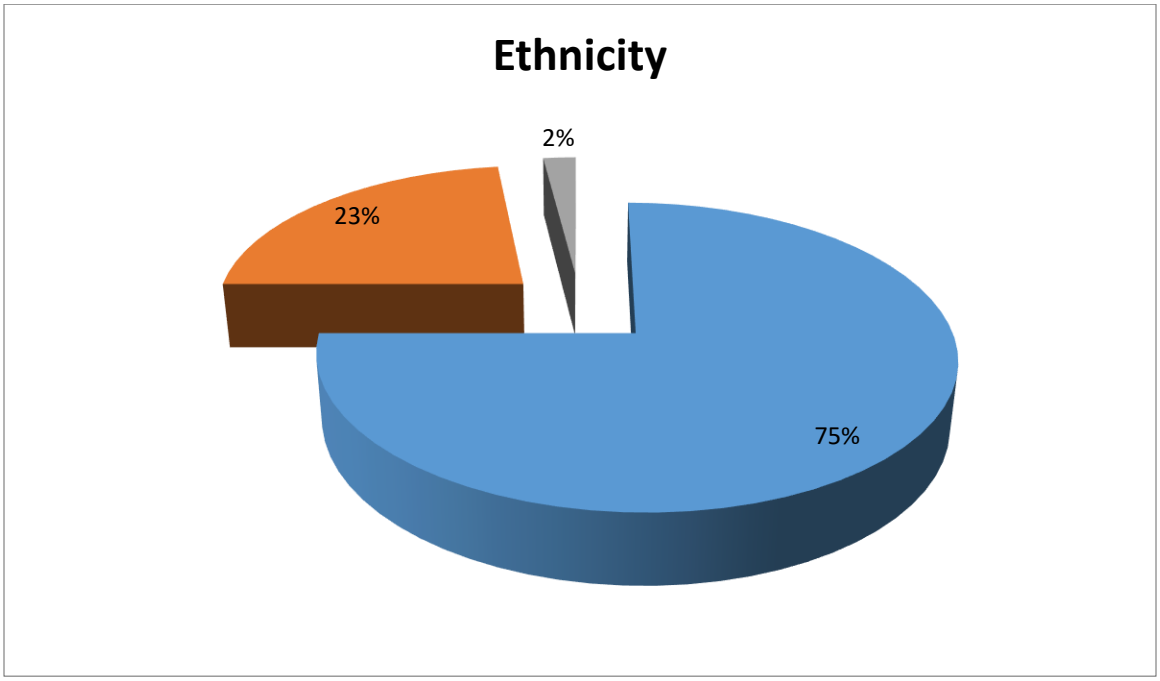


Figure 3. 24: Ethnic composition of the study area - Enarmac field study, 2021

3.6.5 Marital Status

The study area is predisposed to the practice of polygamy as permitted by Islam; most families are polygamous families where the Head of the family is allowed to marry up to four (4) wives. The marital status of the study area indicates that married individuals were dominant and constitute 65% of the inhabitants of the study areas. This was expected based on the common practice of early marriage in Northern Nigeria. Individuals (single) not married accounted for 25 % while both the widowed and separated/divorced represented 10% as shown in table 2.9

Table 3. 17: Marital Status of the Study area

Status	**Percentage (%)**
Single	25
Married	65
Widowed	7
Divorced/Separated	3

Source: Enarmac Studies, 2007

3.6.6 Religion

Islam is the predominant religion in the study area; this is evident in the presence of numerous mosque and Islamayia within and around the study area. Islam accounts for 99% of the religious inclination of the respondents of the study area. No church or shrine was observed within the study area. Figure 2.11 depict the religious inclination.

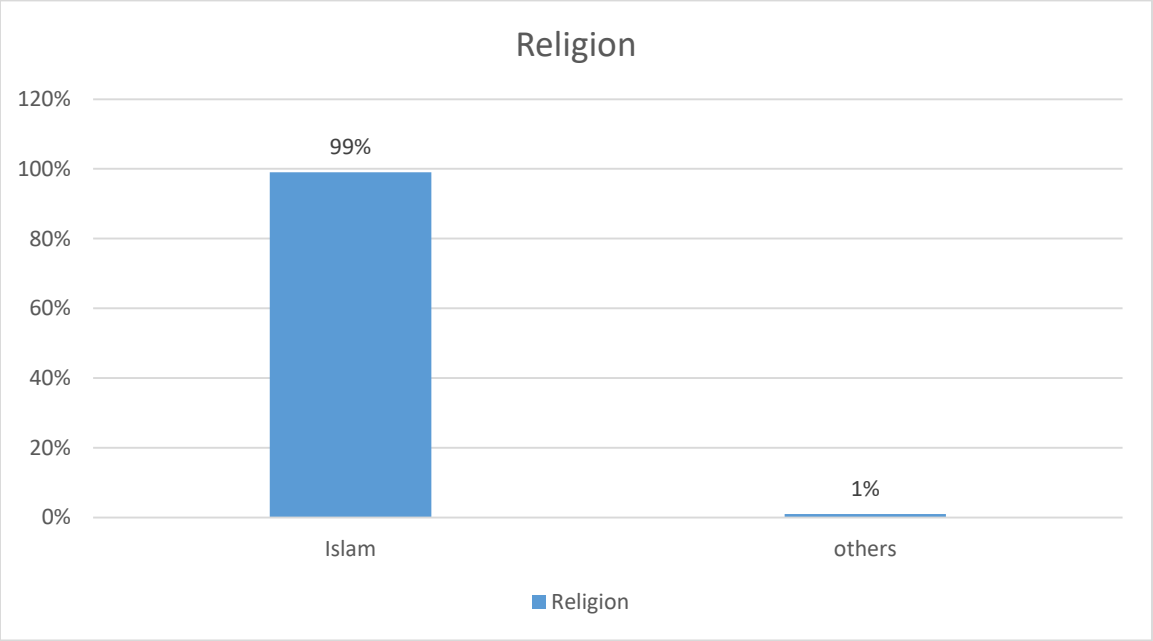


Figure 3. 25: Religious Inclination of the study area - Enarmac field study, 2021

3.6.7 Social Infrastructure and Amenities

Social infrastructure and amenities are crucial to creating sustainable communities; inadequate social infrastructure is not just an inconvenience for inhabitants of an area but has significant long-term consequences, and associated costs.

Lack of social infrastructure can create long-term problems for the social and economic wellbeing and opportunities for individual families residing in that locality. Social infrastructures such as public transport, school, hospital; market/shops, Police station, and good road network, drainage system, recreational centres and electricity supply among others are pertinent and enhances the community lives.

The social infrastructure observed within the project study areas are inadequate and therefore requires urgent attention of the government in order to enhance the live support system of the various communities such as in Kofarawa communities among others.

3.6.8 Educational Status and Facilities

The educational attainment in the study area shows that majority of the residents of the study area obtained both Qur'anic (Islamiyya) and primary education, representing 53%; Secondary education accounted for 38% where about 9% of the respondents attained tertiary level of education as seen in table 2.18.

School enrolments were observed to be skewed towards the male gender with a ratio of 50:40, male students were observed to be more in junior secondary schools, this could be attributed to early marriage with respect to female students, religious inclination where women are believed to be at home taking care of the home hence more female/girls are involved in petty trading to support their families.

Table 3. 18: Educational attainment of respondents in the study area.

Educational Attainment	**Percentage composition (%)**
Primary education	24
Junior Secondary education	20
Senior Secondary education	18
Tertiary education	9
Qur'anic education	29

Source: Enarmac field study, 2021

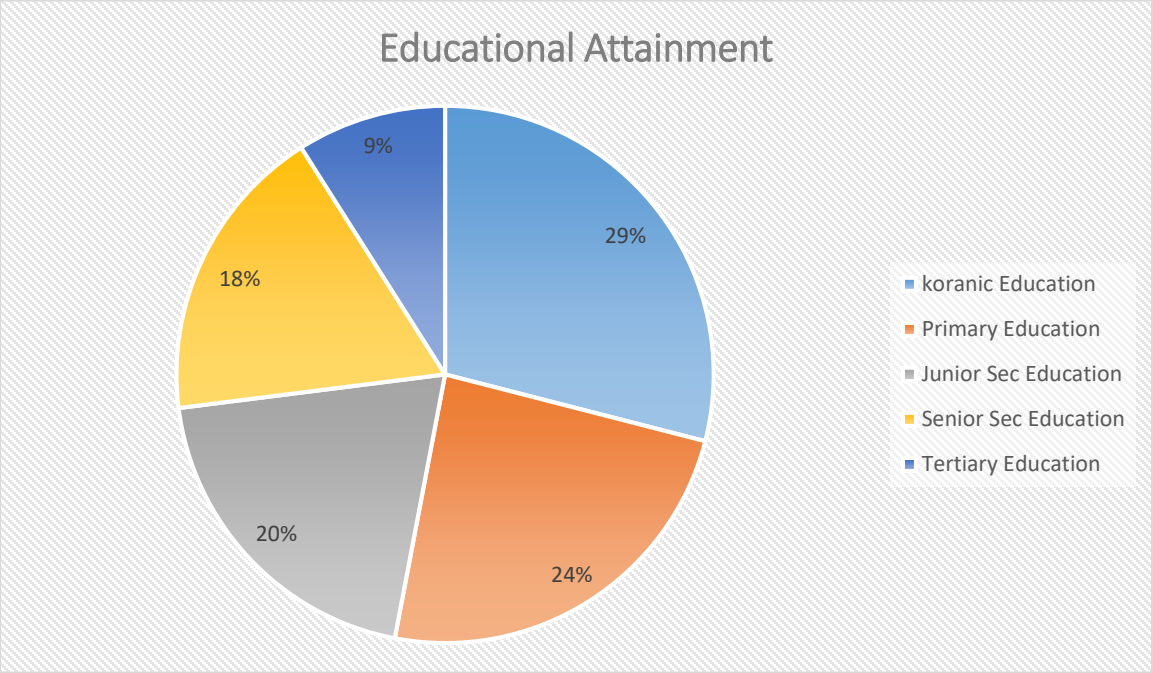


Figure 3. 26: Educational Attainment in the study area, – Enarmac field study, 2021

Plate A. 5: Sultan Abubakar College, in Sokoto South L.G.A, Sokoto State

3.6.9 Health Services

The survey carried out in the project area shows that there is a four-wheel approach in the treatment of ailments by respondents. Respondents make use of government hospitals, private clinics, off-the-shelf self-medication and also resort to consulting herbal and traditional alternative health practitioners, including traditional birth attendants and traditional orthopedic practitioners. Numerous public and private medical facilities are available in the project area. These include an orthopedic hospital in Wamakko town, numerous Primary Health Care clinics, dispensaries. There is also a rural ambulance service in Wamakko LGA that caters for the residents of the rural areas in the LGA. The plates that follow show some of the available health care infrastructure in the LGA.

Plate A. 6: Entrance gate of Orthopaedic hospital in Wamakko town
Source: Enarmac: 2021

3.6.10 Sources of Income

The major occupation is farming which includes cultivation of crops, livestock rearing, and fishing. Civil service, Auto-Mechanic, Petty trading/sales of household and others are the major sources of livelihood in the project area.

Major crops produced include; groundnut, soybeans, rice, maize, beans, Guinea corn among others. Domestic animals reared include; sheep, goats, and cows. Petty trading activities were observed to be practiced by both male and female genders who were selling household items such as soft drinks, masa, kunu, snacks and food items.

The survey conducted shows the respondents have multiple streams of incomes, farming account for the highest percentage which is 59%. About 20% of the population derive their income from various business activities within the communities. 11% earn their income from salaries from government employment while 10% derived their income from daily paid labourers.

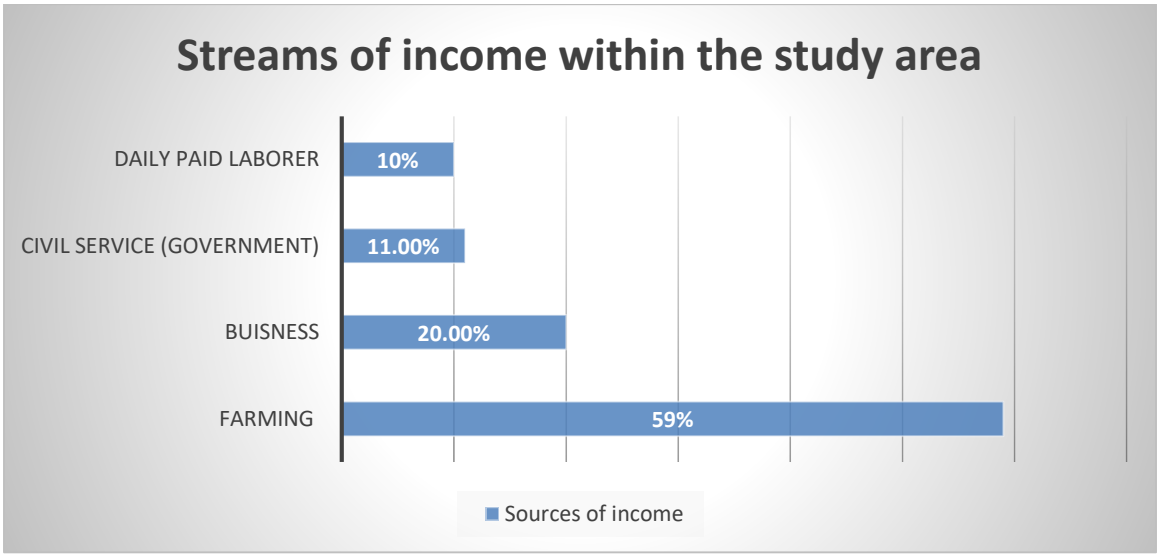


Figure 3. 27: Streams of Incomes within the study area

3.6.11 Transportation

The predominant means of transportation within the locality include the use of motor bike, popularly called Okada, tricycles called keke and cars. The motor bikes are very useful in navigating within the study area; Residents make use of cars, tricycles either privately owned or rented in conveying their wares/ agricultural produce to and from the market. Rail services was once active within the study area as evident from the figure below. The trains were once a means of conveying people and goods in the study area. Currently, the rail transportation system has been abandoned.

PLATE 3. 1 Abandoned rail transportation system

Plate A. 7: Camels being used as means of Transportation

3.6.12 Water Supply

Wamakko LGA is supplied with pipe-borne water. There are also boreholes provided by the three tiers of Government, as well as by International Donor Agencies and similar organizations. Other sources of water in the project area include wells and surface water in ponds and rivers. Many households in the project area, especially those in remote parts, use water from hand-dug wells. Table 4.16 below presents the distribution of domestic water sources used by households in the three districts; however, respondents that use pipe-borne water use other sources because of the

erratic nature of the supply.

Plate A. 8: Rural well at Project Communities

Table3. 19: Domestic water sources

District	Source of domestic water	No. of respondents	Percentage (%)
Wamakko	Pipe-borne water	2	5
	Bore-hole	13	32.5
	Well	9	22.5
	River	16	40
	Total	40	100
Minanata	Pipe-borne water	2	7.7
	Bore-hole	21	80.8
	Well	3	11.5
	River	0	0
	Total	26	100
Kofarawa	Pipe-borne water	5	17.9
	Bore-hole	19	67.9
	Well	2	7.1
	River	2	7.1
	Total	28	100

3.6.13 Consultation Process

Consultation is defined as the process of exchanging information about the environmental and socio-economic implications of a proposed project, which is being subjected to an EIA process, with Project Affected Persons, designated bodies, organizations or persons with environmental responsibilities or interests. The purpose of the consultation exercise conducted for this project was to provide an opportunity for stakeholders to offer valuable inputs, which will assist the project team and other agencies of the Federal Government of Nigeria and Sokoto State in making decisions and recommendations throughout the project phases. It is essential for the project stakeholders to have the opportunities to participate in and provide input early on and throughout

the impact assessment process. With timely and meaningful input, concerns can be identified, considered and appropriately addressed before final decisions are made.

The Nigerian Government stipulates that stakeholders be consulted in order for them to have the opportunity to express their views and provide relevant inputs on a proposed project before it is implemented. Through this process, stakeholders and the general public have an opportunity to contribute to the overall project design by raising concerns and making recommendations. In addition, consultation brings about commitment of project stakeholders by creating the needed sense of ownership and being valued by the project proponents.

3.6.14 Objectives of Consultation

The main objectives of consultations carried out for this EIA were to:

Inform stakeholders about the proposed project and its potential benefits as well as discuss environmental and social issues associated with the project and solicit for their views and concerns;

- Collect relevant information for the project design;
- To identify and mitigate impacts before the project gets underway;
- To avoid conflicts by addressing issues of concern early and continuously in the life of the project; and
- To ensure that any fears or apprehension about the nature, scale and impacts of the project have been fully addressed.

3.6.15: Stakeholders Consulted

The proposed project has a wide range of stakeholders representing various and sometimes differing views on the relationships between the project, economic development and environmental protection. The primary stakeholders consulted were:

- Sokoto State Ministry of Environment;
- Sokoto Environmental Protection Agency;
- The Traditional Councils in the three districts of the project area; and
- All affected communities in the three districts of the project area.

Stakeholder consultation for the proposed project took several forms which include, institutional consultations, questionnaire administration, personal interviews, FGDs, as well as stakeholder/scoping and workshops

Stakeholders were consulted directly through visitations and Focused Group Discussions. Some of the stakeholders consulted are shown in the plates below

Plate A. 9: FGD with Ruga Busau Community

Plate A. 10: FGD with Rector, Umar Ali Shinkafi Polytechnic

Plate A. 11: FGD with Provost Shehu Shagari College of Education.

CHAPTER FOUR: BENEFICIAL AND ADVERSE IMPACTS

4.1 INTRODUCTION

All major development projects have environmental and/or socio-economic impacts. In order for the objectives of such projects to be realized, the associated and potential environmental, socio-economic and health impacts of the projects must be identified, evaluated and adequately mitigated or enhanced as appropriate. Although the greatest concern about impacts is with regard to their negative aspects, some impacts are positive and should be enhanced. Whether positive or negative, impacts can vary considerably in magnitude, extent and significance.

In this chapter a detailed analysis of beneficial and adverse impacts of various components of the proposed project on the physical, biological and human (social, cultural and economic) environments is presented. All environmental and social, direct and indirect, short and long-term, temporary and permanent impacts shall be described and assessed, indicating their importance and their probability of occurrence. The importance of potential impacts may be assessed on the basis of the nature, extent, intensity and duration of the impact, as well as on the sensitivity of the concerned environmental and social components and perceptions of the public. Irreversible or unavoidable impacts shall be clearly identified.

4.2 IMPACTS ASSESSMENT METHODOLOGY

This section identifies relevant issues associated with the proposed project and defines the nature of the potential impacts.

Analysis of impacts identifies the following:

- Types of impact;
- Predicts the magnitude of impact;
- Probability of occurrence of impact;
- Extent of the impact; and
- Determines the overall significance of the impact.

The impact assessment methodology applied in this EIA used a combination of Scaling Checklist and Leopold Matrix. Scaling is essentially the rating system which we can use to rate an environmental quality of a given resource. For example, we may rate high quality water as 5 and worst water quality as 1. Using the Leopold matrix, the impact associated with the action columns

and the environmental condition row is described in terms of its magnitude and significance, and the product of the two gives the overall impact for the particular aspect.

Firstly, relevant issues were described as they relate to particular project activities and those aspects of the activities that are likely to result in impacts. The nature of the impacts was then described, after which the significance of the impacts was determined.

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4.3 ENVIRONMENTAL AND SOCIAL IMPACTS

The following definitions are applicable to the assessment process:

- An **activity** is a distinct process or task undertaken by an organization for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organization.
- An **environmental aspect** is an element of activities of organizations or their products and services which can interact with the natural or human environment. The interaction of an aspect with the environment may result in an impact.
- **Environmental and social impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to adverse air quality. Receptors can comprise of, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers and flora.

Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative.

Direct impacts refer to changes in environmental components that result from direct cause-effect consequences of interactions between the environment and project activities. Indirect impacts result from cause-effect consequences of interactions between the environment and direct

impacts. Cumulative impacts refer to the accumulation of changes to the environment caused by the project and other ongoing or planned human activities.

4.4 DESCRIPTION OF ASPECTS AND IMPACTS

The findings of the environmental investigations form the basis for prediction of impacts. Once a potential impact has been determined during the scoping process, it is necessary to identify which project activity will cause the impact, its probability of occurrence as well as its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies.

The aspects and impacts identified will therefore be described according to the definitions below:

4.4.1 Extent

The extent for each aspect, receptor and impact will be defined. The geographical coverage (spatial scope) description will take account of the following factors:

- The physical extent/distribution of the aspect, receptor and proposed impact; and
- The nature of the baseline environment within the area of impact.

