FINAL ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)

OF

ESTABLISHMENT OF COLLEGE OF HEALTH SCIENCES AND EQUIPPING OF UNIVERSITY TEACHING HOSPITAL AT THE SOKOTO STATE UNIVERSITY, SOKOTO, SOKOTO STATE

SUBMITTED TO

FEDERAL MINISTRY OF ENVIRONMENT

MABUSHI, ABUJA - NIGERIA

BY

SOKOTO STATE GOVERNMENT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF ACRONYMS, SYMBOLS AND ORGANIZATIONS

ADF	African Development Fund
AfDB	African Development Bank
BCS	Broad Community Support
BHCPF	Basic Health Care Provision Fund
BOD	Biological Oxygen Demand
CBN	Central Bank of Nigeria
Cd	Cadmium
Cfu	Colony Forming Unit
Cl^-	Chloride Ion
cm	Centimetre
CO_2	Carbondioxide {Carbon(IV) Oxide}
COD	Chemical Oxygen Demand
Cr	Chromium
CSR	Corporate Social Responsibility
CT	Computerized Tomography
dB(A)	A-Weighted Decibel
ERP	Emergency Response Plan
ERGP	Economic Recovery & Growth Plan
ESO	Environmental and Safety Officer
ESMF	Environmental and Social Management Framework
FGD	Focused Group Discussions
FGN	Federal Government of Nigeria
GDP	Gross Domestic Product

H_2S	Hydrogen Sulphide
HF	Health Facility
M&E	Monitoring and Evaluation
MDAs	Ministries, Departments and Agencies
MRI	Magnetic Resonance Imaging
NBS	National Bureau of Statistics
NDHS	Nigeria Demographic and Health Survey
NESREA	National Environmental Standards and Regulations Enforcement Agency
NH_3	Ammonia
NHIS	National Health Insurance Scheme
Ni	Nickel
NO_X	Oxides of Nitrogen
NTU	Nephlomeric Turbidity Unit
Pb	Lead
PIU	Project Implementing Unit
PAC	Polycycli Aromatic Compounds
PWDs	People with Disabilities
RAPID	Resources for the Awareness of Population Impacts on Development
RE	Resident Engineer
PE	Project Engineer
SDG	Sustainable Development Goal
SOCHEMA	Sokoto State Contributory Health Management Agency
SOSMEnv	Sokoto State Ministry of Environment

SO_X	Oxides of Sulphur
SPM	Suspended Particulate Matter
SSMOF	Sokoto State Ministry of Finance
SSMOH	Sokoto State Ministry of Health
SSMOHE	Sokoto State Ministry of Higher Education
SSMOW	Sokoto State Ministry of Works
SSU	Sokoto State University
TDS	Total Dissolved Solids
THC	Total Hydrocarbon Content
TMP	Traffic Management Plan
UDUS	Usmanu Danfodiyo University Sokoto
UDUTH	Usmanu Danfodiyo University Teaching Hospital
UHC	Universal Health Coverage
USAID	United States Agency for International Development
USD	United States Dollar
VOC	Volatile Organic Compounds
WMP	Waste Management Plan
WHO	World Health Organization
Zn	Zinc

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EXECUTIVE SUMMARY

Although Usmanu Danfodiyo University Sokoto has a Medical School that has been contributing indigenous medical doctors to the Sokoto State civil service since 1980, in addition to few others being contributed by the Bayero University Kano and Ahmadu Bello University Zaria, these numbers do not sufficiently meet the needs of the State Government. There is thus a need by the State Government to increase indigenous medical manpower provision within the State. In this regard the Sokoto State Government plans to establish a medical college and equip the existing Sokoto State University Teaching Hospital.

A major constraint being faced by the Sokoto State Government in the execution of the proposed project is the dearth of financial capital. Consequently, the State Government approached the African Development Bank (AfDB) for a credit facility to finance the project.

However, in Nigeria and many other environmentally conscious countries, for development projects of this nature and magnitude the conduct of an Environmental and Social Impact Assessment (ESIA) is a major and mandatory requirement. Similarly, the African Development Bank has established an Integrated Safeguard System (ISS) for a comprehensive project review and ensuring across the board perspectives of environmental and social linkages. The ISS provides guidelines on the conduct of Environmental and Social Impact Assessments (ESIAs) through its Environmental and Social Assessment Procedures (ESAPs).

Therefore, to comply with the requirements of AfDB and the Nigerian Government, an ESMP must be designed for the proposed project. In this regard the Sokoto State Government commissioned ENARMAC Nigeria Limited to carry out the ESIA for the above-described project and its component, which is the subject of this report.

PROJECT OBJECTIVES

The proposed project has the following objectives:

- To establish a College of Medical Science which will include identifying, developing, and upgrading infrastructure for the medical school within Sokoto State University.

- To equip the Sokoto State University Teaching Hospital along with three (3) other Premier Hospitals, and College of Medical Science, which in involve the provision and installation of equipment including MRI, CT scan, Ventilators, Ultra-Sound machines, chemical analysers, blood transfusion equipment, X-ray machines etc.
- To build the capacity of the human resources in the health sector and
- To build and develop the institutional capacity of existing health institutions and that of the Project Coordination and Management team

PROPONENT OF THE PROPOSED PROJECT

The proponent of the proposed is the Sokoto State Government. The Project will be implemented by the State Ministries of Higher Education, Health, Works, and the State University through a Project Implementation Unit (PIU) to be formed using the AfDB guidelines. The PIU will run the day-to-day activities of the Project.

PROJECT LOCATION

The proposed site for the Medical College is sandwiched between Sokoto State University, along the Sokoto-Jega Highway and the Sokoto State University Teaching Hospital. The geographical area is in Kasarawa District of Wammako Local Government Area. The project site is bounded by the following geographic coordinates: $12^0$57'09.98" N, $5^0$11'50.38"E; $12^0$57' 09.70"N, $5^0$11'56.03"E; $12^0$57' 05.90"N, $5^0$11'49.49"E; and $12^0$57' 05.65"N, $5^0$11'55.14"E. The topography of the area is generally flat with few undulations.

OBJECTIVES OF THE ESMP

This ESMP aims to bring the project into compliance with applicable national environmental and social legal requirements, policies and procedures as well as those of AfDB's Integrated Safeguard System (ISS). The other objective of the ESMP is to outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts of the proposed project and to enhance the project beneficial impacts. The objectives of this ESMP are therefore to:

- ✓ Improve the environmental aspects of the proposed project design in order to arrive at an environmentally sound and sustainable design;
- ✓ Ensure compliance with environmental standards, regulations and legislations;
- ✓ Avoid irreversible and serious damage to the project environment;
- ✓ Safeguard valued environmental, socio-economic and cultural resources in the project area;
- ✓ Protect human health, safety and welfare in the immediate and extended project environment;
- ✓ Propose effective measures to mitigate the negative impacts and enhance positive impacts associated with the project;
- ✓ Prepare a monitoring and management plan indicating parameters to be monitored, responsibilities and outputs throughout the project life cycle; and
- ✓ Facilitate informed decision making, including formulating the environmental terms, conditions, monitoring and management plans for implementing the proposal.

METHODOLOGY

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

Desktop study was undertaken to acquire information on climate, geology, soil, groundwater, socioeconomics, and other environmental components of the proposed project area. The materials consulted included textbooks, articles, maps, and previous EIA reports. The potential adverse and beneficial 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 source/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.

ADMINISTRATIVE AND LEGAL FRAMEWORK

Several policies that play vital roles in environmental protection were considered in the design of this ESMP. These policies included the following:

- ✓ National Policy on Environment 2017;
- ✓ National Climate Change Policy and Strategy;

National and international laws and regulations dealing with development, health and environmental matters were also considered which include the following:

i. EIA Act CAP E12 LFN 2004;
ii. FMEnv published EIA Sectoral Guidelines for Infrastructure projects;
iii. Applicable National Environmental Standards and Regulations Enforcement Agency (NESREA) regulations relevant to this project;
iv. Land Use Act Cap. L5, 2004
v. Nigerian Urban and Regional Planning Act Cap N138, LFN 2004
vi. Criminal Code
vii. The Endangered Species Act, CAP E9, LFN 2004
viii. Forestry Act CAP 51, LFN 1994
ix. Natural Resources Conservation Act Cap 286 LFN 1990.

International Treaties and Convention

In addition to the national laws/ regulations supporting the use of EIA as an environmental management tool, Nigeria is also a signatory or party to several relevant international conventions and treaties that support the use of standard environmental management tools/ measures for achieving sustainable development. Some of these include:

i. *African Convention on the Conservation of Nature and Natural Resources;*
ii. *United Nations Guiding Principles on the Human Environment;*

iii. *World Heritage Convention;*

iv. *International Labour Organization (ILO) Core Conventions;*

v. *Vienna Convention for the Protection of the Ozone Layer;*

vi. *United Nations Conference on Environment and Development;*

vii. *Convention on Biological Diversity;*

viii. *United Nations Framework Convention on Climate Change;*

ix. *The Copenhagen Accord; and*

x. *Paris Accord.*

PROJECT DESCRIPTION

The Medical College will be constructed within the Sokoto State University. Various medical related courses will be offered i.e medicine and surgery, dentistry, ophthalmology, nursing, medical laboratory science, public health, etc.

The Project will focus on the following:

i. Construction of the College of Health Sciences (Medical School)

ii. Equipping (furniture, books, laboratory equipment, software, etc) the College and the Teaching Hospital along with the three General Hospitals in Tambuwal, Sabon-birni and Binji which will be converted into Premier Hospitals.

The Need for the Proposed Project

Sokoto State has had a rapid population growth that can have negative outcomes on the availability and accessibility health care among others. Although indigenous medical doctors are being trained locally and find their way into the Sokoto State Civil Service, the number of medical doctors within the service do not sufficiently meet the needs of the State. Moreover, the available medical services rendered by the State Government and private medical practitioners in the State is woefully inadequate. Consequently, Resources for the Awareness of Population Impacts on Development (RAPID, 2007) predicts that Sokoto State Government needs to establish a medical school to train at least three thousand and five hundred medical doctors (3,500) before year 2050 to adequately provide essential health care services to its people. Thus, there is a critical need for the State Government to establish a medical college and equip the

existing Sokoto State University Teaching Hospital and three other "premier" hospitals, to provide essential medical services needed in the State.

The Value of the proposed project

The project is aligned with the Nigerian Government's development priorities, including the Economic Recovery & Growth Plan (ERGP) 2017-2020, which focuses on tackling constraints to growth, leveraging the power of the private sector and promoting social inclusion in many areas, including investment in infrastructure, improvement of the business environment, job creation and youth employment. It is also aligned with the national framework, aimed at lifting 100 million people out of poverty within 10 years across 11 priorities, including enhancing investment in human capital development to restore growth and create jobs for the youth. Total project cost is estimated at thirty million and four hundred thousand Dollars (USD $30.4 Million), 95% of which will be provided by AfDB Bank Group as loan, while Sokoto State Government will provide the 5% of the total sum.

Envisaged Sustainability of the proposed Project

The project is envisaged to be sustainable on the grounds that the feasibility studies conducted have indicated a bankable project, availability of funding coupled with an implementable environmentally sound project design. The social, economic, legal, cultural, educational, and political environments for implementing the proposed project have also been studied and found to be receptive and relevant stakeholders and advocates have been identified and consulted by the proponent.

The project options and alternatives considered before selecting the sites

Other locations considered for the construction of the Medical College, apart from the proposed site, include the City Centre (near Gadar Alu, along Zaria Road) and the outskirts of Sokoto town close to the proposed Veterinary Specialist Hospital in the Dange Shuni area. Both locations were rejected because the proposed location has the advantage of being very close to the University Teaching Hospital and the State University, the medical student's hostel and the recently commissioned N3.2b Sokoto Diagnostic Centre and has the advantage of cutting down transport time, cost and safety risks.

Estimated workforce for the proposed project

In the construction phase, the proposed project will directly employ about fifty (50) skilled professionals as well as about a hundred one hundred (100) unskilled employees; in the operational phase, the Medical School and the Teaching Hospital will create about nine thousand (9000) direct and indirect jobs, out of which about five hundred (500) will be for highly skilled professionals.

THE PROJECT AREA

The Medical College will be constructed within the Sokoto State University. Various medical related courses will be offered i.e medicine and surgery, dentistry, ophthalmology, nursing, medical laboratory science, public health, etc.

The Project will focus on the following:

i. Construction of the College of Health Sciences (Medical School)

ii. Equipping (furniture, books, laboratory equipment, software, etc) the College and the Teaching Hospital along with the three General Hospitals in Tambuwal, Sabon-birni and Binji to be converted into 3 “Premier Hospitals”.

PROJECT COMPONENTS

Preconstruction Phase

Pre-construction activities

Preconstruction activities for this project broadly include feasibility studies, licensing/permitting and environmental planning as well as building and technical designs and establishment of project implementing unit.

Construction Phase

The construction phase of the project will witness many activities including developing and upgrading infrastructure for the medical college. The medical college will have different units under it like colleges of medicine, pharmacy, medical laboratory, each with its own physical structure and separated from the others.

Waste expected in the Construction Phase of this project include: insulation materials concrete, bricks, tiles and ceramics, wood, glass and plastic materials. Others include

metallic waste (including cables and pipes), excavated soil, stones and dredging spoil. bituminous mixtures, coal tar cement. paints and varnishes, etc.

Procurement of equipment and installation of equipment

The construction phase of the proposed project will also involve the procurement of building accessories and operational equipment to support the College of Health Sciences with Equipment as well as the Teaching Hospital and 3 Premier Hospitals, to be selected in due course, which will improve the needed health services, teaching for both undergraduates and postgraduates as well as research and development. The equipment includes Magnetic Resonance Imaging (MRI) equipment, CT scanners, Ventilators, ultra-sound machines, chemical analyzers, blood transfusion and blood banking, X-raying, etc.

Capacity Building for Human Resources

The construction phase of the project will witness capacity building for the recruited Academic and Non-academic Staff to ensure the smooth running of the College of Health Sciences. The Academic Staff will in turn train undergraduates as well as residency and post-basic scholars in the state, country, and even at the global level.

Institutional Capacity Development, Project Coordination and Management

The last component of the construction phase will entail the following activities:

1) Enabling institutions, policy, regulatory and business environment framework for health through the implementation of the following: a) developing/strengthening of enabling policy, legislation, and regulation for health and b) technical assistance and capacity building for staff of relevant health institutions.

2) Support the establishment of structures required for project implementation and coordination.

Operational Activities

Operational phase of the project will succeed the construction phase and would be characterized by operationalizing the Medical College. Operational activities will include teaching of medical, pharmaceutical and laboratory procedures to the students at the college as well as conducting research and development activities, at both the undergraduate and post-graduate levels. Operational activities will also involve

building and infrastructural maintenance as well as maintenance of teaching and laboratory equipment.

Expected waste to be generated in the Operational Phase include general and medical wastes. The general waste may be similar to municipal waste and will be from food preparation, administrative activities, landscaping, housekeeping, waste generated during maintenance of health-care premises. Medical waste will include cultures, stocks of infectious agents, pathological, blood and other fluids, sharps, surgery and laboratory wastes.

Decommissioning Phase

The design life of the proposed project is fifty (50) years, depending on proper maintenance. It is unlikely that the project would be decommissioned early. In future, the project may even be upgraded. 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 full demobilization.

Waste categories expected in both the demobilization and Decommissioning Phase will be similar to those to be generated in the Construction Phase.

BASELINE ENVIRONMENTAL CONDITIONS

The environmental baseline data was acquired through desktop research, field studies, sampling and measurements as well as laboratory analysis of collected samples. To fast track the ESMP process, Federal Ministry of Environment gave approval that field data gathering and sampling activities should be restricted to the wet season and be supplemented with data from secondary sources, such as from similar recent EIAs carried out in the project area. Thus, wet season field work was carried out from 20th to 25st September 2021.

Through administration of questionnaires, conducting Focused Group Discussions and personal interviews, consultations were held with stakeholders on issues relating to the

potential ecological and socio-economic impacts of the proposed project. Likewise, prior to field investigations, background and design information on the project was obtained from the proponent of the project.

A central policy in the design of an ESMP is to provide an opportunity for public participation in the design and implementation of mitigation measures throughout its entire life cycle. In this respect, stakeholders including Project Affected Persons, communities in the project area, Government officials who have roles to play in the implementation of the proposed project were consulted. These consultations proved useful in identifying major environmental and socio-economic consideration and concerns.

Sampling Criteria

Based on the objectives, one groundwater and ten soil samples were taken from ten sampling stations and later analyzed in Lab Annal Concept, Elelewo Disrtrict, Port Harcourt, Rivers State.

Water Quality and Hydro-biological Studies

In-situ measurements for pH, temperature, conductivity and dissolved oxygen were conducted, on a groundwater sample from a well on the project site, with a Pye Unicam meter. Further physiochemical analysis was also carried out in Lab Annal Concept, Elelewo District, Port-harcourt-Rivers State.

Socio-Economic Studies

The spacial boundary selected for the socio-economic studies comprised of six districts. These include: Gwiwa, Alkammawa, Tudun-Wada, Mabera, Runjin Sambo and Rijiya. Although the proposed project will be located within Wamakko LGA, an extended socio-economic boundary was selected based on the fact that the potential socio-economic impacts of the proposed project will be experienced by community stakeholders from all nooks and crannies of the LGAs in Sokoto State.

The methodology applied consisted of cluster sampling (where the 3 metropolitan local government areas were divided into smaller segments of districts, and then the six districts were randomly selected to represent the general population of the Sokoto

metropolis) to select two hundred and eighty-eight (288) households from the six districts, for administration of the questionnaires. For each household, one copy of the questionnaire was administered. And all the copies of the questionnaires were retrieved. The retrieved copies of the administered questionnaire were then analyzed, and some key conclusions were arrived at.

Bio-physical Baseline

The spatial boundary considered for the bio-physical studies consisted of areas located not more than five hundred (500) metres from the proposed site for the medical college located close to the Sokoto State University Teaching Hospital.

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 in Sokoto is 29.1 °C while the average annual rainfall is 398 mm. The month with the highest relative humidity is August (76.05 %), while the month with the lowest relative humidity is March, with 9.27 %. The average hourly wind speed in Sokoto experiences significant seasonal variation over the course of the year with the windier part of the year lasting for 7.7 months (from November 17 to July 9) with average wind speeds of more than 3.5m/s. The windiest month of the year in Sokoto is January, with an average hourly wind speed of 4.7m/s.

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.

Geology

Sokoto State is within the Sokoto Basin, which is in the northwestern part of Nigeria, 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. 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 soil in the study area is composed of sand, silt and clay having an average composition of Mean particle size of 68.67% sand, 15.33% silt and 13.00% clay were recorded for topsoil and 76.06% sand, 10.32% silt and 13.62% clay for sub soil at the study area. The pH of the soil sampled was generally varying from basic to moderately acidic. It ranged from 7.01 to 8.14 with a mean value of 7.54 at the topsoil and between 6.17 and 7.81 with a mean value of 7.05 at subsoil. which means that pH of soils in the project area falls within the recommended limit of FMEnv. The result indicates that the soil had a mean total organic content of 0.78% and 0.62% in top and subsoil respectively. The Total Hydrocarbon Content, THC, analysed from the soil samples during the study were below the equipment detection limit of <0.01mg/kg in all stations.

Exchangeable ions in soils of the project area included chloride, Potassium, Phosphate, Total Nitrogen, Nitrate, Nitrite, Sulphite, Sulphate, Sodium, Magnesium and Calcium. All these ions in the collected soil samples had concentrations well below the maximum limits stipulated by FMEnv.

Values obtained from heavy metal content analysis of soil samples were 1.02-2.48mg/kg (top soil) and 1.04-2.26mg/kg (sub soil) for Cu; 0.37-1.75mg/kg (top soil) and 0.44-1.57mg/kg (sub soil) for Pb; 18.67-24.88mg/kg (top soil) and 18.19-27.77mg/kg (sub soil) for Fe; 5.24-11.69mg/kg (top soil) and 5.24-8.58mg/kg (sub soil) for Ni; 0.06-0.57mg/kg (topsoil) and 0.07-0.47mg/kg (subsoil) for Cr; 0.04-

0.46mg/kg (top soil) and 0.04-0.55mg/kg (sub soil) for Cd; and 1.23-8.37mg/kg (top soil) and 3.17-5.54mg/kg (sub soil) for Zn. Values were within the range of those obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Water Resources

Groundwater samples were collected from a well on the proposed site. pH value was 7.80 for the groundwater samples collected within the study area. These values are tending towards alkalinity and are within the stipulated limits by FMENV. Conductivity and TDS values were 155.0µS/cm and 142.0mg/l respectively. These values complied well with stipulated limits by FMENV. The value recorded for Total Suspended Solids was 2.41mg/l while the value recorded for turbidity was 5.15NTU in the groundwater 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).

The Dissolved Oxygen, Biological Oxygen Demand and Chemical Oxygen Demand values obtained in samples collected from the study area were 5.17mg/l, 2.45mg/l and 5.16mg/l respectively. These values complied well with stipulated limits by FMENV and were lower than the range of values obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

The THC analysed from the ground water samples in the proposed facility areas were below the equipment detection limit of <0.001mg/l in all stations.

The concentration of sulphate accounted for the larger part of the nutrient content with a mean value of 55.10mg/l. The order of nutrient concentration present in the samples are Sulphate >Nitrate>Phosphate> Ammonium. The concentration of Potassium accounted for the larger part of the cations content with a mean value of 5.003mg/l. The order of cations concentration present in the samples for the facilities are Potassium> Sodium> Calcium >Magnesium.

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 an average concentration of 1.015mg/l in the sample collected. In all, the heavy metals results were below FMEnv limits for

heavy metals and were also below values obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

Results of microbial counts in groundwater samples were all below equipment detection limit except for coliforms count, where a count of 3 was obtained.

Ambient Air Quality and Noise Level

The mean concentrations of the air pollutants (CO_2, SO_X, SPM, NH_3, VOC, NO_X, CH_4, H_2S) and noise levels were measured at seven (7) selected sampling stations on the project site. Generally, measurements indicated that, at the time of the study, the ambient air had relatively low concentrations of the measured pollutants.

SPM concentrations in the study area ranged from 8.0µg/m^3 to 17.0 µg/m^3 with a mean value of 11.86 µg/m^3, which compared well with the control. Values were also below the regulatory limit of 250µg/m^3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

Noise levels measured in the study area ranged from 42.1 d(B) to 48.1 d(B) with a mean value of 44.41 d(B) and 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).

Biological Features

Flora

The plant diversity at the project site was assessed. Their occurrences, abundance,

density and importance were recorded. Dorminant species identified in the project area include Acacia Senegal, (Gum Arabic, or "Karo" in Hausa); Azadirachta indica (Neem, or "Dogon yaro/Bedi" in Hausa); Combretum micranthum (Geza in Hausa); Andropogon gayanus (Gamba grass,"Gamba" in Hausa); Securinega virosa (Snowberry tree, "Gwiwar Kare" in Hausa); Ziziphus abbysinica (catch thorn, "Magarya" in Hausa); Adansonia digitata (baoba tree, "Kuka" in Hausa); Fhaiderbia albida (apple-ring acacia, "Gawo" in Hausa); Vitellaria paradoxum (shea tree, "Dorawa" in Hausa); and Acacia nilotica (Bagaruwa in Hausa).

Fauna

Seed and insect eating birds such as barn swallow, doves, pied crows, common thrush, etc., as well as tuber-eating birds such as partridge (bush fowl) were observed in farmlands and less dense vegetation areas.

The mammals documented in the area are mostly rats, rabbit and African giant rat.
The invertebrates documented in the area include gastropoda such millipedes (*Pochybolus* sp), dragon flies and butterflies were observed visiting flowers for pollination.

Where most insects can easily be recognized to order, such as Hymenoptera (bees, wasps, and ants) or Coleoptera (beetles) were recorded *in situ*. However, insects other than Lepidoptera (butterflies and moths) that were difficult to identify to genus or species were taken to the laboratory for identification using standard keys and monographs. Other information on insect occurrence was obtained through interviews with the locals.

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*), Brooks Gecko (*Hemidactilus brooki*) etc.

Personal interviews with people in the project area have established that in the rainy season frogs and toads are commonly found in the area. Additionally, squirrel, rats, gerbils, shrews and mice are among the more frequently sighted mammals in the area.

Birds seen in the area include several species such as heron and egret.

The invertebrate fauna are ubiquitous species in the area. Some fauna is present in very high numbers such as the black ants, honeybees, earth worms, wood lice while other are very low in numbers, such as dragon and damsel files, bugs, crickets, butterflies and moths, beetles, mantis, bees and wasps. Earth worms, woodlice are abundant in the wet season.

Socio-Economic Studies

The methodology used for the socio-economic study included Key Informant Interviewers (KII), Focus Group Discussions and administration of questionnaires .

Demographic Profile

The socio-economic survey revealed that people of Sokoto predominantly comprise of Hausas and Fulanis. Other minority ethnic groups include Igbos, Yoruba and Zabarmawa. Majority of the people practice Islam, while Christianity and other religions are also practiced in a limited extent. The inhabitants of Sokoto are mainly farmers, civil servants, traders, artisans, and entrepreneurs. The population of the project area shows a predominance of the working-age population comprising people within the age brackets of 21-30,31-40, 41-50 and 51 years of age. The educational background of the population ranges from those with only Arabic/Islamic education and others having primary, tertiary and postgraduate educational backgrounds.

Religious Affiliation

The socio-economic survey revealed that Sokoto is an accommodative community of people predominantly comprising of Hausa, Fulani. Others include Igbos, Yoruba and Zabarmawa.

Age Profile

The age distribution of respondents in the area shows a predominance of the working-age population comprising people within the age brackets of below 21-30,31-40, 41-50 and 51 and above.

Gender Ratio of the Population

Based on the cumulative number of 288 respondents across the six districts surveyed, 79.17% of the respondents are male with a population of 228, while 20.83% are female with a population of 60 respondents.

Marital Status of Respondents

The proportion of married respondents in the socio-economic survey ranged from 56% to 79%, with the remaining percentage shared between unmarried and divorcee members of the community.

Educational Background

The educational background of the respondents in the project area varied widely. Respondents with Arabic literacy/Islamic religious educational background constitute the highest composition (at least 40% in all the districts), while those with tertiary educational backgrounds constitute the lowest composition.

Occupation

People in the project area are predominantly peasant farmers and livestock keepers. Other occupations practiced include mechanical artisanship, hawking, masonry, civil service, etc. The Most major streets are characterized by petty trading involving sale of food stuffs, provisions, clothing etc. Some residents have multiple streams of incomes from different occupations.