For example, the impacts of noise are likely to be more confined to a smaller geographical area than the impacts of atmospheric emissions, which may be experienced a long distance away. The significance of impacts also varies spatially. Many will be significant only within the immediate vicinity of the site or within the surrounding community, whilst others may be significant at a local (project) or regional (district) level.

The **extent** of the impact will be rated as shown in Table 4.1 below.

Table 4. 1: Rating for extent of impacts

S/No	Extent	Scale of magnitude
1.	Localized (At localized scale i.e., on the proposed project site)	1
2.	Project area (Wamakko,Isa,Tambuwal,Sokoto South LGA's)	2
3.	Regional (Sokoto State)	3
4.	National (At country level)	4
5.	International (Beyond Nigeria)	5

4.4.2 Duration

Duration refers to the time span over which a positive or negative change caused by the aspect may be experienced by the environment.

The assessment method will rate time periods for impact duration in table 4.2 below.

Table 4. 2: Impact duration rating

S/No	Duration of impact	Rating
1.	Very short (0 – 1 Years)	1
2.	Short term (1 – 5 Years)	2
3.	Medium term (5 – 15 years)	3
4.	Long term (>15 years)	4
5.	Permanent	5

4.4.3 Magnitude

The **magnitude** of an environmental or social impact is determined by the degree of change to the baseline condition, and includes consideration of the following factors:

- The reversibility of the impact;
- The sensitivity of the environmental receptor;
- The impact duration, its permanency and whether it increases or decreases with time; Whether the aspect is controversial or would set a precedent; and
- The threat to environmental and health standards and objectives.

Magnitude of impacts was rated according to the scale in Table 4.3 below.

Table 4. 3: **Impact magnitude rating**

S/No	Impact Magnitude	Rating
1.	Small (will have no effect on the physical, biological or social environment)	0
2.	Minor (will cause a minimal impact on physical, biological or social environment)	2
3.	Low (will cause a slight impact on the physical, biological or social environment)	4
4.	Moderate (will result in a physical, biological or social environment component or process continuing but in a modified way)	6
5.	High (physical, biological or social environment or component or process is altered to the extent that they temporarily cease to exist or operate)	8
6.	Very high (results in complete destruction of physical, biological or social environment components and permanent cessation of the processes)	10

4.4.4 Probability of impact

The **probability** or **frequency** of impact means how often an aspect may impact either positively or negatively on the environment. In other words, the probability of an impact expresses the likelihood of an impact occurrence.

The probability rating used for the assessment is summarized in Table 4.4 below

Table 4. 4: Impact probability rating

S/No	Impact probability	Rating
	Highly improbable (<20% chance of occurring)	1
	Improbable (20 – 40% chance of occurring)	2
	Probable (>40% - 70% chance of occurring)	3
	Highly probable (>70% - 90% chance of occurring)	4
	Definite (>90% - 100% chance of occurring)	5

4.5 ASSESSING THE SIGNIFICANCE OF IMPACTS

The purpose of impact assessment is to assign overall relative significance to predicted impacts associated with a proposed project, and to determine the methods to be used in avoiding, mitigating or managing anticipated impacts. For this study the information presented above was summarized in a tabular form and significance was assigned based on reasonable deductions. Significance was determined before and after application of appropriate mitigation measures.

A "significant impact" for the purposes of this study is: "An impact which, either in isolation or in combination with others, could in the opinion of the specialist, have an influence on the decision-making process, including the specification of mitigation measures."

4.6 DETERMINATION OF SIGNIFICANCE OF IMPACTS

Environmental significance rating is an attempt to evaluate the importance of a particular impact, the likelihood and consequence of which has already been assessed by the relevant specialist. The description and assessment of the aspects and impacts undertaken is presented in a consolidated table with the significance of the impacts assigned using the process and matrix (Table 4.5) below.

The sum of the first three characteristics (extent, duration and magnitude) provides a total score for the **Consequence** of each impact. The last characteristic determines the **Probability** of the potential impact. The product of **Consequence** and **Probability** represents the **Significance** of the impact.

Table 4. 5: Significance Assessment Matrix

	CONSEQUENCE (Extent + Duration + Magnitude)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

4.7 ENVIRONMENTAL AND SOCIAL COMPONENTS

Environmental and social components are the elements of the physical, biological and socio-economic environment that are likely to be affected by one or more sources of impact. The

components identified for this project are listed in Table 4.6. The study focused only on these components.

Table 4. 6: Environmental and social components

S/No.	Component		Description
1.	**Physical Environment**	Soil	Physical and chemical characteristics of the soil in the project area, including vulnerability to erosion
		Water	Physical and chemical characteristics of surface water and groundwater
		Air quality	Physical and chemical characteristics of the air
		Noise	Noise, vibrations
2.	**Biological Environment**	Terrestrial flora	Terrestrial plant communities
		Terrestrial fauna	All terrestrial and semi-aquatic animal species and their habitats
3.	**Socio-economic Environment**	Employment and economic development	Local and regional economic development and employment
		Land use	Land uses: agricultural, livestock rearing, etc.
		Infrastructure	Electricity supply, local road network, etc.
		Cultural and archeological heritage	Religious, cultural or historical sites and structures
		Public health and safety	Population well-being and health, including Sexually Transmitted Infections (STIs)

4.7.1 Positive impacts

The proposed fertilizer blending plant project will yield benefits to both the formal and informal economy of the project area and the entire country. For example, residents of the project area could be temporarily employed during the construction phase for unskilled and semi-skilled work. The stakeholders consulted had observed that they expect their youth to be employed in the operational phase of the project. Community stakeholders also expect their women to be engaged to provide catering services to construction workers.

Additionally, it is expected that as a result of the influx of workers in the construction phase, there will be a demand for temporary housing and lodging services which is identified as a benefit to the project communities.

The initiative will also result in creating enabling environment for supporting industries such as transportation, banking and insurance.

4.7.2 Negative impacts

The main impacts on the socio-economic environment are the temporary loss of farm land by the owners of the land parcel that has been acquired for the establishment of the factory.

Other impacts may occur during construction and maintenance works but will be of temporary nature. These may include traffic accidents, noise, and degradation of water quality and soil contamination by poor waste management or accidental spill of hydrocarbons. However, negative impacts that may occur during the construction phase will be localized and of a short-term duration. There may also be negative impacts in the operational phase of the project, which may include:

- Operational noise from production equipment and vehicular movements;
- Odour and pollution from gaseous emissions;
- Kidnapping risk on personnel and residents;
- Traffic hold-ups associated with cumulative impacts;
- Soil and water pollution problems as a result of operational waste.

4.8 IMPACT APPRAISAL

Direct impacts of the proposed project will result from its preconstruction, construction, and maintenance/operation phases. Some of the major project activities that will have potential impacts on the environment in this project are discussed in the following sections.

4.8.1 Identified Impacts in the Preconstruction Phase

Activities in this phase of the project include surveys, designs, studies, licensing and permits/approvals as well as establishment of construction camps and yards and other preliminary activities.

4.8.1.1 Positive Impacts in the Pre-construction Phase

Table 4. 7*: Positive Impacts in the Pre-construction Phase*

S/No.	Impact	Mitigation/Activities	Ratings
1.	*4.8.1.1.1 Temporary employment and increase in income*	Recruitment of construction employees in the preconstruction phase will provide temporary employment and increased income to a number of people including those in the project area which may be employed as unskilled workers for example as watchmen and in the construction of camps to accommodate construction employees during the construction phase. This impact is rated as being of negligible significance which can however be enhanced to an impact of low significance.	low.
2.	*4.8.1.1.2 Boost in Local Trading Activities*	Influx of preconstruction workers into the project area and employment of local people as preconstruction employees will stimulate the local economy of the project area by way of increased demand from the presence of an external workforce as well as increased income and subsequent demand from the local workforce. This impact is rated as being of negligible significance which can however be enhanced to a low significance level by appropriate enhancement measures.	low

4.8.2 Negative Impacts in the Construction Phase

The project construction activities will involve civil engineering construction works, vegetation (bush) clearing, earth (soil) movement, alignment of access road segments, culvert works, erection of reinforced concrete structures, casting of equipment bases, mounting of equipment and wiring connections, etc.

This phase of the proposed project may be associated with negative impacts such as social conflicts which may arise from compensation, dissatisfaction/disagreement during land take and local employment, interference with other public and private transport activities, risk of accident on local roads around the project area, increase in noise levels, increased emission of atmospheric pollutants from the exhausts of construction machineries and vehicles, soil contamination,

increased pressure on existing infrastructure due to minor population increase and exposure of the local population to HSE hazards such as, Covid-19, STIs.

However positive impacts expected in this phase include a slight boost to the local demand of some goods as a result of influx of some of the project construction personnel as well as temporary indirect employment at the construction camp and yard leading to increase in income of the project area.

Table 4. 8: ***Negative Impacts in the Construction Phase***

S/No.	Impact	Mitigation/Activities	Rating
1.	**4.8.2.1 Loss of Football Field**	As a result of using the existing football pitch being used by the students of Sultan Abubakar College, the community youths and other students of the school will lose playground which will affect their fitness and wellbeing. However, this impact will not be significant as an alternative football field has been provided within the premises of Sultan Abubakar College, not too far from the former football pitch.	low
2.	**4.8.2.2 Loss of Farm Lands**	There will also be loss of farm lands in the areas allocated for the development of the entrepreneurship centres at Sokoto State University, College of Education, Umar Ali Polytechnic, Government Day Secondary School, Isa, and at Tambuwal Local Government Areas. This will adversely affect the people using the farm lands. This impact will also not be significant because the land is owned by the respective institutions and the people using the farm lands are staff of the institutions that have the financial wherewithal to acquire new farm lands elsewhere, as there are vast lands available for farming within Sokoto town.	low
	4.8.2.3 Reduction of Abundance and Species of Fauna and Flora	Vegetation and fauna will be directly affected by the removal of plants, shrubs and trees from the proposed project sites at the institutions. However, application of mitigation measures such	low

		as re-vegetating and landscaping the finished structures will minimize the impact on fauna and flora.	
	4.8.2.4 Soil and Water Pollution from Construction Equipment	Oil and grease may drip from construction equipment and may contaminate soil or be washed down into underlying aquifers or nearby water bodies. This potential impact is however assessed as being of low significance. It is therefore concluded that, with application of appropriate mitigation measures, the proposed project will have negligible direct impact on surface and groundwater resources.	low
	4.8.2.5 Disruption of Road Traffic and Increased Risk of Traffic Accident	Movement of land clearing and construction equipment into the project area has the potential of disrupting normal traffic flow and increasing the risk of traffic accidents. A potential impact of the proposed project on traffic is assessed as being of low significance. Application of appropriate mitigation measures will, however, make this impact of negligible significance.	low
	4.8.2.6 Air quality	The primary air pollutants during project construction phase will be exhaust from construction machinery and airborne dust from construction truck movements and other moving vehicles along road to the construction site. The major air pollutants are dust, gaseous emissions and other particulate matter that may impact adversely on fauna and flora, human health and the built environment. It is expected that particulate concentration would not increase significantly above FMEnv limits as a result of construction activities and since construction phase activities will be of short duration, the impact on air quality is considered negative but insignificant. Mitigation measures will however be carried out to further reduce the anticipated impact.	low
	4.8.2.7 Noise Pollution	The existing daytime ambient noise levels in the nearby communities were within the day time acceptable limit (70 dBA). Other sources of noise pollution will be vehicles	low

		transporting construction materials to the construction area. Impacts from noise pollution will be mostly on construction workers, staff and students of the respective institutions and residents living within 100 meters from construction sites. Impact from noise pollution is considered negative but insignificant with mitigation measures in place.	
	4.8.2.8 Water Quality	During site preparation and construction works, silt from disturbed soil and construction activities may result in increased suspended solids (SS) in rivers immediately downstream from construction areas. Such impacts will be temporary and limited to small areas downstream. Construction workers and activities generate other wastes which when improperly disposed may also pollute streams. Surface run-off from construction sites may include hydrocarbons such as waste oil and lubricants.	low
	4.8.2.9 Traffic Problems	Road users near the sites for the project may experience traffic hold-up and other inconveniences in the construction period. Traffic disruptions could result into time wastage and accidents. Potential impact of the proposed project on traffic is assessed as being of low significance which can however be mitigated to become an insignificant negative impact through application of appropriate traffic management strategies around the project areas.	low
	4.8.2.10 Public Health and Occupational Health and Safety	Influx of construction workers into the area could increase the risk of spreading sexually transmitted infections (STIs) such as HIV/AIDS to inhabitants of the local communities. Construction workers may be exposed to many occupational hazards including slips and falls from heights, cuts and being hit by heavy objects, among others. Accidents caused by poor handling, misuse or malfunctioning equipment may also take	low

		place. Increase in social vices (drug abuse, commercial sex workers, etc.) loss of cultural values of the inhabitants.	
	4.8.2.11 Gender Gaps	Gender gaps exist across the local communities which could further compound project impacts for women as a social group. These gaps include cultural norms which prevent women from participating in the delivery of construction projects as well as community level decision making processes. Interactions with construction workers are more detrimental to women and girls, who could easily be exposed to casual sex and its attendant risks of STDs and Covid 19.	high

4.9 POSITIVE IMPACTS IN CONSTRUCTION PHASE

Table 4. 9: Positive impacts in construction phase

S/No.	Impact	Mitigation/Activities	Ratings
	4.9.3.1 Employme-nt and Income Generation	More tangible and immediate benefits in this phase of the project will be direct employment opportunities, for both skilled and unskilled labour, related to project construction execution. The project labour force will include engineers, surveyors, machine operators, drivers, masons, carpenters, food vendors, etc. Security personnel will also be needed to safeguard contractor's equipment, construction materials and other supplies. A significant part of the required labour force for this project is expected to come from the local population. Indirect employment relating to services, vendors, etc. will also generate additional income-earning opportunities, especially for women and children during the construction period. Potential impact on employment and income generation is assessed as being of low significance which can however be enhanced to an impact of moderate positive significance.	low

	4.9.3.2 Enhanced skills for Local Artisans	The local artisans like the carpenters, masons, welders, will have the opportunity to acquire new skills as well as more experience during the construction phase of the project. Thus, an on-the-job training will enhance their skills and promote them to higher levels in their professions. Potential impact of the proposed project on skills of the local work force is assessed as being of low significance which can however be enhanced to an impact of moderate positive significance	low
	4.9.3.3 Stimulation /boosting of local economy	Presence of a large number of construction employees in the project area as well as increased income and purchasing power of local construction employees can stimulate/boost the local economy of the project area through increased demand for goods and services. This impact is rated as being of low significance and can however be enhanced to an impact of moderate positive significance through application of appropriate enhancement measures.	low

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4.10.4 Operation and Maintenance Activities

Operation and maintenance activities include the following:

Periodic inspection of entrepreneurship centres to ensure functional conditions;

- Housekeeping activities to ensure clean and safe work environment
- Maintenance of equipment at centres;
- Maintaining adequate warning signs on dangerous high voltage equipment and power tools.

4.10.4.1 Negative Impacts in the Operational Phase

The impacts of the activities associated with the operations phase of this project are discussed succinctly below:

Table 4. 10: Negative Impacts in the Operational Phase

S/No.	Impact	Mitigation/Activities	Ratings
	4.10.4.2 Noise	Noise emission from mechanical and power tools would impact negatively on staff and students of the institutions. Impact from noise is assessed as being of low negative significance and can be mitigated to negligible insignificance through application of appropriate measures.	low
	4.10.4.3 Water Quality	In the operational phase, small quantities of oil/grease, electronic waste and hazardous chemicals such as from wood treatment may be washed out and discharged to nearby surface water bodies as runoff during the rainy season. Additionally, if enough provision is not made for sanitary conveniences, it may lead to open defecation by students and result into pollution of nearby water bodies. Impact on water quality is assessed as being of low negative insignificance and can be mitigated to a negligible insignificance through application of appropriate mitigation measures.	low
	4.10.4.5 Occupation-al Accidents	In the operational phase of the proposed project, there is a potential for occupational accidents such as electrocution, cuts and burns, trips and falls, etc. at the workshops in the centres and during routine maintenance or through unauthorized access to equipment. The potential for occupational accidents is assessed as being of high significance. This potential impact can however be mitigated to a low significance through application of appropriate mitigation measures.	low
	4.10.4.6. Risk of Explosion and Fire Outbreak	In the operational phase there is also a risk of explosion and fire outbreak (as a result of disregard for safety rules and precautions) in areas of high electricity voltage and where highly combustible	low

		materials such as cylinders of compressed gases and refrigerants (for welding and other application) are used or kept. This potential impact can however be mitigated to a low significance through application of appropriate mitigation measures.	

4.11.5 Positive Impacts during Operations Phase of the Project

Table 4. 11: Positive Impacts during Operations Phase

S/No.	Impact	Mitigation/Activities	Ratings
	4.11.5.1 Stimulating/ Boosting of Local Economy	Although, from the viewpoint of the economy, the impacts of the project on employment will be limited, there are some impacts that are worth noting. In the operations phase of the proposed project, operations and maintenance activities will create new jobs that will directly impact positively on the local and even the regional labour markets. These jobs will create additional income and thereby inducing increased demand for local goods and services. Stimulating the local economy as a result of employment creation and increased income in the area is assessed as being of negligible significance which can however be enhanced to a low significance level through ensuring that local people are given preference in terms of recruitment.	low
	4.11.5.2 Skills Acquisition from Maintenanc-e Operations	In the operations phase of the proposed project there will be a potential for skill acquisition by people employed from the project communities. Employees from the project area will acquire more skills and build capacity by acquiring new skills which they can utilize in subsequent engagements in future. The potential for skills acquisition by the local employees is assessed as being of negligible significance which can be enhanced	low

		to a low level significance through carrying out appropriate enhancement measures.	
	4.11.5.3 Climate Change Mitigation	Exhaust emission from electricity generation in the proposed project area is a major source of greenhouse gases and a major contributor to climate change. In the operational phase of the project local capacity of the people in the project area in the field of renewable energy will be built and enhanced leading to exploitation of renewable energy alternatives leading to climate change mitigation. The project is thus expected to positively impact on the environment by way of climate change mitigation. Once there is a significant increase in utilization of renewable energy at the expense of electricity and fossil fuels, there will be a reduction in greenhouse gas emission, which mitigates climate change. The potential decrease in greenhouse gas emission as a result of the proposed project is assessed as being of low significance.	Low
	4.11.5.4 Increased Potential for Industrial Developme-nt	A very significant impact of the project which is generally the overall aim of the proposed project is the potential of the project to significantly lead to local, regional and national capacity building by way of providing trainees at the institution with entrepreneural and vocational skills needed for job and wealth creation leading to local, regional and national poverty eradication and industrial development. Implementation of the proposed project will significantly lead to a high potential for industrial development. A significantly improved entrepreneural skill in the project area will tend to lead to establishment of industries with high comparative advantage in the area leading to industrialization of the entire region and the country at large. The potential impact of the proposed project on industrialization of the project area is assessed as	High

		being of moderate significance which can be enhanced to a high significance through appropriate enhancement measures.	
	DECOMMI -SSIONING PHASE	The design life of the proposed entrepreneur centres will be 25 years, depending on proper maintenance. Therefore, it is unlikely that the centres would be decommissioned early. In future, the centres may even be upgraded or rehabilitated, if this is found to be necessary. However, should decommissioning be decided in the long run, the general good practice guidelines for decommissioning of infrastructure as well as the existing environmental legislation of the time would guide appropriate decommissioning. Nonetheless, at the end of the construction phase the construction area will be rehabilitated according to recommended plans before abandonment.	

CHAPTER FIVE: MITIGATION/ENHANCEMENT MEASURES AND COMPLIMENTARY INITIATIVES

5.1 INTRODUCTION

Apart from identifying and predicting the likely impacts that may arise from the project development, there is need to provide abatement strategies and cost–effective environmental controls to ensure that environmental resources are harnessed in a sustainable manner. Therefore, in order to preserve the integrity of the proposed project environment, certain measures have been designed to mitigate the impacts identified in this study; while enhancement measures are also proffered for the positive impacts. The mitigation measures are provided to ensure that potential and associated negative impacts of the various project activities on the biophysical, socio-economic and health environments eliminated or reduced to as low as reasonably possible (ALARP).

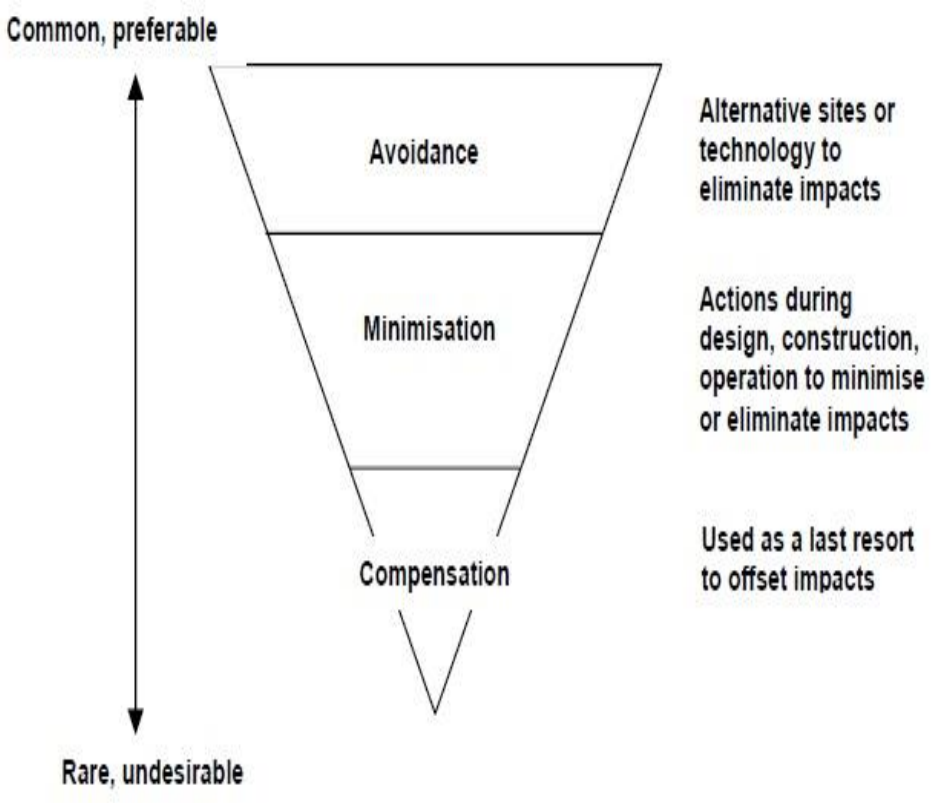
Mitigation measures are activities aimed at reducing the severity of, avoiding or controlling project impacts and where possible they are used to enhance environmental quality. Mitigation may be in form of avoidance (alternative action taken to avoid impact), impact minimization/reduction, compensatory payment of money or replacement in kind for losses or recreation of lost/damaged habitat..

The main objectives of providing mitigation measures include the following:

- Finding better alternatives and ways of doing things;
- Avoiding, minimizing or remedying adverse impacts;
- Enhancing the environmental and social benefits of a proposal;
- Enhancing the environmental and social benefits of a proposal; and
- Ensuring that residual adverse impacts are kept within acceptable levels.
- Elements of mitigation are normally organized into a hierarchy of actions as follows:
- Firstly, avoid adverse impacts as much as possible by using preventative measures;
- Secondly, minimize or reduce adverse impacts to as low as practicable levels; and
- Thirdly, remedy or compensate for adverse residual impacts, which are unavoidable and cannot be reduced further.

Generally, as project design becomes more detailed, opportunities for impact avoidance narrow and the concern is then to minimize and compensate for unavoidable impacts. However, these distinctions are not rigid and opportunities for creative mitigation should be sought at all stages of project planning.

Figure 5.1 presents the hierarchy of action steps to mitigate impacts.



Source: UNEP, 2002

Figure 5. 1The Elements of Mitigation

Step One: Impact Avoidance

This step is most effective when applied at an early stage of project planning. It can be achieved by:

Not undertaking certain projects or elements that could result in adverse impacts;

Avoiding areas that are environmentally sensitive; and

Putting in place preventative measures to stop adverse impacts from occurring.

Step Two: Impact Minimizations

This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- Scaling down or relocating the proposal;
- Redesigning elements of the project; and
- Taking supplementary measures to manage the impacts.

Step Three: Impact Compensation

This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- Rehabilitation of the affected site or environment;
- Restoration of the affected site or environment to its previous state or better; and
- Replacement of the same resource values at another location.

Environmental enhancements/ mitigations are essential and shall therefore be undertaken in the various phases of the proposed project, that is, during pre-construction (including those already undertaken), construction/equipping and operation phases of the project.
The mitigation measures proposed for the predicted impacts were based on the following considerations among others:

- Environmental laws in Nigeria, with emphasis on permissible limits for waste streams
- Best Available Technology for Sustainable Development
- Feasibility of application of the measures in Nigeria
- Concerns of stakeholders during consultation meetings, etc.

5.1.1 Mitigation and Enhancement Measures in the Preconstruction Phase

5.1.1.1 Loss of Farmlands

This impact has been mitigated from the onset as land for the project has already been acquired through official allocation by the State Government in overriding public interest with a Certificate of Occupancy (C of O) granted. However, staff of the various institutions that would house the entrepreneurship centres are using the existing lands for farming activities, there is need to provide them with alternative farm lands available within the institutions.

Mitigation Measures are:

- Provide alternative farm lands for staff of the institutions using the proposed project sites as farms;
- In the event that there are no available alternative farmlands within the institutions, encourage the members of staff using the sites as farmlands to get farmlands outside the institutions;
- Alternative football pitch has been provided for the students of Sultan Abubakar College

5.1.1.2 Temporary employment and increase in income

Enhancement measures are as follows:

- Give priority to people from the project area during recruitment employees;
- Vulnerable groups such as women and children should be given more priority to benefit from the project such as in provision of services that may be requested by the preconstruction employees;

5.1.1.3 Boost in Local Trading Activities

Enhancement measures are as follows:

- Encourage pre-construction employees to patronize local traders and service providers from the immediate project communities;

5.1.1.4 Occupational Hazards during Field Work by Consultants

Consultants engaged in field work and other activities may fall victims of occupational and other hazards. Examples of such hazards include snake bites in the fields, automobile accidents, kidnapping, etc.

Mitigation measures are as follows:

- Provide all field workers with armed security personnel to ensure their safety against kidnappers and other criminals;
- All field workers must use appropriate PPE at all times;
- All drivers engaged during field work must be well-trained and must follow all traffic rules and regulations; and
- Teams carrying out preliminary studies and works must avoid unsafe places and other potentially troublesome places and should always stick together to ensure their security.

5.1.1.5 Exposure to STIs and COVID 19

Project employees as well as the communities may be exposed to STIs and COVID 19 in the preconstruction phase. To mitigate this impact, preconstruction employees/consultants should be reminded of the dangers of casual sex and other potentially dangerous conduct such as disregard for COVID 19 protocols and STIs prevention measures during field work;

5.2.2 Mitigations and Enhancement Measures in Construction Phase

5.2.2.1 Site Clearing

The following mitigation measures are proposed:

- To ensure that alien plants are eradicated from the site during construction and operation, an integrated alien plant species control programme should be complied with;
- Construction scheduling must include rehabilitation of disturbed areas with replanting of local species as soon as possible;
- All equipment used for site clearing should be regularly maintained; and
- Avoid unnecessary clearing of vegetation;

5.2.2.2 Reduction of Abundance and Species of Fauna and Flora

The following mitigation measures should be employed in order to limit loss of fauna and flora as a result of vegetation loss during construction work:

- Avoid unnecessary clearing of vegetation;
- Limit movement of heavy machinery to designated routes and construction areas;
- Earthworks should be planned and executed with due diligence;
- To ensure that alien plants are not introduced into the area, an integrated alien plant species control programme should be complied with;
- Re-vegetate exposed areas

5.2.2.3 Soil and Water Pollution from Construction Equipment

The mitigation measures for this identified impact are as follows:

- Provide suitable material for absorption of oil spills from construction equipment;
- Servicing and repair of machinery and equipment should be restricted to designated workshops to avoid oils contaminating the soil and water of the project area.
- The contractor should make sure oils or chemical wastes are disposed of in accordance with best practice and relevant laws.
- Lubricants and engine oils must be stored in a manner that prevents spillage into the environment.

5.2.2.4 Disruption of Road Traffic and Increased Risk of Traffic Accident

The following are enhancement measures for the above identified impacts:

- Ensure the use of safety signage, signals and alarms during transportation of construction equipment;
- Ensure the use of well-trained and skilled construction drivers;
- Ensure that vehicles to be used for construction work are in good quality;
- Ensure low driving speeds when transporting equipment; and
- Manual Traffic Control may be employed in which case police or flaggers/flagmen would be required to control traffic along roads to construction sites as may be required.

5.2.2.5 Air Quality

Mitigation measures are:

- Cover soil stockpiles and truck loads to avoid being blown by winds and causing adverse air quality;
- Enforcing lower driving speeds along roads to and in the construction sites;
- The contractor should also make sure that his equipment and vehicles are well-maintained, in good condition and have minimal emissions; and

5.2.2.6 Noise and Vibration

The mitigation measures are:

- Maintaining construction equipment regularly in accordance with the manufacturer's specifications;
- Execute all works so that they do not become a nuisance to the staff and students of the institution and to the general public;
- Locate noisy plants/generators far away from office and classroom blocks;
- Construction employees should be prevented from working at night;
- Provide and enforce use of ear plugs/muffs by operators of noisy construction equipment; and
- Construction vehicles and equipment noise would be reduced using properly sized and maintained mufflers and engine silencers. Equipment should also be turned off when not in use.

5.2.2.7 Public Health and Occupational Hazards

The following mitigation measures will be employed for the above identified impacts:

- Ensure strict adherence to COVID 19 protocols, e.g. hand washing, hand sanitizing and social-distancing at work environment;
- Sensitize construction workers on methods of prevention on HIV/AIDS, COVID-19 upon commencement of works;
- Sensitize construction workers on the need to respect and maintain good relationship with project host communities;
- Ensure Occupational Health and Safety (OHS) requirements are observed at all times during construction at work areas at the construction sites;
- Ensure enhanced safe driving by all construction drivers;
- Secure all construction sites (material sites and construction areas) from public access to ensure safety, using caution tapes and barricades.

- The Project Contractor shall develop and implement an Occupational Safety and Health (OSH) Management System which is in line with Nigerian Factory Act and other relevant legal provisions;
- Project Contractor shall develop and implement an Health Safety and Environment (HSE) training program to be conducted during the induction of all construction workers;
- Ensure that all guidelines and safety regulations for installation of equipment are strictly followed during equipment installation;
- Ensure that fire-fighting equipment, first-aid stations and medical ambulance service and appropriate personnel are provided throughout the duration of the construction phase;
- Provide adequate toilet facilities for construction employees;
- Provide waste receptacles/bins at appropriate locations for waste management;
- Project Contractor shall ensure that every employee working at the project site is provided with appropriate and adequate PPE; and
- Project Contractor shall ensure educating employees on the detrimental effects of drug and alcohol abuse.

5.2.2.8 Vulnerable Groups

In order to ensure effective participation of women and the vulnerable poor and prevent other forms of discrimination, the following mitigation measures are proposed:

- Prior to project implementation, recruitment team should remove barriers to women's participation in the execution by having transparent recruitment procedures and ensuring that women are also part of the recruitment process;
- Deliberate efforts should be made to involve women at various stages of the project implementation, which may be for example by allowing them to run catering services for the construction employees;
- Construction employees should be discouraged from taking advantage of vulnerable women and girl-child and also from sexually abusing them; and
- Persons with Disabilities (PWDs) be given opportunities to participate in project implementation.

5.2.2.9 Waste Management

Construction activities will generate various categories of waste in the construction phase of the project. The following mitigation measures should be applied by the contractor:

- Waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage should be provided in the construction sites;
- The contractor should ensure a comprehensive daily house-keeping in storage and construction areas;
- The strategy of waste reduction, re-using and recycling should as much as possible be implemented throughout the construction phase;
- Hazardous waste should be handled and managed separately; and
- Construction and domestic waste as well as sewage should be disposed of appropriately.

The following are enhancement measures for the identified positive impacts in the construction phase.

5.2.2.10 Stimulation of local economy as a result of presence of construction workers

The presence of construction workers in the project area will create an increased demand for goods and services in the project area. This in turn will cause an increase in income and purchasing power of people in the project area which can be enhanced through the following measures:

- Unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in procurement activities;
- Food and other requirements of the construction workers should be provided by people from the host communities;
- There will be increased revenue as a result of creation of secondary employment;
- Increase in tax revenue generation through taxes on goods and services associated with the project; and
- The Project Contractor should source for as many materials required for construction purposes as possible locally, before resorting to importation;

5.2.2.11 Employment of Locals Leading to Increased Income and Capacity Building

- Give preference to people of the project area during recruitment of construction workers;
- Give construction employees especially unskilled ones capacity acquisition/building training to enhance their capacities in current project job and for subsequent jobs after completion of current project;
- The Project Contractor shall whenever possible, source for expert employees locally first, then regionally and nationally before engaging international experts; and

- In all cases, the traditional local authorities shall be consulted when recruiting local workers.

5.3.3 Mitigation and Enhancement Measures in the Operational Phase

5.3.3.1 Noise Emissions Associated with Generators and Heavy Equipment.

Noise emissions that may be associated with some equipment at the centres can be mitigated as follows:

- Low noise equipment shall be selected and procured for the centres;
- High noise equipment shall be muffled with effective silencers;
- High noise equipment shall be located far away from sensitive receptors and whenever possible enclosed in sound-proof enclosures;
- Employees working in noisy areas at the centres shall be provided with ear plugs to muffle noise from production equipment; and
- High vibration equipment shall be dampened to reduce vibrations.

5.3.3.2 Electrocution Risks

- High voltage areas should be well secured and notices of the dangerous high voltage should be boldly written and fixed to demarcate high voltage zones;
- High voltage zones should be made off-limits to unauthorized personnel;
- Ensuring that maintenance work is carried out by certified authorized personnel; and
- Ensuring the use of relevant PPEs at all times by operations and maintenance personnel.

5.3.3.4 Risk of Fire Outbreak

- All workshop buildings should be appropriately designed with appropriate emergency fire-exits;
- Fire-fighting equipment should be provided and stationed strategically in appropriate locations;
- All employees and trainees at the centres should be trained on fire and general emergency response preparedness;
- Fire drills should be carried out regularly at the centres to prepare all employees and trainees on emergency response procedures;

5.3.3.4 Occupational Accidents

Mitigation measures against occupational accidents are as follows:

- Ensure that warning signs and symbols are conspicuously displayed in dangerous zones and on hazardous equipment;
- Restrict access to hazardous equipment to trained personnel only;

- Ensure that the safety rules and regulations for operation of workshop machineries and equipment are strictly enforced;
- Ensure that relevant PPE are used at all times for work and trainings in the workshops at the centres;
- First-aid stations should be provided in all workshops at the centres;
- Ensure that medical ambulance is always on standby at the centres for prompt evacuation of accident victims;

5.3.3.5 Public Health and Security

- Mitigation measures for maintaining public health include the following:
- Sensitize staff and trainees on issues of public health such as malaria, cholera, HIV/AIDs and Covid-19 prevention measures;
- Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the centres at all times;
- Ensure that good house-keeping is also maintained at all times;
- Provide a 'round-the-clock' armed security personnel at all the centres to screen all entering and leaving persons;
- Provide dedicated lines of communication with the security personnel at the centres to ensure efficient communication in times of crisis; and
- Design and popularise a security response procedure to be deployed at the instance of a security breach.

5.3.3.6 Soil and Water Pollution

Mitigation measures against soil and water pollution include the following:

The Contractor should ensure that waste disposal facilities including waste bins, and septic tanks for sewage are provided at the centres;

- Hazardous waste such those from cells/accumulators be treated with due care and following appropriate procedures;
- All wastes should be disposed following appropriate procedures; and
- Workshops should have proper oil interceptors to collect spilled oil and other hazardous chemicals;

5.3.3.7 Reduction in crime rate

- Enhancement and mitigation measures for Crime rate include the following:
- Provision of employment opportunities for people in the project area will go a long way in reducing crime rate in the area. In every community, crime rate is generally associated with unemployment. It therefore follows that provision of employment to the people in

the project area, especially the youth, will lead to a reduction in the rate of committing crime in the project area.

- The contractor should give preference to the people of the project area when recruiting for employee;
- People from the project area are given opportunity to provide essential services such as food and transportation to factory employees; and
- The contractor should support local security arrangements operated by vigilante groups in the project area.

5.4 Positive Enhancements Measures in the Operational Phase of Construction

5.4.1 Stimulating/Boosting of Local Economy

Enhancement measures include the following:

- Provide credit facilities for entrepreneurs in the project communities;
- Simplify procedures for industrial land acquisition;

5.4.2 Skills Acquisition from Maintenance Operations

Enhancement measures include the following:

- Organize business plans competition
- Introduce networking events through workshops, seminars, lectures and stakeholders to get ideas from others
- Role model interaction and mentoring to deliver motivational discussions in form of key notes
- Counseling trainees on right careers to follow after graduation
- Give some forms of innovative to trainees who have done well during internships, this will motivate them to establish business after graduation.

5.4.3 Climate Change Mitigation

Enhancement measures are as follows:

- Incentivize the use of renewable energy by project host communities for example through the reduction of income/revenue tax rate;
- The State Government can provide interest free loans for entrepreneurs willing to invest in renewable energy dependent industries;
- Sensitize the project communities on the advantages of embracing renewable energy sources;

5.4.4 Increased Potential for Industrial Development

Enhancement measures include:
Suppression of industrial dispute;
The government can encourage development of research and technology;
Increase in power resources;
Efficient system of industrial management;
Encourage capital formation; and Increase in power resources.

CHAPTER SIX: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

6.1 INTRODUCTION

All major development projects are associated with environmental and socio-economic impacts which may be either desirable or undesirable and it is the role of Environmental Impact Assessment exercise to determine potential environmental and socio-economic impacts of such development projects with a view to ensuring a sustainable project design and implementation that avoids damage to the environment or mitigates the damage and enhance socio-economic benefits of the project. In previous sections of this report potential adverse environmental and beneficial socio-economic impacts have been identified. In this section the plan for mitigating the identified adverse environmental and social impacts is presented. Environmental management measures including actions to be taken, stakeholder roles and responsibilities, timeframes, monitoring and cost of implementation, will be provided. The ESMP shall also clearly specify guidelines to ensure conformity with the project implementation procedure, practices and recommendations outlined in the previous sections of this report.

6.2 OBJECTIVES

The Environmental and Social Management Plan for this project aims at ensuring the following:

- That environmental, social, health and safety factors are carefully managed throughout the project cycle.
- That the project complies with regulatory stipulations and guidelines;
- That there is sufficient allocation of resources on the project budget so that the scale of ESMP-related activities is consistent with the significance of project impacts;
- That environmental performance is verified through information on impacts as they occur;
- That institutional arrangements required to implement the environmental impact mitigation and enhancement measures are specified and include a monitoring program, for selected environmental parameters, to assess the success of the mitigating/enhancement measures, as well as their timely execution; and
- That an implementation schedule for the mitigation measures is provided.

6.3 CONTEXT

The environmental context against which this Environmental and Social Management Plan is designed based on the national objective of enhancing environmental, social and economic benefits to affected persons in the project area as well as on the desire for sustainable national development and compliance with Nigerian environmental laws (Environmental Impact Assessment (EIA) ACT 86, CAP E12, LFN 2004 and associated regulations as well as on the African Development Bank Integrated Safeguard Systems. To achieve these objectives, the project should be acceptable to majority of the people and ensure minimal impacts on the bio-physical and socio-economic environments through integrated stakeholder consultations, evaluation and review of the design aspects throughout the project phases as well as sustained monitoring of the project in its operational phase.

Important factors to be considered in the project implementation and evaluation initiatives include the following:

- Enhanced integration of environmental, social and economic functions (in the project design and implementation;
- Protection and conservation of biological diversity at designated centres; and
- Incorporating all safety provisions in the project design and construction.

6.4 SCOPE OF THE ESMP

The scope of the ESMP has been stated in the introductory chapter of this report. However, the following long-term objectives deserved to be mentioned:

- Ensuring that environmental management conditions and requirements are implemented during the construction and post-construction period;
- Ensuring that the interests of the general public and other stakeholders are considered throughout the construction and operational phases of the project; and
- Ensuring that maximum socio-economic benefits accrue to the project area and the entire country.

In both the construction and the operational phases of the proposed project efforts should be directed at ensuring compliance with Nigerian Factory Act of 1961 which was adopted from the British Government.

Generally, the act provides for the safety and welfare of workers and trainees through the provision of adequate and safe working conditions and tools.

Specifically, the act stipulates the following:

- Employees/trainees should be protected from rain, heat, excessive cold, solar radiation, atmospheric pollution;
- Employees/trainees should be provided with sufficient free circulation of fresh air and free space for movement;
- Employees/trainees should be provided with essential services such as water, light, canteen, toilet, refuse collection facilities and sewage disposal system;
- There shall be fire-fighting equipment to include fire alarms, fire hydrants and emergency control services and people trained to handle emergency situations;
- Employees/trainees should be provided wherever necessary with Personnel Protective Equipment (PPE) such as safety boots, helmets, protective clothing (overall, apron, etc), hand gloves; face protector, ear mug protector, etc.
- Employees/trainees should be provided with first aid boxes in the small sections and clinic for their medical care and emergencies; and
- Employees should be appropriately trained on the use of equipment they are to work with.