Income Distribution

The monthly income distribution in the project area shows that more than half of the household heads have average monthly income in the lowest income bracket of N10,000 - N40,000. Generally, therefore, findings from the socio-economic survey show that there is a high incidence of poverty in the study area.

Social Infrastructure

Social infrastructure in the project area includes housing schemes, good road network, storm water drainage, electricity supply, security, telecommunication, water supply and social services such as hospital and recreational facilities, etc.

Water Supply

Sokoto South, Sokoto North & Wamakko LGAs are supplied with pipe-borne water. There are also boreholes provided by the three tiers of Government, as well as by International Donor Agencies. Other sources of water in the project area include wells and surface water in ponds and rivers in the rainy season. Many households in the project area, especially those in remote parts, use water from hand-dug wells.

Electricity Supply

Electricity in the project area is provided by Kaduna Electricity Distribution Company (KEDCO). However, as in other parts of the country, several reasons have combined

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

Telecommunication

Private telecommunication companies in the project area include MTN, 9Mobile, Airtel and Glo.

Transportation

Means of transportation in the project area includes motor vehicles, tricycles, motorcycles, bicycles, animals, such as donkeys and camels, as well as animal-driven carts, especially in the rural areas.

Road Network

The project area is characterized by a good, tarred road network. However, the very good, tarred road network is more prominent in the town centers.

Security

Sokoto town is relatively secure and free from activities of criminals such as kidnappers and armed robbers. With greater presence of military and other security agencies and more commitment from the local vigilante groups, the security situation is relatively good.

Criminal Activities

Crime rate is generally low in Sokoto South, Sokoto North and Wamakko LGAs; however, cases of drug abuse are alarming.

Communal Land Disputes

Communal land disputes and litigations are rare in the project area. This is partly because of the existence of clear land tenure systems and the system of land inheritance under Shari'ah adopted by adherents of Islamic religion in the area. Under the system, whenever a landowner dies his/her heirs both male and female are entitled to their shares in a given ratio, as specified by the Shari'ah law.

Social Vices

To a limited extent, social vices like drug abuse and prostitution take place in some of the districts especially in the hotels, albeit secretly as a result of the Shari'ah legal

system being practiced. People in the area normally frown at such vices, which mainly take place in hidden or isolated areas (especially the outskirt areas).

Markets/Heritage Sites

The major markets across the study area are the township markets that open daily, such as: Central market (Sabuwar kasuwa) which is a general market for all stuffs; Tsohuwar kasuwa, where provisions, clothes, cosmetics, shoes, and jewelries are sold; Maggi market (kasuwar Dan kure) where food stuff, meat, fish, fruits and vegetables are mostly found; Kasuwar daji (which is mainly a depot of fruits and vegetables), Kara market (this where animals are sold), Kasuwar Kanawa, where shoes, clothes, bags and accessories are sold; Hajiya Halima central market, where cell phones and other kinds of electronics are sold.

The Sultan Palace is a major archaeological and historical site. It is a majestic building constructed in 1808 to house the Sultan of Sokoto who the traditional and spiritual leader of all Muslims in Nigeria is.

Another cultural heritage site in the project area is the Surame Cultural landscape located about fourty kilometres (40km) from Sokoto, which was declared an ancient Nigerian National Monument 1964 is also located in Sokoto state.

Other tourist destinations of unique aarchaeological features and great historical background in Sokoto are the Usman Dan Fodio Tomb (the tomb of the founder of the Sokoto caliphate), and Waziri Junaidu History & Culture Museum, which displays many relics.

Community Needs and Perception

Community stakeholders raised several issues and concerns which significantly border on employment and economic development. The meetings conducted at all locations show that the project communities firmly support the implementation of the proposed project. Community residents expressed their desire to be given procurement and job opportunities during the construction and operational phases of the project.

Major needs of the communities include improved electricity supply as well as improved healthcare and educational systems that can cope with the increasing

population in the districts. Other needs of the communities include improvement of the road network and drainage systems in the area.

Land Use Pattern

Major land use observed in the immediate project area is institutional and agricultural, followed by commercial as well as residential, and to a much lesser extent recreational.

Land Ownership

Land ownership in the area include private, family, religious, community and institutional ownerships. Private and family ownerships mainly involve residential and business buildings as well as land parcels owned by individuals and families in the project area. On the other hand, community ownership is for lands and properties commonly used by members of the community, such as: playgrounds, cemeteries, markets, motor parks, town squares, etc., while institutional ownership of land is for lands and properties belonging to Local, State and Federal Governments.

Housing and Settlement Pattern

The project area enjoys a predominantly linear housing settlement pattern with single housing units arranged linearly along streets in towns. However, the villages nearby have dispersed and nucleated settlement patterns. Housing types in the project area are both modern and traditional. Along major streets, houses made of cement and concrete blocks in form of individual bungalows, duplexes, storeyed buildings, shared apartments, traditional housing settings, etc. predominate, while in other smaller settlements in the outskirts and neighbouring villages, houses are mostly made of mud and thatched hay roofs or in some cases zinc sheets.

Toilet systems in the area are mainly water closet (WC) system and pit latrines. The modern houses are invariably use WCs, while the traditional houses use pit latrines.

Waste Management

Most people in the project area dispose of their domestic waste by open dumping. Sometimes they openly burn such waste after gathering it over a long period of time. The residue of the burnt refuse is later moved to farms as manure. Sewage from some houses is sometimes allowed to flow along the streets.

In the construction phase waste categories envisaged include Solid waste comprising of felled vegetation/trunks, obsolete equipment and tools, excessive/unused concretes and debris from civil works, hips of sand generated from the earth works, woods from crates, metals, papers, etc. Others include domestic waste such as waste generated from the kitchen, packing materials, boxes, plastics, etc. Liquid waste such as hazardous and non-hazardous waste generated from work construction sites e.g. lubes, lubricants, sanitary water, paints etc.

Waste categories expected in the Operational Phase of the project include non-risk or "general" health-care waste, similar to domestic waste and waste category regarded as hazardous which may create a variety of health risks such as infectious waste e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients excreta, etc. and chemical waste containing chemical substances e.g. laboratory reagents.

In the various project phases waste will be managed using the 3-R Concept of waste management, i.e. Waste Reduction, Waste Re-using and Waste Recycling. This will be done by the project contractor and an accredited waste vendor to be procured by the contractor.

Health Services

Residents in the project area make use of government hospitals, private clinics, off-the-shelf self-medication and 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 and dispensaries.

Common Ailments

The commonest ailments in the project area include malaria, typhoid fever, ulcers, cardiovascular diseases, and diabetes. It was also established that certain ailments could be seasonal, environmental and/or occupational. Typhoid fever, diarrhea and dysentery in children that take place occasionally may be linked to unhygienic living environment and polluted water.

Traditional Administration

The project area is within the Sultanate of Sokoto. The Sultan is the head of the Sultanate who has historically been the head of the entire emirates of the Northern Nigeria and the leader of all Muslims in the country. The six (6) districts in the project area, namely, Gwiwa, Alkammawa, Tudun-wada, Mabera, Runjin Sambo and Rijiya are all over headed by Hakimis (District Heads) who are appointed by the Sultan.

Stakeholders' Consultation

Consultations were carried out with the project affected communities and relevant institutional stakeholders. Consultations were carried out with due regards for the desire to ensure Broad Community Support (BCS) and with reference to informed consultation participation. The consultation process was carried out in conjunction with dissemination of relevant environmental and social information to concerned stakeholders.

Objectives of the Stakeholders Consultation

The main objectives of consultations carried out for this ESMP 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 proposed project have been fully addressed.

Stakeholders Consultation

The primary community stakeholders in the project area is the Kasarawa Community, comprising Hausa and Fulani ethnic groups. Other major stakeholders of the project include the general public in Sokoto State, the medical students and staff of the medical faculty of Sokoto State University, the African Development Bank as the

financing institution as well as the local and national environmental protection agencies, among others.

The primary stakeholders consulted include:

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

The stakeholders were consulted directly through visitations, administration of questionnaires and by Focused Group Discussions.

Concerns/Observations

The objectives of the project were made known to the stakeholders. A major request expressed by communities in the project area is that of youth employment in both the construction and operations phases of the project.

ASSOCIATED AND POTENTIAL IMPACTS

In general, impacts are the resultant changes in environmental parameters, over a given space and a period, compared with what would have happened had the project not been undertaken (baseline scenario). The parameters may belong to any characteristic of environmental components such as air quality, water quality, noise levels or local occupational employment. There are direct and indirect impacts which may sometimes correlate with short – run and long run impacts. For some impacts however, the distinction between short run and long run impact may relate to the distribution between the construction and operational stages of the project. Although the greatest concern about impacts is about the negative aspects, some impacts are positive and should be enhanced. The following potential and associated impacts were identified.

Positive Impacts in the construction phase

Significant positive impacts identified in the construction phase include provision of skill acquisition training and local employment and procurement opportunities to the host communities as well as boost in local trading, demand for temporary housing, lodging, catering services, etc., because of the influx of workers.

Positive Impacts in the operational phase

The most significant positive impact of the proposed project in the operational phase is provision of improved healthcare infrastructural facilities and job creation. The proposed project has a very high potential for reduction of disease and enhancing productivity and will contribute foreign exchange savings and gender equality as well as create an aesthetically pleasing site, beautified with landscaping and gardens.

Negative Impacts in the construction phase

The main negative impact on the socio-economic environment includes cessation of farming activities on the proposed project site. Other environmental and social impacts associated with this phase may include traffic disruption, noise, and adverse air quality, as well as occupational health and safety risks associated with construction work and occupational accident hazards as well as the potential for spread of communicable diseases such as Covid 19, HIV/AIDs and other STDs. These, however, can readily be avoided or mitigated through the application of general good practices such as PPE usage and compliance with measures stipulated in the ESMP.

Negative impacts in the Operational phase

The most significant negative impact of the project in the operational phase is generation of hazardous medical waste and occupational accident risk due to non-compliance with safety procedures and precautions.

MITIGATION AND ENHANCEMENT MEASURES

Mitigation measures have been designed against identified negative impacts. Some of these measures in the construction phase include devising effective traffic management plans as well as regular maintenance of construction equipment to reduce emission and

appropriate planning of noisy operations. As mitigation measures against HIV/AIDs, COVID-19 and operational accidents in the construction phase, employees and communities should be sensitized on protection and prevention measures against HIV/AIDs, COVID-19 and occupational accidents.

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

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

A robust Environmental and Social Management Plan has been designed for this project giving details of management measures that include actions to be taken, stakeholder roles and responsibilities, time frames and monitoring schedule for ensuring that all potential impacts are effectively managed.

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

- ✓ That environmental, social and health & safety factors are carefully managed throughout the project cycle;
- ✓ That the project complies with regulatory stipulations 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 ESIA; and
- ✓ 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/enhancement measures, as well as their timely execution.

The contractor shall be responsible for the implementation of the ESMP falling under the scope of his contract. SOSMEnv, SEPA and the E& S Consultant shall undertake the monitoring of the ESMP for all the phases of the project. This shall be done in close collaboration with FMEnv.

To ensure the success of environmental management of the proposed project, the entire project team and other relevant stakeholders shall be properly mobilized and oriented on the necessity and methods for sound and environmentally responsible project operations and delivery. The Resident Engineer is expected to convey and discuss the contents of the ESMP developed for this project with the Contractor and the project personnel. The 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 public services and business 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.

CONCLUSIONS

In conclusion, the proposed 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

ACKNOWLEDGEMENTS

The Sokoto State Government and ENARMAC Nigeria Limited wish to use this opportunity to express their profound gratitude to Federal Ministry of Environment (FMEnv), Sokoto State Ministry of Environment (SOSMEnv), Sokoto State Environmental Protection Agency (SEPA) and the Project Implementation Unit (PIU) of the proposed project for their guidance and worthwhile contributions towards discharging this onerous responsibility. Contributions of other stakeholders, especially community leaders engaged during the designing of this Environmental Management Plan are hereby acknowledged. Their enormous contributions have proved invaluable in the successful conduct of this assignment.

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Over the years, Sokoto State has had a rapid population growth that can have negative outcomes on the availability and accessibility of education, health care and employment in the State. In this regard, the United Nations Population Fund (UNFPA, 2020), has observed that Sokoto State has one of the worst reproductive health indices in Nigeria, with an estimated maternal mortality of more than 2000 for every 100,000 live births. Likewise, a UNICEF nutrition specialist in Sokoto, Mr. Walton Beckley, has observed that the 2018 Nigeria Demographic and Health Survey showed that Sokoto state has the highest prevalence of children with Severe Acute Malnutrition (SAM) at 6.5 percent. According to the specialist, the increase in violence and internal displacement, coupled with global effects of the COVID-19 pandemic, has worsened the plight of populations in Sokoko state. These statistics underline the need for overhauling the health infrastructure in Sokoto State.

Although Usmanu Danfodiyo University Sokoto has a Medical College that has been contributing an average of about 10-15 (of recent) indigenous medical doctors to the Sokoto State civil service since the 1980s, in addition to an average of five (5) indigenous medical doctors being contributed by the Bayero University Kano and Ahmadu Bello University Zaria, these numbers do not sufficiently meet the needs of the State Government. Considering the anticipated future population growth and its negative impacts on health care and socio-economic condition, Resources for the Awareness of Population Impacts on Development (RAPID, 2007) predicts that Sokoto State Government needs to establish a medical school to train 3,500 Doctors between then and 2050 to adequately provide essential health care services to its people. In this regard the Sokoto State Government plans to establish a medical college and equip the existing Sokoto State University Teaching Hospital and three other “premier” hospitals.

A major constraint being faced by the Sokoto State Government in the implementation of the proposed Medical College and Equipping of the State University Teaching Hospital Project is dearth of financial capital. Consequently, the State Government approached the African Development Bank (AfDB) for a credit facility to finance the project.

However, in Nigeria and many other environmentally conscious countries, for development projects of this nature and magnitude the conduct of an Environmental and Social Impact Assessment (ESIA) is a major and mandatory requirement. Similarly, the African Development Bank has established an Integrated Safeguard System (ISS) for a comprehensive project review and ensuring across the board perspectives of environmental and social linkages. The ISS provides guidelines on the conduct of Environmental and Social Impact Assessments (ESIAs) through its Environmental and Social Assessment Procedures (ESAPs).

Therefore, to comply with the requirements of AfDB and the Nigerian Government, an ESMP must be designed for the proposed project. In this regard the Sokoto State Government commissioned ENARMAC Nigeria Limited to carry out the ESIA for the above-described project and its component, which is the subject of this report.

1.2 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 lifespan of the proposed project including compliance-monitoring, auditing and contingency planning.

1.2.1 Project Objectives

The proposed project has the following objectives:

- To establish a College of Medical Science which will include identifying, developing, and upgrading infrastructure for the medical school within Sokoto State University.
- To equip the Sokoto State University Teaching Hospital along with three (3) other Premier Hospitals, and College of Medical Science, which in involve the provision and installation of equipment including MRI, CT scan, Ventilators, Ultra-Sound machines, chemical analysers, blood transfusion equipment, X-ray machines etc.
- To build the capacity of the human resources in the health sector and
- To build and develop the institutional capacity of existing health institutions and that of the Project Coordination and Management team

1.2.2 Scope of Work

The scope of work specified for the Environmental Consultant in the preparation of the ESMP included the following:

- Comprehensive literature reviews to generate background information on the environmental characteristics of the study area;
- Reviewing of relevant national and international environmental regulations;
- Carrying out a 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 and enhancement measures; and
- Preparation of a robust Environmental and Social Management Plan (ESMP).

1.2.3 Methodology

The methodology adopted by the consultant in execution of this project involved desktop studies, field research, consultation, impact assessment and proffering of mitigation measures and the development of the Environmental and Social Management Plan (ESMP). The approach used involved the use of a blend of multidisciplinary methods for field work and analysis and impact prediction/identification which was followed up with designing of appropriate mitigation measures to be carried out in the implementation of the ESMP.

The national ESMP process adopted for this study is summarized in Figure 1.1 below.

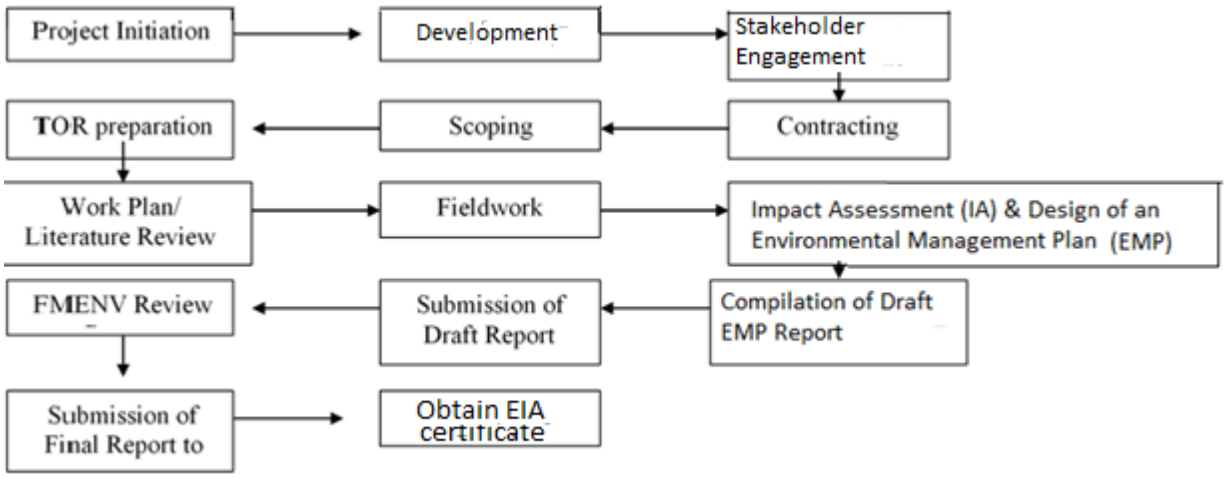


Figure 1. 1: EIA design methodology

1.2.3.1 Desktop Studies

Desktop studies were undertaken to acquire information on climate, geology, soil, groundwater, socio-economics characteristics of the project area, legal, institutional and organizational framework, as well as the African Development Bank's Safeguard Policies related to the project. 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 Sokoto State.

1.2.3.2 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.

1.2.3.3 Impact Mitigation

In proffering mitigation measures to prevent or reduce 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.

1.2.3.4 Terms of Reference

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

- To define relevant framework of legal and administrative requirements for the project;
- To carry out a detailed wet 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 proposed project.

1.2.3.5 National EIA Procedure

Federal Environmental Protection Agency Act No. 58, 1988 (now defunct) detailed regulations that are tools under the Federal Ministry of Environmental Impact

Assessment (EIA) Act CAP E12 LFN 2004 which are termed “Regulations S.I. 8, S.I. 9 and S.I. 15”. The regulations are summarized in the following paragraphs.

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

Section 40 of this regulation specifies the installation of anti-pollution equipment for the detoxification of effluent and chemical discharges emanating from industries and that such installation shall be based on the Best Available Technology (BAT), the Best Practical Technology (BPT) or the Uniform Effluent Standards (UES).

The section also provides that selected wastewater parameters for certain specified industries shall be continuously monitored to ensure compliance with the Regulations, and that an industry which discharges effluent shall treat the effluent to a uniform level as specified in the Regulations to ensure assimilation by the receiving water into which the effluent is discharged.

The nearest office of the Federal Environmental Protection Agency (Federal Ministry of Environment) shall be furnished from time to time with the composition of any effluent treated as specified in paragraph (1) of the regulation.

National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations [S.1. 9 Of 1991.]

Section 37 of this regulation provides the following:

- Restriction on the release of toxic substances, monitoring of pollution units, submission of monthly discharge monitoring report, reporting of unusual or accidental discharges (to the nearest office of the Ministry not later than 24 hours of the discharge), submission of list of chemicals used and details of stored chemicals and storage conditions; as well as the name of any secondary buyer of chemicals from the industry.
- The regulation also provides for industries to have contingency plans against accidental release of pollutants and machinery for combating pollution, while FMEnv serves as an "On-the-Scene Co-ordinator" to co-ordinate all response activities and restricts persons or corporate bodies from engaging in the

storage, treatment and transportation of harmful toxic waste within Nigeria without a permit issued by the Ministry.

Other areas provided for in the regulation include disposal of solid wastes in an environmentally safe manner, maintenance of surroundings of a factories/facilities to preserve their aesthetic and sanitary conditions, safety of workers, conducting Environmental impact assessments, etc.

National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations, 2011, Regulation S.I. No 15 of 2011

The principal thrust of these Regulations is to prevent and minimize the destruction of ecosystem through fire outbreak and burning of any material that may affect the health of the ecosystem through the emission of hazardous air pollutants.

No person or corporate body should engage in bush/forest/open burning for the purposes of hunting, clearing of farmlands, destroying of electronic wastes, municipal waste, asbestos containing, automotive parts, dead animals, plastics, rubber products, tyres, waste oil, petroleum treated and related materials and any material producing dense smoke or noxious odours, etc. except in accordance with the provisions of the regulations. Such a person or body corporate shall not burn, cause, suffer, allow or permit any combustible material in an open fire without permit from the Agency.

The national EIA 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 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 1.2 is a schematic summary of the national EIA process.

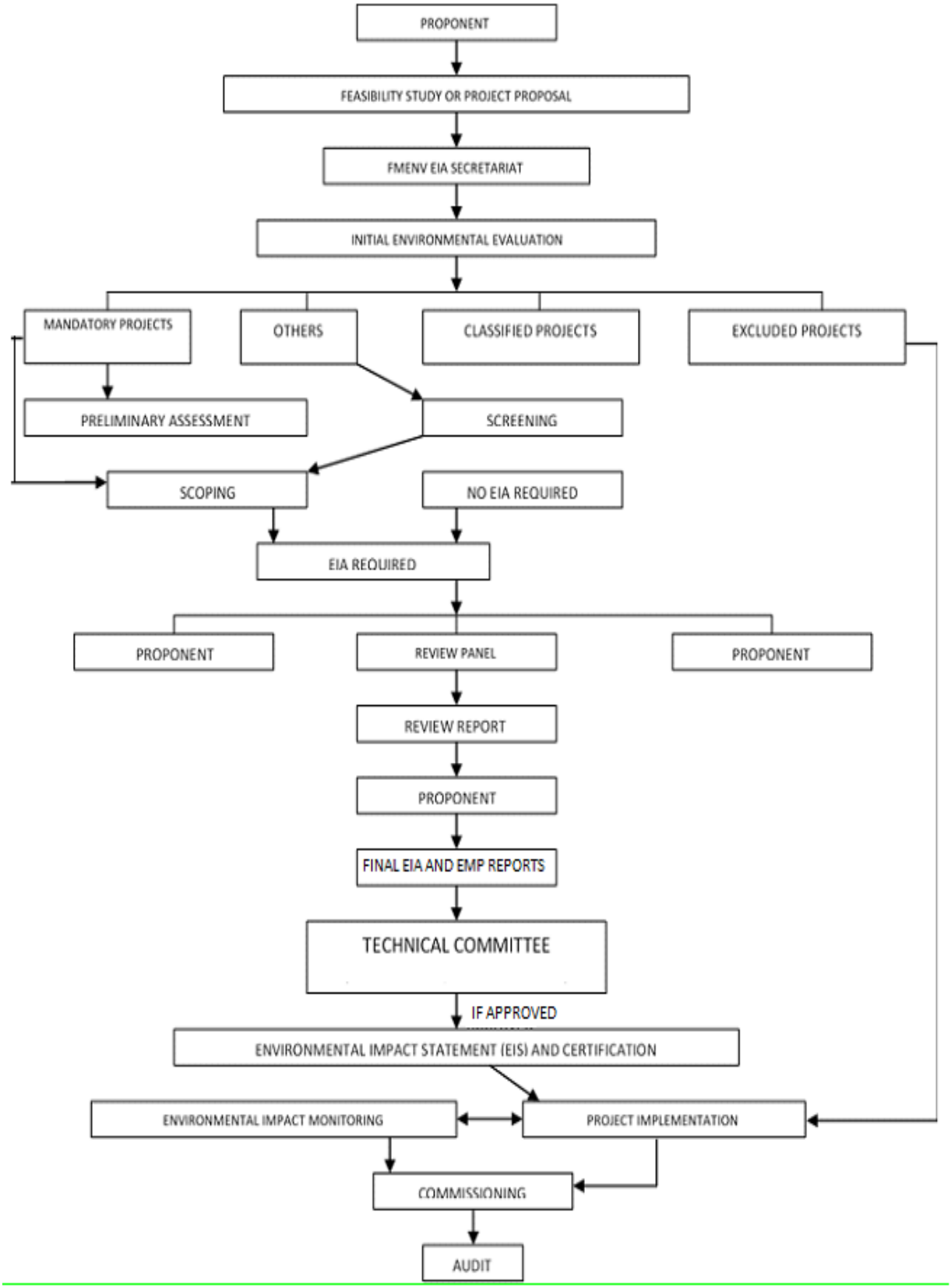


Figure 1. 2: **Nigerian EIA procedure**

In addition to a literature review, structured site visits were undertaken to collect primary data and to get stakeholders perceptions regarding some environmental and 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, executed from 20 to 25th September 2021, covered all the relevant aspects of the ecological and socio-economic environment.
- Stakeholder consultation, a very important aspect of this ESMP planning, was carried out accordingly and its results form the basis for further future consultations with stakeholders.

1.3 ADMINISTRATIVE AND LEGAL FRAMEWORK

This section gives brief discussions on applicable administrative and legal provisions for ensuring environmental protection during implementation and entire life cycle of the proposed project.

1.3.1. Relevant National Policies

A number of policies that play vital roles in environmental protection have been approved by Nigerian government. Some of these policies are outlined in following subsections.

1.3.1.1 National Policy on Environment, 1989 (revised 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; and
- ✓ Participation Principle.

1.3.1.2 National Climate Change Policy and Strategy

Nigeria has a National Adaptation Strategy and Response Plan (NASPA) on Climate Change 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.

1.3.1.2.1 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.

1.3.2 Legal Provisions

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:

1.3.2.1 Environmental Impact Assessment (EIA) 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

Federal Ministry of Environment Sectoral and Procedural Guidelines for EIA

FEPA Act, Cap 131, LFN, 1990 allocates powers of environment legislation making and enforcement to the Federal Environmental Protection Agency (FEPA) now (FMEnv). In-line with its functions, defunct FEPA has published the EIA Sectoral Guidelines (revised in September 1995). The guidelines cover major development projects and are intended to inform and assist proponents in conducting EIA studies. In September 1995, FMEnv published EIA Sectoral Guidelines for Infrastructure projects. The guidelines are intended to assist in the proper and detailed execution of EIA studies of infrastructure and projects in consonance with the EIA Act. The guidelines were used to guide the conduct of this EIA.