6.5: RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS

The key stakeholders involved in this project include; Federal Ministry of Environment, (FMEnv), the contractor, Sokoto State Ministry of Education, Sokoto State Ministry of Environment, the project communities, as well as the Management of the affected institutions.

Each contractor shall be responsible for the implementation of the ESMP falling under the scope of his contract. FMEnv through Enarmac Consultant's E&S expert and the supervising engineer shall undertake the monitoring of the ESMP for all the phases of the project. This shall be in close collaboration with the Federal Ministry of environment (FMEnv) and Sokoto State Ministry of Environment.

To ensure the success of an environmental management of the project, the entire project team and other relevant stakeholders should be properly mobilized and oriented on the necessity and

methods for sound and environmentally responsible project implementation. The Resident Engineer is expected to convey and discuss the contents of the ESMP with the Contractor and the project personnel. Sokoto State Ministry of Environment and its local offices and the project host communities are also expected to be part of the monitoring programme to be carried out under the ESMP. Good relations and interactions between the contractor and the other stakeholders and exchange of timely information and project scheduling, duration of construction works, potential interference with businesses and social activities and other issues that may arise will go a long way in avoiding social conflicts. Communication channels between the contractor, host communities and other stakeholders should always be open to ensure proper and timely responses to any complaints that may arise during project execution.

Specific responsibilities of project stakeholders are as outlined in the following sections.

6.5.5.1 The Resident Engineer

The Engineer is to design the project with minimum negative environmental impacts using environmentally friendly operations and equipment;

Ensure that his detailed design conforms to the concept design approved;

Prescribe feasible safety measures for project implementation;

Select construction materials with least negative environmental impacts;

Design appropriate functional Entrepreneurs centres and Heavy equipment systems;

Insert all suitable clauses that stipulate that the contractor must execute all project works with due diligence and application of environmentally friendly construction methods;

Monitor and supervise all construction works to ensure that the contractor conforms to environmental clauses inserted into contract documents; and

Monitor the overall environmental impacts of the project and recommend additional mitigation measures for implementation.

6.5.5.2 The Contractor

- Prepare a detailed Environmental and Social Management Plan to be approved by FMEnv as stated in the contract documents;
- Ensure that his detailed design conforms to the concept design already carried out and approved by FMEnv.
- Ensure that the project manager as well as site managers and foremen are well informed about all environmental issues relevant to the project;

- Ensure that all site managers and foremen are trained in appropriate and environmentally harmless construction methods;
- Ensure that all equipment to be employed in construction work are environmentally sound;
- Establish, operate and rehabilitate an appropriate and environmentally responsible construction camp;
- Establish a waste management plan covering all types of wastes;
- Ensure hazard-free and safe operating environment for all workers and visitors at all times;
- Execute all works in compliance with all environmental requirements of the contract documents;
- Inform Carter Consultants whenever any unforeseen negative environmental impact occurs;
- Ensure hazard-free flow of traffic around or through the work sites;
- Ensure that all workers at the construction camp maintain harmonious relationships with the communities in the project area; and
- Ensure that all project areas are cleared of construction waste, graded and re vegetated

6.5.5.3 Environmental and SAFETY Officers

An Environmental and Safety Officer (ESO) is to be appointed by the Contractor to monitor and review the implementation of the ESMP. The ESO shall be on site daily throughout the duration of the project construction works.

His responsibilities will include the following:

- Assist in making sure that the necessary environmental permits are obtained by the Contractor;
- Open and maintain communication lines between the Employer, Contractor, Consultant and relevant institutions on environmental matters;
- Monitor project activities to ensure compliances with the ESMP at all times;
- Take appropriate corrective actions whenever the ESMP is violated;
- Assist the Contractor in finding solutions to environmental problems;

- Plan and carry out safety and environmental training for new project personnel reporting for work;
- Ensure that employees are provided Personal Protective Equipment;
- Advise on the removal of person(s) and/or equipment not complying with environmental specifications;
- Recommends penalties for contraventions of the ESMP;
- Keep detailed records of all project activities that may impact on the environment;
- Continuously review the ESMP and recommend modifications when necessary; and
- Prepare and submit, to the employer, a final audit report regarding the ESMP and its implementation during the construction and operational phases of the project.

6.5.5.4: Federal Ministry of Environment (FMEnV)

The FMEnv is responsible for coordinating environmental issues in Nigeria. The Ministry is expected to issue the necessary environmental permits and to ensure that monitoring and reporting are done in accordance with both the provisions of the EMSP and the standards and regulations set by NESREA. NESREA's mandates on the other hand include taking actions that may be needed to ensure environmental quality standards are not breached and permit requirements are maintained.

6.5.5.5: SOKOTO State Ministry of Environment (SSME)

Sokoto State Ministry of Environment on the other hand is responsible for coordinating environmental issues in Sokoto State. In this project SSME will complement the supervisory role of Federal Ministry of Environment and also ensure that the ESMP is strictly adhered to.

6.5.5.6: SMALL AND MEDIUM ENTERPRISE DEVELOPMENT AGENCY OF NIGERIA

The Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) was established in 2003, to facilitate the promotion and development of the Micro, Small and Medium Enterprises (MSMEs) sector in an efficient and sustainable manner. The overall objective was reducing poverty through wealth and job creation to facilitate socio-economic transformation. This necessitates the need for accurate and reliable data for a strategic plan that will foster economic transformation in Nigeria. To facilitate this objective the Small and

Medium Enterprise Development Agency of Nigeria (SMEDAN) and the National Bureau of Statistics (NBS) conducted this national survey.

With the overall objective of reducing poverty throu gh wealth and job creation and

facilitating national economic development, the Micro, Small and Medium Enterprise are perceived as engine of socio-economic transformation in both developed and developing counties. SMEDAN is striving to fill the gap of the death and paucity of credible and reliable database, which is one of the main
constraints in the development of this sub sector.

Small and Medium Enterprises Development Agency of Nigeria ("SMEDAN") is guided by empirical research based on experiences of successful similar enterprise development initiatives in Africa and Asia and the pilot projects in Kano and Niger States.

Benefits/Potentials of NEDEP

It is aimed at generating an estimated 5.0 million direct and indirect jobs between 2013 and 2015. It will revitalize the rural economy, improve employment opportunities, create wealth and alleviate poverty in rural areas in Nigeria. This will be done through the establishment of sustainable MSMEs in the 774 Local Government Areas (LGAs) based on comparative and competitive advantages.

Entrenchment of entrepreneurial culture, industrialization of rural areas, enhanced industrial cluster development, increased MSMEs contribution to GDP, increased export potentials, etc.

Elimination of youth restiveness, militancy and other social vices (e.g. kidnapping, extremists' insurgence like banditry Boko haram, prostitution, armed robbery, drug abuse, thuggery.

6.5.5.8: The General Public

The general public has no formal responsibility for the implementation of the ESMP for this project. However, they are major stakeholders as far as potential impacts are concerned. Project impacts may certainly affect them in various ways. These negative impacts may include water, air and noise pollutions, loss of land, traffic accidents etc. The project host communities must express their concerns over unforeseen impacts or whenever project impacts take different forms or become of higher significance than anticipated. The general public has an informal obligation to inform the Supervising Engineer or the Contractor about new developments or other issues of concern to them as early as possible. The general public is also the target of awareness campaigns to be carried out in order to mitigate negative impacts associated with the project.

6.5.5.9 Community Liaison Committees

Project host communities in the project area will be required to form Community Project Liaison Committees to collaborate with the Project Management on issues of concern to the communities. The Committees will be established with the facilitation of the traditional rulers in the communities. Members of the Committees will be drawn from a wide cross section of the community to include local elders, landowners, institutions, trade associations, vulnerable groups, youth, etc. The Committee will comprise of a Chairman and a Secretary and will register with the Resident Engineer and the Contractor. The committee is to resolve problems including the following:

- Land acquisition and relocation issues;
- Health and safety;
- Impacts on resources and amenities.

6.5.5.10: Supervising Engineer

The supervising Engineer will be a staff of State ministry of Education, who will collaborate with Enarmac Consultant, FMEnv and SSME to ensure effective implementation of the environmental management plan drawing attentions of construction teams to its details, recommendations, proposed action plans, timeframes and expected targets. The supervising Engineer and E&S expert should be the liaison persons between the contractor and Sokoto State Ministry of Education on the implementation of the ESMP. They should also ensure that issues of concern to the communities and other stakeholders including environmental pollution, safety, noise, land acquisition/relocation issues, recruitment, security, etc are addressed.

6.6 Change/Modification of Project Design

In the event that a certain aspect of the design for the project is to be changed or modified, the potential environmental and socio-economic consequences of such changes/modifications must be determined and mitigation and enhancement measures determined and communicated to the project proponent for vetting and approval by FMEnv, before the contemplated change/modification.

6.7 Guidelines for Implementation Programme

Tables 6.1, 6.2 and 6.3 respectively summarize the ESMP for the Pre-Construction, Construction and Operations phases of the project.

Table 6. 1: ESMP FOR THE PRE-CONSTRUCTION PHASE

S/No.	Receptor	Project Activity	Impact	Mitigation	Responsibility
1.	The Institutions' communities	Land Clearing	Loss of Farmlands	➢ Provide alternative farm lands for staff of the institutions previously using the proposed project sites as farms; and ➢ In the event that there are no available alternative farmlands within the institutions, encourage the members of staff using the sites as farmlands to get farmlands outside the institutions.	The Institutions housing the Entrepreneurship Centres
	Sultan Abubakar College students	Loss of football pitch		➢ Provision of alternative football pitch within the premises of Sultan Abubakar College considering the safety of students and to avoid clashes with the students of Sokoto Science College during sporting activities.	Principal of Sokoto Science College
2	Community	Temporary Employment	Creation of employment	➢ Give priority to people from the project area during recruitment employees; ➢ Vulnerable groups such as women and children should be given more priority to benefit from the project such as in provision of services that may be requested by the preconstruction employees;	Contractor
3	Construction workers	Occupational Hazards		➢ Provide all field workers with armed security personnel to ensure their safety against kidnappers and other criminals; ➢ All field workers must use appropriate PPE at all times;	Contractor

				➢ Drivers engaged during field work must be well-trained and must follow all traffic rules and regulations; and ➢ Teams carrying out preliminary studies and works must avoid unsafe places and other potentially troublesome places and should always stick together to ensure their security.	

Table 6. 2: ESMP FOR THE CONTRUCTION PHASE

S/No.	Receptor	Project Activity	Impact	Mitigation	Responsibility
1.	Project sites	Site Clearing	Loss of vegetation	➢ To ensure that alien plants are eradicated from the site during construction and operation, an integrated alien plant species control programme should be complied with; ➢ Construction scheduling must include rehabilitation of disturbed areas with replanting of local species as soon as possible; ➢ All equipment used for site clearing should be regularly maintained; and ➢ Avoid unnecessary clearing of vegetation;	Contractor
2.	Host community	Reduction of Abundance and Species of Fauna and Flora	Soil erosion	➢ Avoid unnecessary clearing of vegetation; ➢ Limit movement of heavy machinery to designated routes and construction areas; ➢ Earthworks should be planned and executed with due diligence;	Contractor

				➢ To ensure that alien plants are not introduced into the area, an integrated alien plant species control programme should be complied with; and ➢ Re-vegetate exposed areas	
3.	Host Environment	Soil and Water Pollution	i. Erosion ii. Subsidence iii. Compaction	➢ Provide suitable material for absorption of oil spills from construction equipment; ➢ Servicing and repair of machinery and equipment should be restricted to designated workshops to avoid oils contaminating the soil and water of the project area; ➢ The contractor should make sure oils or chemical wastes are disposed of in accordance with best practice and relevant laws; and ➢ Lubricants and engine oils must be stored in a manner that prevents spillage into the environment.	Contractor
4.	Host communities	Disruption of road traffic	Road accident	➢ Ensure the use of safety signage, signals and alarms during transportation of construction equipment; ➢ Ensure the use of well-trained and skilled construction drivers; ➢ Ensure that vehicles to be used for construction work are in good quality; ➢ Ensure low driving speeds when transporting equipment; and ➢ Manual Traffic Control may be employed in which case police or flaggers/flagmen would be required to	Contractor

				control traffic along roads to construction sites as may be required	
5.	Community	Movement of construction materials	Adverse air quality	➢ Cover soil stockpiles and truck loads to avoid being blown by winds and causing adverse air quality; ➢ Enforcing lower driving speeds along roads to and in the construction sites; and ➢ The contractor should also make sure that his equipment and vehicles are well-maintained, in good condition and have minimal emissions.	Contractor
6.	Host community	Operating construction vehicles and machineries	Noise and Vibration	➢ Maintaining construction equipment regularly in accordance with the manufacturer's specifications; ➢ Execute all works so that they do not become a nuisance to the staff and students of the institution and to the general public; ➢ Locate noisy plants/generators far away from office and classroom blocks; ➢ Construction employees should be prevented from working at night; ➢ Provide and enforce use of ear plugs/muffs by operators of noisy construction equipment; and ➢ Construction vehicles and equipment noise would be reduced using properly sized and maintained mufflers and engine silencers. Equipment should also be powered off when not in use.	Contractor

7.	Employees/host communities	Construction activities and conduct of workers	Public Health and Occupational Hazards	➢ Ensure strict adherence to COVID 19 protocols, e.g. hand washing, hand sanitizing and social-distancing at work environment; ➢ Sensitize construction workers on methods of prevention of HIV/AIDS, COVID-19 upon commencement of works; ➢ Sensitize construction workers on the need to respect and maintain good relationship with project host communities; ➢ Ensure Occupational Health and Safety (OHS) requirements are observed at all times during construction at work areas at the construction sites; ➢ Ensure enhanced safe driving by all construction drivers; ➢ Secure all construction sites (material sites and construction areas) from public access to ensure safety, using caution tapes and barricades. ➢ The Project Contractor shall develop and implement an Occupational Safety and Health (OSH) Management System which is in line with Nigerian Factory Act and other relevant legal provisions; ➢ Project Contractor shall develop and implement an Health Safety and Environment (HSE) training program to be conducted during the induction of all construction workers;	Contractor

				➢ Ensure that all guidelines and safety regulations for installation of equipment are strictly followed during equipment installation; ➢ Ensure that fire-fighting equipment, first-aid stations and medical ambulance service and appropriate personnel are provided throughout the duration of the construction phase; ➢ All workshop buildings should be appropriately designed with appropriate emergency fire-exits; ➢ Provide adequate toilet facilities for construction employees; ➢ Provide waste receptacles/bins at appropriate locations for waste management; ➢ Project Contractor shall ensure that every employee working at the project site is provided with appropriate and adequate PPE; and ➢ Project Contractor shall ensure educating employees on the detrimental effects of drug and alcohol abuse.	
8.	Women, children and PWDs	Employee recruitment	Social inequalities	➢ Prior to project implementation, recruitment team should remove barriers to women's participation in the execution by having transparent recruitment procedures and ensuring that women are also part of the recruitment process; ➢ Deliberate efforts should be made to involve women at various stages of the project implementation, which may be for example by	Contractor

				allowing them to run catering services for the construction employees; ➢ Construction employees should be discouraged from taking advantage of vulnerable women and girl-child and also from sexually abusing them; and ➢ Persons with Disabilities (PWDs) should be given opportunities to participate in project implementation.	
9.	Environment	Waste Management	Air/water/water pollution	➢ Waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage should be provided in the construction sites; ➢ The contractor should ensure a comprehensive daily house-keeping in storage and construction areas; ➢ The strategy of waste reduction, re-using and recycling should as much as possible be implemented throughout the construction phase; ➢ Hazardous waste should be handled and managed separately; and Construction and domestic waste as well as sewage should be disposed of appropriately	Contractor
10..	Local economy	Stimulation of local economy	Increased Revenue	➢ Unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in procurement activities; ➢ Food and other requirements of the construction workers should be provided by people from the host communities; ➢ The Project Contractor should source for as many materials required for construction	Contractor

				purposes as possible locally, before resorting to importation; and ➢ Local and State Governments should widen their taxation nets to cover construction material sourcing businesses and construction employee personal income taxes.	

Table 6. 3: ESMP for the operational phase

S/No.	Receptor	Project Activity	Impact	Mitigation	Responsibility
1.	Host community	Operations and skills acquisition activities	Noise and vibration emissions	➢ Low noise equipment and machineries shall be selected and procured for the centres; ➢ Unavoidably high noise equipment shall be muffled with effective silencers; ➢ High noise equipment shall be located far away from sensitive receptors and whenever possible enclosed in sound-proof enclosures; ➢ Employees working in noisy areas at the centres shall be provided with ear plugs to muffle noise from production equipment; and ➢ High vibration equipment shall be dampened to reduce vibrations.	Management of the centres
2.	Construction employees	Operating electric machines	Electrocution Risks	➢ High voltage areas should be well secured and notices of the dangerous high voltage should be boldly written and fixed to demarcate high voltage zones; ➢ High voltage zones should be made off-limits to unauthorized personnel;	Management of the centres

				➢ Ensuring that maintenance work is carried out by certified authorized personnel; and Ensuring the use of relevant PPEs at all times by operations and maintenance personnel	
3.	Employees and buildings	Operations and skills acquisition activities	Risk of Fire Outbreak	➢ Fire-fighting equipment should be provided and stationed strategically in appropriate locations; ➢ All employees and trainees at the centres should be trained on fire and general emergency response preparedness; ➢ Fire drills should be carried out regularly at the centres to prepare all employees and trainees on emergency response procedures;	Centre Managers
4.	Construction employees	Operations and skills acquisition activities	Occupational accidents	➢ Ensure that warning signs and symbols are conspicuously displayed in dangerous zones and on hazardous equipment; ➢ Restrict access to hazardous equipment to trained personnel only; ➢ Ensure that the safety rules and regulations for operation of workshop machineries and equipment are strictly enforced; ➢ Ensure that relevant PPE are used at all times for work and trainings in the workshops at the centres; ➢ First-aid stations should be provided in all workshops at the centres; and ➢ Ensure that medical ambulance is always on standby at the centres for prompt evacuation of accident victims.	Centre Managers
5.	Host communities	Interaction amongst community		➢ Sensitize staff and trainees on issues of public health such as malaria, cholera, HIV/AIDs and Covid-19 prevention measures;	Centre Managers

		members and trainees		➢ Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the centres at all times; ➢ Ensure that good house-keeping is also maintained at all times; ➢ Provide a round-the-clock armed security personnel at all the centres to screen all entering and leaving persons; ➢ Provide dedicated lines of communication with the security personnel at the centres to ensure efficient communication in times of crisis; and ➢ Design and popularise a security response procedure to be deployed at the instance of a security breach.	
6.	Physical and human environments of the project area	Pollution		➢ Hazardous waste such those from cells/accumulators should be segregated and treated with due care and following appropriate safety procedures; ➢ All wastes should be disposed following appropriate procedures; and ➢ Workshops should have proper oil interceptors to collect spilled oil and other hazardous chemicals;	Centre Managers
7.	Host communities	Recruitment of operations employees	Reduction in crime rate	➢ Sokoto State Government should give preference to the people of the project area when recruiting for employees; ➢ People from the project area are given opportunity to provide essential services such as food and transportation to employees at the centres; and	SOSG

				➢ The State Government should support local security arrangements operated by vigilante groups in the project area.	
8.	Host Communities	Operations at the centres	Stimulating/ boosting of local economy	➢ Provide credit facilities for entrepreneurs in the project communities; ➢ Simplify procedures for industrial land acquisition	SOSG
9.	Host Communities	Training of trainees at the centres	Local economic empowerment	➢ Organize business plans competitions to promote and encourage entrepreneurship as well as creation of novel ideas/inventions and innovation; ➢ Introduce networking events through workshops, seminars, lectures and stakeholders to get ideas from others; ➢ Role model interaction and mentoring to deliver motivational discussions in form of key notes to stimulate entrepreneurship; ➢ Counselling trainees on right careers to follow after graduation; and ➢ Give some forms of financial support to trainees who have done well during internships, this will motivate them to establish businesses after graduation.	SOSG
10.	Host communities	Renewable energy development	Climate change mitigation	➢ Incentivize the use of renewable energy by project host communities for example through the reduction of income/revenue tax rate; ➢ The State Government can provide interest free loans for entrepreneurs willing to invest in renewable energy dependent industries; and ➢ Sensitize the project communities on the advantages of embracing renewable energy sources.	SOSG

11.	Local economy	Demonstrated entrepreneural skills and production of inventive and innovative products	Increase Potential for Industrial Development	➢ Arbitrate industrial and intellectual property/patent disputes; ➢ Establish a Research and Development Fund to support entrepreneural efforts; and ➢ Improve the provision of power for industrial development.	SOSG

6.8 SITE REHABILATION ACTIVITIES

Over time, it has been discovered that the lifespan of any project is primarily hinged on a number of factors, including; the design parameters and construction materials; maintenance and technological development. The design life of the proposed entrepreneurship centres, depending on proper maintenance, is at least 20 years. This, in effect, means that the centres will be expected to be fully operational for at least 20 years, and may be more, if they are still in good shape. In fact, the centres may more likely be upgraded or at least rehabilitated for an extended life span.

Therefore, should the project require decommissioning, it would be distant enough to assume that the existing legislative context and receiving environment would have changed. Decommissioning would then need to comply with the relevant legislation of the time and guidance may be required from the relevant environmental authority of the time and the most feasible option for the end use of the various components of the production plant would then be determined.

Since the proposed project is not expected to be decommissioned in the near future and given the known fact that projects always have both positive and negative impacts on their physical and social environments, especially in the construction phase; it is important to put in place plans to recover and/or restore the project site to its original state at the end of the construction phase. This requires a good understanding of all the environmental components of the project in the ecosystem during the construction phase.

On the other hand, impacts of dismantling workshop equipment and demolishing the built area are likely to be similar to those that may occur in the construction phase. A decommissioning ESMP would therefore need to be developed and approved by the relevant authority of the time, so as to effectively manage these impacts. The plan must include management measures in order to mitigate unavoidable negative impacts to acceptable levels. Similarly, any potential positive impacts, e.g. job creation must also be managed in order to maximize the benefits.

This section of the report will therefore be restricted to providing an overview of the various site rehabilitation activities that will be carried out at the end of the construction phase.

6.8.1: Rehabilitation of Construction Activities

Temporary concrete structures will need to be broken up and their rubble taken to an approved waste dump site or used to rehabilitate impacted areas. The exposed surface must be tested for contamination by FMEnv accredited laboratory. If any contaminants are found, the contaminated

soil shall be removed along with the concrete to an acceptable waste disposal site. Re-vegetation must also be carried out.

6.8.2 Spoil Dumps

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

6.8.3 Re-vegetation Process

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

- Prepare the area to be re-vegetated for top soiling – this may require soil ripping and/or scarifying, and digging of steps or terraces. The scarification should take place to a depth of 150mm. If ridges are made, they should be about 100mm high and about 400mm wide.
- Replace stored topsoil on the slope to be re-vegetated to a depth of between 75mm and 150mm (depending on the soil and slope conditions). The topsoil should be spread when it is dry by means of hand raking or mechanical balding and trimmed to a uniform thickness of not less than 100mm.
- Apply seeds or grass sods according to the supplier's specifications. The seed must be fresh, good quality seed as specified in the sod mix, certified by the supplier and free from contamination by seeds of other species.
- If the indigenous grass seeds are used, they should be placed close together and label put on each. Gaps between the sods should be filled in with topsoil.
- Mulch should be applied to protect the seeded area from erosion. The mulch must be excessively fresh and green or in an advanced stage of decomposition as it could smother growth. It must be applied to a depth and manner that will prevent erosion by wind and water, but not completely block out the rays of sunlight to the soil or prevent penetration by young plants.

- Protect the re-vegetated area from excessive trampling and any other factor that might cause erosion or compaction. No construction equipment, trucks or heavy equipment should be allowed onto re-vegetated areas.
- Ensure that suitable temporary and permanent drainage protection is installed parallel with the re-vegetation process.
- Water the seeded/planted area on a regular basis (according to need, but on average of twice per week).
- Institute an appropriate maintenance and monitoring program for a minimum of one year. This program should include, monitoring of the success of seed germination, growth of the plants, removal of invasive weeds, replanting of areas where re-vegetation has not been successful once the cause of the inhibiting factor has been identified and remedied. Repair of any funnels or erosion channel by the contractor must not allow erosion to develop on a large scale before implementing repairs.

6.8.4: Seed Mixes

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

6.9 MONITORING

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the ESMP.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions in form of implementation of all mitigation measures. The contractor shall employ an Environmental and Safety Officer (ESO) responsible for implementation of social/environmental requirements. The contractor and Federal and State Ministries of Environment have responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will take place throughout the preconstruction, construction, and operation phases of the project. It will consist of a number of activities, each with a specific purpose with key indicators and criteria.

Environmental monitoring is an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Monitoring Requirements

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

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

Table 6. 4: Monitoring programme for the preconstruction phase

S/ No.	Project Activity	Impact	Management Action	Objectives	Time-frame	Monitor. Parameter	Respons-ibility
1.	Taking over the farmland by the contractor	Loss of Farmlands	➢ Provide alternative farm lands for staff of the institutions previously using the proposed project sites as farms; and ➢ In the event that there are no available alternative farmlands within the institutions, encourage the members of staff using the sites as farmlands to get farmlands outside the institutions.	To minimize socio-economic impacts on the farmers	Before commence-ment of construction work	Visits to the newly acquired farmlands	FMEnv/ SOSME
	Taking over of the football pitch by the contractor	Loss of football pitch	➢ Allow the students of Sultan Abubakar College to share the use of the football pitch at Sokoto Science College which is just across the road from Sultan Abubakar College; and ➢ Ensure that the students of Sultan Abubakar College are given access to the football pitch in Sokoto Science College at all times and without any discrimination	To ensure that the students of Sultan Abubakar College continue to engage in sporting activities	Before commence-ment of construction work	Results of interview with the students of Sultan Abubakar College	FMEnv/ SOSME
2	Short-term Employme-nt	Creation of employment	➢ Give priority to people from the project area during recruitment of employees; ➢ Vulnerable groups such as women and children should be given more priority to benefit from the project such as in provision of services that may be requested by the preconstruction employees;	To maximize employment opportunities for the local communities	During pre-construction field work	Interviews with pre-constructi-on employees	FMEnv/ SOSME

3	Pre-construction field work, feasibility studies and construction design etc	Occupati-onal Hazards	➢ Provide all field workers with armed security personnel to ensure their safety against kidnappers and other criminals; ➢ All field workers must use appropriate PPE at all times; ➢ Drivers engaged during field work must be well-trained and must follow all traffic rules and regulations; and ➢ Teams carrying out preliminary studies and works must avoid unsafe places and other potentially troublesome places and should always stick together to ensure their security.	To prevent occupational hazards on pre-construction employees	During field work in the pre-construction phase	Physical appearance of constructio-n employees in the field	FMEnv/ SOSME

Table 6. 5: Monitoring programme for the construction phase

S/ No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsib i-lity
1.	Site Clearing	Introductio n of Alien Invasive Species (AIPs)	➢ An integrated alien plant species control programme should be complied with.	To ensure that alien plants are not introduced into the site	During site clearing	Supervision of decontaminat ion procedures of equipment	FMEnv/ SOSME/ HSE Consultant
2.	Site Clearing	Indiscrim-inate destruction of vegetation	➢ Construction scheduling must include rehabilitation of disturbed areas with replanting of local species as soon as possible;	To minimize vegetation loss	During site clearance	Physical condition of cleared site	FMEnv/ SOSME/ HSE Consultant

			➢ All equipment used for site clearing should be regularly maintained; and ➢ Avoid unnecessary clearing of vegetation.				
3.	Site clearing, earthwork, and movement of construction equipment	Soil erosion	➢ Avoid unnecessary clearing of vegetation; ➢ Limit movement of heavy machinery to designated routes and construction areas; ➢ Earthworks should be planned and executed with due diligence; ➢ To ensure that alien plants are not introduced into the area, an integrated alien plant species control programme should be complied with; and ➢ Re-vegetate exposed areas	To minimize soil erosion of exposed soil	During site clearance	Physical condition of the site	FMEnv/ SOSME/ HSE Consultant
4.	Use, servicing, and repair of construction machineries	Soil and Water Pollution	➢ Provide suitable material for absorption of oil spills from construction equipment; ➢ Servicing and repair of machinery and equipment should be restricted to designated workshops; ➢ The contractor should make sure oils or chemical wastes are disposed of in accordance with	To avoid oils contaminating the soil and water of the project area	Monthly throughout the constructi-on period	Monitoring Water quality conditions on site	FMEnv/ SOSME/ HSE Consultant

			best practice and relevant laws; and ➢ Lubricants and engine oils must be stored in a manner that prevents spillage into the environment.				
4.	Use of construction vehicles	Disruption of road traffic	➢ Ensure the use of safety signage, signals and alarms during transportation of construction equipment; ➢ Ensure the use of well-trained and skilled construction drivers; ➢ Ensure that vehicles to be used for construction work are in good quality; ➢ Ensure low driving speeds when transporting equipment; and ➢ Manual Traffic Control may be employed in which case police or flaggers/flagmen would be required to control traffic along roads to construction sites as may be required	Protect workers and the public from accidents and ensure minimal traffic disruptions.	Monthly throughout the constructi-on period	Physical supervision of Traffic Management Plan and driving habits of construction drivers	FMEnv/ SOSME/ HSE Consultant
5.	Movement of construction materials	Adverse air quality	➢ Cover soil stockpiles and truck loads to avoid being blown by winds and causing adverse air quality; ➢ Enforcing lower driving speeds along roads to and in the construction sites; and ➢ The contractor should also make sure that his equipment and	.Minimize dust generation during construction vehicle with low emissions, Compliance with air Quality Standards	Monthly throughout the constructi-on period	Visual observation of dust and exhaust generated by construction machineries	FMEnv/ SOSME/ HSE Consultant

			vehicles are well-maintained, in good condition and have minimal emissions.				
6.	Operating construction vehicles and machineries	Noise and Vibration	➢ Maintaining construction equipment regularly in accordance with the manufacturer's specifications; ➢ Execute all works so that they do not become a nuisance to the staff and students of the institution and to the general public; ➢ Locate noisy plants/generators far away from office and classroom blocks; ➢ Construction employees should be prevented from working at night; ➢ Provide and enforce use of ear plugs/muffs by operators of noisy construction equipment; and ➢ Construction vehicles and equipment noise would be reduced using properly sized and maintained mufflers and engine silencers. Equipment should also be powered off when not in use.	To minimize noise and vibration from the institutions	Monthly throughout the constructi-on period	Physical inspection of equipment's and noise measurements throughout the construction period	FMEnv/ SOSME/ HSE Consultant

7.	Construction activities and conduct of workers	Public Health and Occupational Hazards	➢ Ensure strict adherence to COVID 19 protocols, e.g. hand washing, hand sanitizing and social-distancing at work environment; ➢ Sensitize construction workers on methods of prevention of HIV/AIDS, COVID-19 upon commencement of works; ➢ Sensitize construction workers on the need to respect and maintain good relationship with project host communities; ➢ Ensure Occupational Health and Safety (OHS) requirements are observed at all times during construction at work areas at the construction sites; ➢ Ensure enhanced safe driving by all construction drivers; ➢ Secure all construction sites (material sites and construction areas) from public access to ensure safety, using caution tapes and barricades. ➢ The Project Contractor shall develop and implement an Occupational Safety and Health (OSH) Management System which is in line with Nigerian	To ensure that workers are protected from work accidents/ occupational hazards, by providing adequate PPEs	Physical Interviews and inspections on provisions of PPEs and their usage as well as inspection of general construction environment and provisions by construction managers.	Monthly throughout the construction period	FMEnv/ SOSME/ HSE Consultant

			Factory Act and other relevant legal provisions; ➢ Project Contractor shall develop and implement an Health Safety and Environment (HSE) training program to be conducted during the induction of all construction workers; ➢ Ensure that all guidelines and safety regulations for installation of equipment are strictly followed during equipment installation; ➢ Ensure that fire-fighting equipment, first-aid stations and medical ambulance service and appropriate personnel are provided throughout the duration of the construction phase; ➢ All workshop buildings should be appropriately designed with appropriate emergency fire-exits; ➢ Provide adequate toilet facilities for construction employees; ➢ Provide waste receptacles/bins at appropriate locations for waste management; ➢ Project Contractor shall ensure that every employee working at				

			the project site is provided with appropriate and adequate PPE; and ➢ Project Contractor shall ensure educating employees on the detrimental effects of drug and alcohol abuse.				
8.	Employee recruitment	Social inequalities	➢ Prior to project implementation, recruitment team should remove barriers to women's participation in the execution by having transparent recruitment procedures and ensuring that women are also part of the recruitment process; ➢ Deliberate efforts should be made to involve women at various stages of the project implementation, which may be for example by allowing them to run catering services for the construction employees; ➢ Construction employees should be discouraged from taking advantage of vulnerable women and girl-child and also from sexually abusing them; and ➢ Persons with Disabilities (PWDs) should be given opportunities to participate in project implementation.	To improve social and economic well- being of women and PWDs	Monthly throughout the construction period	Frequent visitations and personal interviews	FMEnv/ SOSME/ HSE Consultant

9.	Constructio-n activities	Mismanagement of waste	➢ Waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage should be provided in the construction sites; ➢ The contractor should ensure a comprehensive daily house-keeping in storage and construction areas; ➢ The strategy of waste reduction, re-using and recycling should as much as possible be implemented throughout the construction phase; ➢ Hazardous waste should be handled and managed separately; and Construction and domestic waste as well as sewage should be disposed of appropriately	To protect the construction and biological environment. as well as the health of workers	Monthly throughout the construction phase of the centres	Physical conditions of the construction sites, offices, and contractor's yard	FMEnv/ SOSME/ HSE Consultant
10. .	Supplies of construction materials and other goods demanded by the construction employees	Increased revenue for the members of the project communities	➢ Unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in procurement activities; ➢ Food and other requirements of the construction workers should be provided by people from the host communities; ➢ The Project Contractor should source for as many materials	Job creation for the project communities leading to improving the financial earnings of the members of the community	Monthly throughout the duration of construction activities.	Interview interactions with the project communities to ascertain the level of compliance by the contractor	FMEnv/ SOSME/ HSE Consultant

			required for construction purposes as possible locally, before resorting to importation; and ➢ Local and State Governments should widen their taxation nets to cover construction material sourcing businesses and construction employee personal income taxes.				

Table 6. 6: Monitoring programme for the operational phase

S/No.	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsib-ility
1.	Operations and skills acquisition activities	Noise and vibration pollution	➢ Low noise equipment and machineries shall be selected and procured for the centres; ➢ Unavoidably high noise equipment shall be muffled with effective silencers; ➢ High noise equipment shall be located far away from sensitive receptors and whenever possible enclosed in sound-proof enclosures; ➢ Employees working in noisy areas at the centres shall be provided with ear plugs to muffle noise from production equipment; and ➢ High vibration equipment shall be dampened to reduce vibrations.	To minimize noise pollution	Biannually	Physical planning of positioning of noise and vibration making machineries	FMEnv/ SOSME/
2.	Operating electric machines	Electrocuti-on Risks	➢ High voltage areas should be well secured and notices of the dangerous high voltage should be boldly written and fixed to demarcate high voltage zones; ➢ High voltage zones should be made off-limits to unauthorized personnel; ➢ Ensuring that maintenance work is carried out by certified authorized personnel; and	To minimize electrocution risks	Biann-ually	Physical planning of high-voltage area and presence and nature of safety signage and inspection of PPE usage by personnel	FMEnv/ SOSME/

			always ensuring the use of relevant PPEs by operations and maintenance personnel				
3.	Operations and skills acquisition activities	Risk of Fire Outbreak	➢ Fire-fighting equipment should be provided and stationed strategically in appropriate locations; ➢ All employees and trainees at the centres should be trained on fire and general emergency response preparedness; ➢ Fire drills should be carried out regularly at the centres to prepare all employees and trainees on emergency response procedures;	To minimize fire hazards	Biannually	Fire-fighting preparedness and interviews with personnel on fire-safety preparedness and drills performed	FMEnv/ SOSME/
4.	Operations and skills acquisition activities	Occupation-al accidents	➢ Ensure that warning signs and symbols are conspicuously displayed in dangerous zones and on hazardous equipment; ➢ Restrict access to hazardous equipment to trained personnel only; ➢ Ensure that the safety rules and regulations for operation of workshop machineries and equipment are strictly enforced; ➢ Ensure that relevant PPE are used at all times for work and trainings in the workshops at the centres; ➢ First-aid stations should be provided in all workshops at the centres; and ➢ Ensure that medical ambulance is always on standby at the centres	To minimize occupational accidents and incidents	Biann -ually	Physical planning of workshops and provision of safety signage and PPEs, First-Aid kits and medical ambulance as well as enforcement of safety procedures during workshop sessions	FMEnv/ SOSME/

			for prompt evacuation of accident victims.				
5.	Interaction amongst community members and trainees	Public health and safety risks	➢ Sensitize staff and trainees on issues of public health such as malaria, cholera, HIV/AIDs and Covid-19 prevention measures; ➢ Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the centres at all times; ➢ Ensure that good house-keeping is also maintained at all times; ➢ Provide a round-the-clock armed security personnel at all the centres to screen all entering and leaving persons; ➢ Provide dedicated lines of communication with the security personnel at the centres to ensure efficient communication in times of crisis; and ➢ Design and popularise a security response procedure to be deployed at the instance of a security breach.	To minimize public health hazards and safety risks	Biann -ually	Evidence of sensitization from records and interviews and physical conditions of general premises, offices, toilets, food canteens as well as presence of security men	FMEnv/ SOSME/
6.	Hazardous waste management	Health and safety risks from hazardous waste	➢ Hazardous waste such those from cells/accumulators should be segregated and treated with due care and following appropriate safety procedures; ➢ All wastes should be disposed following appropriate procedures; and	To minimize risks from hazardous waste	Biann -ually	Evidence of proper hazardous waste management	FMEnv/ SOSME/

			➢ Workshops should have proper oil interceptors to collect spilled oil and other hazardous chemicals;				
7	Recruitment of operation employees	Reduction in crime rate	➢ Sokoto State Government should give preference to the people of the project area when recruiting for employees; ➢ People from the project area are given opportunity to provide essential services such as food and transportation to employees at the centres; and ➢ The State Government should support local security arrangements operated by vigilante groups in the project area.	To enhance job provision to members of the project communities	Biannually	Employment and procurement records,	FMEnv/ SOSME
8.	Operations at the centres	Stimulating/ boosting of local economy	➢ Provide credit facilities for entrepreneurs in the project communities; ➢ Simplify procedures for industrial land acquisition	To encourage entrepreneurs	Annu-ally	Evidence of credit disbursement by SOSG	FMEnv/ SOSME
9.	Training of trainees at the centres	Local economic empowerment	➢ Organize business plans competitions to promote and encourage entrepreneurship as well as creation of novel ideas/inventions and innovation; ➢ Introduce networking events through workshops, seminars, lectures and stakeholders to get ideas from others; ➢ Role model interaction and mentoring to deliver motivational	To encourage entrepreneurs hip and invention and innovation	Annu ally	Evidence in form of official records of the events taking place	FMEnv/ SOSME

			discussions in form of key notes to stimulate entrepreneurship; ➢ Counselling trainees on right careers to follow after graduation; and ➢ Give some forms of financial support to trainees who have done well during internships, this will motivate them to establish businesses after graduation.				
10.	Renewable energy development	Climate change mitigation	➢ Incentivize the use of renewable energy by project host communities for example through the reduction of income/revenue tax rate; ➢ The State Government can provide interest free loans for entrepreneurs willing to invest in renewable energy dependent industries; and ➢ Sensitize the project communities on the advantages of embracing renewable energy sources.	To encourage investment in renewable energy projects and minimization of climate change	Annually	Results of interviews with entrepreneurs engaged in renewable energy projects	FMEnv/ SOSME
11.	Demonstrated entrepreneural skills and production of inventive and innovative products	Increase Potential for Industrial Development	➢ Arbitrate industrial and intellectual property/patent disputes; ➢ Establish a Research and Development Fund to support entrepreneural efforts; and ➢ Improve the provision of power for industrial development.	To enhance the potential for industrialisa-tion	Annually	Evidence in form of official records and physical presence of offices or infrastructure	FMEnv/ SOSME

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

Environmental and Social Management Plan for the proposed Entrepreneurship and Vocational Training Centres Project was designed in compliance with existing national and international guidelines and regulations as well as the AfDB's safeguard system. Relevant stakeholders were duly consulted during the exercise so as to ensure the success of the implementation of the ESMP for the project.

7.1 CONCLUSION

The exercise has established a robust environmental and social baseline for the project area, identified the potential and associated environmental impacts of the proposed project and proffered appropriate mitigation measures to be carried out under the Environmental and Social Monitoring Plan designed for the project. The associated and potential impacts of the proposed project were identified and include adverse air quality, operational/equipment noise, soil erosion and water pollution. Other identified less significant impacts from the project include generation of construction and domestic wastes and the potential for occupational accidents as well as the potential for spread of communicable diseases such as Covid 19, HIV/AIDs and other STDs.

On the other hand, the proposed project is expected to, in the construction phase, boost local trading activities as well as provide employment and procurement opportunities for the local communities.