1.3.2.2 Forestry Law CAP 55, 1994

This law prohibits any act that may lead to the destruction of or cause injury to any forest produce, forest growth or forestry property in Nigeria. It also prescribes the administrative framework for the management, utilization and protection of forestry resources in Nigeria.

Abiding by this law was one of the considerations that guided the choice of the proposed site for this project.

1.3.2.3 Endangered Species (Control of International Trade and Traffic) Act (Cap E9 LFN 2004)

This provides for the conservation and management of wildlife and the protection of endangered species, as required under certain international treaties.

Harmful Waste Special Criminal Provisions Act CAP HI, LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

Section 6 provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.

Section 7 makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where the offence is committed by a company.

Section 12 defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offending act.

1.3.2.4 National Environmental Regulations

The Federal Government through the Federal Ministry of Environment has developed Environmental Regulations which have been published in the Federal Republic of Nigeria Official Gazette and are now in force.

Applicable regulations relevant to this project are briefly discussed below.

1. National Environmental (**Construction Sector)** Regulations, 2010. S. I. No. 19. The purpose of these Regulations is to prevent and minimize pollution from construction, decommissioning and demolition activities.
2. National Environmental **(Effluence Limitation)** Regulations S.I.8 of 1991
This instrument makes it mandatory that industrial facilities install anti - pollution equipment, makes provision for further effluent treatment, prescribe maximum limit of effluent parameters allowed for discharge, and spell out penalties for contravention.
3. National Environmental **(Noise Standards and Control)** Regulations, 2009. S. I. No. 35. The main objective of the provisions of this Regulation is to ensure tranquillity of the human environment or surrounding and their psychological wellbeing by regulating noise levels.
4. National Environmental **(Pollution Abatement in Industries facilities Generating Waste)** Regulations S.I.9 of 1991.

This imposes restrictions on the release of toxic substances and stipulate monitoring of pollution to ensure permissible limits are not exceeded; provides procedure for dealing with unusual and accidental discharges, generator's liabilities; provides for designing of contingency plans and strategies for waste reduction and safety for workers.

5. National Environmental **(Management of Solid and Hazardous Wastes Management of Solid and Hazardous Wastes)** Regulations S.I. 15 of 1991.

These Regulations, make up section 37 of the Federal Environmental Protection Agency Act and provide guidelines on methods of handling and management of solid, radioactive and (infectious) hazardous waste. They specifically define the objectives of management of solid and hazardous waste, the functions of appropriate Governmental agencies and the obligations of industries. They also classify waste and make provision for contingency plan and emergency procedure, groundwater protection and monitoring.

6. National Environmental (**Soil Erosion and Flood Control)** Regulations, 2010. S. I. No. 12. The overall objective of these Regulations is to check all earth-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.
7. National Environmental **(Control of Vehicular Emissions from Petrol and Diesel Engines)** Regulations, 2010. S. I. No. 20. The purpose of these regulations is to restore, preserve and improve the quality of air. The standards contained herein provide for the protection of the air from pollutants from vehicular emission.
8. National Environmental (**Sanitation and Wastes Control)** Regulations, 2009. S. I. No. 28. The purpose of this Regulation is to provide the legal framework for the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.
9. National Environmental (**Surface and Groundwater Quality Control)** Regulations, 2010. S. I. No. 22. The purpose of this Regulation is to

restore, enhance and preserve the physical, chemical and biological integrity of the nation's surface waters, and to maintain existing water uses.

10. National Environmental **(Permitting and Licensing System)** Regulations, 2009. S. I. No. 29. The provision of this Regulation enables consistent application of environmental laws, regulations and standards in all sectors of the economy and geographical region.
11. National Environmental **(Ozone Layer Protection)** Regulations, 2009. S. I. No. 32. These provisions seek to prohibit the import, manufacture, sale and the use of ozone-depleting substances.

Thus, a robust EMP was designed which is based on measures that will make sure that the above regulations are respected and strictly adhered to.

1.3.2.5 Factory Act CAP F1, LFN 2004

The Act enjoins the contractor and manufacturing industries to ensure that every worker employed by them works under satisfactory, safe and healthy conditions. They are also 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.

Factory Act will therefore regulate the work conditions that will prevail during both the construction and operational phases of the project.

1.3.2.6 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.

1.3.2.7 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.

1.3.2.8 Public Health Law CAP 103 LFN 1990

This 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 environmental and safeguard the water air and land, forest and wildlife of Nigeria. The law prohibits the public or private sector of the economy to undertake or embark on or authorize projects or activities without prior consideration of the effect on the environment.

Undoubtedly, the conduct of this EIA goes a long way in meeting the provision of the above law.

1.3.2.9 Employee's Compensation Act 2011

This act provides for an open and fair system of guaranteed and adequate compensation for all employees or their dependents for any death, injure, disease or

disability arising out of or in the course of employment. The Act also makes provision for rehabilitation of employees with work-related disabilities and establishment of a solvent compensation fund managed in the interest of employees and employers. One of the core objectives of the Act is to harness combined efforts and resources of relevant stakeholders for the prevention of workplace disabilities and the enforcement of occupational safety and health standards in Nigeria.

This act will be applicable to constructional, operational and maintenance phases of the proposed project where labourers and other workers will be involved.

1.3.2.10 Natural Resources Conservation Act CAP 286 LFN 1990

This Act established the Natural Resources Conservation Council to be responsible for the conservation of natural resources in Nigeria and formulate national policy for natural conservation.

Section 3 of the Act provides that the functions of the council shall be to:

(a) Coordinate matters concerning the conservation of natural resources in Nigeria;

(b) Formulate a national policy for natural resources conservation;

(c) To carry out such other activities calculated to facilitate the effectiveness of the performance of the functions of the council under this Act as in Section 3(e).

Moreover, the Act, in collaboration with other agencies, controls coastal zone development to minimize erosion on the national coastline. As contained in Section 4(e) of the Act, it also designates sites and species of conservation interest as in Section 4(a).

1.3.2.11 Nigeria 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.

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, and the right to be accompanied by family (not exceeding 2 wives).

Part III relates to special classes of workers, including apprentices, women, and young persons. 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.

An employer who wishes to employ foreign nationals must obtain a specific authorization that approves the maximum number of expatriates the employer can engage, their job designations and the duration of such employment. Employers must show that there are no suitably qualified Nigerian employees for the positions to be occupied by expatriates and, where approval is granted, Nigerians are expected to be trained to fill the positions over time.

Compliance with this law will go a long way in ensuring local content with a view to enhancing the positive benefits of the proposed project.

1.3.2.12 Water Resources Act CAP W2 LFN 2004

This act generally aims at promoting the optimum development, use and protection of water resources in Nigeria.

Sections 1-4 of the act are summarized as follows:

Section 1: Vesting of rights and control of water in the Federal Government

The right to the use and control of all surface and groundwater and of any water-course affecting more than one State as described in the Schedule to this Act, together with the bed and banks thereof, are by virtue of this Act and without further assurance vested in the Government of the Federation for the purpose of-

(a) promoting the optimum planning, development and use of Nigeria's water resources;

(b) ensuring the co-ordination of such activities as are likely to influence the quality, quantity, distribution, use and management of water;

(c) ensuring the application of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water resources; and

(d) facilitating technical assistance and rehabilitation for water supplies.

(2) The provisions of subsection (1) of this section, shall not be construed as infringing or constituting a compulsory acquisition of any right over, or interest in property.

Section 2: Rights to take and use of water

Notwithstanding the provisions of section 1 of this Act-

(a) any person may:

(i) take water without charge for his domestic purpose or for watering his livestock from any water course to which the public has free access; or

(ii) may use water for the purpose of fishing or for navigation to the extent that such use is not inconsistent with any other law for the time being in force; or

(iii) who has a statutory or customary right of occupancy to any land, may take and use water from the underground water source or if abutting on the bank of any watercourse, from that watercourse, without charge for domestic purposes, for watering livestock and for personal irrigation schemes.

Section 3: Acquisition for rights to use or take water

Any person or any public authority may acquire a right to use or take water from any watercourse or any groundwater described in the Schedule to this Act for any purpose in accordance with the provisions of this Act and any regulations made pursuant thereto.

Section 4: Control of groundwater

Notwithstanding the provisions of section 2 of this Act, the Minister shall have power to-

(a) define the places from which or the manner in which and the times at which such water may be taken or used;

(b) fix, in times of actual or anticipated shortage of water, the amount which may be taken by any person for such purposes;

(c) prohibit temporarily or permanently, the taking or use of water from any source for such purposes, when in his opinion, the taking or use of such water would be hazardous to health;

(d) revoke a right to use or take water when such a right is likely to override the public interest;

(e) require to be examined or licensed, any person undertaking the work of drilling for water;

(f) regulate the place, depth, manner of construction or mode of operation of any borehole or well; and

Other sections of the act specify the powers of the Minister, procedures for administration of provisions of the Act and the National Water Master Plan application for and issuance of licence and licence fee. power to order removal of hydraulic work.define the times at which water may be taken from such borehole or well, unlawful diversion of water and specify penalties for contravening of the provisions of the Act. The provisions of this act will thus be met through compliance with other laws and regulations discussed above, especially the relevant NESREA regulations.

1.3.2.13 Harmful Waste (Special Criminal Provisions) Act Cap H1, LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria.

1.3.2.14 Penal Code Act CAP 53 LFN 1990

The Nigerian Criminal Code makes it an offence punishable with up to 6 month's imprisonment for any person who:

- ✓ Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood, or passing along a public way; or

- ✓ Does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, whether human or animal.

The above criminal code provisions will also be given regard to in the design of an EMP for the proposed project.

1.3.2.14 State Legislations: States Environmental Protection Edicts

In accordance with Section 24 of the FMEnv Act, Chapter 131 of the Laws of the Federal Republic of Nigeria, 1990, the State Environmental Protection Edicts are enacted. The edict empowers the State Environmental Protection Agencies to establish such environmental criteria, guidelines/specifications or standards for the protection of the state's air, lands and waters as may be necessary to protect the health and welfare of the people. The functions of SEPAs among others 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 the FMEnv and other relevant regulatory agencies in the promotion of environmental education;
- Be responsible for monitoring compliance with waste management standards; and
- Monitor the implementation of the EIA and Environmental Audit Report (EAR) guidelines and procedures on all developmental policies and projects within the State.

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

Sokoto State Ministry of Environment

Sokoto State Ministry of Environment oversees activities involving the environment in Sokoto State. Among its other mandates, the Ministry supervises the Sokoto State Environmental Protection Agency (SEPA).

The ministry has the responsibility of maintaining a clean and healthy environment through provision of sanitation and waste management services as well as oversight of spatial development planning.

Sokoto State Environmental Protection Agency (SEPA)

SEPA is responsible for the protection and improvement of the environment within the State as well as assists in implementation and enforcement of the National Environmental Regulation and Guidelines within Sokoto Stat. In carrying out its duties of environmental protection, SEPA is required to collaborate with relevant Federal and State Ministries, Local Government Councils, statutory bodies, research and educational institutions. Although the primary regulatory authority overseeing environmental concerns of the proposed project lies with FMEnv, SEPA plays a role as a key stakeholder in environmental management of the state through:

- ✓ Protection of environment and biodiversity conservation and sustainable development in Sokoto State;
- ✓ Conduct research on matters relating to environment;
- ✓ Collaborate with federal government through the Federal Ministry of Environment in conducting public investigation on major environmental problems;
- ✓ Monitor the quality of water, air, land and natural resources in the state; and
- ✓ Promote environmental education and awareness.

1.3.2.15 International Treaties and Convention

In addition to the national laws/ regulations supporting the use of EIA as an environmental management tool, Nigeria is also signatory or party to several international conventions and treaties that support the use of standard environmental management tools/ measures for achieving sustainable development.

Some of these include:

International Labour Organization (ILO) Core Conventions

International Labour Organization (ILO) Core Conventions are as follows:

- ✓ Convention 1973, No. 138 regarding admission of age to employment which is 18years for Hazardous work or 16 under strict conditions, 14 as basic minimum age and 12-14 for light works and
- ✓ Convention 1999 No. 182 regarding worst forms of Child Labour. Under this convention Article 3 below applies;

For the purposes of this convention, the term the worst forms of child labour comprise:

(a) all forms of slavery or practices similar to slavery, such as the sale and trafficking of children, debt bondage and serfdom and forced or compulsory labour, including forced or compulsory recruitment of children for use in armed conflict;

(b) The use, procuring or offering of a child for prostitution, for the production of pornography or for pornographic performances;

(c) The use, procuring or offering of a child for illicit activities, in particular for the production and trafficking of drugs as defined in the relevant international treaties;

(d) Work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children.

The implication of these conventions is that during recruitment of project personnel, under-aged persons would not be considered. Also, no person shall be forced to carry out any activity relating to the project against his or her wish.

Vienna Convention for the Protection of the Ozone Layer

This convention held in 1985 places general obligations on countries to take appropriate measures to protect human health and the environment against adverse effects resulting from human activities which tend to modify the ozone layer.

This convention will be relevant in terms of avoidance of the use of ozone layer depleting chemical agents in the implementation of the project.

United Nations Conference on Environment and Development

The Rio 'Earth Summit' of 1992 emphasized the need for the preservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including access to genetic resources and appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies. Nigeria is signatory to these international agreements on the environment. The principles adopted include:

Principle 1

Humans are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 5

All states and people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standard of living and better meet the needs of the majority of the people of the world.

Principle 17

Environmental Impact Assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

The above conference and principles, especially Principle 17, form the basis for the EIA as a sustainable development tool.

Convention on Biological Diversity

This convention is the most important of all the international agreements on biodiversity. Negotiated under the auspices of United Nations Environment Programme (UNEP), the Biodiversity Convention was opened for signature in June 1992 at the 'Earth Summit' held in Rio de Janeiro, Brazil, and entered into force in December 1993. It is the first global agreement to cover all aspects of biological diversity: the conservation of biological diversity, the sustainable use of its

components and the fair and equitable sharing of benefits arising from the use of genetic resources.

Thus, any biological diversity present on the proposed project site or its surrounding will be protected by the application of this convention.

International Union for Conservation of Nature (IUCN) Guidelines 1948

IUCN Red List Categories and Criteria were developed for classifying species at high risk of global extinction, i.e., for assessment at the global level. Guidelines on the application of the IUCN Red List Criteria at national or regional levels were also developed.

The Guidelines are regularly updated: the current version is **version 14 (August 2019)**.

The IUCN Red List of Ecosystems Categories and Criteria The basis of the IUCN Red List of Ecosystems is the IUCN Red List of Ecosystems Categories and Criteria, a set of eight categories and five criteria that provide a consistent method for assessing the risk of ecosystem collapse. The eight categories of ecosystem risk are: Collapsed (CO), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), and Not Evaluated (NE). The IUCN Red List of Ecosystems protocol comprises five rule-based criteria (A-E) for assigning ecosystems to a risk category. Two of these criteria assess spatial symptoms of ecosystem collapse: declining distribution (A) and restricted distribution (B). Two criteria assess functional symptoms of ecosystem collapse: environmental degradation (C) and disruption of biotic processes and interactions (D). Multiple threats and symptoms can be integrated in a model of ecosystem dynamics to produce quantitative estimates of the risk of collapse (E). The Guidelines include comprehensive sections to support application of each of the five criteria, including information on relevant theory, thresholds and examples.

In the implementation of the proposed project, the IUCN Guidelines will assist correct implementation of the IUCN Red List of Ecosystems Categories and Criteria by providing information on the development of the protocol and a detailed overview

of the scientific foundations supporting the categories and criteria.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (**CITES**)

This is a multilateral treaty to protect endangered plants and animals which was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The convention was opened for signature in 1973 and CITES entered into force on 1 July 1975.

Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than thirty-five thousand (35,000) species of animals and plants.

World Bank Guidelines on Environmental Assessment, 1991

This resource was used to improve awareness of, and access to, existing impact assessment guidelines. It generally helps planners, decision-makers, practitioners and institutions with a mandate or professional interest in promoting, advising or managing impact assessment.

United Nations Framework Convention on Climate Change

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys universal membership with 193 countries having ratified.

Under the Convention (entered into force on 21 March 1994), governments:

- gather and share information on greenhouse gas emissions, national policies and best practices;
- launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries;

- cooperate in preparing for adaptation to the impacts of climate change.

This convention is applicable in the implementation of this project in terms of efforts that will be geared towards minimization of greenhouse gas emissions.

The Copenhagen Accord

This Accord reached by some Heads of State, Heads of Government, Ministers and other heads of delegation at the United Nations Climate Change Conference 2009 in Copenhagen, Denmark recommends that deep cuts in global greenhouse gas emission be made. It also underlined the need to pursue various approaches, including opportunities to use markets, to enhance the cost-effectiveness of, and to promote mitigation actions. Figure 1.4 below is a historical timeline of the aforementioned agreements/ conventions.

This accord is also applicable in terms of the need to cut down on greenhouse gas emissions.

The Paris Climate Accord

This is a major international treaty arrived at after the expiration of the Kyoto Protocol in 2012. Nigeria is one of the more than 140 countries that ratified this agreement in Paris, France in December 2015. The central aim of the agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise in this century well below 2 degrees Celsius above pre-industrial levels and to also pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The agreement also aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework are being put in place globally, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework.

The Paris Agreement requires all Parties to put forward their best efforts through nationally determined contributions (NDCs) and to strengthen these efforts in the years

ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

AfDB's Safeguard Policies and Procedures

The AfDB has a safeguard policy and an Integrated Safeguard System for project implementation which are summarized in the following sections.

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.

AfDB's 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.

The proposed Establishment of College of Health Sciences and Equipping of Sokoto State University Teaching Hospital is therefore categorized as a Category 2 project and therefore an adequate ESMP has been designed to manage the environmental and social risks 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.

CHAPTER TWO: PROJECT JUSTIFICATION

2.1 THE NEED FOR THE PROPOSED PROJECT

Sokoto State has had a rapid population growth that can have negative outcomes on the availability and accessibility of healthcare among others. Although indigenous medical doctors are being trained locally and find their way into the Sokoto State Civil Service, the number of medical doctors within the service do not sufficiently meet the needs of the State. Moreover, the available medical services rendered by the State Government and private medical practitioners in the State is woefully inadequate. Thus, there is a critical need for the State Government to establish a medical college and equip the existing Sokoto State University Teaching Hospital and three other "premier" hospitals, to provide essential medical services needed in the State.

The World Health Organization (WHO) recommended that, for effective management of medical conditions in a given population, doctor to population ratio should be at least 1:600. However, Sokoto state has about 200 doctors on its payroll currently. Although the Sokoto State population was projected to be about 5.8 Million in 2021 (2021 population projection), going by these, Sokoto State doctor to population ratio will be 1:29,000 which is grossly inadequate. Using the Nigeria Medical Association Sokoto State chapter's register, about 700 medical doctors are practicing in the State, and their ratio is still below WHO standard (1:8,285). Consequently, Resources for the Awareness of Population Impacts on Development (RAPID, 2007) predicts that Sokoto State Government needs to establish a medical school to train at least three thousand and five hundred medical doctors (3,500) before year 2050 to adequately provide essential health care services to its people. Therefore, to help address shortages in human resource for health as well as service delivery, the Sokoto State Government is currently building State own University Teaching Hospital and Diagnostic Center paving way for establishment of Medical School under the Sokoto State University in order to train its students and provide manpower in different medical fields, which necessitate the need for equipment. In addition, the state requires a medical school, which is expected to contribute significantly to the State by integrating relevant health issues and health care research. Forming a partnership between university health professional schools and the State's health-care system can

facilitate the coordination and advancement of health education, research and health care for the entire state and thus benefit the people.

The proposed project is aligned with the Nigerian Government's development priorities, including the Economic Recovery & Growth Plan (ERGP) 2017-2020, which focuses on tackling constraints to growth, leveraging the power of the private sector and promoting social inclusion, including investment in infrastructure, improvement of the business environment, job creation and youth employment. It is also aligned with the national framework, aimed at lifting 100 million people out of poverty within 10 years across.

2.2 THE BENEFITS OF THE PROPOSED PROJECT

The benefits of the proposed project include the following among others:

- To protect and enhance the health status of the people of Sokoto State;
- To develop the medical sector of Sokoto State and improve the basic healthcare statistics in the State;
- To enhance medical human capital development in the State and create jobs for youth;
- To increase the total number of medical professionals, which will greatly improve the health care system of the State and the Country.
- To enhance capacity building of medical professionals and other stakeholders;
- To reduce to a certain extent the State government's training budget for medical students outside the country; and
- To utilize the comparative advantage of being a cultural heritage centre, which can encourage medical tourism.

2.3 THE VALUE OF THE PROPOSED PROJECT

The project is aligned with the Nigerian Government's development priorities, including the Economic Recovery & Growth Plan (ERGP) 2017-2020, which focuses on tackling constraints to growth, leveraging the power of the private sector and promoting social inclusion in many areas, including investment in infrastructure, improvement of the business environment, job creation and youth employment. It is

also aligned with the national framework, aimed at lifting 100 million people out of poverty within 10 years across 11 priorities, including enhancing investment in human capital development to restore growth and create jobs for the youth. Total project cost is estimated at twelve billion seven hundred million Naira (thirty million and four hundred thousand Dollars, USD $30.4 Million), 95% of which will be provided by AfDB Bank Group as loan, while Sokoto State Government will provide the 5% of the total sum.

2.4 ENVISAGED SUSTAINABILITY OF THE PROPOSED PROJECT

The project is envisaged to be sustainable on the grounds that the feasibility studies conducted have indicated a bankable project as well as availability of funding coupled with an implementable environmentally sound project design. The social, economic, legal, cultural, educational, and political environments for implementing the proposed project have also been studied and found to be receptive. More medical doctors and paramedical personnel will be sent for training overseas, in addition to those currently undergoing training. Additionally, relevant stakeholders and advocates have already been identified and consulted by the proponent and would continuously be consulted throughout the phases of the proposed project. The project has also been designed to integrate elements which enhance climate change adaptation and mitigation.

2.5 THE PROJECT OPTIONS AND ALTERNATIVES CONSIDERED

Other locations considered for the construction of the Medical College, apart from the proposed site, include the City Centre (near Gadar Alu, along Zaria Road) and the outskirts of Sokoto town close to the proposed Veterinary Specialist Hospital, in the Dange Shuni area. Both locations were rejected because the proposed location has the advantage of being very close to the University Teaching Hospital and the State University, the medical student's hostel and the recently commissioned N3.2b Sokoto Diagnostic Centre and has the advantage of cutting down transport time, cost and safety risks.

2.6 ESTIMATED WORKFORCE FOR THE PROPOSED PROJECT

In the construction phase, the proposed project will directly employ about fifty (50) skilled professionals as well as about a hundred one hundred (100) unskilled employees; in the operational phase, the Medical School and the Teaching Hospital will create about nine thousand (9000) direct and indirect jobs, out of which about five hundred (500) will be for highly skilled professionals.

CHAPTER THREE: PROJECT DESCRIPTION

3.1 PROJECT DESCRIPTION

The Medical College will be constructed within the Sokoto State University. Various medical related courses will be offered i.e medicine and surgery, dentistry, ophthalmology, nursing, medical laboratory science, public health, etc.

The Project will focus on the following:

i. Construction of the College of Health Sciences (Medical School)

ii. Equipping (furniture, books, laboratory equipment, software, etc) the College and the Teaching Hospital along with the General Hospitals in Tambuwal, Binji and Sabon-birni towns which are called the "3 Premier Hospitals".

The project is expected to:

- Build College of Medical Sciences for Sokoto State University to satisfy the desired needs of the society.
- Increase the total number of medical professionals, which will greatly improve the health care system of the State and the Country.
- Capacity building enhancement of medical professionals and other stakeholders.
- Reduce to a certain extent the State government's training budget for medical students outside the country
- The project will help to shape Sokoto State health care policy and delivery through participation of indigenous medical professionals/students and specialist doctors in patient care, research, and formulation of health care protocols, guidelines, and policy
- Ability to attract major grants for expansion regional and international partners
- Improve the quality and quantity of physical infrastructure for teaching and learning;

- The medical school will strengthen the capacity of State University teaching hospital in the provision of tertiary health care services for the entire region and the country, thereby reducing medical tourism outside the country.

- The Project has **Four** broad components:

i. Component 1– Support the establishment of College of Medical Science in Sokoto State University

This includes activities such as: a) identifying, developing and upgrading infrastructure for the Medical School. The Medical College will have different colleges under it like medicine, pharmacy, medical laboratory, among others. The school would offer associated services like specialized health care, research, and other allied services. The building will be one-storeyed building with ground and upper floors. The twenty (20) wards in the Teaching Hospital will accommodate two thousand (2000) beds for patients. National grid, Generators, and solar will run the facility.

The College and Teaching Hospital will be supplied with electricity from the national grid, which will be supplemented with a diesel-powered generator and solar electricity supply. Pipe-borne water will be supplied to the college and the hospital Sokoto State Water Board and will be supplemented by five motorised boreholes with huge water storage tanks to be provided.

ii. Component 2 – Equip the Teaching Hospital, 3 Premier Hospitals, and College of Medical Science

Thi**s** includes activities to Support the College of Medical Sciences with equipment as well as the Teaching Hospital and 3 Premier Hospitals, which provide needed health services, teaching for both undergraduates and postgraduates as well as research and development. The Teaching Hospital and the three Premier Hospitals will provide diagnostic, surgical, and medical in-patient and outpatient services. The services to be offered by the hospitals and required facilities which will be provided by the project include an Assessment Suite, Outpatients Centre, Diagnostic Centre, Intensive Care Unit, and other specialised services such as obstetrics, gynaecology, paediatrics, orthopaedics, neurosurgery, urology, cardiology, renal medicine, dental and oral surgery and general medicine. The needed equipment for the four hospitals and the Medical School includes diagnostic imaging services, comprising eight X-Ray

machines, one CT scanner, eight Ultrasound, eight X-ray machines and one MRI Scanner. Other equipment needed include ten Ventilators, ten Chemical Analyzers, four Blood Banks, etc.

iii. Component 3 – Capacity Building for Human Resource for Health. The Capacity of the recruited staff both Academic and Non-academic will be built for the smooth running of the College of Health Sciences, who will in turn support capacity building (undergraduate training, residency, post basic,) for human resources for health in the state, country, and even to the global level. The capacity to be built by these institutions will be at all levels.

iv. Component 4 – Institutional Capacity Development, Project Coordination and Management. This is made up of two sub-components namely:

1) Enabling institutions, policy, regulatory and business environment framework for health through the implementation of the following: a) developing/strengthening of enabling policy, legislation, and regulation for health and b) technical assistance and capacity building for staff of relevant health institutions.

2) Support the establishment of structures required for project implementation and coordination.

3. 2 PROJECT LOCATION

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 site for the Medical College is sandwiched between Sokoto State University, along the Sokoto-Jega Highway and the Sokoto State University Teaching Hospital. The geographical area is in Kasarawa District of Wammako Local Government Area. The proposed project site is bounded by the following geographic coordinates: $12^0$57’ 09.98”N, $5^0$11’50.38”E; $12^0$57’ 09.70”N, $5^0$11’56.03”E; $12^0$57’ 05.90”N, $5^0$11’49.49”E; and $12^0$57’ 05.65”N, $5^0$11’55.14”E.. The topography of the area is generally flat with few undulations.

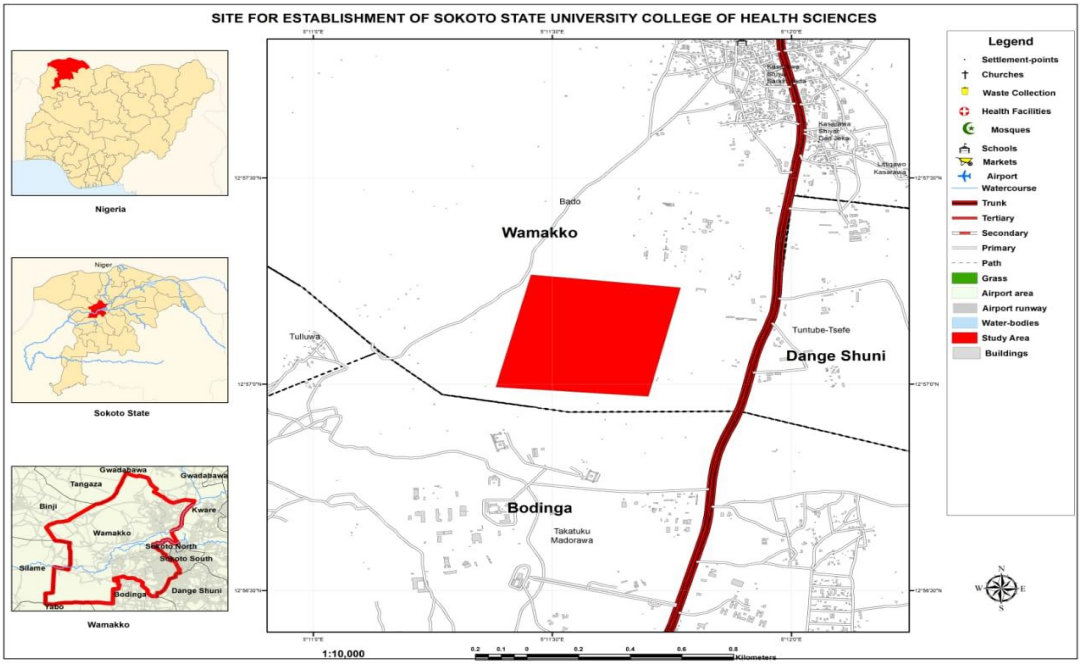


Figure 3. 1: Map of the project site (inset: maps of Nigeria, Sokoto and Wamako)

Plate 3. 1: Proposed site for the Medical College

Plate 3. 2: Showing Sokoto State University School Gate

3.2.1 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 site for the Medical School and all areas located not more than 1km 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 LGA.

3.2.3 The project's Extended Area of influence

The project's extended area of influence includes the entire LGAs located within the metropolitan area of Sokoto Town.

3.3 SCOPE OF WORKS

The Project has four broad components:

3.3.1 Establishment of College of Medical Science in Sokoto State University

This includes activities such as: a) identifying, developing and upgrading infrastructure for the Medical school. The Medical school will have different colleges under it like medicine, pharmacy, medical Lab. among others. The school would offer associated services like specialized health care, research, and other allied services.

3.3.2 Equipping the Teaching Hospital and three (3) Premier Hospitals, and College of Medical Science

This includes activities to Support the College of Medical Sciences with equipment as well as the Teaching Hospital and 3 Premier Hospitals, which provide needed health services, teaching for both undergraduates and postgraduates as well as research and development. The needed equipment include: MRI, CT scan, Ventilators, Ultra-Sound machines, Chemical Analysis equipment, Blood transfusion equipment, X-ray machines etc.

3.3.3 Capacity Building for Human Resource for Health

The Capacity of the recruited staff both Academic and Non-academic will be built for the smooth running of the College of Health Sciences, who will in turn support capacity building (undergraduate training, residency, post basic,) for human resources for health in the state, country, and even to the global level. The capacity to be built by these institutions will be at all levels.

3.3.4 Institutional Capacity Development and Management

This is made up of two sub-components namely:

1) Enabling institutions, policy, regulatory and business environment framework for health through the implementation of the following: a) developing/strengthening of enabling policy, legislation, and regulation for health and b) technical assistance and capacity building for staff of relevant health institutions.

2) Support the establishment of structures required for project implementation and coordination.

3.4 ACTIVITIES WITHIN PROJECT PHASES

3.4.1 Pre-construction activities

Preconstruction activities for this project broadly include feasibility studies, licensing/permitting and environmental planning as well as building and technical designs and establishment of project implementing unit. The Project will be implemented by the State Ministries of Higher Education, Health, Works, and the State University through a Project Implementation Unit (PIU) to be formed using the AfDB guidelines. The PIU will run the day-to-day activities of the Project.

3.4.2 Construction Phase

The construction phase of the project will witness many activities including developing and upgrading infrastructure for the medical school. The medical school will have different colleges under it like colleges of medicine, pharmacy, medical laboratory, each with its own physical structure and separated from the others.

3.4.2.1 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 land through provision of naturally occurring lateritic material as fill.

3.4.2.2 Building and Civil construction

The building will be one-storeyed, with ground and upper floors. The hospital will have 2000-bed capacity.

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

- Foundations of the blocks of building.
- Stair access, walkways, roofing, siding, and railings.
- Other ancillary facilities include: Administrative building, generator room, canteen, gate-house, car park, drainage and road infrastructures as well as land scaping.

3.4.2.2.1 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 shall 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.

2.4.2.2.2 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.

There will also be constructed a diesel-powered generation station, at the frontage of the building, that will supplement electricity supply from the national grid, as well as installation of solar energy system for lighting and other lighter applications.

Pipe born water will be supplied from the public system operated by the Sokoto State Water Board, which will be supplemented by five motorised borehole stations with water storage tanks.

2.4.2.2.3 Roads and Parking Lots

The Central Park will occupy about 17.5% of the total area of the project site. A road network is required for the movement of motor vehicles, as well as lawns and walkways.

2.4.2.2.4 Firefighting plan

A fire-fighting station will be constructed in between the medical college and teaching hospital. The station will have two fire-trucks in its fleet as well as an assortment of fire-fighting equipment, fire extinguishers and fire hydrant along various sections of the medical college and teaching hospital. In addition, the fire-fighting staff will be guided by a fire-fighting plan to be developed and popularised amongst staff.

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 must be protected and required duration of protection; and
v. To clearly delineate a muster point

2.4.2.3 Procurement of equipment and installation of equipment

The construction phase of the proposed project will also involve the procurement of building accessories and operational equipment to support the College of Health Sciences with Equipment as well as the Teaching Hospital and 3 Premier Hospitals, to be selected in due course, which will improve the needed health services, teaching for both undergraduate and postgraduate students, as well as research and development. The equipment includes one (1) Magnetic Resonance Imaging (MRI) equipment, one (1) Computerized Tomography (CT) scanner, ten (10) Ventilators, eight (8) Ultra-Sound machines, ten (10) chemical analyzers, fifteen (15) blood transfusion and blood banking units, eight (8) X-ray equipment and about thirteen thousand two hundred units of equipment, including morgue units, etc.

2.4.2.4 Capacity Building for Human Resources

The construction phase of the project will witness capacity building for the recruited Academic and Non-academic Staff to ensure the smooth running of the College of Health Sciences. The Academic Staff will in turn train undergraduates as well as residency and post-basic scholars in the state, country, and even at the global level.

2.4.2.5 Institutional Capacity Development, Project Coordination and Management

The last component of the construction phase will entail the following activities:

1) Enabling institutions, policy, regulatory and business environment framework for health through the implementation of the following: a) developing/strengthening of enabling policy, legislation, and regulation for health and b) technical assistance and capacity building for staff of relevant health institutions.

2) Support the establishment of structures required for project implementation and coordination.

3.4.3. Operational Activities

Operational phase of the project will succeed the construction phase and would be characterized by operationalizing the Medical College. Operational activities will include teaching of medical, pharmaceutical and laboratory procedures to the students at the college as well as conducting research and development activities, at both the undergraduate and post-graduate levels. Operational activities will also involve building and infrastructural maintenance as well as maintenance of teaching and laboratory equipment.

3.5 GENERAL

3.5.1 Estimated Project Workforce

In the construction phase, the proposed project will directly employ about fifty (50) skilled professionals as well as about a hundred one hundred (100) unskilled employees; in the operational phase, the Medical School and the Teaching Hospital will create about nine thousand (9000) direct and indirect jobs, which will consequently reduce poverty, hunger youth restiveness, armed banditry and

kidnapping among other social vices in Sokoto. The job projection is beyond the college setting. The projection is that the medical school will create jobs directly by employing the following about two hundred (200) Administrative Staff, about five hundred (500) technicians as well as about two hundred (200) academic staff. Other jobs to be created indirectly like in hospitality sector, bookshops, laundry, transport, and service sectors will amount to about eight thousand (8000).

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.

3.5.2 Land Requirement

The total land requirement for this project is 10.0 hectares for the current proposed development and future possible expansion which will be a subject of another ESMP. The University Teaching Hospital and Medical school will be established within the Sokoto State University. Locating the medical school within the State University will provide important support through its extensive system of legal, regulatory, academic, and other processes and services. Likewise, it will also benefit from the University's existing teaching and learning, research, and library resources.

3.5.3 Expected Waste

In the construction phase waste categories envisaged from the project execution are outlined as follows:

Solid waste: These include felled vegetation/trunks, obsolete equipment and tools, excessive/unused concretes and debris from civil works, hips of sand generated from the earth works, woods from crates, metals, papers, printer cartridges and other office equipment scraped which are due to be removed during site clean-up,

Domestic waste: This comprises of waste generated from the kitchen, packing materials, boxes, plastics, etc.

Liquid waste: These include non-hazardous waste generated from work construction sites e.g. lubes, lubricants, sanitary water, paints etc.

Waste categories expected in the Operational Phase of the project include non-risk or "general" health-care waste, similar to domestic waste, which will come mostly from the administrative and housekeeping functions including waste generated during maintenance of health-care premises. This category of waste shall be dealt with by the municipal waste disposal mechanisms.

The remaining waste category is regarded as hazardous and may create a variety of health risks such as infectious waste which is suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients excreta; pathological waste, comprising of human tissues or fluids e.g. body parts; blood and other body fluids; foetuses; Sharps e.g. needles; infusion sets; scalpels; knives; blades; broken glass; pharmaceutical waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes); genotoxic waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); chemicals waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed, solvents; wastes with high content of heavy metals such as batteries; broken thermometers; blood-pressure gauges, etc; pressurized containers, e.g. gas cylinders; gas cartridges; aerosol cans; and radioactive waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research, contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides.

3.6 DECOMMISSIONING PHASE

The design life of the proposed project is fifty (50) years, depending on proper maintenance and it is therefore unlikely that the project would be decommissioned early. In the future, the project may even be upgraded. 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 full demobilization.

3.7 PROJECT IMPLEMENTATION SCHEDULE

The Gantt chart of Figure 3.2 is self-explanatory and briefly summarizes the project scheduling.

According to the proposed schedule, preconstruction phase of the proposed project will last for 18 months, i.e., from January 2021 to June 2022, culminating with obtaining all relevant permits include building development permit, environmental permit, building design and permit, etc.

The construction phase, which will include physical building construction activities and developing related infrastructure as well as installation of medical, pharmaceutical and laboratory equipment and accessories, is expected to begin in July 2022 and lasts for twelve months, i.e., June 2023.

The operational phase of the project during which teaching, training and research and development as well as healthcare delivery by the project's components will commence as scheduled in July 2023 and to lasts for at least fifty years.

S/N	Activity	Preconstruction Phase	Construction Phase	Operations Phase
		Duration (timeframe)		
		January 2021 - June 2022	July 2022-June 2023	June 2023-July 2073
1.	Preconstruction activities, including site acquisition, building and process designs, permits/approvals including this ESIA			
2.	Construction of buildings and associated structures at the site for the Medical College and Capacity-building training for human resources and institutions			
3.	Installation medical, pharmaceutical and laboratory equipment and accessories as well as test-running at the Medical College, State University Teaching Hospital and the 3 Premier Hospitals			
4.	Demobilization from construction site			
5.	Operations and periodic maintenance			

Figure 3. 2: Gant chart for the schedule of the proposed project

CHAPTER FOUR: DESCRIPTION OF EXISTING PROJECT ENVIRONMENT

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.

4.1 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 out from the 20th to 25th of September 2021. The specific objectives of the field work were to:

- Determine the ambient air quality and noise level characteristics of the study area;
- Determine the physio-chemical and microbiological characteristics of the soil within the study area;
- Determine the physico-chemical and microbiological characteristics of water resources of the study area;
- Determine the vegetation characteristics of the area; and
- Establish the socio-economic and health baseline of the project area.

4.1.1 Soils Sampling

Surface soil was investigated through visual observation and sampling. Composite soil samples were obtained from designated sampling points in ten (10) locations on the project site. 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 polythene bags that were then appropriately labeled and sealed.

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 later transferred to the refrigerator at 4^0C. Physico-chemical analysis of soil samples were carried out using the analytical methods recommended by defunct FEPA.

4.1.2 Soil Organisms

Tulgren and Floatation methods were used for the extraction of soil organisms. Surface soil macroscopic organisms from 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).

4.1.3 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 from a well on the proposed site. For other physiochemical analysis, duplicate water samples were collected from the well 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 Lab Annal Concept, Elelewo District, Port Harcourt, Rivers State, for analysis within 24 hours. This was because the consultant engaged is not aware of the existence of any FMEnv-accredited laboratory in Sokoto State.

4.1.4 Microbiological Studies

Groundwater samples from a well near the site for the proposed project were collected in 100ml plastic containers covered with aluminum foil and kept in ice-cool container prior to culturing in the laboratory and sent for microbiological studies. 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.

4.1.5 Air Quality and Noise Level Studies

The air pollutants that are of greatest concern to the proposed project are Sulphur Oxides (SOx), Nitrogen Oxides (NOx), Particulate Matter (PM), Hydrocarbon (HC) gases, Volatile Organic Compounds (VOCs), Carbondioxide and Carbon Monoxide (CO). Air quality and noise level characteristics were monitored in seven (7) locations on the proposed site for the project.

Plates 4.1 depicts soil sampling and air quality/noise level measurements at the proposed project site.

Plate 4. 1: **Soil Sampling and Air quality /Noise level measurements**

4.1.6 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.

4.1.7 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 diverse and fairly evenly distributed points;

- 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 not later than one day of collection; and
- All samples were properly analyzed in line with required methods and standards.

4.1.8 Analytical Methods

Samples collected from the field were analysed in Lab Annal Concept, Elelewo District, an FMEnv Accredited laboratory located in Port Harcourt, Rivers State, Nigeria. The methods presented in Table 4.1 were employed in the samples analyses**.** Also shown on the table are the equipment detection limits for the different parameters analyzed.

Table 4. 1: Sample analysis methods used

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

4.1.9 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.

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.

4.1.6.7 Methods used in Collecting the Baseline Samples

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

Fauna (Wildlife): Direct observations and informal interviews

4.1.10 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.

4.1.11 Spatial boundary for the socio-economic studies

A simplified spatial boundary considered for the socio-economic studies in this ESMP 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.

4.2 BASELINE CHARACTERISTICS OF THE PROJECT AREA

4.2.1 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 is low and erratic, lasting for about 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 temperatures. The area is also characterized by Sudan Savannah type of vegetation dominated by short grasses interspaced by short woody trees and shrubs.

4.2.2 Rainfall/Relative Humidity

Much of the rain in Sokoto State falls between June and September. 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 southern part of the state; 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 4.2 and 4.3 below:

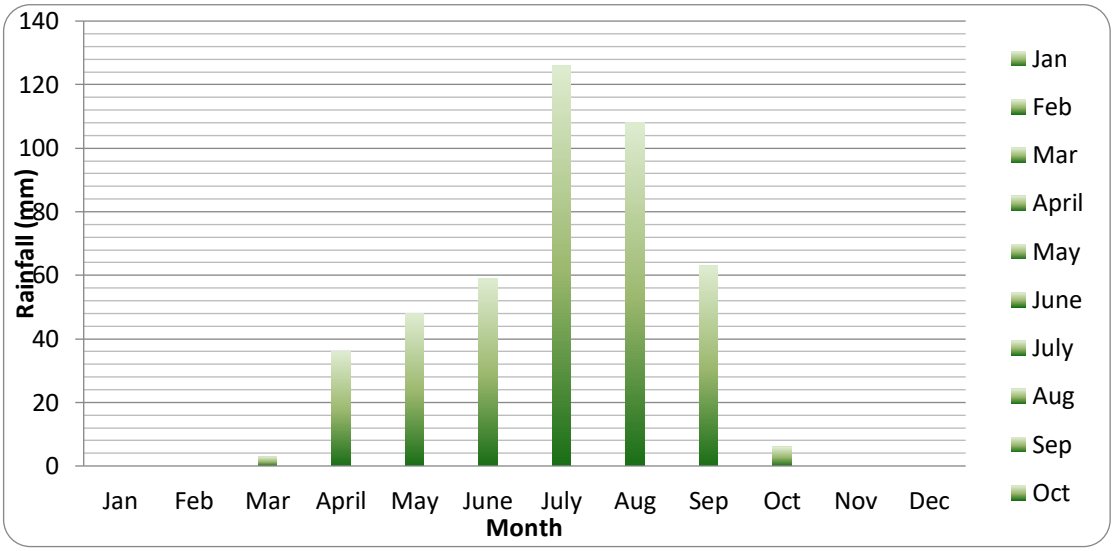


Figure 4. 1: Twenty-Year Monthly Rainfall within Sokoto State (NIMET, 2021)

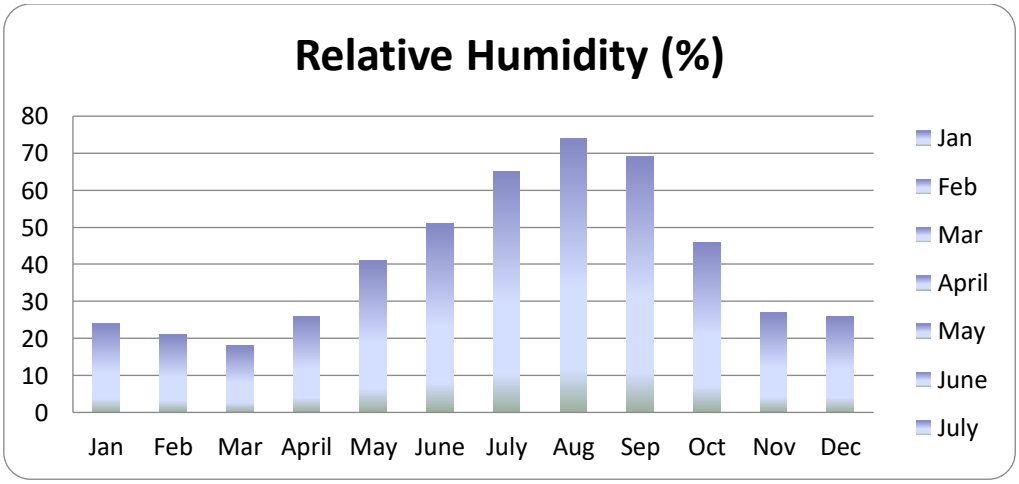


Figure 4. 2: Twenty-Year Monthly Relative Humidity within Sokoto State (NIMET, 2021)

4.2.3 Temperature

Sokoto is characterized by two extreme temperatures related 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°C – 45.2°C obtained in the study during the sampling agree with the climatic data (Figure 3.3).

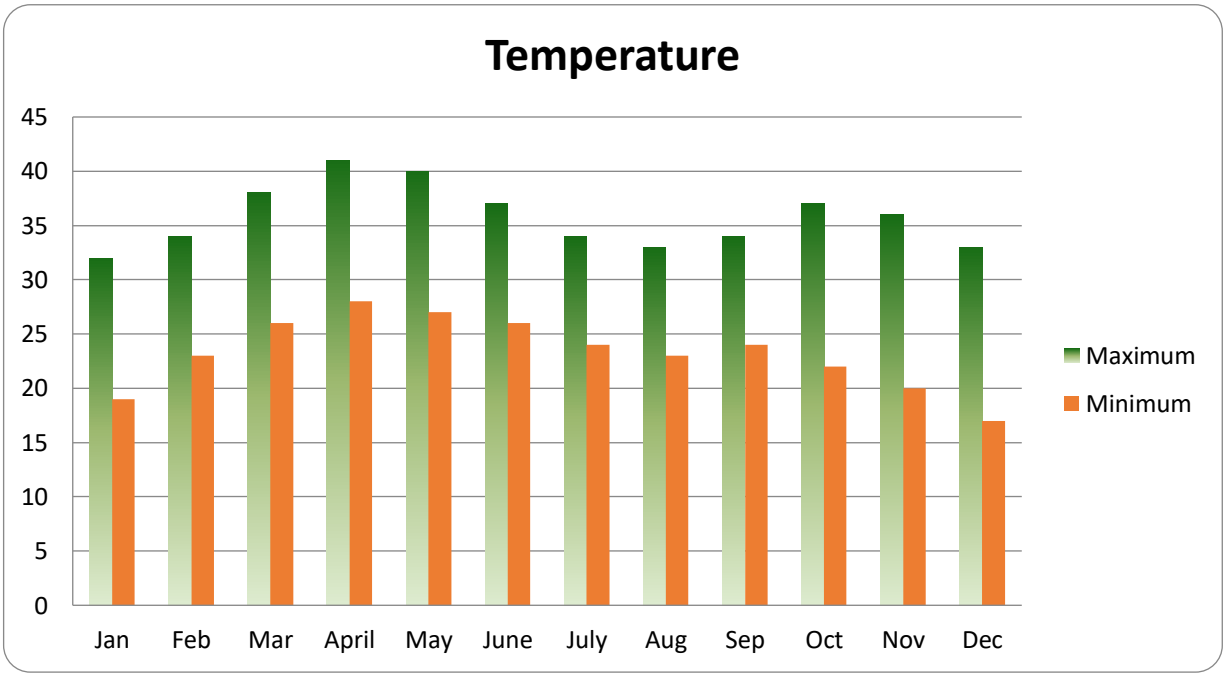


Figure 4. 3: 20-Year Air Temperature Distribution in the Area (NIMET, 2021)

4.2.4 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.

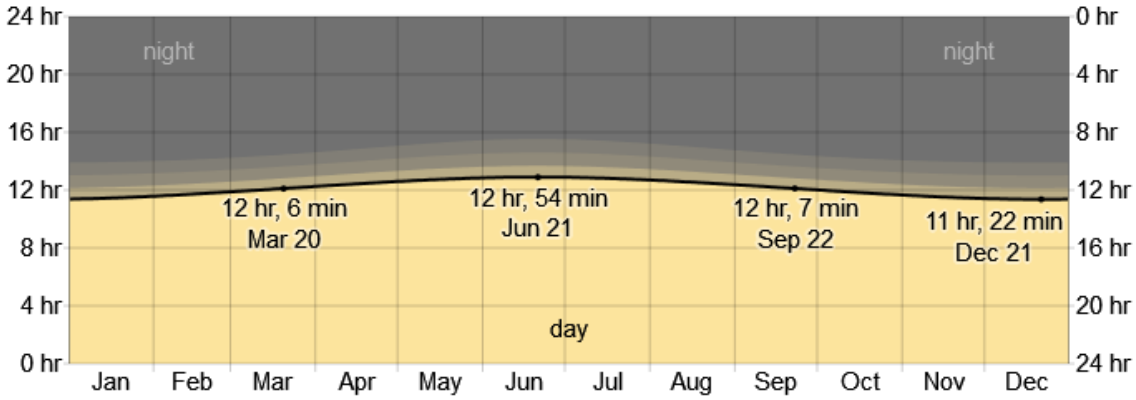


Figure 4. 4: **20-Year Sunshine Distribution in the Area (NIMET, 2021)**

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.

4.2.5 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 consists of clays and shales, while the Kalambaina Formation, which overlies the former, consists 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).

4.2.6 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.

4.2.7 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 groundwater.

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 groundwater.

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 groundwater.