In its operational phase, the proposed project also has a very high potential for job and wealth creation at both the cottage and industrial levels. The project is also expected to positively mitigate Climate Change because of its high potential for reducing greenhouse gas emissions because of its tendency to induce renewable energy research and development and eventual adoption by community stakeholders in the project area. Additionally, the very high potential of the project in enhancing industrial development in the region and at the national level will lead to overall socio-economic development of the people of Sokoto State and Nigerians at large.

A notable negative impact identified in the operational phase of the project is occupational accident risk due to non-compliance with safety procedures and precautions.

Although the project is expected to produce negative impacts, most of which are expected to occur during the constructional phase, these impacts can be mitigated by implementing appropriate actions specified in the ESMP.

In conclusion, the proposed project is environmentally and socially justified and acceptable to the entire project stakeholders, as long as the ESMP is strictly implemented and monitored. The project is therefore recommended for an integrated implementation with the Environmental and Social Management Plan.

7.2 RECOMMENDATIONS

In order to ensure the success of the environmental and social management of the proposed entrepreneurship centres, the following are recommended:

- Recommendations presented in the ESMP should be strictly implemented to address the identified potential environmental and socio-economic impacts of the projects.
- Stakeholders and the general public should be fully involved in the constructional and operational phases of the project to ensure the success of the project;
- Since the contractor(s) will be expected to strictly implement the ESMP developed in this report, there is therefore a need to ensure strict supervision and continuous monitoring by FMEnv, Sokoto State Ministry of Education, SEPA and the E&S Consultant;
- It is recommended that resettlement of the Project Affected Persons and cash compensation payments, where applicable, should be paid before implementation of the project;
- Continuous engagement with the construction and operations employees as well as the project communities will be necessary for the long-term management of the project; and
- Federal Ministry of Environment should approve and issue a certificate of compliance for the execution of the project.

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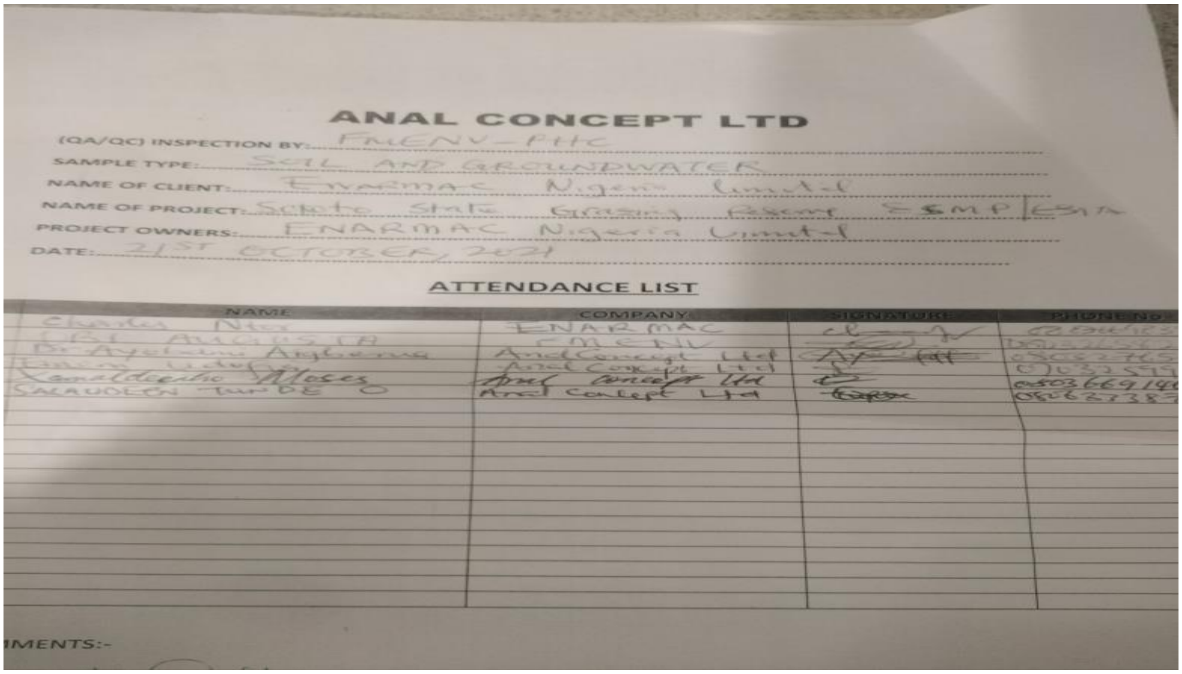
APPENDIX I: ATTENDANCE FROM SOIL AND WATER SAMPLES



ANAL CONCEPT LTD

(QA/QC) INSPECTION BY: FMENV-PHC

SAMPLE TYPE: SOIL AND GROUNDWATER

NAME OF CLIENT: Enarmac Nigeria Limited

NAME OF PROJECT: Sokoto State Grazing Reserve ESMP/ESIA

PROJECT OWNERS: ENARMAC Nigeria Limited

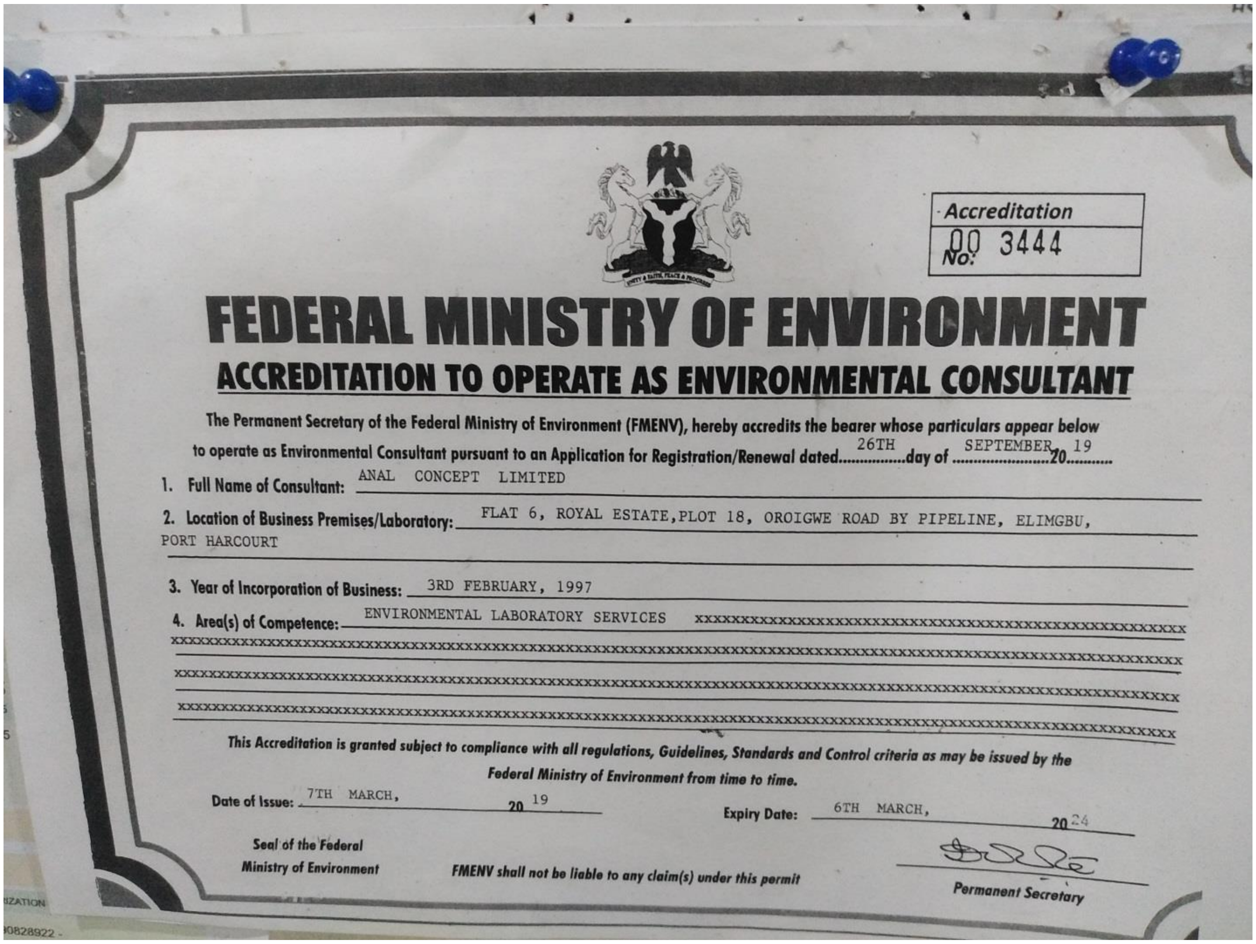
DATE: 21ST OCTOBER, 2021

ATTENDANCE LIST

NAME	COMPANY	SIGNATURE	PHONE No
Charles [illegible]	ENARMAC		[illegible]
UBI AUGUSTA	FMENV		[illegible]
Dr Ayo[illegible] [illegible]	Anal Concept Ltd		[illegible]
[illegible]	Anal Concept Ltd		[illegible]
[illegible] Moses	Anal Concept Ltd		[illegible]
SALAUDEEN TUNDE O	Anal Concept Ltd		[illegible]

MENTS:-

APPENDIX II: LABORATORY CERTIFICATE



Accreditation No: 00 3444

FEDERAL MINISTRY OF ENVIRONMENT

ACCREDITATION TO OPERATE AS ENVIRONMENTAL CONSULTANT

The Permanent Secretary of the Federal Ministry of Environment (FMENV), hereby accredits the bearer whose particulars appear below to operate as Environmental Consultant pursuant to an Application for Registration/Renewal dated 26TH day of SEPTEMBER 20 19

1. Full Name of Consultant: ANAL CONCEPT LIMITED
2. Location of Business Premises/Laboratory: FLAT 6, ROYAL ESTATE,PLOT 18, OROIGWE ROAD BY PIPELINE, ELIMGBU, PORT HARCOURT
3. Year of Incorporation of Business: 3RD FEBRUARY, 1997
4. Area(s) of Competence: ENVIRONMENTAL LABORATORY SERVICES

This Accreditation is granted subject to compliance with all regulations, Guidelines, Standards and Control criteria as may be issued by the Federal Ministry of Environment from time to time.

Date of Issue: 7TH MARCH, 20 19

Expiry Date: 6TH MARCH, 20 24

Seal of the Federal Ministry of Environment

FMENV shall not be liable to any claim(s) under this permit

Permanent Secretary

APPENDIX III: LAB RESULTS

ANALYTICAL CONCEPT LTD RC:306699
Head Office: Poultry Road By 2nd Railway Odani Green City, Elelenwo Port Harcourt, Rivers State.
Postal Address P.O Box 398. Woji Obio/Akpor L.G.A Port Harcourt.

Our Ref: ROF/LD/A-227/11/2021

Attention:

Mr Charles Ntor
ENARMAC Nigeria Limited
Date: October17, 2021
Sir,

CONSTRUCTION AND EQUIPPING OF ENTREPRENEURSHIP CENTER

The result herein presents the analytical data for soil, air/noise, groundwater samples collected and relinquished for laboratory testing under the above-named contract. The results are presented in tables.

The analysis has been conducted in lines with the method approves by the federal ministry of environment such as the American Society for Testing and Material (ASTM) and American Public Health Association (APHA)
methods as well as international best practices.

Signature: - 

ANALYTICAL CONCEPT LTD RC:306699
Head Office: Poultry Road By 2nd Railway Odani Green City, Elelenwo Port Harcourt, Rivers State.
Postal Address P.O Box 398. Woji Obio/Akpor L.G.A Port Harcourt.

Table 1: Air Quality = ENTREPRENEURSHIP CENTER

Parameters/units	AQ1	AQ2	AQ3	AQ4	AQ5	Ctrl 1	Ctrl Upstream
Noise level, d(B) A	43.1	43.4	45.5	43.3	46.1	40.7	41.3
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SPM µg/m3	12	9	11	12	8	13	11
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO2 µg/m3	0.02	0.07	0.08	0.05	0.01	0.01	0.02
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	35.18	35.01	36.04	35.01	35.03	35.01	36.04
Wind Speed (m/s)	0.01	0.01	0.04	0.02	0.07	0.01	0.04
Relative Humidity (%)	38.3	39.2	42.8	42.9	32.9	45.3	41.8

Table 2: Air quality /noise =COLLEGE OF EDUCATION

Parameters/units	AQ1	AQ2	AQ3	AQ4	AQ5	Ctrl 1	Ctrl Upstream
Noise level, d(B) A	43.1	42.1	45.5	43.3	46.1	40.7	41.3
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SPM µg/m3	12	9	11	12	8	13	11
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO2 µg/m3	0.02	0.07	0.08	0.05	0.01	0.01	0.02
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	35.18	35.02	36.04	35.04	35.03	35.01	36.04
Wind Speed (m/s)	0.01	0.01	0.04	0.02	0.07	0.01	0.04
Relative Humidity (%)	38.3	39.2	42.8	42.9	32.9	45.3	41.8

Table 3: Air quality and noise measurement within the POLYTECHNIC Area

Parameters/units	AQ1	AQ2	AQ3	AQ4	AQ5	Ctrl 1	Ctrl Upstream
Noise level, d(B) A	43.2	42.5	45.5	43.3	48.4	40.7	41.3
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SPM µg/m3	12	9	11	15	8	13	11
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO2 µg/m3	0.02	0.07	0.08	0.05	0.01	0.01	0.02
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	35.18	35.01	37.04	35.01	35.03	35.01	36.04
Wind Speed (m/s)	0.01	0.01	0.04	0.02	0.07	0.01	0.04
Relative Humidity (%)	38.3	39.2	42.8	42.9	32.9	45.3	41.8

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Table 4= Air quality and noise data within the SECONDRAY SCHOOL Area

Parameters/units	AQ1	AQ2	AQ3	AQ4	AQ5	Ctrl 1	Ctrl Upstream
Noise level, d(B) A	43.2	42.1	45.5	43.3	46.1	40.7	41.3
SOX, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SPM µg/m3	12	9	11	12	8	13	11
NH3, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CH4 µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO2 µg/m3	0.02	0.07	0.08	0.05	0.01	0.01	0.02
H2S, µg/m3	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (oC)	35.18	35.01	36.04	35.01	35.03	35.01	36.04
Wind Speed (m/s)	0.01	0.01	0.04	0.02	0.07	0.01	0.04
Relative Humidity (%)	38.3	39.2	42.8	42.9	32.9	45.3	41.8

Table 5: Groundwater Results

	Entrepreneurship center	College of education	Polytechnic	Secondary school
pH	7.5	6.85	6.7	8.53
COND (µs/cm)	85	66	92	85
TDS (mg/l)	42	31	47	42
TSS mg/l	0.41	0.33	0.27	0.41
Turbidity, NTU	1.1	2	3.01	2.1
BOD (mg/l)	0.451	0.556	0.582	0.451
COD (mg/l)	1.161	1.155	1.164	1.161
Petroleum Hydrocarbons				
THC (mg/l)	<0.001	<0.001	<0.001	<0.001
Nutrient				
Nitrate (mg/l)	0.17	0.2	0.15	0.17
Sulphate (mg/l)	35.01	55	51.7	35.01
Ammonium (mg/l)	<0.01	<0.01	<0.01	<0.01
Phophate (mg/l)	0.41	0.27	0.35	0.41
Heavy Metals				
Nickel (mg/l)	<0.001	<0.001	<0.001	<0.001
Iron (mg/l)	0.015	0.021	0	0.015
Lead (mg/l)	<0.001	<0.001	<0.001	<0.001
Copper (mg/l)	<0.001	<0.001	<0.001	<0.001
Chromium (mg/l)	<0.001	<0.001	<0.001	<0.001
Zinc (mg/l)	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	<0.001	<0.001	<0.001	<0.001
Barium (mg/l)	<0.001	<0.001	<0.001	<0.001
Cobalt (mg/l)	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/l)	<0.001	<0.001	<0.001	<0.001
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001
Cations				
Potassium (mg/l)	0.003	0.01	0.006	0.003
Sodium (mg/l)	0.215	0.253	0.233	0.215
Magnesium (mg/l)	0.012	0.01	0.01	0.012
Calcium (mg/l)	0.022	0.028	0.017	0.022
Microbiology				
Coliforms	10	12	8	10
E. coli	0	0	0	0
Faecalstreptacocci	--	--	--	--
Straphylococcciaureus	Absent	absent	absent	Absent

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Table 6; Soil physico-chemical (WET season) - ESMP for the Construction of Entrepreneurship Centres

S/N	FIELD CODE	pH	TOC%	THC (mg/kg)	SO4	NH_3 - N (mg/kg)	% TOTAL SAND	% TOTAL SILT	% TOTAL CLAY	TEXTURE	Ca (mg/k
1	SS1 0-15	8.34	1.02	0.01	1.12	0.02	63.0	10.2	25.8	sandy clay	14.1
2	SS1 15-30	8.21	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	15.6
3	SS2 0-15	7.44	1.10	0.01	1.18	0.03	68.0	19.0	13.0	sandy	13.1
4	SS2 15-30	7.29	2.15	0.01	1.82	0.04	71.5	19.0	9.5	sandy	12.9
5	SS3 0-15	7.31	1.51	0.01	1.14	0.06	71.2	18.0	10.8	sandy	14.6
6	SS3 15-30	7.27	1.11	0.01	2.23	0.07	75.0	9.0	16.0	sandy	16.4
7	SS4 0-15	8.25	1.01	0.01	2.25	0.03	93.4	5.0	1.6	sand	11.1
8	SS4 15-30	7.24	0.11	0.01	3.12	0.04	92.3	2.6	5.1	sand	16.1
9	SS5 0-15	7.32	1.01	0.01	1.91	0.01	78.2	9.5	12.3	sand	17.1
10	SS5 15-30	6.19	0.10	0.01	3.01	0.01	80.0	12.0	8.0	sand	12.1
11	SS 0-15 ctrl	7.11	1.04	0.01	1.22	0.04	58.0	13.0	3.0	sandy	12.1
12	SS 15-30 ctrl	7.32	1.11	0.01	3.20	0.01	85.0	5.3	9.7	sandy	11.0
13	SS 0-15 ctrl	8.14	1.16	0.01	3.92	0.18	29.8	44.3	25.9	loam	11.9
14	SS 15-30 ctrl	7.23	1.25	0.01	3.13	0.18	48.3	5.1	46.6	sand clay	11.3

Table X: Soil physico-chemical (WET season) - ESMP for the ESMP for the Construction of Entrepreneurship Centres

S/N	FIELD CODE	Cu (mg/kg)	Pb (mg/kg)	Fe (mg/kg)	Ni (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Zn (mg/kg)
1	SS1 0-15	1.032	1.752	24.882	224	0.06	0.04	2.356
2	SS1 15-30	1.142	1.569	20.960	2.768	2.067	0.043	2.526
3	SS2 0-15	1.412	0.373	19.694	9.724	0.080	0.065	1.486
4	SS2 15-30	14.32	1.222	20.888	7.789	0.089	0.045	3.599
5	SS3 0-15	1.362	1.386	19.034	11.69	0.574	0.044	2.203
6	SS3 15-30	1.245	1.266	27.765	6.147	0.179	0.045	5.538
7	SS4 0-15	2.484	0.935	18.665	7.438	0.100	0.064	1.231
8	SS4 15-30	1.032	0.443	26.169	5.239	0.078	0.053	4.552
9	SS5 0-15	1.912	0.589	20.555	6.942	0.085	0.061	2.484
10	SS5 15-30	2.258	1.558	20.195	8.513	0.021	0.069	4.520
11	SS 0-15 ctrl1	1.105	1.013	22.055	7.539	0.092	0.071	1.790
12	SS 15-30 ctrl1	1.379	1.325	18.194	8.161	0.069	0.073	3.164
13	SS 0-15 ctrl2	1.913	1.456	21.654	9.310	0.083	0.048	8.371
14	SS 15-30 ctrl2	2.232	1.341	18.674	8.583	0.084	0.047	4.797

Table 7: Soil Microbiology (wet season) - ESMP for the ESMP for the Construction of Entrepreneurship Centres

S/N	FIELD CODE	HUB cfu/g X 104	HUF cfu/g X 10^3	THB cfu/g X 10^4	THF cfu/g X
1	SS1 0-15	0.00	0.00	0.00	0.00
2	SS1 15-30	0.00	0.00	0.00	0.00
3	SS2 0-15	0.00	0.00	0.00	0.00
4	SS2 15-30	0.00	0.00	0.00	0.00
5	SS3 0-15	0.00	0.00	0.00	0.00
6	SS3 15-30	0.00	0.00	0.00	0.00
7	SS4 0-15	0.00	0.00	0.00	0.00
8	SS4 15-30	0.00	0.00	0.00	0.00
9	SS5 0-15	0.00	0.00	0.00	0.00
10	SS5 15-30	0.00	0.00	0.00	0.00
11	SS 0-15 ctrl1	0.00	0.00	0.00	0.00
12	SS 15-30 ctrl1	0.00	0.00	0.00	0.00
13	SS0-15 ctrl2	0.00	0.00	0.00	0.00
14	SS 15-30 ctrl2	0.00	0.00	0.00	0.00

Table 8; Soil physico-chemical (WET season) – College of Education Centre

S/N	FIELD CODE	pH	TOC%	THC (mg/kg)	SO4	NH_3 - N (mg/kg)	% TOTAL SAND	% TOTAL SILT	% TOTAL CLAY	TEXTURE
1										
2	SS1 0-15	7.35	1.12	0.01	0.92	1. 31	63.0	10.6	25.4	sandy clay
3	SS1 15-30	7.21	1.12	0.01	0.21	0.11	72.4	15.9	11.7	sandy
4	SS2 0-15	7.43	1.10	0.01	1.14	0.11	68.0	19.0	13.0	sandy
5	SS2 15-30	7.21	2.15	0.01	1.72	0.15	71.5	19.0	9.5	sandy
6	SS3 0-15	7.21	1.01	0.01	1.11	0.16	71.2	18.0	10.8	sandy
7	SS3 15-30	7.27	1.12	0.01	2.13	0.17	75.0	9.0	16.0	sandy
8	SS4 0-15	8.05	1.01	0.01	2.15	0.13	93.4	5.0	1.6	sand
9	SS4 15-30	7.24	0.81	0.01	1.12	0.14	92.3	2.6	5.1	sand
10	SS5 0-15	7.32	1.07	0.01	1.21	0.11	78.2	9.5	12.3	sand
11	SS5 15-30	6.79	0.10	0.01	1.01	1.01	80.0	12.0	8.0	sand
12	SS 0-15 ctrl	7.51	1.03	0.01	1.12	1.04	58.0	13.0	3.0	sandy
13	SS 15-30 ctrl	7.82	1.12	0.01	1.10	1.01	85.0	5.3	9.7	sandy
14	SS 0-15 ctrl	8.04	1.10	0.01	1.22	0.18	29.8	44.3	25.9	loam
	SS 15-30 ctrl	7.13	1.05	0.01	1.14	0.18	48.3	5.1	46.6	sand clay

ANALYTICAL CONCEPT LTD RC:306699
Head Office: Poultry Road By 2nd Railway Odani Green City, Elelenwo Port Harcourt, Rivers State.
Postal Address P.O Box 398. Woji Obio/Akpor L.G.A Port Harcourt.