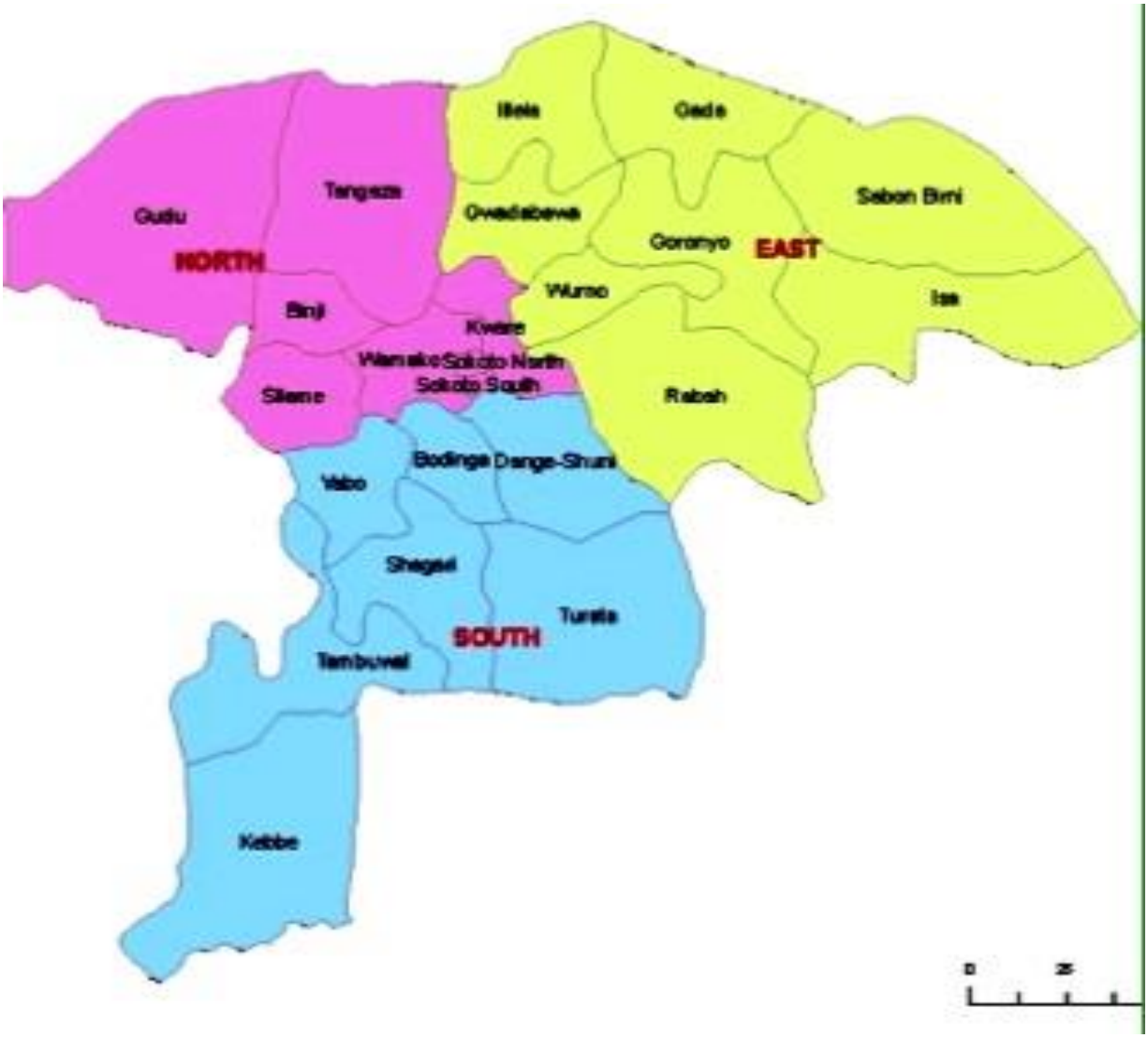


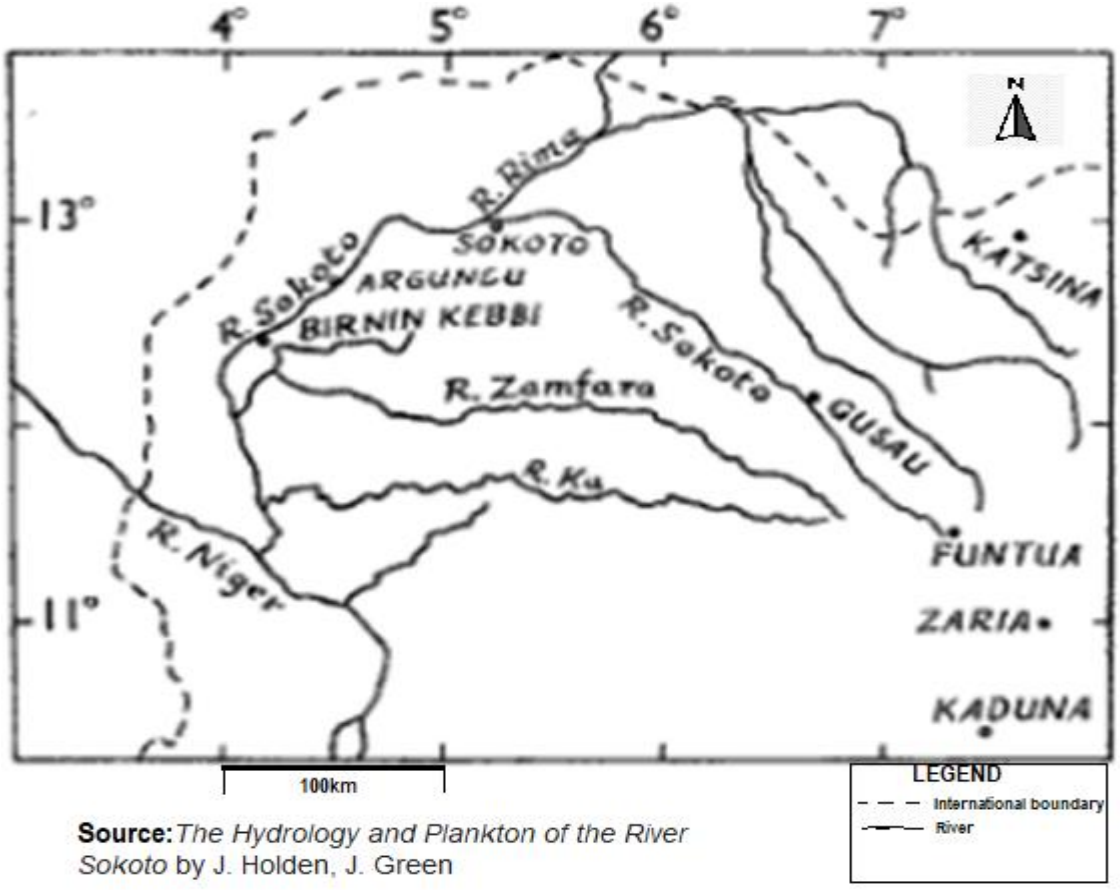
Figure 4. 5: Map of Sokoto State showing different zones and local governments

4.2.8 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.



Source: *The Hydrology and Plankton of the River Sokoto* by J. Holden, J. Green

Figure 4. 6: Hydrology of Sokoto State

4.2.9 Soil

Physicochemical Characteristics

Soil samples of the proposed project sites were collected from the study area. Ten (10) samples were collected on the proposed site. The soil samples were collected from two depth levels: 0 – 15cm, and 15 – 30cm. The result from analyses is summarized in Table 4.3, while Table 4.2 below summarizes the analytical methods used for the analysis.

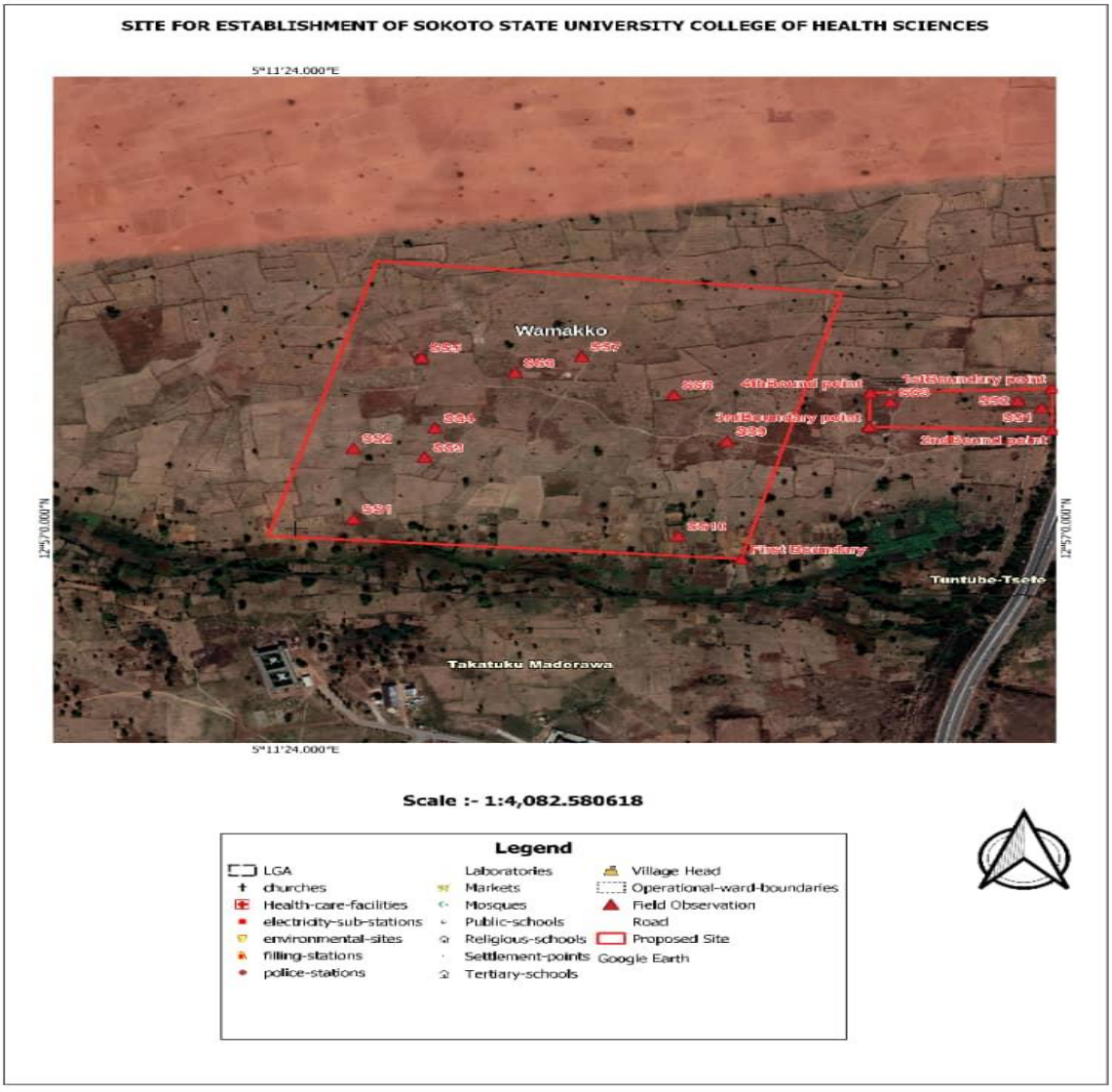


Figure 4. 7: Satellite image of the soil sampling locations

Table 4. 2: **Physico-Chemical and Microbiological Result of Soil Samples**

Parameters	Current Study, 2021						Fertilizer Blending Plant Project EIA, 2021		FMEnv Standard
	0-0.15m			0.15-0.30m			0-0.15m	0.15-0.30m	
	min	max	mean	min	max	mean	mean	mean	
pH	7.01	8.14	7.54	6.17	7.81	7.05	8.1	8.25	
TOC, %	0.04	1.16	0.78	0.10	1.52	0.62	NA	NA	NA
THC, mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA	NA
SO_4, mg/kg	0.12	4.13	2.56	0.21	3.31	2.58	97.5	98.55	500
NH3, mg/kg	0.01	0.18	0.07	0.01	0.57	0.16	NA	NA	NA
% Sand	29.80	93.40	68.67	48.30	92.30	76.06	10.36	14.195	NA
% Silt	5.00	44.30	15.33	2.60	19.00	10.32	53.89	44.77	NA
% Clay	1.60	25.90	13.00	5.10	46.60	13.62	35.73	41.11	NA
Ca (mg/kg)	11.15	17.11	13.18	11.01	16.41	13.31	3.65	3.91	NA
Mg (mg/kg)	12.10	15.11	12.70	12.11	14.92	13.03	5.73	5.17	NA
Na (mg/kg)	10.14	18.51	13.56	10.17	24.52	17.14	NA	NA	NA
K (mg/kg)	8.93	28.53	16.09	10.15	18.35	13.41	NA	NA	NA
Cu (mg/kg)	1.02	2.48	1.45	1.04	2.26	1.66	1.11	1.17	NA
Pb (mg/kg)	0.37	1.75	0.96	0.44	1.57	1.31	0.018	0.27	<1
Fe (mg/kg)	18.67	24.88	20.86	18.19	27.77	21.47	6.59	2.31	NA
Ni (mg/kg)	5.24	11.69	7.97	5.24	8.58	7.69	0.015	0.02	NA
Cr (mg/kg)	0.06	0.57	0.14	0.07	0.47	0.18	NA	NA	NA

Cd (mg/kg)	0.04	0.46	0.10	0.04	0.55	0.11	0.15	0.05	NA
Zn (mg/kg)	1.23	8.37	3.39	3.17	5.54	4.38	2.62	2.67	NA
HUB ($CFU/gx10^4$)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	NA
HUF ($CFU/gx10^3$)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	NA
THB ($CFU/gx10^4$)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	NA
THB ($CFU/gx10^3$)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	NA
E. Coli	Nil	3.46	1.67	Nil	3.03	1.28	Nil	Nil	NA

NA: Not Applicable; Source: Fieldwork, 2021

4.2.10 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.

The pH of the soil sampled was generally varying from basic to moderately acidic. It ranged from 7.01 to 8.14 with a mean value of 7.54 at the topsoil and between 6.17 and 7.81 with a mean value of 7.05 at subsoil. All obtained values compared well with values from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.2.11 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 area. Hence, the return of organic matter to the soil is poor. Total organic carbon content in the soil was generally low. The result indicates that the soil had a mean total organic content of 0.78% and 0.62% in top and subsoil respectively.

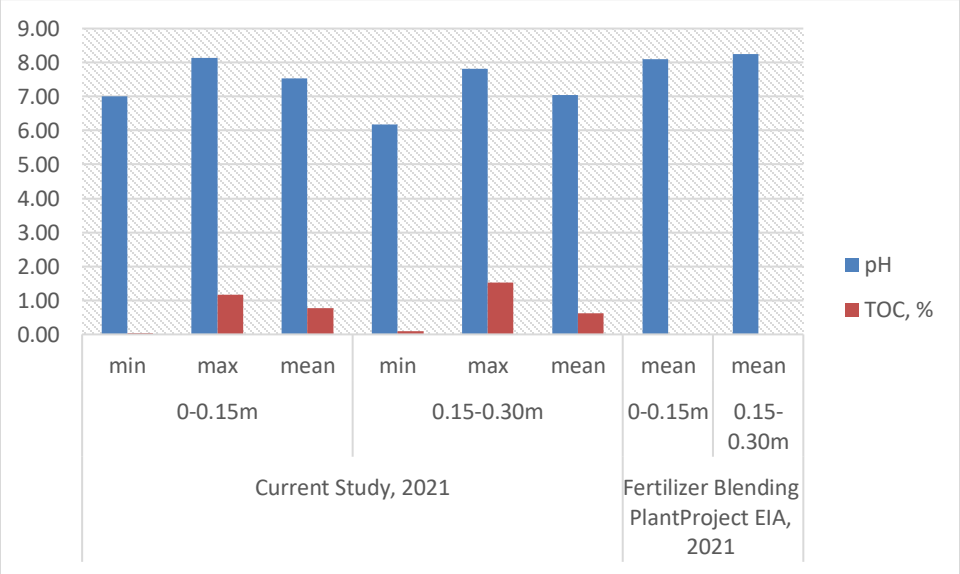


Figure 4. 8: pH and Total Organic Carbon in Soil.

Source: Fieldwork, 2021

4.2.12 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 break down 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 hydrocarbon decomposition. Industrial processes and man-induced activities often result in the increased loading of hydrocarbons in soil. The natural ability of the soil to decompose the hydrocarbons become overwhelmed.

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

4.2.13 Particle-size distributions (PSDs)

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 68.67% sand, 15.33% silt and 13.00% clay were recorded for topsoil and 76.06% sand, 10.32% silt and 13.62% clay for sub soil at the study area. These findings did not corroborate the previous study as the soil was silty (Fertilizer Blending Plant Project EIA, 2021).

4.2.14 Sulphate

At the study area, sulphate values were low with values ranging from 0.12 to 4.13mg/kg (mean= 2.56mg/kg) and from 0.21 to 3.31mg/kg (mean=2.58 mg/kg) respectively for top and sub soil. The values were lower than those obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.2.15 Ammonia:

Ammonia values were low, ranging from 0.01 to 0.18mg/kg (mean=0.07mg/kg) and from 0.01 to 0.57mg/kg (mean=0.16mg/kg) respectively for top and sub soil.

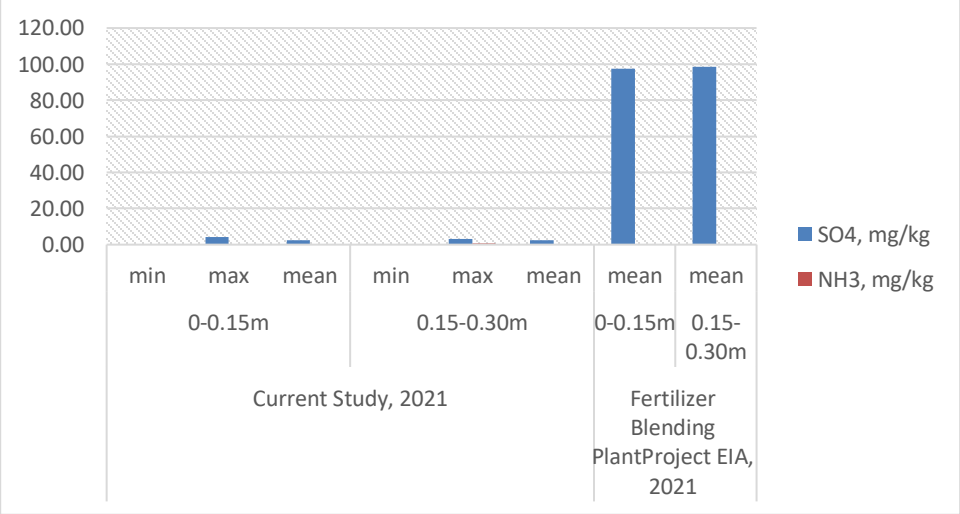


Figure 4. 9: **Sulphate and Ammonia in Soil. Source: Fieldwork, 2021**

4.2.16 Exchangeable Bases

The exchangeable bases of the soil measured were Na, K, Ca and Mg. In all, sodium dominated the exchange site. Two factors that 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.

The mean values of Na, K, Ca and Mg in the topsoil were 13.56mg/kg, 16.09mg/kg, 13.18mg/kg and 12.70mg/kg respectively. In sub soil, these values were 17.14mg/kg, 13.41mg/kg, 13.31mg/kg and 13.03mg/kg respectively.

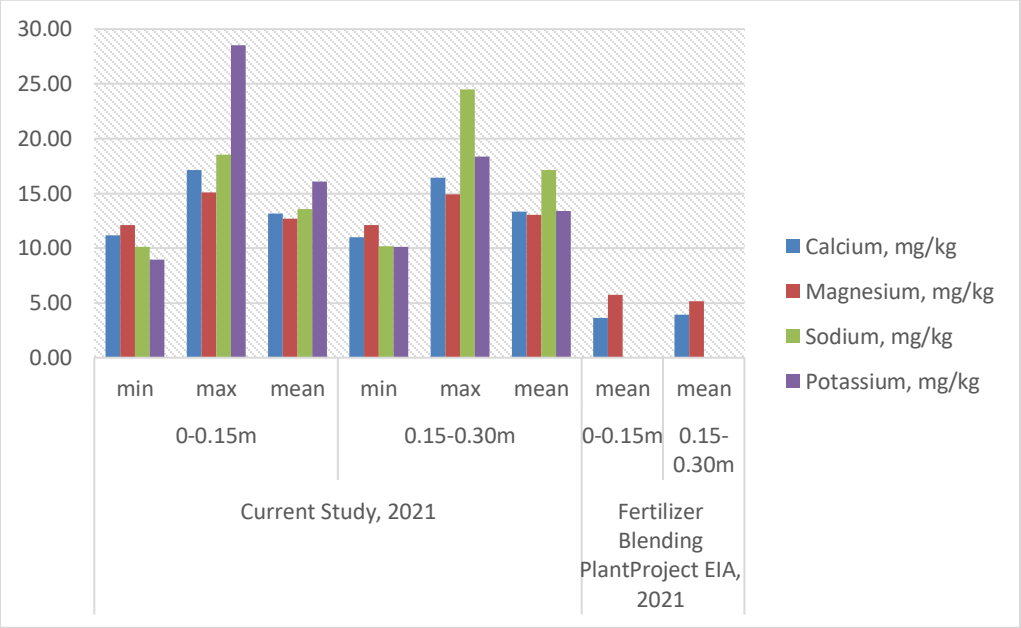


Figure 4. 10: Exchangeable Bases. Source: Fieldwork, 2021

4.2.17 Heavy Metals

Human activities have dramatically changed the composition and organization of soils. Industrial and urban wastes, agricultural applications and mining activities have resulted in an increased concentration of heavy metals in soils. Soils normally contain low 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). Soil investigation involved sampling of soil (0-15cm and 15-30cm depth) at the designated stations on the proposed site.

Values obtained were 1.02-2.48mg/kg (top soil) and 1.04-2.26mg/kg (sub soil) for Cu; 0.37-1.75mg/kg (top soil) and 0.44-1.57mg/kg (sub soil) for Pb; 18.67-24.88mg/kg (top soil) and 18.19-27.77mg/kg (sub soil) for Fe; 5.24-11.69mg/kg (top soil) and 5.24-8.58mg/kg (sub soil) for Ni; 0.06-0.57mg/kg (topsoil) and 0.07-0.47mg/kg (subsoil) for Cr; 0.04-0.46mg/kg (top

soil) and 0.04-0.55mg/kg (sub soil) for Cd; and 1.23-8.37mg/kg (top soil) and 3.17-5.54mg/kg (sub soil) for Zn. Values were within the range of those obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

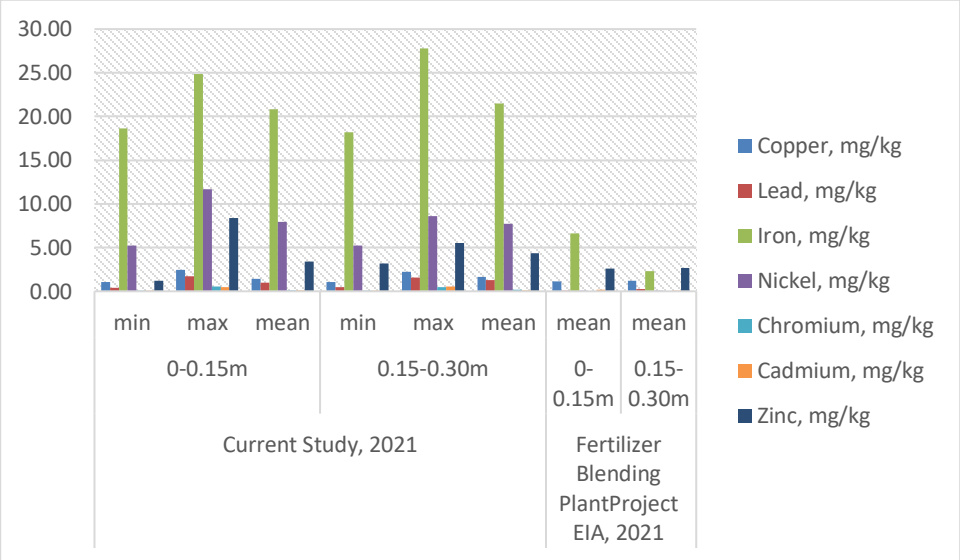


Figure 4. 11: Soil Heavy Metals (Source: Fieldwork, 2021)

4.3 WATER ANALYSIS

The result from analyses of groundwater collected from the proposed project's site is summarized in Table 3.3.

Table 4. 3: Physico-Chemical and Microbiological Characteristics of Groundwater from the Site

Parameters	**Value**	**Fertilizer Blending Plant Project EIA, 2021**	**FMEnv. Standard**
pH	7.8	7.7	6-9
Temperature (^{0}c)	29.18	28.55	<40
Conductivity (µs/cm)	155	252	1000
TDS (mg/l)	142	84	2000

Parameters	Value	Fertilizer Blending Plant Project EIA, 2021	FMEnv. Standard
DO (mg/l)	5.17	8.29	2-8
TSS (mg/l)	2.41	0.00555	30
Turbidity NTU)	5.15	0.65	5
BOD (mg/l)	2.451	21.2	7.5
COD (mg/l)	5.161	106.45	30
Hydrocarbons			
THC (mg/l)	<0.001	NA	NA
Nutrient			
Nitrate (mg/l)	1.37	4.625	<1
Sulphate (mg/l)	55.01	11.745	500
Ammonium (mg/l)	<0.01	0.0045	10
Phosphate (mg/l)	2.41	0.112	5
Heavy Metals			
Nickel (mg/l)	<0.001	0.05	<1
Iron (mg/l)	1.015	0.82	1.5
Lead (mg/l)	<0.001	0.0055	<1
Copper (mg/l)	<0.001	0.1705	<1

Parameters	Value	Fertilizer Blending Plant Project EIA, 2021	FMEnv. Standard
Chromium (mg/l)	<0.001	<0.001	<1
Zinc (mg/l)	<0.001	1.562	3
Cadmium (mg/l)	<0.001	0.0455	<1
Barium (mg/l)	<0.001	NA	NA
Cobalt (mg/l)	<0.001	NA	NA
Arsenic (mg/l)	<0.001	NA	NA
Mercury (mg/l)	<0.001	NA	NA
Cations			
Potassium (mg/l)	5.003	NA	NA
Sodium (mg/l)	3.215	NA	NA
Magnesium (mg/l)	3.012	119.84	NA
Calcium (mg/l)	3.022	308.16	NA
Microbiology			
Coliforms	3	6.6	<1
E. coli	Absent	NA	absent
Faecal streptacocci	Absent	NA	absent
Staphylococococci aureus	Absent	NA	absent

Source: Field work, 2021. NA: Not Applicable

4.3.1 Physicochemical Characteristics of Groundwater

pH value was 7.80 for the groundwater samples collected within the study area. These values are tending towards alkalinity and are within the stipulated limits by FMENV. Conductivity and TDS values were 155.0µS/cm and 142.0mg/l respectively. These values complied well with stipulated limits by FMENV. The value recorded for Total Suspended Solids was 2.41mg/l while the value recorded for turbidity was 5.15NTU in the groundwater 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).

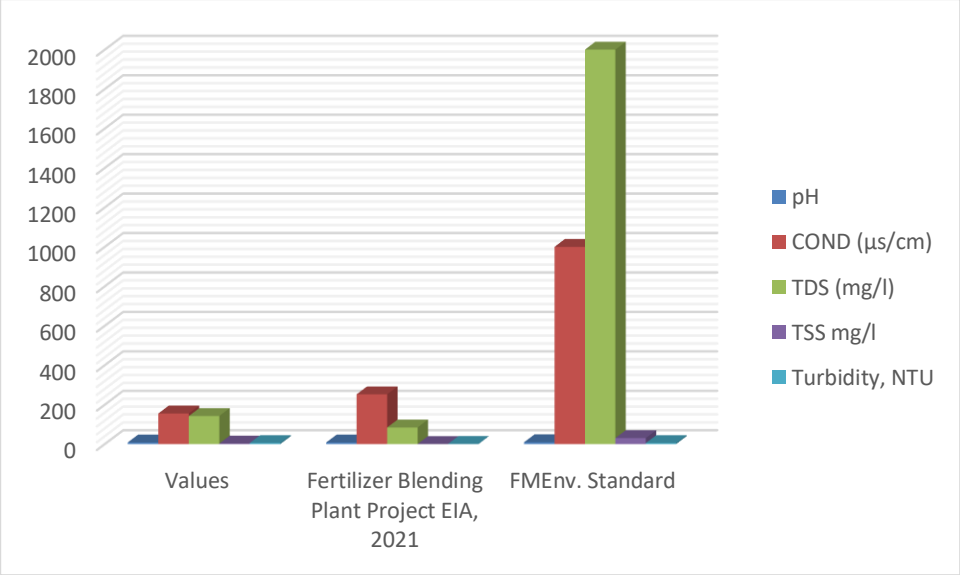


Figure 4. 12: pH, Conductivity, Total Dissolved Solids, Total Suspended Solids and Turbidity Levels in Ground water.