Table 9: Soil physico-chemical (WET season) - College of Education Centre

S/N	FIELD CODE	Cu (mg/kg)	Pb (mg/kg)	Fe (mg/kg)	Ni (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Zn (mg/kg)
1	SS1 0-15	1.132	1.152	24.582	224	0.06	0.04	1.056
2	SS1 15-30	1.117	1.562	20.660	2.758	2.077	0.054	1.026
3	SS2 0-15	1.311	0.343	19.694	9.624	0.580	0.053	1.086
4	SS2 15-30	14.34	1.225	20.488	7.189	0.089	0.055	1.099
5	SS3 0-15	1.362	1.382	19.234	11.329	0.674	0.024	2.003
6	SS3 15-30	1.245	1.265	27.715	6.147	0.179	0.015	1.038
7	SS4 0-15	2.434	0.932	18.565	7.448	0.100	0.014	1.031
8	SS4 15-30	1.032	0.444	26.169	5.269	0.048	0.013	1.052
9	SS5 0-15	1.922	0.581	20.516	6.842	0.085	0.011	0.084
10	SS5 15-30	2.251	1.558	20.155	8.573	0.051	0.019	1.020
11	SS 0-15 ctrl1	1.103	1.413	22.054	7.839	0.062	0.011	1.790
12	SS 15-30 ctrl1	1.308	1.025	18.104	8.061	0.069	0.070	0.164
13	SS 0-15 ctrl2	1.013	1.056	21.054	9.010	0.083	0.008	0.071
14	SS 15-30 ctrl2	2.032	1.041	18.074	8.083	0.084	0.007	0.097

Table 10: Soil Microbiology (wet season) - College of Education Centre

S/N	FIELD CODE	HUB cfu/g X 104	HUF cfu/g X 10 3	THB cfu/g X 4	THF cfu/g X 3	E.Coli
1	SS1 0-15	0.00	0.00	0.00	0.00	0.01
2	SS1 15-30	0.00	0.00	0.00	0.00	0.04
3	SS2 0-15	0.00	0.00	0.00	0.00	0.28
4	SS2 15-30	0.00	0.00	0.00	0.00	0.06
5	SS3 0-15	0.00	0.00	0.00	0.00	0.04
6	SS3 15-30	0.00	0.00	0.00	0.00	0.09
7	SS4 0-15	0.00	0.00	0.00	0.00	1.49
8	SS4 15-30	0.00	0.00	0.00	0.00	1.04
9	SS5 0-15	0.00	0.00	0.00	0.00	0.02
10	SS5 15-30	0.00	0.00	0.00	0.00	0.09
11	SS 0-15 ctrl1	0.00	0.00	0.00	0.00	0.00
12	SS 15-30 ctrl1	0.00	0.00	0.00	0.00	0.00
13	SS0-15 ctrl2	0.00	0.00	0.00	0.00	0.00
14	SS 15-30 ctrl2	0.00	0.00	0.00	0.00	0.00

ANALYTICAL CONCEPT LTD RC:306699
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Postal Address P.O Box 398. Woji Obio/Akpor L.G.A Port Harcourt.

Table 11; Soil physico-chemical (WET season) - Polytechnic Centre

S/N	FIELD CODE	pH	TOC%	THC (mg/kg)	SO4	NH_3 - N (mg/kg)	% TOTAL SAND	% TOTAL SILT	% TOTAL CLAY	TEXTURE	(
1	SS1 0-15	7.14	1.14	0.01	1.02	0.01	71.5	19.0	9.5	sandy	
2	SS1 15-30	7.11	1.11	0.01	0.14	0.16	71.2	18.0	10.8	sandy	
3	SS2 0-15	1.34	2.02	0.01	1.12	0.12	63.0	10.2	25.8	sandy clay	
4	SS2 15-30	7.23	3.25	0.01	1.13	0.14	48.3	5.1	46.6	sand clay	
5	SS3 0-15	7.29	1.15	0.01	1.82	0.04	71.5	19.0	9.5	sandy	
6	SS3 15-30	7.27	1.11	0.01	1.23	0.07	75.0	9.0	16.0	sandy	
7	SS4 0-15	8.25	1.01	0.01	1.25	0.03	93.4	5.0	1.6	sand	
8	SS4 15-30	8.34	1.02	0.01	1.12	0.02	63.0	10.2	25.8	sandy clay	
9	SS5 0-15	8.21	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	
10	SS5 15-30	7.44	1.10	0.01	1.15	0.03	68.0	19.0	13.0	sandy	
11	SS 0-15 ctrl	8.21	2.15	0.01	1.12	0.04	71.5	19.0	9.5	sandy	
12	SS 15-30 ctrl	7.31	1.51	0.01	1.14	0.06	71.2	18.0	10.8	sandy	
13	SS 0-15 ctrl	8.14	1.02	0.01	1.72	0.02	63.0	10.2	25.8	sandy clay	
14	SS 15-30 ctrl	7.13	1.25	0.01	1.13	0.18	48.3	5.1	46.6	sand clay	

Table 12: Soil physico-chemical (WET season) - Polytechnic Centre

S/N	FIELD CODE	Cu (mg/kg)	Pb (mg/kg)	Fe (mg/kg)	Ni (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Zn (mg/kg)
1	SS1 0-15	0.032	1.752	24.882	224	0.011	0.042	1.351
2	SS1 15-30	0.142	1.161	20.961	2.168	0.067	0.013	1.521
3	SS2 0-15	1.212	0.173	19.691	9.714	0.080	0.015	1.482
4	SS2 15-30	1.321	1.122	20.881	7.789	0.089	0.015	1.109
5	SS3 0-15	1.362	1.186	19.031	11.69	0.174	0.014	1.003
6	SS3 15-30	1.245	1.161	27.715	6.117	0.179	0.015	1.108
7	SS4 0-15	1.484	1.135	18.165	7.138	0.100	0.014	1.231
8	SS4 15-30	1.132	1.143	26.192	5.139	0.078	0.013	1.052
9	SS5 0-15	1.212	1.581	20.515	6.142	0.085	0.061	1.084
10	SS5 15-30	2.258	1.558	20.195	8.513	0.021	0.069	0.120
11	SS 0-15 ctrl1	1.105	1.013	22.055	7.539	0.092	0.071	1.790
12	SS 15-30 ctrl1	1.379	1.325	18.194	8.161	0.069	0.073	3.164
13	SS 0-15 ctrl2	1.913	1.456	21.654	9.310	0.083	0.048	1.371
14	SS 15-30 ctrl2	2.232	1.341	18.674	8.583	0.084	0.047	1.797

Table 13: Soil Microbiology (wet season) -Polytechnic Centre

S/N	FIELD CODE	HUB cfu/g X 104	HUF cfu/g X 10	THB cfu/g X	THF cfu/g X	E.Coli
1						
2						
3	SS1 0-15	0.00		0.00	0.00	1.01
4	SS1 15-30	0.00	0.00	0.00	0.00	1.04
5	SS2 0-15	0.00	0.00	0.00	0.00	1.21
6	SS2 15-30	0.00	0.00	0.00	0.00	1.06
7	SS3 0-15	0.00	0.00	0.00	0.00	2.04
8	SS3 15-30	0.00	0.00	0.00	0.00	1.03
9	SS4 0-15	0.00	0.00	0.00	0.00	1.40
10	SS4 15-30	0.00	0.00	0.00	0.00	1.04
11	SS5 0-15	0.00	0.00	0.00	0.00	1.02
12	SS5 15-30	0.00	0.00	0.00	0.00	1.04
13	SS 0-15 ctrl1	0.00	0.00	0.00	0.00	0.00
14	SS 15-30 ctrl1	0.00	0.00	0.00	0.00	0.00
	SS0-15 ctrl2	0.00	0.00	0.00	0.00	0.00
	SS 15-30 ctrl2	0.00	0.00	0.00	0.00	0.00

Table 14: Soil physico-chemical (WET season) – Secondary School Centre

S/N	CODE FIELD	pH	TOC%	THC (mg/kg)	SO4	NH_3 - N (mg/kg)	SAND TOTAL	% TOTAL SILT	% TOTAL CLAY	TEXTURE	Ca (mg/l
1											
2											
3	SS1 0-15	6.34	1.02	0.01	1.12	0.02	63.0	10.2	25.8	sandy clay	14.1
4	SS1 15-30	7.21	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	15.6
5	SS2 0-15	7.44	1.10	0.01	1.18	0.03	68.0	19.0	13.0	sandy	13.1
6	SS2 15-30	7.29	2.15	0.01	1.82	0.04	71.5	19.0	9.5	sandy	12.9
7	SS3 0-15	7.31	1.51	0.01	1.14	0.06	71.2	18.0	10.8	sandy	14.6
8	SS3 15-30	7.27	1.11	0.01	2.23	0.07	75.0	9.0	16.0	sandy	16.4
9	SS4 0-15	8.25	1.01	0.01	2.25	0.03	93.4	5.0	1.6	sand	11.1
10	SS4 15-30	7.34	1.02	0.01	1.12	0.02	63.0	10.2	25.8	sandy clay	14.1
11	SS5 0-15	7.21	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	15.6
12	SS5 15-30	7.34	1.02	0.01	1.12	0.02	63.0	10.2	25.8	sandy clay	14.1
13	SS 0-15 ctrl	7.21	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	15.6
14	SS 15-30 ctrl	7.44	1.10	0.01	1.18	0.03	68.0	19.0	13.0	sandy	13.1
	SS 0-15 ctrl	7.29	2.15	0.01	1.82	0.04	71.5	19.0	9.5	sandy	12.9
	SS 15-30 ctrl	7.23	1.25	0.01	3.13	0.18	48.3	5.1	46.6	sand clay	11.3

ANALYTICAL CONCEPT LTD RC:306699
Head Office: Poultry Road By 2nd Railway Odani Green City, Elelenwo Port Harcourt, Rivers State.
Postal Address P.O Box 398, Woji Obio/Akpor L.G.A Port Harcourt.

Table 15: Soil physico-chemical (WET season) - Secondary School Centre

S/N	FIELD CODE	Cu (mg/kg)	Pb (mg/kg)	Fe (mg/kg)	Ni (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Zn (mg/kg)
1	SS1 0-15	2.258	1.558	20.195	8.513	0.021	0.069	4.520
2	SS1 15-30	1.105	1.013	22.055	7.539	0.092	0.071	1.790
3	SS2 0-15	1.379	1.325	18.194	8.161	0.069	0.073	3.164
4	SS2 15-30	1.254	1.553	20.191	8.514	0.025	0.066	4.521
5	SS3 0-15	1.105	1.013	22.055	7.531	0.094	0.073	1.791
6	SS3 15-30	1.379	1.325	18.194	8.161	0.069	0.073	3.164
7	SS4 0-15	1.913	1.456	21.654	9.311	0.083	0.044	8.376
8	SS4 15-30	2.258	1.558	20.195	8.513	0.021	0.069	4.523
9	SS5 0-15	1.105	1.013	22.055	7.539	0.092	0.071	1.791
10	SS5 15-30	2.258	1.558	20.195	8.513	0.021	0.069	4.521
11	SS 0-15 ctrl1	1.105	1.013	22.055	7.539	0.096	0.071	1.794
12	SS 15-30 ctrl1	1.379	1.325	18.194	5.161	0.069	0.073	3.164
13	SS 0-15 ctrl2	1.913	1.456	21.654	9.310	0.083	0.048	8.371
14	SS 15-30 ctrl2	2.232	1.341	18.674	8.583	0.084	0.047	4.797

Table 16: Soil Microbiology (wet season) - Secondary School Centre

S/N	FIELD CODE	HUB	cfu/g X 104	HUF	cfu/g X 10^3	THB	cfu/g X 10^4	THF	cfu/g X 10^3	E.Coli
1	SS1 0-15		0.00				0.00		0.00	3.01
2	SS1 15-30		0.00		0.00		0.00		0.00	1.04
3	SS2 0-15		0.00		0.00		0.00		0.00	1.21
4	SS2 15-30		0.00		0.00		0.00		0.00	1.06
5	SS3 0-15		0.00		0.00		0.00		0.00	1.04
6	SS3 15-30		0.00		0.00		0.00		0.00	1.00
7	SS4 0-15		0.00		0.00		0.00		0.00	1.49
8	SS4 15-30		0.00		0.00		0.00		0.00	1.04
9	SS5 0-15		0.00		0.00		0.00		0.00	1.02
10	SS5 15-30		0.00		0.00		0.00		0.00	1.05
11	SS 0-15 ctrl1		0.00		0.00		0.00		0.00	0.00
12	SS 15-30 ctrl1		0.00		0.00		0.00		0.00	0.00
13	SS0-15 ctrl2		0.00		0.00		0.00		0.00	0.00
14	SS 15-30 ctrl2		0.00		0.00		0.00		0.00	0.00

SOCIO-ECONOMIC SURVEY QUESTIONNAIRE

FOR

ESTABLISHMENT OF VOCATIONAL CENTER IN SOKOTO STATE

COMMUNITY……

LOCAL GOVERNMENT AREA……

DATE…….

1) **Name of Respondent……2) Age……3) Tribe……**

4) **Gender……5) Marital Status……6) State the No of your wives……and children/defendants……**

7) **Religion……8) Sect/Denomination……..**

9) **Monthly income……**

10) **Educational background: a) Primary b) Secondary c) Tertiary d) Postgraduate**

e) Islamic/Quranic f) Others (specify)…….. g) Uneducated

11) **What are the educational institutions in your community?**

12) **What are the domestic water sources available in your community? a) Pipe borne water b) Borehole c) Well d) River e) pond**

13) **Which of the above water sources do you use? …….**

14) **What are the available electricity sources in your community?.....**

15) **Which electricity sources do you use?.....**

16) **What mobile telecommunication networks do you have in your community?.....**

……

17) **What are the common means of transportation used in your community?.....**

18) **What type of house do you leave in? please can you fully describe it?.....**

19) **What type of toilet system do you use?.....**

20) **How do you dispose your domestic waste?.....**

21) **What are the health facilities available to people in your community?.....**

…….

22) **What are the prevalent diseases/health problems in your community?.....**

APPENDIX IV: PICTURES FROM COMMUNITY SURVEY AND ENGAGEMENT.

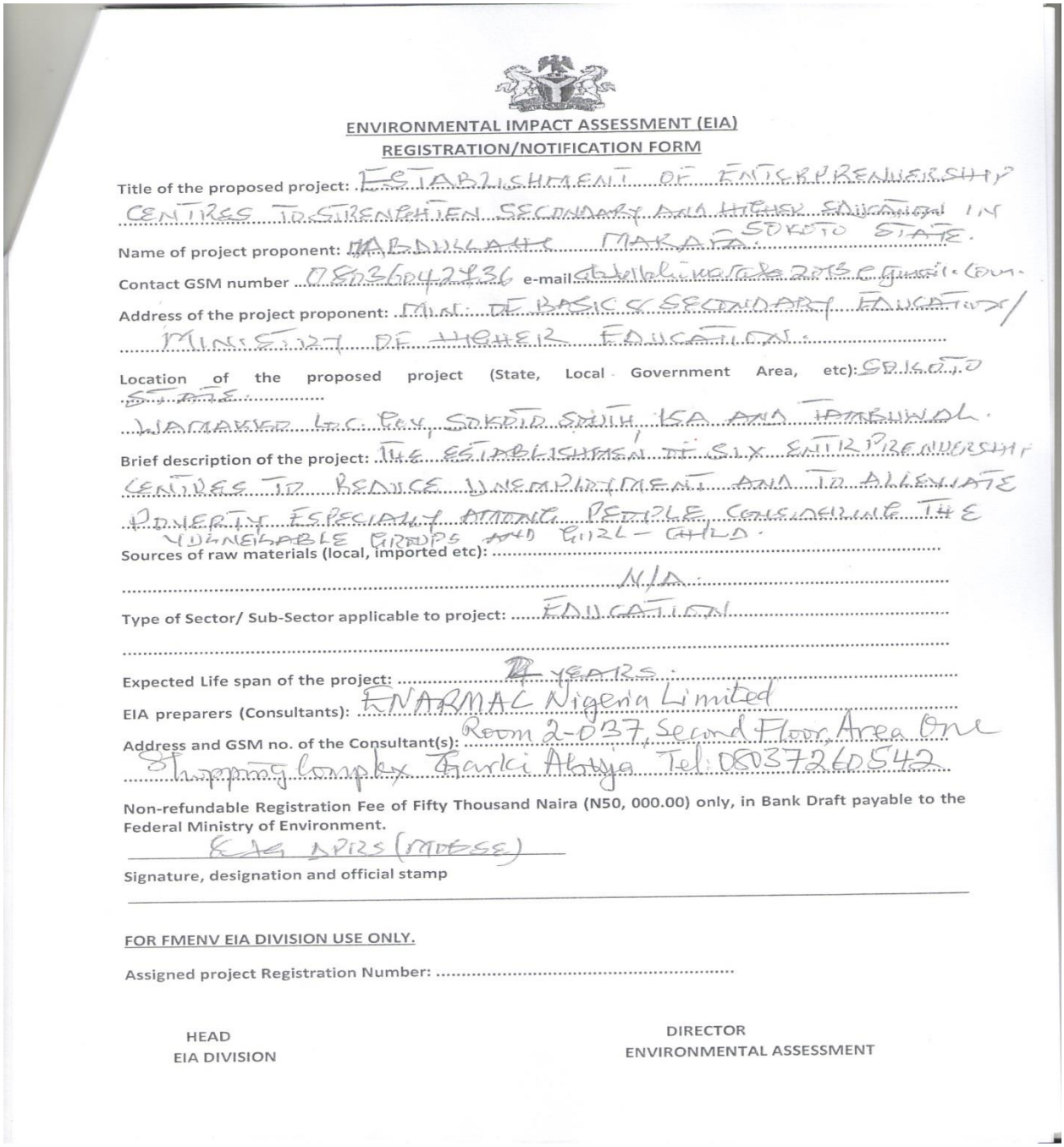
PLATE A1: Consultations with the residents of Ruga Busau Community

PLATE A2: Consultations with the Provost of Shehu Shagari College of Education

PLATE A3: Consultations with Representative of the Rector of Umar Ali Shinkafi Polytechnic

PLATE A4: Interactive Session with Representative of SEPA, Finance, Agric, Environment and other Stakeholders

APPENDIX V: SOIL AND WATER SAMPLES DATA SHEETS



ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
REGISTRATION/NOTIFICATION FORM

Title of the proposed project: ESTABLISHMENT OF ENTREPRENEURSHIP CENTRES TO STRENGTHEN SECONDARY AND HIGHER EDUCATION IN SOKOTO STATE.