Source: Fieldwork, 2021

4.3.2 DO, BOD and COD

The Dissolved Oxygen, Biological Oxygen Demand and Chemical Oxygen Demand values obtained in samples collected from the study area were 5.17mg/l, 2.45mg/l and 5.16mg/l respectively. These values complied well with stipulated limits by FMENV and were lower than the range of values obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

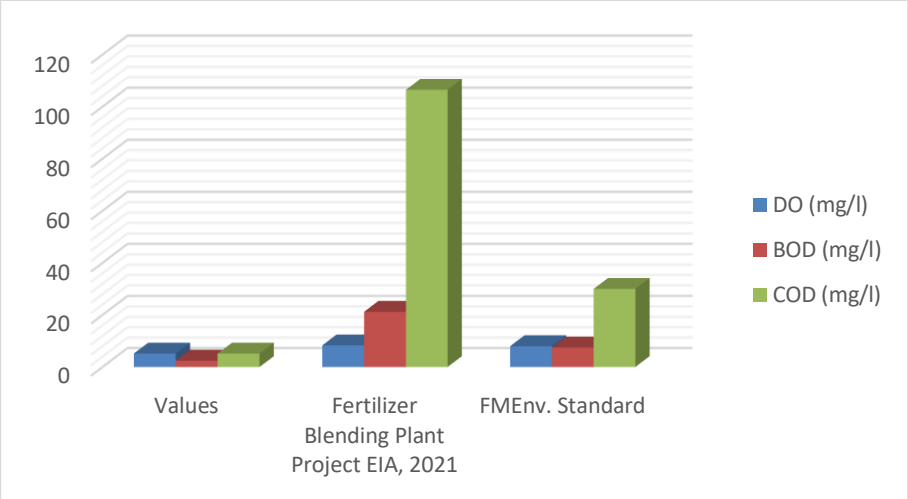


Figure 4. 13: **DO, BOD and COD Levels in Ground water. Source: Fieldwork, 2021**

4.3.3 Total Hydrocarbon Content (THC)

The THC analysed from the ground water samples in the proposed facility areas were below the 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).

4.3.4 Nutrients

From Table 3.4 the concentration of sulphate accounted for the larger part of the nutrient content with a mean value of 55.10mg/l. The order of nutrient concentration present in the samples are Sulphate >Nitrate>Phosphate> Ammonium.

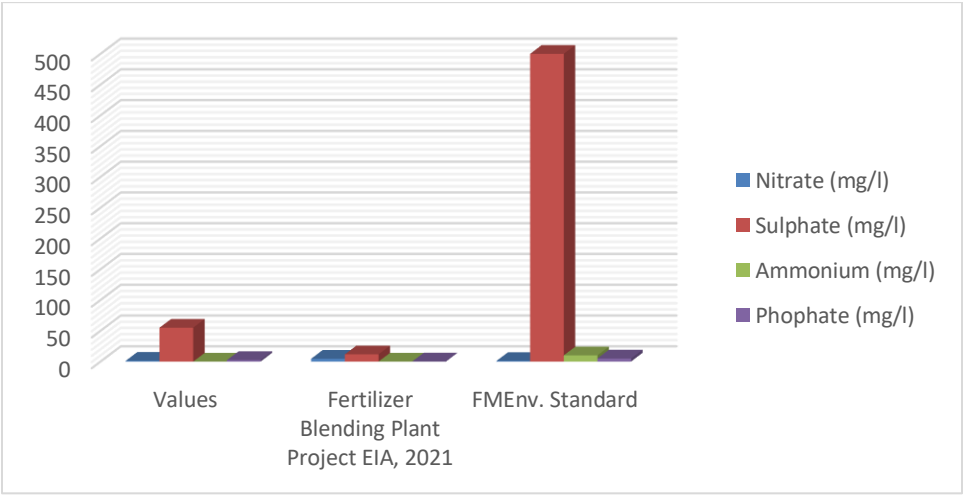


Figure 4. 14: Nutrients Levels in Ground water. Source: Fieldwork, 2021

4.3.5 Cations

From Table 3.4 the concentration of Potassium accounted for the larger part of the cations content with a mean value of 5.003mg/l. The order of cations concentration present in the samples for the facilities are Potassium> Sodium> Calcium >Magnesium.

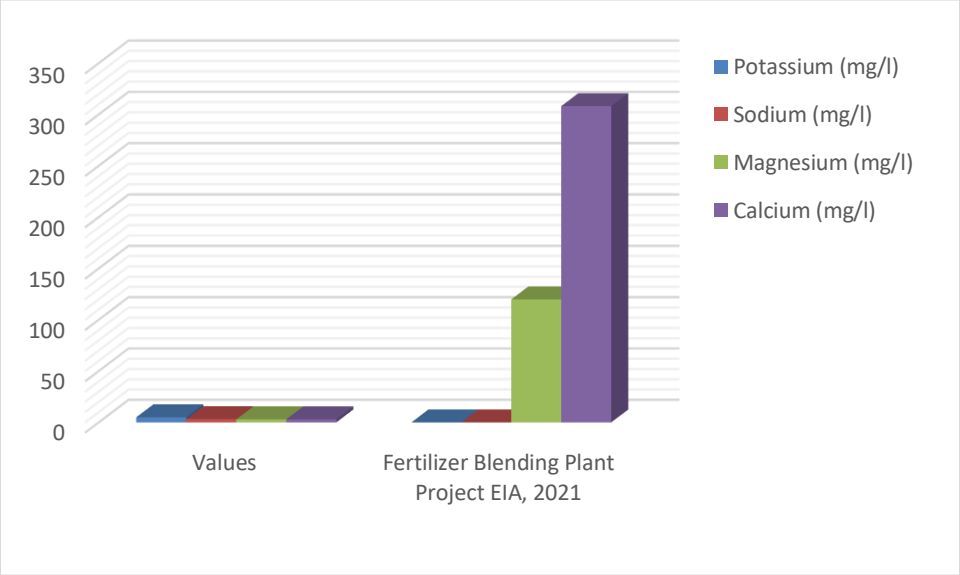


Figure 4. 15: **Cations Levels in Ground water. Source: Fieldwork, 2021**

4.3.6 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 an average concentration of 1.015mg/l in the sample collected. In all, the heavy metals results were below FMEnv limits for heavy metals and were also below values obtained from a previous study (Fertilizer Blending Plant EIA, 2021).

4.3.7 Ground Water Microbiology

Results of microbial counts in groundwater samples collected in the project area are presented in Table 3.4 where values were all below equipment detection limit except for coliforms count, where a count of 3 was obtained.

4.3.8 Air Quality and Climate Studies

Ambient Air Quality and Noise Level

Air generally contains water vapour, gases, and particulate matter in small but very variable quantities (Oguntoyinbo and Derek, 1987). Air pollution is the presence in the atmosphere of one or more contaminants in such quantities, characteristics, duration as to make them actually or potentially injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property.

The mean concentrations of the air pollutants (CO_2, SO_X, SPM, NH_3, VOC, NO_X, CH_4, H_2S) and noise levels were measured at selected sampling stations on the project site. Generally, measurements indicated that, at the time of the study, the ambient air had relatively low concentrations of the measured parameters. The air quality and noise level characteristics of the study area are presented in Table 4.4.

Table 4. 4: Air Quality within the study area

Parameter/unit	**Min**	**Max**	**Mean**	**Control**	**Fertilizer Blending Plant Project EIA, 2021**	**FMEnv Limits (Daily Average) ****
Noise level, d(B) A	42.10	48.10	44.41	41	47.34	90
SO_X, µg/m^3	0.01	0.01	0.01	0.01	0.89	26
NOx, µg/m^3	0.01	0.01	0.01	0.01	NA	75-113
SPM µg/m^3	8.00	17.00	11.86	12	50	250
NH_3, µg/m^3	0.01	0.01	0.01	0.01	0.7	0.13
CH_4 µg/m^3	0.01	0.01	0.01	0.01	NA	0.01

CO µg/m^3	0.01	0.08	0.05	0.015	2.13	11.4
H_2S, µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (^oC)	33.14	36.04	34.92	35.525	NA	NA
Wind Speed (m/s)	0.01	0.07	0.02	0.025	NA	NA
Relative Humidity (%)	32.90	43.80	40.40	43.55	NA	NA

Source: Field work, 2021. NA: Not Applicable

4.3.9 Suspended Particulate Matter

These are finely divided particles (solid and liquid) of 0.01 to over 100 microns in diameter, suspended in ambient air. These particles existing above the tolerable limit in the atmosphere can initiate a variety of respiratory diseases (bronchitis, emphysema and cardiovascular diseases). Also, fine particulates may cause cancer and aggravate morbidity and mortality from respiratory dysfunctions. The SPM levels in the study area ranged from 8.0µg/m^3 to 17.0 µg/m^3 with a mean value of 11.86 µg/m^3, which compared well with the control. Values were also below the regulatory limit of 250µg/m^3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

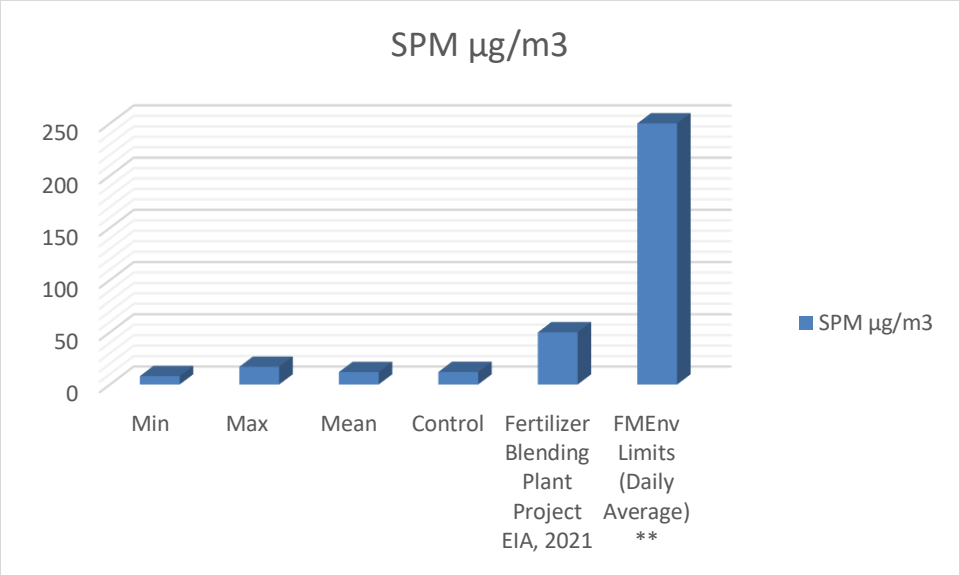


Figure 4. 16: Suspended Particulate Matter in Air. Source: Fieldwork, 2021

4.3.10 Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless and tasteless gas produced by the incomplete combustion of carbonaceous materials or fossil fuels – gas, oil, coal and wood. Adverse health effect has been observed with carbon monoxide concentrations of 12 – 17ppm for 8 hours while prolonged (45 minutes to 3 hours) exposure to concentrations of CO between 200ppm and 800ppm often results in severe headache, dizziness, nausea and convulsions. The recorded level of CO ranged from 0.01µg/m^3 to 0.08µg/m^3 with a mean value of 0.05 µg/m^3 during the sampling period. These obtained values compared well with control readings. Values were also below the regulatory limit of 11.4µg/m^3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

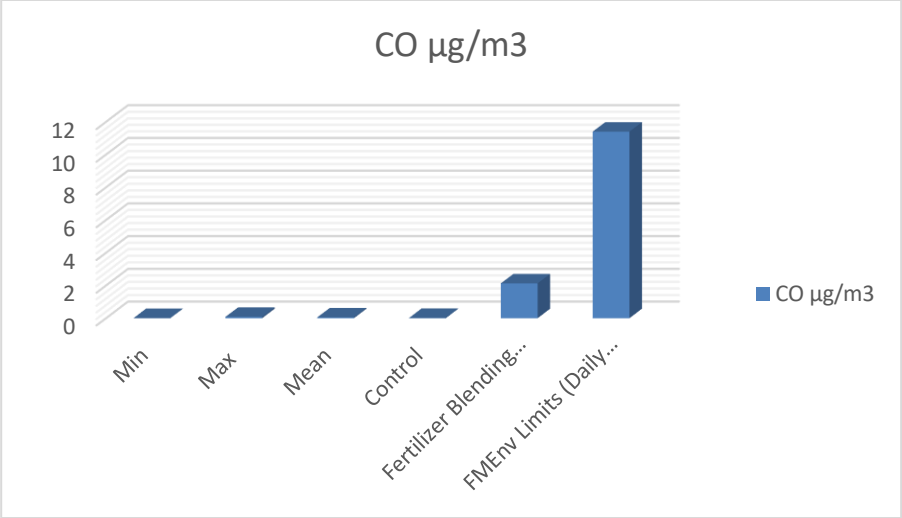


Figure 4. 17: **Carbon Monoxide in Air. Source: Fieldwork, 2021**

4.3.11 Hydrogen Sulphide

Hydrogen sulphide is a chemical compound with the formula H_2S. It is a colourless gas with the characteristic foul odour of rotten eggs; it is heavier than air, very poisonous, corrosive, flammable, and explosive. Hydrogen sulphide often results from the bacterial breakdown of organic matter in the absence of oxygen gas, such as in swamps and sewers; this process is commonly known as anaerobic digestion. H_2S also occurs in volcanic gases, natural gas, and in some sources of well water. It is also present in natural halite type rock salts. Hydrogen sulphide occurs naturally and is also produced by human activities. Just a few breaths of air containing high levels of hydrogen sulphide can cause death. Lower, longer-term exposure can cause eye irritation, headache, and fatigue. It is also produced by human and animal wastes. Bacteria found in the mouth and digestive tract produce hydrogen sulphide during the digestion of food containing vegetable or animal proteins. Hydrogen sulphide can also form from industrial activities, such as food processing, coke ovens, paper mills, tanneries, and petroleum refineries. H_2S on the project site was generally below the detectable level of <0.01µg/m3. This result compared well with values obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.3.12 Sulphur Oxides

Sulphur Oxides (SO_x) are the group formula for oxides of sulphur such as SO and SO_2 which usually occur as both primary and secondary air pollutants. Power plants and other equipment that burn fossil fuels emit this primary pollutant. In addition, biological decay processes and some industrial sources emit H_2S which is oxidized to form the secondary pollutant, SO_2. The combustion of fossil fuels containing sulphur yields SO_2 in direct proportion to the sulphur content of the fuel.

The primary threat of SO_2 to the urban atmosphere may arise not from SO_2 itself but from the changes it undergoes in the atmosphere such as the formation of sulphuric acid (H_2SO_4), a reaction which is catalysed by particulate matter; and the formation of sulphate aerosols. SO_2 can also be absorbed on small particles such as the salts of iron, manganese and vanadium present in the atmosphere and thus enter the alveoli of the lungs. SO_x measured on the proposed site was also generally below the detectable level of <0.01µg/m^3. This result also compared well with values obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

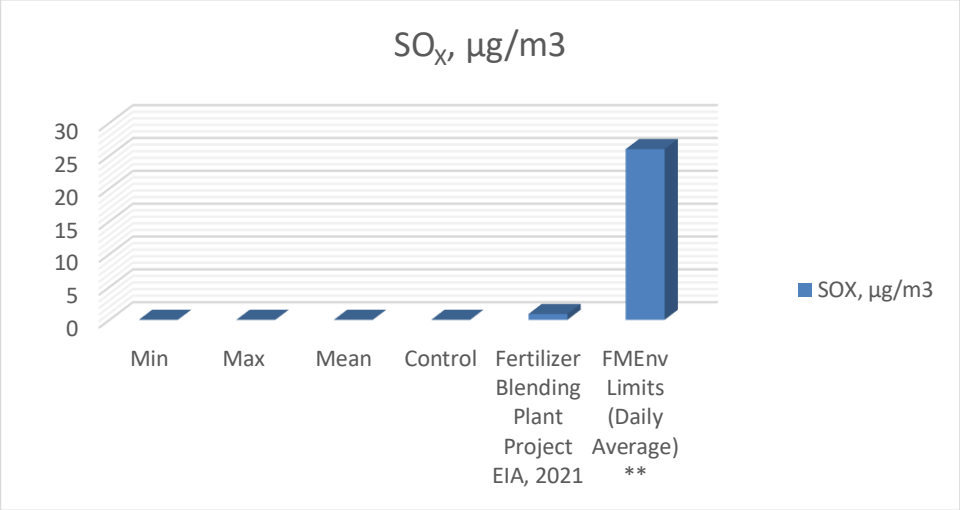


Figure 4. 18: **Sulphur Oxides in Air. Source: Fieldwork, 2021**

4.3.13 Nitrogen Oxides

Nitrogen oxides (NO_x) are the family of highly reactive gases also called oxides of nitrogen, which are formed during combustion processes NO_x is a generic term for the mono-nitrogen oxides NO and NO_2 (nitric oxide and nitrogen dioxide). They are produced from the reaction of

nitrogen and oxygen gases in the air during combustion, especially at high temperatures. In areas of high motor vehicle traffic, such as in large cities, the amount of nitrogen oxides emitted into the atmosphere as can be significant. NO_x gases are formed whenever combustion occurs in the presence of nitrogen – as in an air-breathing engine; they are also produced naturally by lightning. In atmospheric chemistry, the term means the total concentration of NO and NO_2. NO_x gases react to form smog and acid rain as well as being central to the formation of tropospheric ozone. NO_x should not be confused with nitrous oxide (N_2O), which is a greenhouse gas and has many uses as an oxidizer, an anaesthetic, and a food additive. NO_x (reactive, odd nitrogen) is defined as the sum of NO_x plus the compounds produced from the oxidation of NO_x which includes nitric acid.

Nitrogen oxides (NO_x) consist of nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O) and are formed when nitrogen (N_2) combines with oxygen (O_2). Their life spans in the atmosphere range from one to seven days for nitric oxide and nitrogen dioxide, to 170 years for nitrous oxide. Nitric oxide has no colour, odour, or taste and is non-toxic. In the air, it is rapidly oxidized to nitrogen dioxide. Nitrogen dioxide is a reddish-brown gas with a pungent, irritating odour. It absorbs light and leads to the yellow-brown haze sometimes seen hanging over cities. It is one of the important components of smog. Nitrous oxide is a colourless, slightly sweet-smelling, non-toxic gas that occurs naturally in the atmosphere. Man-made nitrous oxide is used as the anaesthetic commonly called "laughing gas". Nitrogen oxides occur naturally and are produced by man's activities. In nature, they are a result of bacterial processes, biological growth and decay, lightning, and forest and grassland fires.

The primary source of man-made nitrogen oxides is the burning of fossil fuels. Of the nitrogen oxides emitted, most are nitric oxide, some are nitrous oxide and less than 10 per cent is nitrogen dioxide. The amount of nitrogen dioxide emitted varies with the temperature of combustion as temperature increases so do the level of nitrogen dioxide. Agriculture also plays a role in nitrogen oxide emissions with the use of fertilizers contributing nitrous oxide to the atmosphere. Concentration of NO_x on the project site was below the detectable level of <0.01µg/m3 and compared well with readings from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.3.14 Methane

Methane is a colourless, odourless gas with a wide distribution in nature. It is the principal component of natural gas. The "firedamp" of coal mines is chiefly methane. Anaerobic bacterial decomposition of plant and animal matter produces marsh gas, which is also methane.

At room temperature, methane is a gas less dense than air. It is not very soluble in water. Methane is combustible, and mixtures of about 5-15% in air are explosive. Methane is not toxic when inhaled, but it can produce suffocation by reducing the concentration of oxygen inhaled.

Methane gas concentration on the proposed site was below the detectable level of $<0.01 \mu g/m^3$ and compared well with values obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.3.15 Ammonia

Ammonia (NH_3), colourless, pungent gas composed of nitrogen and hydrogen. It is the simplest stable compound of these elements and serves as a starting material for the production of many commercially important nitrogen compounds. Ammonia contributes significantly to the nutritional needs of terrestrial organisms by serving as a precursor to food and fertilizers. Although in wide use, ammonia is both caustic and hazardous. Ammonia is found in trace quantities in the atmosphere, being produced from the putrefaction (decay process) of nitrogenous animal and vegetable matter. Ammonia and ammonium salts are also found in small quantities in rainwater, whereas ammonium chloride and ammonium sulphate are found in volcanic districts. In the environment, ammonia is part of the nitrogen cycle and is produced in soil from bacterial processes. Ammonia is also produced naturally from the decomposition of organic matter, including plants, animals and animal wastes.

Most people are exposed to ammonia from inhalation of the gas or vapours. Since ammonia exists naturally and is also present in cleaning products, exposure may occur from these sources. The widespread use of ammonia on farms and in industrial and commercial locations also means that exposure can occur from an accidental release or a deliberate terrorist attack. Ammonia interacts immediately upon contact with available moisture in the skin, eyes, oral cavity, respiratory tract, and particularly mucous surfaces to form the very caustic ammonium hydroxide. Ammonium hydroxide causes the necrosis of tissues through disruption of cell

membrane lipids (saponification) leading to cellular destruction. As cell proteins break down, water is extracted, resulting in an inflammatory response that causes further damage.

NH_3 concentration on the proposed site was below the detectable level of <0.01µg/m3 and compared well with both the control readings and the values obtained from a previous study (Fertilizer Blending Plant Project EIA, 2021).

4.3.16 Noise Level

Noise is a periodic fluctuation of air pressure causing unwanted sound. Apart from causing disturbance to the affairs of man, long term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995). The effects of noise on residents generally relate to the annoyance/nuisance caused by the short- and long-term high noise levels. Noise disturbance to wildlife is significant especially during breeding seasons and/or when rare species are present.

Noise levels are measured in decibels (dB), which have a logarithmic scale. Most legislation and measurements refer to the 'A' frequency weighting, dB(A) which covers the range audible to the human ear. A 10 dB(A) increase typically represents a doubling of loudness. Sound pressure level (SPL) or sound level is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. The commonly used "zero" reference sound pressure in air is 20µPa RMS, which is usually considered the threshold of human hearing (at 1kHz). The regulatory limit for noise provided by the FMENV is specific to the workplace (90dB (A)). WHO Guidelines for Community Noise have been provided in Table 3.6 as a benchmark for noise levels in areas other than the workplace.

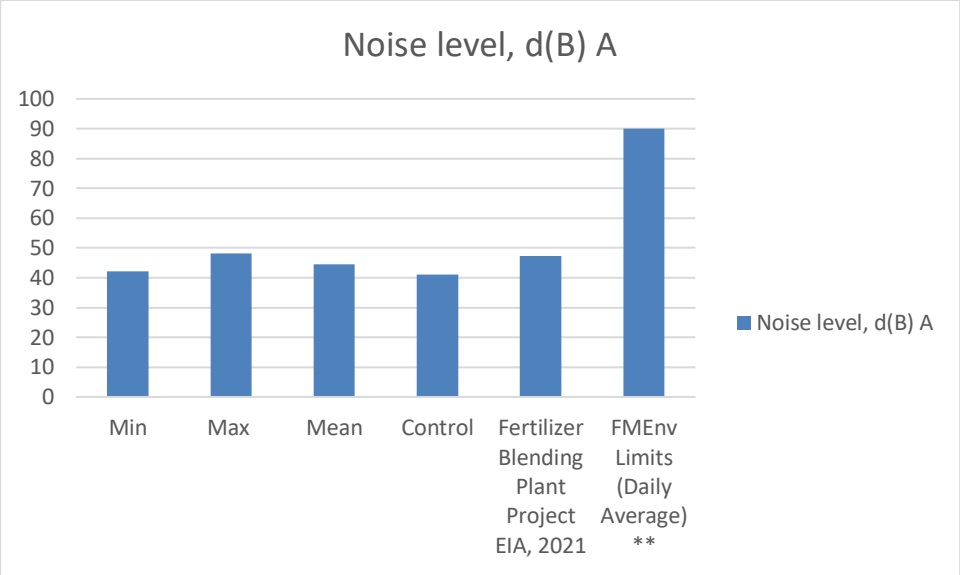


Figure 4. 19: Noise Level in Air. Source: Fieldwork, 2021

Table 4. 5: WHO Guidelines for Community Noise

Specific Environment	**Critical health effect(s)**	**LAeq (dB)**	**Time base (hr)**	**LAmax, fast (dB)**
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance at daytime and evening. Sleep disturbance at night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

School classrooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	During class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	Sleeping time	45
School, playground outdoor	Annoyance (external source)	55	During play	-
Hospitals, ward rooms, indoors	Sleep disturbance at night-time. Sleep disturbance in daytime and evenings.	30 30	8 16	 40
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1	-	-
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (Patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/earphones	Hearing impairment (Free-field value)	85#4	1	110

Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	-	-	140#2 120#2
Outdoors in parkland and conservation areas	Disruption of tranquillity	#3		

#1: as low as possible; #2: peak sound pressure (not LAmax, fast), measured 100mm from the ear.

Noise levels in the study area ranged from 42.1 d(B) to 48.1 d(B) with a mean value of 44.41 d(B) and 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).

4.4 ECOLOGICAL BASELINE

4.4.1 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 fuelwood, 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 4. 2: ***Hyphaene thebiaca stands***

4.4.2 Flora diversity

The plant diversity at the project site was assessed. Their occurrences, abundance, density and importance were recorded in Table 3.6.

Table 4. 6: **Plant species at the site for College of Health Sciences**

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	*Securinega virosa*	Carry me seed	High/na	Euphorbiaceae	Diabetes	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	Fabaceae	Fodder	Tree
11	*Indigofera sp*	Indigos	High/LC	Fabaceae	Fodder	Shrub
12	*Andropogon gayanus*	Gamba grass	High/na	Poaceae	Thatch	Grass

Source: Field Survey (2021)

4.4.3 Aerial Fauna

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, etc., as well as tuber-eating birds such as partridge (bush fowl) were observed in farmlands and less dense vegetation areas.

4.3.4 Terrestrial Fauna

1. Mammals

The mammal occurrence and diversity at the proposed project site and its environment were assessed. To predict the occurrence and diversity of mammals in the project area, existing map of the project site and surrounding community was used. Trapping and opportunistic recording of mammals by our entire field team members, and informal interview of the locals were used. The mammals documented in the area are mostly rats, rabbit and African giant rat.