Name of project proponent: MAHMUDU MAKAIA.

Contact GSM number 08036042436 e-mail abdulmumin2015@gmail.com.

Address of the project proponent: MIN. OF BASIC & SECONDARY EDUCATION/ MINISTRY OF HIGHER EDUCATION.

Location of the proposed project (State, Local Government Area, etc): SOKOTO STATE.

WARWICK L.G. BOY, SOKOTO SOUTH, LGA AND ITS ENVIRONS.

Brief description of the project: THE ESTABLISHMENT OF SIX ENTREPRENEURSHIP CENTRES TO REDUCE UNEMPLOYMENT AND TO ALLEVIATE POVERTY ESPECIALLY AMONG PEOPLE, CONSIDERING THE VULNERABLE GROUPS AND GIRL-CHILD.

Sources of raw materials (local, imported etc): N/A.

Type of Sector/ Sub-Sector applicable to project: EDUCATION.

Expected Life span of the project: 25 years.

EIA preparers (Consultants): ENARMAC Nigeria Limited

Address and GSM no. of the Consultant(s): Room 2-037, Second Floor Area One Shopping Complex Garki Abuja Tel: 08037260542

Non-refundable Registration Fee of Fifty Thousand Naira (N50, 000.00) only, in Bank Draft payable to the Federal Ministry of Environment.

EIA DIRS (MRS)

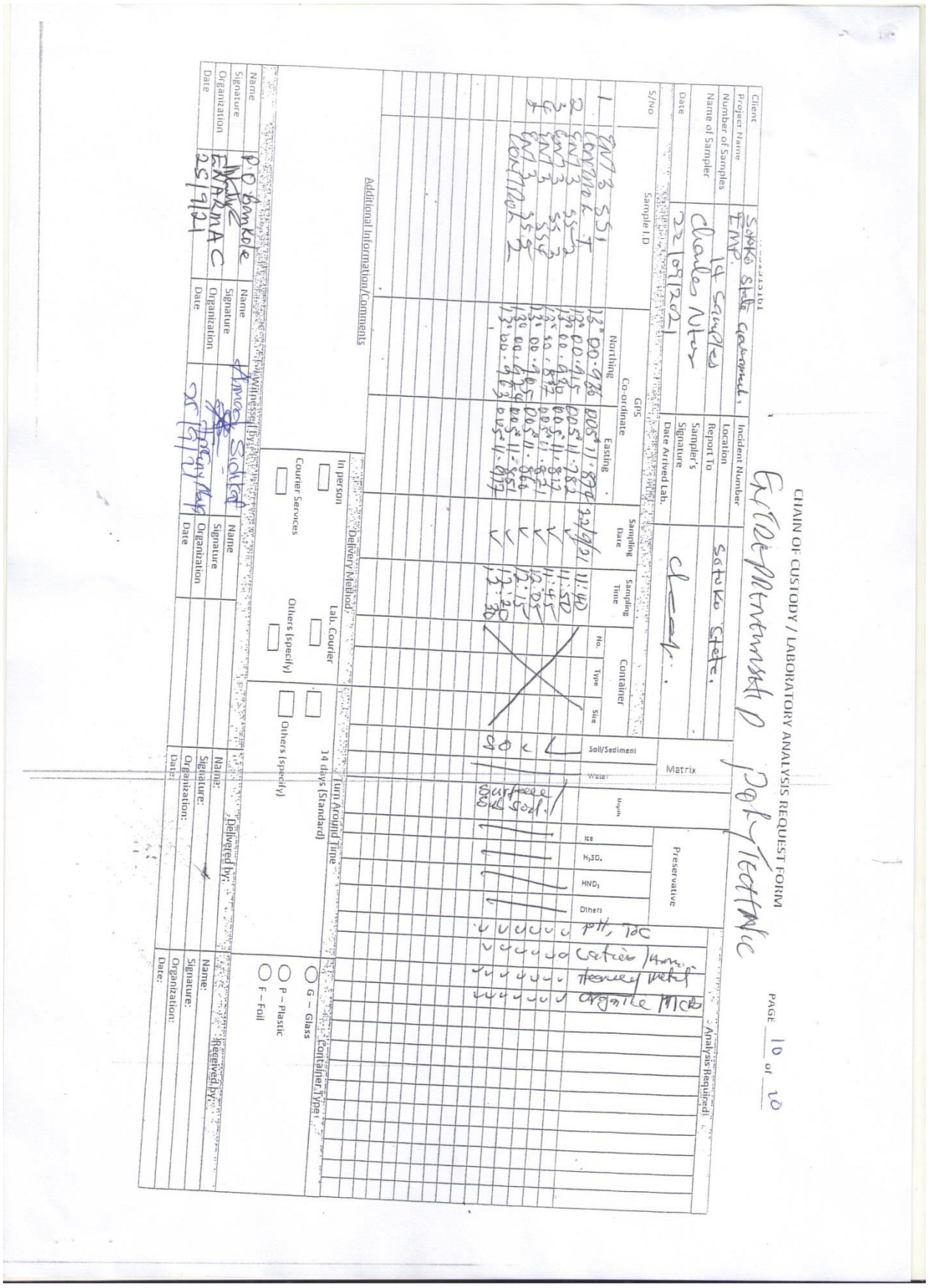
Signature, designation and official stamp

FOR FMENV EIA DIVISION USE ONLY.

Assigned project Registration Number: .....

HEAD
EIA DIVISION

DIRECTOR
ENVIRONMENTAL ASSESSMENT



CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

PAGE 10 of 10

Client: Sokoto State Government
Project Name: ENV. Sokoto State Geological
Number of Samples: 14 samples
Name of Sampler: Charles Nter
Date: 22/09/2021
Incident Number:
Location: Sokoto State.
Report To:
Sampler's Signature:
Date Arrived Lab.:

S/No	Sample I.D	GPS Co-ordinate Northing	GPS Co-ordinate Easting	Sampling Date	Sampling Time	Container No.	Container Type	Container Size	Matrix Soil/Sediment	Matrix Water	Preservative Units	Preservative Ice	Preservative H_2SO_4	Preservative HNO_3	Preservative Others	Analysis Required
1	ENV3 SS1	13° 00.926	005° 11.824	22/9/21	11:40											
2	Control T	13° 00.915	005° 11.283		11:50											
3	ENV3 SS2	13° 00.918	005° 11.812		11:55											
4	ENV3 SS3	13° 00.892	005° 11.851		12:05											
5	ENV3 SS4	13° 00.865	005° 11.866		12:15											
	Control SS3	13° 00.963	005° 11.851		12:30											

Additional Information/Comments

Delivery Method: In person; Lab. Courier; Courier Services; Others (specify)

Turn Around Time: 14 days (Standard); Others (specify)

Container Type: G – Glass; P – Plastic; F – Foil

Name: P.O. Bamkole
Signature:
Organization: ENVMAC
Date: 25/9/21

Witness' Signature:

Name / Signature / Organization / Date

Delivered by: Name / Signature / Organization / Date

Received by: Name / Signature / Organization / Date

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

Entrepreneurship College of Education

PAGE 8 of 10

Client	Sokoto State Govt	Incident Number	
Project Name	EMP	Location	Sokoto
Number of Samples	4 Samples	Report To	
Name of Sampler	Charles, Ntor	Sampler's Signature	[signature]
Date	22/09/2021	Date Arrived Lab.	

S/No	Sample I.D	GPS Co-ordinate Northing	GPS Co-ordinate Easting	Sampling Date	Sampling Time	Container No.	Container Type	Container Size	Matrix Soil/Sediment	Matrix Water	Depth	Preservative Ice	Preservative H_2SO_4	Preservative HNO_3	Preservative Others	Analysis Required
1	ENT (2) SS1	12° 59.671'	005' 13.173'	22/9/21	9:45				SOIL		Tops / bottom					TOC pH; Cation/Anion; Heavy Metal; MCBS
2	ENT2 SS2	12° 59.639	005' 13.181	✓	9:50											
3	ENT2 SS3	12° 59.617	005° 13.226	✓	9:58											
4	ENT2 SS4	12° 59.657	005' 13.246	✓	10:06											
5	ENT CONTROL I	12° 59.708	005° 13.306	✓	10:12											
	ENT2 SS5	12° 59.41.552	005° 13.19.241	✓	10:22											
	CONTROL II	12° 59.727	005' 13.097	✓	10:34											

Additional Information/Comments

Delivery Method: In person ☐ Lab. Courier ☐ Courier Services ☐ Others (specify) ☐

Turn Around Time: 14 days (Standard) ☐ Others (specify) ☐

Container Type: ○ G – Glass ○ P – Plastic ○ F – Foil

		Witnessed by:				Delivered by:	Received by:
Name	P.O. Bamkole	Name	Amad Siddiq	Name		Name:	Name:
Signature	[signature]	Signature	[signature]	Signature		Signature:	Signature:
Organization	ENARMAC	Organization		Organization		Organization:	Organization:
Date	25/9/21	Date	25/9/21	Date		Date:	Date:

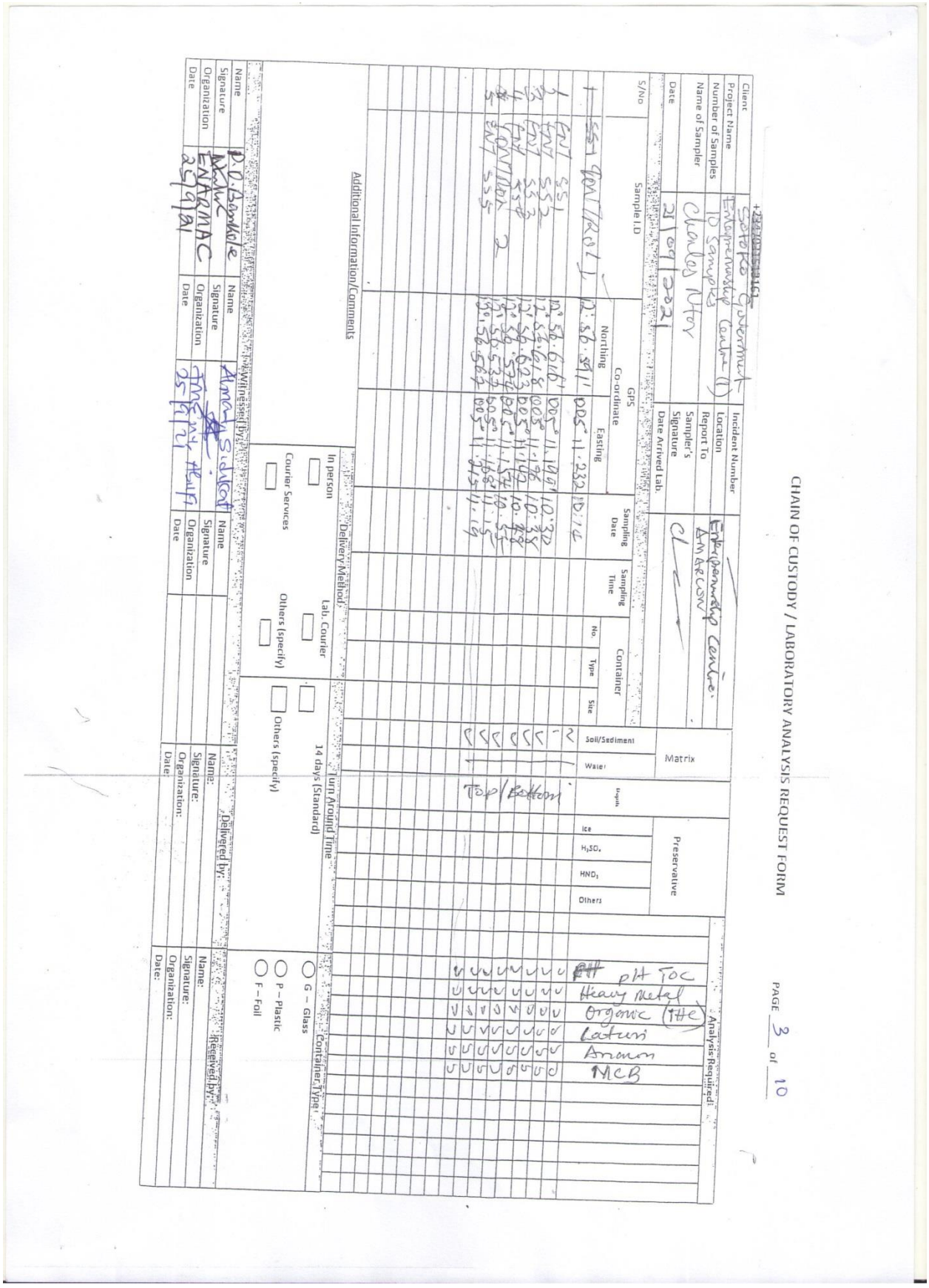
IN-SITU PARAMETERS MEASUREMENT

PROJECT NAME: EMP / ESIA CLIENT NAME: Sokoto State Govt. PROJECT LOCATION: Sokoto State

DATE OF SAMPLING: 20 – 24 / 07 / 21 NAME OF SAMPLER: Rec Cons. SIGNATURE OF SAMPLER:

Sample I.D	Sampling location	Sampling coordinate	Sample type	Grab /Bailing	Composite	In-situ parameters									
						pH	TSS	E.C (µS/cm)	TDS (mg/L)	Temp. °C	TURBIDITY (NTU)	Salinity	DO (mg/L)	Odour
AT-GW1	20/9/21 Date	12 47.158 005 10 151	water	✓		6.5		216.2	120	28.9	6.4			
AT-GW2	20/9/21	12 48.152 005 10 152	water	✓		6.7		245.2	188	29.5	6.3		5.6	odour
CHS-GW1	21/9/21	12 57.457 005 11 457	✓	✓		6.3		312.4	160	27.9	6.2		5.9	✓
CHS-GW2	21/9/21	12 57.137 005 11 137	✓	✓		6.8		218.2	178	28.9	6.4		5.6	✓
MM1-GW1	23/9/21	12 54.284 005 13.284	✓	✓		6.6		245.2	148	29.4	5.4		5.9	✓
ENV2-GW1	21/9/21	12 54.671 005 13.173	✓	✓		6.8		217.4	138	28.9	2.5		5.4	✓
													5.4	odour.

Regulatory Agents/Client Representative	Name	Designation	Signature	Date
ENVIRMAC NIG. LTD	MR. PHILIP D. BANKOLE	MD/CEO		25/9/21
Ahmad Bukar A.	Ibrahim Abuja	PSO		25/9/21



CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

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Client: +234 [illegible] Government
Project Name: Sokoto Government Entrepreneurship Centre (1)
Number of Samples: 10 samples
Name of Sampler: Charles Utoy
Date: 21/09/2021
Incident Number: Entrepreneurship Centre
Location: AMAROSW
Report To:
Sampler's Signature:
Date Arrived Lab.:

S/No	Sample I.D	GPS Co-ordinate Northing	GPS Co-ordinate Easting	Sampling Date	Sampling Time	Container No.	Container Type	Container Size	Matrix Soil/Sediment	Matrix Water	Depth	Preservative Ice	Preservative H_2SO_4	Preservative HNO_3	Preservative Others	Analysis Required: pH TOC	Heavy Metal	Organic (THC)	Lateris	Aromas	MCB	Container Type: G – Glass	P – Plastic	F – Foil
1	ENT SS1	13°56.616'	005°11.109'	10:32		2	V																	
2	ENT SS2	13°56.618	005°11.196	10:38		2	V																	
3	ENT SS3	13°56.623	005°11.149	10:48		2	V																	
4	ENT SS4	13°56.537	005°11.157	10:55		2	V																	
5	ENT SS5	13°56.542	005°11.168	11:15		2	V																	
6	ENT SS1 Duplicate 2	13°56.542	005°11.168	11:15		2	V				Top/Bottom													

Additional Information/Comments

Delivery Method: In person ☐ Courier Services ☐ Lab. Courier ☐ Others (specify) ☐

Turn Around Time: 14 days (Standard) ☐ Others (specify) ☐

Container Type: G – Glass ○ P – Plastic ○ F – Foil ○

Witnessed by:

Name	P.O. Bamidele	Name	Almaz Sidiqat
Signature		Signature	
Organization	ENARMAC	Organization	ENARMAC
Date	25/9/21	Date	25/9/21

Delivered by:

Name		Name:	
Signature		Signature:	
Organization		Organization:	
Date		Date:	

Received by:

Name		Name:	
Signature		Signature:	
Organization		Organization:	
Date		Date:	

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

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Sultan Abubakar Secondary School

Client		Incident Number	
Project Name	Sokoto State Gov. EMP	Location	Sokoto State Govt.
Number of Samples	14 samples	Report To	
Name of Sampler	Charles Ntor	Sampler's Signature	[signature]
Date	22/09/2021	Date Arrived Lab.	

S/No	Sample I.D	GPS Co-ordinate Northing	GPS Co-ordinate Easting	Sampling Date	Sampling Time	Container No.	Container Type	Container Size	Matrix Soil/Sediment	Matrix Water	Depth	Preservative Ice	Preservative H_2SO_4	Preservative HNO_3	Preservative Others	Analysis Required: pH, T°C	Metal	Cation/Anion	MCB
1	ENT4 SS1	12° 03.051'	005° 56.086'	22/9/21	1:08				Soil		Top/Bottom					✓	✓	✓	✓
2	✓ SS2	13° 03.022'	005° 13.635'	✓	1:14											✓	✓	✓	✓
3	✓ SS3	13° 03.050'	005° 13.640'	✓	12:20											✓	✓	✓	✓
4	✓ SS4	13° 03.065'	005° 13.667'	✓	1:28											✓	✓	✓	✓
5	✓ SS5	13° 03.092'	005° 13.633'	✓	1:33											✓	✓	✓	✓
	CONTROL I	13° 03.157'	005° 13.632'	✓												✓	✓	✓	✓
	CONTROL II	13° 03.128'	005° 13.572'	✓												✓	✓	✓	✓

Additional Information/Comments

Delivery Method: In person ☐ Lab. Courier ☐ Courier Services ☐ Others (specify) ☐

Turn Around Time: ☐ 14 days (Standard) ☐ Others (specify)

Container Type: ◯ G – Glass ◯ P – Plastic ◯ F – Foil

		Witnessed by:				Delivered by:	Received by:
Name	P.D. Bankole	Name	Ahmad Siddiq	Name		Name:	Name:
Signature	[signature]	Signature	[signature]	Signature		Signature:	Signature:
Organization	ENARMAC	Organization	Freeny Aluya	Organization		Organization:	Organization:
Date	25/9/21	Date	28/9/21	Date		Date:	Date:

APPENDIX VI: ATTENDANCE FROM SOCIO ECONOMIC STUDIES.

SANI DINGYADI UNITY SEC, SCH, TAKFHIKU ...

	NAME	ADDRESS	Phone Number	SIGN
1	Buhari Bello Tama		08064626611	
2	JAFAR AKILU		07061518918	
3	Abubakar Alhassan		07038737306	
4	Sibril Dalha		09130385108	
5	Hauwa Shaibu		07069326037	
6	Abdul-aziz Alhassan		09063084333	
7	Mubassir Umar Ashir		08089825926	
8	Imam Sabo		07043161396	
9	Amina M Bello			
10	Stephen			

Usman Aliu Shukafy
Sokoto State Polytechnic

1. Muhammad Usman
2. Adegbite ADEGBITE SODEEL AKINLOYE
3. Rashid Kamaludeen
4. Lukman Haladu
5. Blessing Joseph
6. Sam Monday
7. Martin Sam
8. Zakari Bulakasa

Muhammad Usman emphasized that the Centre should also engage skills such as modern graphic design, as a new form of self reliance. Adegbite brought the idea of interlock building materials in the construction. Lukman Haladu said that tailoring, leather work, soap making should be improved to complete with the city product. Blessing Joseph brought the idea of teaching how to make lotion and perfumes. Satellite dish, solar installations are also self reliable business. Adegbite still brought the idea of Aluminium fabrications as another means of self reliant skills.

Finally the students suggested that the skills acquisition training should be done in free time, not to alter with the normal time for their lectures.

STATE UNIVERSITY

ESTABLISHMENT OF VOCATIONAL CENTER IN SOKOTO STATE

S/No.	Name	Address	Phone No	Signature
1	Abubakar Nuhu	Isa Local Sabon Gari	08107355123	
2	Ibrahim Yusuf	Gidan Name SKT	08106465983	
3	Ahmad Isah	Bodinga	0803274[illegible]	
4	Muhammad Ahmad	Bodinga	09132621433	
5	Abubakar Yusuf	Isah	08034016663	
6	Mubasir Tambuwal	Tambuwal	08108915790	
7	Abdulmajid Umar	Bodinga	09035[illegible]	
8	Shafiu Muhammad	Wammakko	08067700444	
9				
10				