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

II. Insects

The diversity and occurrence of insects' samples were evaluated at the proposed project site. Conservation status according to the IUCN, CBD, CITES or restricted range endemic (RRE) species status was documented. Where most insects can easily be recognized to order, such as

Hymenoptera (bees, wasps, and ants) or Coleoptera (beetles) were recorded *in situ*. However, insects other than Lepidoptera (butterflies and moths) that were difficult to identify to genus or species were taken to the laboratory for identification using standard keys and monographs. Other information on insect occurrence was obtained through interviews with the locals.

III. Invertebrates

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

IV. 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*), Brooks Gecko (*Hemidactilus brooki*) etc.

4.5 SOCIO-ECONOMIC STUDIES

This section presents the socio-economic studies of the metropolitan districts of Sokoto, Sokoto State. Using six districts as the study area, these include: Gwiwa, Alkammawa, Tudun-Wada, Mabera, Runjin Sambo and Rijiya. The districts covered the 3 Local government areas (Sokoto South, Sokoto North and Wamakko) within Sokoto metropolis.

These areas are predominated by such socio-economic activities as farming, trading, cattle rearing, and civil service.

4.5.1 Population

The six districts serve as a representative sample of the total population of Sokoto North, Sokoto South and Wamakko local government areas of the Metropolis, which is 607379 (as of the 2006 Census).

The current population was obtained by projecting the 2006 population figure, using a conservative average population growth rate of 2.5%.

$P_c = P_0 e^{rt}$

Where Pc is the current population

P_0 was the population in 2006

r is the population growth rate

and t is the number of years in between

Therefore the current population is

$P_c = 607379e^{(0.025*15)}$

$= 607379 \text{ X } e^{0.375} = 883731$

Thus, using the exponential theory of population growth, the current population of the project area, represented by Sokoto North, Sokoto South and Wamakko LGAs is 883, 731 people.

Using Social Sciences Sampling Calculator

The population of the study comprised of both the male and female residents of the 6 districts within the Sokoto metropolis.

Thus, using 5.0 confidence interval, the sample size for Sokoto South = 383. Where Sokoto North = 384. And Wamakko with 383. Therefore, some areas were randomly selected to represent the general population, and the sample size was summed together, and a total of 1150 was represented by 288 respondents.

This means that 288 copies of the socio-economic questionnaire should be administered across the 6 districts.

The special boundary selected for the socio-economic studies comprised of six districts. These include: Gwiwa, Alkammawa, Tudun-Wada, Mabera, Runjin Sambo and Rijiya. This is because the project is meant for the entire people of Sokoto State.

The methodology applied consisted of cluster sampling (where the 3 metropolitan local government areas were divided into smaller segments of districts, and then the six districts were randomly selected to represent the general population of the Sokoto metropolis) to select two hundred and eighty-eight (288) households from the six districts, for administration of the questionnaires. For each household, one copy of the questionnaire was administered. And all the copies of the questionnaires were retrieved. The retrieved copies of the administered questionnaire were then analyzed, and some key conclusions were arrived at.

On the other hand, Focus Group Discussions (FGDs) were also conducted targeting the youth, the elderly and women household heads within the six districts.

The Key Informants for the study included traditional rulers such as Ward Heads and residents of the towns. Six Key Indebt Interviews (KIIs) were conducted with each of the two groups (traditional leaders, and residents of the towns).

4.4.1.1 Ethnic Composition

The socio-economic survey revealed that Sokoto is an accommodative community of people predominantly comprising of Hausa, Fulani. Others include Igbos, Yoruba and Zabarmawa.

The Table 4.7 below presents the ethnic composition of the respondents in the six districts surveyed.

Table 4. 7: Ethnic composition of respondents

District	Tribe	No of respondents	% Composition
Gwiwa	Hausa	30	62.5%
	Fulani	13	27.08%
	Others	5	10.42%
Total		**48**	**100**
Alkammawa	Hausa	38	79.17%
	Fulani	7	14.58%
	Others	3	6.25%
Total		**48**	**100**
Tudun wada	Hausa	40	83.33%
	Fulani	8	16.67%
Total		**48**	**100**
Mabera	Hausa	40	83.33%

	Fulani	6	12.5%
	Others	2	4.17%
Total		**48**	**100**
Runjin Sambo	Hausa	38	79.17%
	Fulani	6	12.5%
	Others	4	8.33%
Total		**48**	**100**
Rijiya	Hausa	34	70.83%
	Fulani	10	29.17%
Total		**48**	**100**

4.4.1.2 Religious Affiliation of Respondents

Table 4.8 below presents the data on religious affiliation of the respondents in the six districts. Out of 109 households in Gwiwa, 91.67% are Muslims, while 8.33% are Christians. 95.83% of the respondents in Alkammawa are Muslims, while 4.17% are Christian. Similarly, the table shows that in T/Wada district the population of Muslims is virtually 100%. Moreover, the findings show that 93.75% of respondents in Mabera district are Muslims, while 6.25% are Christians. Furthermore, the table indicates that 83.33% of households in R/Sambo are Muslims whereas 16.67% are Christians. Lastly, the table revealed that the Muslims have a population of 93.75% in Rijiya district while the Christians constitute 6.25% respectively.

Table 4. 8: Religious composition of respondents

District	Religion	No of respondents	% Composition
Gwiwa	Islam	44	91.67%
	Christianity	4	8.33%
Total		**48**	**100**
Alkammawa	Islam	46	95.83%
	Christianity	2	4.17%
Total		**48**	**100**
Tudun wada	Islam	48	100%
	Christianity	0	0%
Total		**48**	**100**
Mabera	Islam	45	93.75%
	Christianity	3	6.25%
Total		**48**	**100**
Runjin Sambo	Islam	40	83.33%
	Christianity	8	16.67%
Total		**48**	**100**
Rijiya	Islam	45	93.75%
	Christianity	3	6.25%
Total		**48**	**100**

4.4.1.3 Age Profile of respondents

Table 4.9 presents the distribution of age groups of the respondents in the six selected districts of the project area.

The age distribution of respondents in the area shows a predominance of the working-age population comprising people within the age brackets of below 21-30,31-40, 41-50 and 51 and above.

Table 4. 9: Age group distribution of respondents

District	Age group of respondents	No of respondents	Percentage (%)
Gwiwa	Below 21	5	10.42%
	21 – 30	26	54.17%
	31 – 40	10	20.83%
	41 – 50	3	6.25%
	51 and above	4	8.33%
Total		**48**	**100**
Alkammawa	Below 21	0	0%
	21 – 30	27	56.25%
	31 – 40	11	22.92%
	41 – 50	7	14.58%
	51 and above	3	6.25%
Total		**48**	**100**
Tudun Wada	Below 21	0	0%
	21 – 30	17	35.42%

	31 – 40	13	27.08%
	41 – 50	10	20.83%
	51 and above	8	16.67%
Total		**48**	**100**
Mabera	Below 21	3	6.25%
	21 – 30	10	20.83%
	31 – 40	17	35.42%
	41 – 50	17	35.42%
	51 and above	1	2.08%
Total		**48**	**100**
Runjin Sambo	Below 21	1	2.08%
	21 – 30	11	22.92%
	31 – 40	19	39.58%
	41 – 50	9	18.75%
	51 and above	8	16.67%
Total		**48**	**100**
Rijiya	Below 21	3	6.25%
	21 – 30	10	20.83%

	31 – 40	20	41.67%
	41 – 50	8	16.67%
	51 and above	7	14.58%
Total		**48**	**100**

Source: Field survey, October 2020

4.4.1.4 Gender Ratio

Table 4.10 presents the gender distribution of the respondent households in the six districts. Based on the cumulative number of 288 respondents across the six districts, 79.17% of the respondents are male with a population of 228, while 20.83% are female with a population of 60 respondents.

Table 4. 10: Gender distribution of respondents

District	**Gender of respondents**	**No of respondents**	**Percentage (%)**
Gwiwa	Male	38	79.17%
	Female	10	20.83%
Total		**48**	**100**
Alkammawa	Male	36	75%
	Female	12	25%
Total		**48**	**100**
Tudun wada	Male	40	83.33%
	Female	8	16.67%

Total		**48**	**100**
Mabera	Male	37	77.08%
	Female	11	22.92%
Total		**48**	**100**
R/Sambo	Male	38	79.17%
	Female	10	20.83%
Total		**48**	**100**
Rijiya	Male	39	81.25%
	Female	9	18.75%
Total		**48**	**100**

4.4.1.5 Marital status of household heads

Table 4.11 presents the distribution of marital status in the project area. For example, in Gwiwa, District, 38 household heads (about 79.17%) are married, while 6.25%, 6.25% and 8.33%. are respectively single, divorced, and widowed. Rijiya has 77.08% of married respondents and thus, signify the highest percentages of married people in the selected areas.

Table 4. 11: Marital status of respondents

District	Marital status	No of respondents	Percentage (%)
Gwiwa	Married	38	79.17%
	Single	3	6.25%
	Divorced	3	6.25%
	Widowed	4	8.33%
Total		**48**	**100**
Alkammawa	Married	30	62.5%
	Single	18	37.5%
	Divorced	0	0
	Widowed	0	0
Total		**48**	**100**
Tudun wada	Married	28	58.33%
	Single	14	29.17%
	Divorced	0	0
	Widowed	6	12.5%
Total		**48**	**100**
Mabera	Married	29	60.42%

	Single	10	20.83%
	Divorced	2	4.17%
	Widow	7	14.58%
Total		**48**	**100**
R/Sambo	Married	27	56.25%
	Single	17	35.42%
	Divorced	0	0
	Widow	4	8.33%
Total		**48**	**100**
Rijiya	Married	37	77.08%
	Single	11	22.92%
	Divorced	0	0
	Widow	0	0
Total		**48**	**100**

4.4.1.6 Educational backgrounds of household heads

Table 4.12 presents the educational background of the respondents in the project area. In Alkammawa, for example 43.75% of respondents have tertiary level education, while 14.58% have secondary level education and 41.67% have religious education only. The result shows that nobody in Alkammawa district has primary education only.

Table 4. 12: Educational qualifications of respondents

District	**Educational background**	**No of respondents**	**Percentage (%)**
Gwiwa	Religious education	26	54.17%
	Primary level	22	45.83%
	Secondary level	0	0
	Tertiary level	0	0
Total		**48**	**100**
Alkammawa	Religious education	20	41.67%
	Primary level	0	0
	Secondary level	7	14.58%
	Tertiary level	21	43.75%
Total		**48**	**100**
Tudun wada	Religious education	20	41.67%
	Primary level	0	0
	Secondary level	15	31.25%
	Tertiary level	13	27.08%
Total		**48**	**100**
Mabera	Religious education	23	47.92%

	Primary level	0	0
	Secondary level	15	31.25%
	Tertiary level	10	20.83%
Total		**48**	**100**
R/Sambo	Religious education	24	50%
	Primary level	O	0
	Secondary level	9	18.75%
	Tertiary level	15	31.25%
Total		**48**	**100**
Rijiya	Religious education	24	50%
	Primary level	0	0
	Secondary level	12	25%
	Tertiary level	12	25%
Total		**48**	**100**

Plate 4. 3: Government Day Secondary School Wamakko

4.5.2 Social Infrastructure

The quality of life is represented by the availability of basic social infrastructure in an area. Social infrastructure includes housing schemes, good road network, storm water drainage, transportation, electricity supply, security, telecommunication, water supply and proximity of social services such as hospital and recreational facilities, etc.

4.5.2.1 Water Supply

Sokoto South, Sokoto North & Wamakko LGAs are 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 in the rainy season. Many households in the project area, especially those in remote parts, use water from hand-dug wells. Table 3.13 below presents the distribution of domestic water sources used by households in the six districts; however, respondents that use pipe-borne water use other sources because of the erratic nature of the supply.

Table 4. 13: Domestic water sources of respondents

District	Source of domestic water	No. of respondents	Percentage (%)
Gwiwa	Pipe-borne water	15	31.25%
	Bore-hole	13	27.08%
	Well	20	41.67%
Total		**48**	**100**
Alkammawa	Pipe-borne water	10	20.83%
	Bore-hole	12	25%
	Well	26	54.17%
Total		**48**	**100**
Tudun wada	Pipe-borne water	5	10.42%
	Bore-hole	24	50%
	Well	19	39.58%
Total		**48**	**100**
Mabera	Pipe-borne water	8	16.67%
	Bore-hole	28	58.33%
	Well	12	25%
Total		**48**	**100**

Runjin Sambo	Pipe-borne water	7	14.58%
	Bore-hole	27	56.25%
	Well	14	29.17%
Total		**48**	**100**
Rijiya	Pipe-borne water	4	8.33%
	Bore-hole	26	54.17%
	Well	18	37.5%
Total		**48**	**100**

4.5.2.2 Electricity

Electricity in the project area is provided by Kaduna Electricity Distribution Company (KEDCO). However, as in other parts of the country, several reasons have combined to impede a constant supply of electricity in the project area, which led many people in the area to be using private electricity generating sets.

4.5.2.3 Telecommunication

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.

4.5.2.4 Transport

Means of transportation in the project area includes motor vehicles, tricycles, motorcycles, bicycles, animals, such as donkeys and camels, as well as animal-driven carts, especially in the rural areas.

Plate 4. 4: A camel being used as a beast of burden at a farm in the project area

4.5.2.5 Road network

The project area is characterized by a good, tarred road network. However, the very good, tarred road network is more prominent in the town centers.

Plate 4. 5: Typical roads in Wamakko LGA

4.5.3 Security

Sokoto town is relatively secure and free from activities of criminals such as kidnappers and armed robbers. With greater presence of the military and other security agencies and more commitment from the local vigilante groups, the security situation is relatively good.

4.5.3.1 Major criminal activities

Crime rate is generally low in Sokoto South, Sokoto North and Wamakko LGAs; however, cases of drug abuse are alarming.

4.5.3.2 Communal land disputes/litigations

Communal land disputes and land litigations are rare in the project area. This is partly because of the existence of clear land tenure systems and the system of land inheritance under Shari'ah adopted by adherents of Islamic religion in the area. Under the system, when a landowner dies his/her heirs both male and female are entitled to their shares in a given ratio, as specified by the Shari'ah law.

4.5.3.3 Social vices/menace in the project area

To a limited extent, social vices like drug abuse and prostitution take place in some of the districts especially in the hotels, albeit secretly as a result of the Shari'ah legal system being practiced. People in the area normally frown at such vices, which mainly take place in hidden or isolated areas (especially the outskirt areas).

4.5.4 Lifestyles and Values

Sokoto State has banned the sale and drinking of alcoholic beverages in the State, in line with the Shari'ah law practices. Accordingly, alcoholic drinks are not sold legally in the project area. However, a small number of youths in the area abuse drugs and misuse some medicines such as narcotics, cough syrups as intoxicants.

The commonest physical exercise/recreational activity is football game, which normally takes place at the playgrounds of public and private schools.

4.5.5 Markets/heritage sites

The major markets across the study area are the township markets that open daily, such as: Central market (Sabuwar kasuwa) which is a general market for all stuffs; Tsohuwar kasuwa, where provisions, clothes, cosmetics, shoes, and jewelries are sold; Maggi market (kasuwar Dan

kure) where food stuff, meat, fish, fruits and vegetables are mostly found; Kasuwar daji (which is mainly a depot of fruits and vegetables), Kara market (this where animals are sold), Kasuwar Kanawa, where shoes, clothes, bags and accessories are sold; Hajiya Halima central market, where cell phones and other kinds of electronics are sold.

However, Wednesdays and Sundays are designated market days in Kanwuri, Rugga area and Kaura Kimba area all in the study area. These markets attract more traders from neighbouring communities and therefore witness high volumes of transactions.

The Sultan Palace is a major archaeological and historical site. It is a majestic building constructed in 1808 to house the Sultan of Sokoto who the traditional and spiritual leader of all Muslims in Nigeria is. The courtiers and other inhabitants dress in beautiful regalia during religious and cultural festivities and stylishly shower praises on the Sultan.

Another cultural heritage site in the project area is the Surame Cultural landscape located about fourty kilometres (40km) from Sokoto, which was declared an ancient Nigerian National Monument 1964 is also located in Sokoto state. It was built by the first king in the 16th century. The city contained fourteen gates, made up of seven great gates connecting the city to the outside world, and the other seven Sare destroyed, there are a few still standing, including the “Dashe Tree Gate”.

Other tourist destinations of unique aarchaeological features and great historical background in Sokoto are the Usman Dan Fodio Tomb (the tomb of the founder of the Sokoto caliphate), and and Waziri Junaidu History & Culture Museum, which stores reserves, and display many relics and displays the story of the people of the Sokoto region in a unique way through art.

4.5.6 Community Perception and Needs

Following public consultations and meetings with community members in the six districts, community stakeholders raised several issues and concerns which significantly bordered on employment and economic development. The meetings conducted at all locations show that the project communities firmly support the implementation of the proposed project. At each Key Informant Interview (KII) or FGD, residents expressed their desire to be given job opportunities during the construction and operational phases of the project. The communities also expressed the view that since unemployment rate is high in the area and aids the spread of the social vices,

the Project Contractor should give the highest priorities for employment to members of their communities. Furthermore, the communities believe that there will be short and long-term direct and indirect benefits to the local economy through supply of construction materials and services such as accommodation, transport and catering for the construction workers as well as job creation in the operational phase of the proposed project.

The communities are enthusiastic about the proposed project development and consider it a step in the right direction in terms of boosting the health status of the people in the project area as well as its potentials for job creation. Overall, they believe that the project will bring about a significant positive impact on the socio-economy of the area.

Major needs of the communities include improved electricity supply as well as improved healthcare and educational systems that can cope with the increasing population in the towns. Other needs of the communities include improvement of the road network and drainage systems in the area.

As regards the proposed project, the most significant need of the people is provision of employment opportunities to the local people in both the constructional and operational phases of the project.

4.5.7 Land Use Pattern

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

The present land use surrounding the proposed site is a mixture of educational, institutional, and agricultural land uses.

Plate 4. 6: Agricultural land use in the project area

4.5.7.1 Land Ownership Structure

Land ownership in the area include private, family, religious, community and institutional ownerships. Private and family ownerships mainly involve residential and business buildings as well as land parcels owned by individuals and families in the project area. On the other hand, community ownership is for lands and properties commonly used by members of the community, such as: playgrounds, cemeteries, markets, motor parks, town squares, etc. Institutional ownership of land in the area is for lands and properties belonging to Local, State and Federal Governments.

4.5.8 Housing and Settlement Pattern

The six districts in the project area enjoy a predominantly linear settlement pattern with single housing units arranged linearly along streets in the residential areas. However, the villages nearby have dispersed and nucleated settlement patterns. Residential densities range between low to high. However, the high-density areas predominate. A relatively low-density area is the outskirts of Gwiwa district.

Housing types in the project area are both modern and traditional. Along 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. Some of these houses were built of mud but rendered with cement/concrete. The shapes of most houses are rectangular with

rectangular doors of about 2 meters high and 1 meter in width. The doors are mostly metallic and wooden. The heights of the houses are normally 3 to 4 meters, and most roofs are made of zinc.

Toilet systems in the area are mainly water closet (WC) system and pit latrines. The modern houses are invariably use WCs, while the traditional houses use pit latrines.

4.5.9 Waste Management

Most people in the project area dispose of their domestic waste by open dumping. Sometimes they openly burn such waste after gathering it over a long period of time. The residue of the burnt refuse is later moved to farms as manure.

Sewage from some houses is sometimes allowed to flow along the streets. However, SEPA is seriously enforcing compliance with environmental laws.

4.5.10 Occupation

People in the project area are predominantly peasant farmers and livestock keepers. Other occupations practiced include mechanical artisanship, hawking, masonry, civil service, etc. The municipalities of the six districts are mostly characterized by petty trading which involves sale of food stuffs, provisions, clothing etc.

Motorcycles operators popularly called “Kabu-kabu” make money conveying people around the districts and to nearby communities.

Plate 4. 7: Road-side restaurants in District

Results from the occupational survey conducted in Wamakko show that some respondents have multiple streams of incomes.

Plate 4.8: Trading activities along a street in District

4.5.11 Income distribution

Table 4.14 presents the average monthly income distribution of respondent household heads. The monthly income distribution in the project area shows that more than half of the household heads in the six districts surveyed have average monthly income in the lowest income bracket of N10,000 - N40,000. The survey shows that the range of 41,000 and above, is the highest average monthly income group of the residents with 31.25% in Gwiwa, and 50% of same range in Alkammawa area. It is also revealed that some residents live below 10,000 Naira per month in

Mabera and R/Sambo having 50% and 47.92% respectively. Generally, therefore, the findings show that there is a high incidence of poverty in the study area.

Table 4. 14: Income distribution of respondents

District	Average monthly income	No of respondents	Percentage (%)
Gwiwa	Below 10,000	0	0
	10,000 – 20,000	12	25%
	21,000 – 30,000	11	22.92%
	31,000 – 40,000	10	20.83%
	41,000 and above	15	31.25%
Total		**48**	**100**
Alkammawa	Below 10,000	0	0
	11,000 – 20,000	3	6.25%
	21,000 – 30,000	10	20.83%
	31,000 – 40,000	11	22.92%
	41,000 and above	24	50%
Total		**48**	**100**
Tudun wada	Below 10,000	0	
	11,000 – 20,000	4	8.33%
	21,000 – 30,000	12	25%

	31,000 – 40,000	12	25%
	41,000 and above	20	41.67%
Total		**48**	**100**
Mabera	Below 10,000	24	50%
	11,000 – 20,000	0	0
	21,000 – 30,000	12	25%
	31,000 – 40,000	0	0
	41,000 and above	12	25%
Total		**48**	**100**
Runjin sambo	Below 10,000	23	47.92%
	11,000 – 20,000	0	0
	21,000 – 30,000	15	31.25%
	31,000 – 40,000	10	20.83%
	41,000 and above	0	0
Total		**48**	**100**
Rijiya	Below 10,000	20	41.67%
	11,000 – 20,000	13	27.08%
	21,000 – 30,000	13	27.08%

	31,000 – 40,000	2	4.17%
	41,000 and above	0	0
Total		**48**	**100**

4.6 HEALTH ENVIRONMENT

Health baseline data acquisition was carried out to establish a database for subsequent monitoring and evaluation of potential impacts that may result from the project.

4.6.1 Health Services

The survey carried out in the project area shows that respondents make use of four types of healthcare providers in the treatment of ailments. Respondents make use of government hospitals, private clinics, off-the-shelf self-medication and 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 and dispensaries.

The Table 4.15 presents the health care facilities withing the six districts in the study area.

Table 4. 15: Healthcare facilities in the project area

S/N	Study Area/Districts	Health Care Facilities	Owned By
1	**GWIWA**	Gwiwa Primary Health Care	Public
		Gwiwa Community Dispensary	Public
		Kontagora Basic Health Clinic	Public
		Jama'a Clinic	Private
		Ashmed Specialist Clinic	Private
		Sahel Clinic	Private

2	**Alkammawa**	Alkammawa Basic Health Clinic	Public
		Helele Basic Health Clinic	Public
		Assada Dispensary	Public
3	**Tudun Wada**	Alfijir Specialist Hospital	Private
		Marina Clinic	Private
		Tudun-Wada Clinic	Public
		Anas Private Hospital	Private
		Standard Hospital	Private
4	**Mabera**	Devin Health Clinic	Private
		Mabera Mujaya Dispensary	Public
		Freehand Specialist Hospital	Private
		Gidan Dahala Dispensary	Public
		Mabera Public Health Clinic	Public
		Police Clinic	Public
		Saraki Specialist Hospital	Private
		Shepperd Clinic	Private
		Wali Bako Clinic	Private
		Reliance Clinic	Private
5	**Runjin Sambo**	Runjin Sambo Basic Health Clinic	Public

		Noma Hospital	Public
		Sokoto Clinic	Private
6	**Rijiya**	Rijiya Clinic	Public
		Specialist Hospital Sokoto	Public
		Toraro Clinic	Private

Plate 4. 9: Entrance gate of Orthopaedic hospital in Wamakko town

4.6.2 Common Ailments

It was established, through hospital records, administered questionnaires and Focused Group Discussions that the commonest ailments include malaria, typhoid fever, ulcers, cardiovascular diseases, and diabetes. It was also established that certain ailments could be seasonal, environmental and/or occupational. Measles, heat rash and cough were said to be rampant in the hot season. Rheumatism is a major ailment in old adults. Typhoid fever, diarrhea and dysentery

in children that take place occasionally may be linked to unhygienic living environment and polluted water.

4.7 TRADITIONAL ADMINISTRATION

4.7.1 Emirate System of Governance

The emirate system of traditional local administration was practiced in all the predominantly Muslim States of Northern Nigeria. Prior to the colonial invasion, the Emir appointed officials to assist in making his governing task easier. Such a decision by the Emir showed that even with the outright centralization of power in the emirate system, there was still some delegation of power like a democratic system of government. Each official in the Emir's cabinet had a unique role to play. For example: the ***Waziri*** was the Prime Minister and was the closest to the Emir; ***Galadima*** oversaw the capital and oversaw matters that pertained to the capital of the emirate; ***Madawaki*** was the commander of the army.

When an external conflict arose, the Emir summoned the Madawaki through the Waziri. While the Madawaki led the army, ***Dogari*** oversaw the police and the ***Ma'aji*** managed the Treasury department.

Other title holders of the traditional emirate include the three ***Sarkins*** of the emirate who were also quite close to the Emir. ***Sarkin Fada*** saw to the welfare and running of the Palace. The ***Sarkin Pawa*** was the head of the butchers in the emirate. ***Sarkin Ruwa,*** oversaw fishing activities in the emirate. Each one of these officials were sought out when it came to running the activities of the emirate; however, the Emir still had served as the preeminent voice of authority and had the power to relinquish any officer of his position.

The Emirate system due to its landmass and population was further subdivided into districts. These districts were supervised by officials known as ***Hakimis***. The Hakimis were responsible for the collection of taxes and had the power to appoint village heads (***Dagachis***) who made the collection of taxes easier. The emirates also had ***Alkali*** courts, led by Alkali judges. These judges ruled based on the precepts of Shari'ah law and delivered judgment on issues such as marriage, murder, stealing, debt to mention a few. Court cases that were of greater consequence to the emirate were heard in the Emir's palace with the Emir as the judge.

The British employed to great success the Emirate system for its Indirect Rule and because of the centralized power structure of the Emirate, the British Indirect Rule approach quickly prospered.

The project area is within the Sultanate of Sokoto. The Sultan is the head of the Sultanate who has historically been the head of the entire emirates of the Northern Nigeria and the leader of all Muslims in the country. The six (6) districts in the project area, namely, Gwiwa, Alkammawa, Tudun-wada, Mabera, Runjin Sambo and Rijiya are all over headed by Hakimis (District Heads) who are appointed by the Sultan.

In a typical emirate, the Mai Anguwa is the closest to the residents and all disputes and misunderstandings are first reported to him for settlement. The Mai Anguwa reports to the Dagachi (Village Head) or Magaji, who in turn is answerable to the Hakimi (District Head). The District Head reports to the Emir. In terms of information/instructions from the emir to the people, the hierarchy trickles down from the emir to the people in the communities. The traditional hierarchy is schematically depicted in Figure 4.32 below.

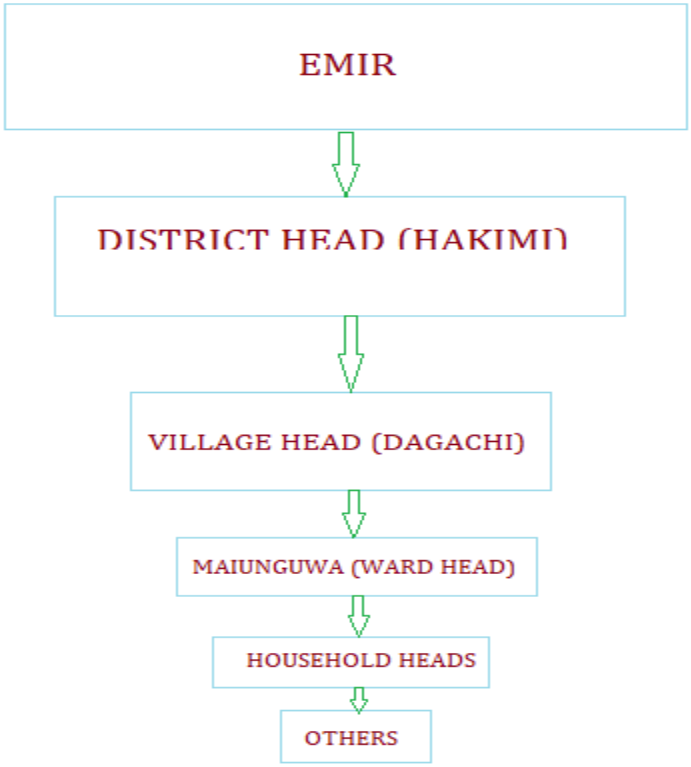


Figure 4. 20: Traditional leadership hierarchy in the project area

4.8 PUBLIC CONSULTATION

Consultations were carried out with the project affected communities and relevant institutional stakeholders. Consultations were carried out with due regards for the desire to ensure Broad Community Support (BCS) and with reference to informed consultation participation. The consultation process was carried out in conjunction with dissemination of relevant environmental and social information to concerned stakeholders.

4.8.1 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 those stakeholders be consulted 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 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.

4.8.2 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.

4.8.3 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;
- ✓ Sokoto State Ministry of Health;
- ✓ Sokoto State Ministry of Finance;
- ✓ The Traditional Councils in the three districts of the project area; and
- ✓ Some of the 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 and FGDs.

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

Plate 4. 10: Consultation with community stakeholders at the Teaching Hospital

Communities within the six districts on their part also expressed their happiness and optimism about the proposed project development. They called on the State Government to ensure that the project communities are given priority in terms of employment in both the constructional and operational phases of the proposed project, and to also package some good CSR intervention projects to improve on their living conditions.

CSR programmes to ensure a harmonious relationship with the host communities.

4.8.4 Brief Outcomes from community consultations

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

- ✓ Attendance at all the consultation were appreciable and cut across the different strata of the communities;
- ✓ The team was well received at all the visited communities;
- ✓ The communities emphasized the need for the proponent to ensure that a competent company is considered for the construction work to ensure timely completion and avoid abandonment of the project midway through;

- ✓ Community stakeholders also want the State Government to compel the construction company to consider some of their youths for employment during the constructional phase of the project;
- ✓ Community stakeholders also want the proponent to consider some of their youths for employment in the operational phase of the project; and
- ✓ Community leaders assured the Environmental Consultant that they would continue to give moral support to the State Government in the implementation of the project.

4.8.5 Summary of Responses and concerns

The outcome of the consultation with the various stakeholders of the project is summarized in forms of expressed appreciations and concerns in as follows.

4.8.5.1 Appreciations

The following positive impacts that would potentially be generated by the proposed project were appreciated by the communities:

- ✓ Provision of advanced healthcare facilities;
- ✓ Creation of business activities to health practitioners in the project area;
- ✓ Creation of employment;
- ✓ Reduction of crime in the project area as a result of youth employment;
- ✓ Creation of employment in the operational phase of the project; and
- ✓ Collective participation in taking climate action.

Plate 4. 11: Consultation with the District Head of Wamakko

4.8.5.2 Concerns/Observation

The objectives of the project were made known to the stakeholders. A major request expressed by communities in the project area is that of youth employment in both the construction and operations phases of the project.

Plate 4. 12: MD SEPA flanked on both sides by members of the EIA team

Plate 4. 13: Consultation with Secretary of Wamakko LGA and council members

4.8.6 Future Consultations

Further consultations would be carried out throughout the project cycle time to realize the overall objectives of the consultation process. Submission of the EIA report is not the end of the EIA process. Key stakeholders would continuously be engaged throughout the project life cycle in several capacities including, but not limited to:

- ✓ Disclosure of the draft ESMP report;
- ✓ Dialogue with authorities and regulators involved in inspection and monitoring;
- ✓ Technical collaboration on design modification where desirable (as appropriate); and
- ✓ Interacting with communities in both the constructional and operational phases of the project to get feedback on the effectiveness of mitigation and enhancement measures being put in place.

CHAPTER FIVE: BENEFICIAL AND ADVERSE IMPACTS

5.1 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. Both 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. 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.

5.2 IMPACT APPRAISAL

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

5.2.1 Impacts Prediction Methodology Used

Analysis of impacts normally 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 prediction methodology applied in this ESMP 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 aspect.

Firstly, relevant issues were studied 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.

5.2.2 Impact Assessment Terminologies

The following definitions were used in the impact prediction 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.

5.2.3 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, 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:

5.2.3.1 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 5.1 below.

Table 5. 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 LGA)	2
3.	Regional (Sokoto State)	3
4.	National (At country level)	4
5.	International (Beyond Nigeria)	5

5.2.3.2 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 5.2 below.

Table 5. 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

5.2.3.3 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 5.3.

Table 5. 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

5.2.3.4 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 5.4.

Table 5. 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

5.3 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 yard and other preliminary activities.

5.3.1 Positive and Negative Impacts in the Pre-construction Phase

5.3.1.1 Temporary employment and increase in income

Presence of various specialists engaged in preliminary studies, field work and project design will provide temporary employment and temporary increased income to several people including those in the project area which may be employed as unskilled workers for example as watchmen, washmen, etc.

5.3.1.2 Boost in Local Trading Activities

Influx of preconstruction professionals into the project area and employment of local people as preconstruction employees will temporarily 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 short-term negligible significance which can however be enhanced to a low significance level by appropriate enhancement measures.

5.3.1.3 Negative Impacts in the Pre-construction

On the other hand, negative impacts in the preconstruction phase of the project include hazards from HIV/AIDs and other communicable diseases because of interactions with external work force as well as HSE hazard to preconstruction workforce which may include snake bite, automobile or occupation accidents.

5.3.1.4 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;

5.4 NEGATIVE IMPACTS IN THE CONSTRUCTION PHASE

The project construction activities will involve civil engineering construction works, vegetation (bush) clearing, earth (soil) movement, 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 short-term (temporary) negative impacts such as social conflicts which may arise from local employment, interference with 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.

5.4.1 Loss of Farmlands

There will also be loss of farmlands by farmers using the land that belongs to the Sokoto State University. This may adversely affect the people using the farmlands. This impact may also not be significant because the land is owned by the university and the people using the farmlands can easily get new farms elsewhere, as there are vast lands available for farming close to Sokoto town.

5.4.2 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 site. However, application of mitigation measures such as re-vegetating and landscaping the finished structures will minimize the impact on fauna and flora.

5.4.3 Soil and Water Pollution

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.

5.4.4 Disruption of Road Traffic and Increased Risk of Traffic Accident

Movement of 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.

5.4.5 Air Pollution

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.

5.4.6 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 transporting construction materials to the construction area. Impacts from noise pollution will be mostly on construction workers, staff and students as well as residents living near the construction site.

Impact from noise pollution is considered negative but insignificant with mitigation measures in place.

5.4.7 Water Pollution

In the rainy season, 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.

5.4.8 Public Health and Occupational Health and Safety

Influx of construction workers into the area could increase the risk of spread of Covid-19 and sexually transmitted infections (STIs) such as HIV/AIDS to and from the inhabitants of the local communities.

Construction workers may be exposed to occupational health and safety hazards, for example, the risk of increased work-related accidents such as those caused by poor handling, misuse or malfunctioning equipment.

5.4.9 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.

5.4.10 Significant Negative Impacts in the Construction Phase

Loss of use of farmlands by farmers and public and occupational health and safety hazards discussed above are predicted to be the significant negative impacts in the Construction Phase of this project.

5.5 POSITIVE IMPACTS IN CONSTRUCTION PHASE

5.5.1 Employment 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, health professionals, 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. There will also be procurement opportunities that would be created through the supply of construction materials and equipment needed for the project.

Indirect employment relating to services, vendors, etc. will also generate additional income-earning opportunities, including 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.

5.5.2 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.

5.5.3 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.

5.5.4 Significant Positive Impacts in the Construction Phase

Employment and procurement opportunities as well as enhancement of skills of local artisans discussed above are the significant positive impacts of the project in the Construction Phase of this project.

5.6 NEGATIVE IMPACTS IN OPERATION AND MAINTENANCE PHASE

Operation and maintenance activities include the following:

- Periodic inspection of facilities to ensure functional conditions;
- Housekeeping activities to ensure clean and safe work environment
- Maintenance of equipment at the hospitals and medical college;

- Maintaining adequate warning signs on dangerous equipment such high voltage equipment and power tools, etc.

5.6.1 Negative Impacts in the Operational Phase

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

5.6.2 Noise Pollution

Noise emission from mechanical and power tools would impact negatively on staff and students of the medical college as well as on staff and patients at the hospitals. Impact from noise is assessed as being of low negative significance and can be mitigated to negligible insignificance through application of appropriate measures.

5.6.3 Water Pollution

In the operational phase, small quantities of oil/grease, electronic waste and hazardous chemicals such as from equipment maintenance and pathogenic hospital waste 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 employees, students and patients 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.

5.6.4 Occupational 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 laboratories 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.

5.6.5 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 materials such as chemical solvents, cylinders of compressed gases and refrigerants are used or kept.

This potential impact can however be mitigated to a low significance through application of appropriate mitigation measures.

5.6.6 Generation of Health Care Risk Waste

The most significant impact of the proposed project is the generation of health care risk waste. This kind of waste can be generated from several departments in the hospitals and has the potential to infect people who may come into contact with it.

5.6.7 Significant Negative Impacts in the Operational Phase

The significant negative impacts identified in the Operational Phase are occupational accident hazard as well as hazards from Healthcare Risk Waste from the hospitals.

5.7 POSITIVE IMPACTS DURING OPERATIONS PHASE OF THE PROJECT

5.7.1 Stimulating/Boosting of Local Economy

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 induce 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 moderate significance which can however be enhanced to a high significance level through ensuring that local people are given preference in terms of recruitment.

5.7.2 Skills Acquisition from Maintenance 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 low significance which can be enhanced to a high level of significance through carrying out appropriate enhancement measures.

5.7.3 Climate Change Mitigation

Exhaust emission from electricity generation and usage in the hospital especially from high-power equipment is a major source of greenhouse gases and a major contributor to climate change. 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.

5.7.4 Improved health of citizens of Sokoto State

The project will significantly cause the reduction of disease in Sokoto State and bring about an enhanced productivity, as a result of operations of the hospitals.

5.7.5 Creation of employment

The proposed project will create direct and indirect employment opportunities during both its construction and operational phases. According to an investigation by the proponent, at least nine thousand jobs would be generated by the project.

5.7.6 Contribution to gender equality

Since the is Medical College is planned to offer obstetrics and gynaecology services, it will have a significant positive social impact on women, create career development opportunities and sustainable jobs for women.

5.7.7 Aesthetic Impact

The proposed architectural design and landscaping of the medical college structure with gardens and newly planted trees is planned to create an aesthetically pleasing site. The overall environmental setting of the project area will therefore be transformed into an aesthetically pleasant and appealing one that will be very conducive for learning, research and healthcare provision.

5.7.8 Saving of foreign exchange from medical tourism

The project when fully operational has the potential to discourage medical tourism overseas, especially if high quality medical service is provided in addition to provision and deployment of high-tech equipment for medical diagnosis and treatment.

5.7.9 Increased Potential for Industrial Development and Tourism

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 medical capacity-building and healthcare provision. With a significantly improved healthcare delivery capacity and infrastructure in the State, there is will be a high tendency for the attraction of entrepreneurs who would be comfortable settling down in the State, knowing fully well that advanced medical care is available for them any time they fall ill. With the rich and abundant historical and cultural heritage in the State, the tourism industry could also be developed into a world-class status and could thus provide foreign exchange for the State and the country. The potential impact of the proposed project on industrialization and tourism development is assessed as being of moderate significance which can be enhanced to a high significance through appropriate enhancement measures.

5.7.10. Significant Positive Impact in the Operations Phase

Significant positive impacts in the Operational Phase of the project include improved health of citizens of Sokoto State and provision of job opportunities for them as well as contribution of the project to gender equality and ensuring foreign exchange savings from reduction of medical tourism.

5.8 SUMMARY OF IMPACTS

5.8.1 Project specific cumulative effects

Enhancement of the healthcare human resources and infrastructure is the notable project specific positive cumulative effect of the proposed project. The proposed project in conjunction with the Usman Danfodio University Medical College and Teaching Hospital as well as the private healthcare practitioners and facilities will cumulatively serve as centre for medical teaching, research and treatment.

5.8.2 Project specific long- and short-term effects

Positive short-term effects

Positive short-term effects of the proposed project comprise of the following:

- Provision of temporary employment and procurement opportunities to local people and other Nigerians;

- Increase in income of project employees; and
- Boosting of local and national demand for goods and services as a result of construction activities.

Negative short-term effects

Negative short-term effects of the proposed project include exposing the local employees and communities as well as other Nigerians to HSE and occupational hazards.

Positive long-term effects

Positive long-term effects of the proposed project include the following:

- Creation of a large number of jobs for the local, regional and national manpower
- Provision of facilities for advance healthcare provision
- Provision of an institution for medical training

Negative long-term effects

Negative long-term effects of the proposed project include the following:

- Generation of healthcare risk waste from the operations of the Medical College and Teaching Hospital
- Exposure of employees to occupational hazards from usage of chemicals, radioactive materials

5.8.3 Project specific reversible and irreversible effects

Reversible effects of the proposed project include:

- Construction noise impacts;
- HSE hazards in the construction phase of the project;
- Adverse air quality from particulate matter; and
- Disruption of traffic by construction vehicles.

On the other hand, the **irreversible effects** of the proposed project include:

- Emission of greenhouse gases by construction and operational equipment;
- Loss of vegetation on the built and tarred areas of the project site;
- Enhanced skills of construction employees;
- Creation of jobs in the operational phase of the project;

- Enhanced earnings by employees in the operational phase of the project;
- Provision of medical training college and healthcare services;
- Provision of capacity-building opportunities for local people and other Nigerians;
- Reduced gender gaps in the project area.

5.8.4 Project Specific Direct and Indirect Effects

Specific direct effects of the proposed project include the following:

- Construction noise impacts;
- HSE hazards in the construction phase of the project;
- Adverse air quality from particulate matter;
- Loss of farming land;
- Reduction in abundance and species of fauna and flora;
- Disruption of traffic by construction vehicles.
- Loss of vegetation on the built and tarred areas of the project site;
- Enhanced skills of construction employees;
- Creation of jobs in the operational phase of the project;
- Enhanced earning by employees in the operational phase of the project;
- Provision of medical training college and healthcare services;
- Provision of capacity-building opportunities for local people and other Nigerians;

Specific indirect effects of the proposed project include the following:

- Adverse air quality from particulate matter;
- Emission of greenhouse gases by construction and operational equipment;
- Reduced gender gaps in the project area; and
- HSE risks

5.8.5 Project Specific Adverse and Beneficial Effects

Adverse and beneficial effects of the proposed project have been identified as negative and positive impacts in the report.

5.8.6 Project specific risk and hazard assessments

Specific risks and hazards in the Preconstruction Phase of the project include hazards from HIV/AIDs and other communicable diseases because of interactions with external work force as well as HSE risks and hazards to preconstruction workforce which may include snake bite,

automobile and occupational accidents. Influx of construction workers into the area could increase the risk of spread of Covid-19 and sexually transmitted infections (STIs) such as HIV/AIDS to and from the inhabitants of the local communities.

In the Construction Phase, workers may be exposed to occupational, health and safety hazards, for example, the risk of increased work-related accidents such as those caused by poor handling, misuse or malfunctioning equipment.

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. in the laboratories and during routine maintenance or through unauthorized access to equipment. In this 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 materials such as chemical solvents, cylinders of compressed gases and refrigerants are used or kept.

A more significant impact in the Operations Phase is the generation of health care risk waste. This kind of waste can be generated from several laboratories in the medical college as well as wards in the hospitals and has a high potential for infecting people who may come into contact with it.

The same risks and hazards identified in the Construction Phase may also be present in the Decommissioning Phase.

CHAPTER SIX: MITIGATION/ENHANCEMENT MEASURES

6.1 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 handled in a sustainable manner. Therefore, in order to preserve the integrity of the proposed project environment, certain measures have been designed to mitigate the negative impacts identified in this study; while enhancement measures are also proffered for the positive impacts.

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:

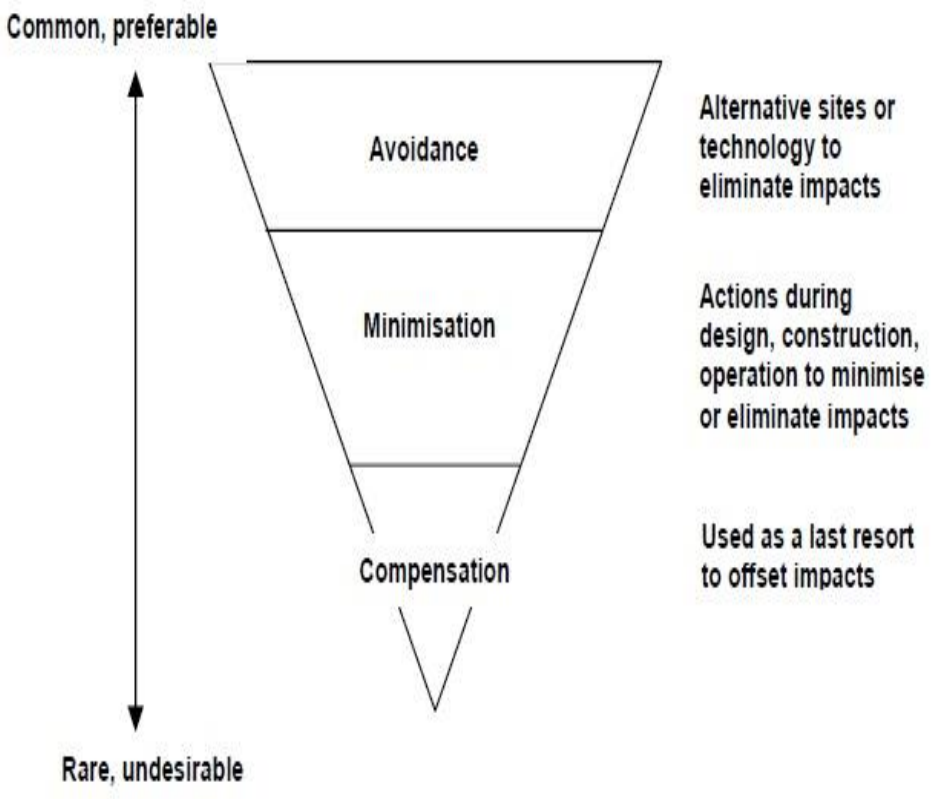
- Finding better alternatives ways of doing things;
- Avoiding, minimizing or remedying adverse impacts;
- Enhancing the environmental and social benefits of a proposal; and
- Ensuring that residual adverse impacts are kept within acceptable levels.

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 6. 1: The 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.

6.1.1 Mitigation and Enhancement Measures in the Preconstruction Phase

6.1.1.1 Temporary employment and increase in income

Enhancement measures are as follows:

- 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;

6.1.1.2 Boost in Local Trading Activities

The enhancement measure for this impact is to encourage pre-construction employees to patronize local traders and service providers from the immediate project communities;

6.1.1.3 Occupational Hazards during Field Work by Consultants

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.

6.1.1.4 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;

6.2.2 Mitigations and Enhancement Measures in Construction Phase

6.2.2.1 Loss of Farmlands

The following mitigation measures are proposed:

- Assist farmers with alternative farmlands within the land owned by the Sokoto State University; or
- Give the farmers financial assistance to hire or acquire farmlands elsewhere ; and
- Allow the farmers to harvest their crops before initiating construction activities.

6.2.2.2 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; and
- Exposed areas should be re-vegetated as soon as possible

6.2.2.3 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 on the construction site 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.

6.2.2.4 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 experienced 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 flagmen would be required to control traffic at the construction site as may be required.

6.2.2.5 Air Pollution

Mitigation measures are:

- Cover soil stockpiles and truck loads to avoid being blown by wind and causing adverse air quality;
- Enforce lower driving speeds along roads to and in the construction site;
- The contractor shall make sure that his equipment and vehicles are well-maintained, in good condition and have minimal emissions; and
- Regular watering of the project site shall be carried out to suppress dispersion of dust.

6.2.2.6 Noise and Vibration

The mitigation measures are:

- Maintaining construction equipment regularly in accordance with the manufacturer's specifications;

- Execute all works by timing them so that they do not become a nuisance to the staff and students of the university and to the general public;
- Locate noisy plants/generators far away from sensitive receptors in the vicinity of the project site;
- Construction employees shall 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.

6.2.2.7 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 construction work zones;
- Sensitize construction workers on methods of prevention on HIV/AIDS, COVID-19 before commencement of construction work;
- 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 work on site;
- Ensure enhanced safe driving by all construction drivers;
- Secure all hazardous 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 a Health Safety and Environment (HSE) training during the induction of all construction workers and during toolbox meetings;
- 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 portable/temporary toilet facilities for construction employees on site;

- Provide waste receptacles/bins at appropriate locations on the construction site 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.

6.2.2.8 Gender Gaps and Vulnerable Groups

In order to ensure effective participation of women and vulnerable groups 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 given recruitment opportunities;
- 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 shall be strongly discouraged from taking advantage of vulnerable women and girl-child and from sexually abusing them; and
- The contractor's recruitment team shall give Persons with Disabilities (PWDs) opportunities to participate in project implementation.

6.2.2.9 Waste Management

Construction activities will generate various categories of waste in the construction phase of the project.

The following mitigation measures shall be applied by the contractor:

- Waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage shall be provided in the construction sites;
- The contractor shall 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 shall be handled and managed separately; and
- Construction and domestic waste as well as sewage shall be collected and disposed of appropriately; and
- All wastes shall be managed by a registered and certified Waste Vendor in the State.

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

6.2.2.10 Stimulation of local economy

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:

- The contractor shall unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in construction procurement activities;
- Food and other requirements of the construction workers shall be provided by people from the host communities; and
- The Project Contractor shall source for as many materials required for construction purposes as possible locally, before resorting to importation;

6.2.2.11 Employment of Locals Leading to Increased Income

- Give preference to people of the project area during recruitment of construction workers; and
- The Project Contractor shall whenever possible, source for expert employees locally first, then regionally and nationally before engaging international experts;

6.2.2.12 Capacity Building for the Local People

- Give construction employees especially unskilled ones on-the-job capacity acquisition/building training to enhance their capacities in current project job and for subsequent jobs after completion of current project; and
- Formally certify their capacities and competences and recommend them for employment in his subsequent project or for employment by other contractors or labour employers.

6.3.3 Mitigation and Enhancement Measures in the Operational Phase

6.3.3.1 Noise Emissions Associated with Generators and Heavy Equipment

- Noise emissions that may be associated with some equipment can be mitigated as follows:
  - Low noise equipment shall be selected and procured for the hospitals;
  - 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 shall be provided with ear plugs to muffle noise from production equipment; and
  - High vibration equipment shall be dampened to reduce vibrations.

6.3.3.2 Soil and Water Pollution

Mitigation measures against soil and water pollution include the following:

- Medical Colleg and hospital Management shall ensure that waste collection and disposal facilities including waste bins, and septic tanks for sewage are provided at the hospitals;
- Hazardous waste such as those from cells/accumulators shall be treated with due care and managed by accredited waste vendors following appropriate procedures; and
- Maintenance workshops shall have proper oil interceptors to collect spilled oil and other hazardous chemicals;

6.3.3.3 Risk of Fire Outbreak

- All flammable materials such as LPG cylinders, chemical solvents and fuels shall be stored appropriately away from open flames and other sources of ignition;

- Fire-fighting equipment such as fire-trucks, fire hydrants and extinguishers shall be provided and stationed strategically in appropriate locations;
- All employees and students shall be trained on fire and general emergency response preparedness; and
- Fire drills shall be carried out regularly to prepare employees and students on emergency response procedures;

6.3.3.4 Occupational Accidents

Mitigation measures against occupational accidents are as follows:

- Ensure that warning signs and symbols are conspicuously displayed in hazardous environments and on hazardous equipment;
- Restrict access to hazardous equipment to trained personnel only;
- Ensure that the safety rules and regulations for operation of laboratory and hospital machineries and equipment are strictly enforced;
- Ensure that relevant PPE are used at all times for work and training sessions at the college and hospitals;
- First-aid stations shall be provided in strategic locations;

6.3.3.5 Public Health and Safety

Mitigation measures for maintaining public health and safety include the following:

- Sensitize staff and students on issues of public health such as HIV/AIDs and Covid-19 prevention measures;
- Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the hospitals and college at all times;
- Ensure that good house-keeping is also maintained at all times;
- Provide a round-the-clock armed security personnel at the medical college and all the hospitals to screen all entering and leaving persons;
- Provide dedicated lines of communication with the security personnel at the s 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.

6.3.3.6 Healthcare Risk Waste

Mitigation measures for healthcare risk waste are as follows:

- Autoclave clinical waste to mitigate its healthcare risk;
- Equip the hospitals with an integrated autoclave-shredder to treat infectious waste, including sharps and pathological waste;
- Combine shredding with the application of pressurized heated steam to destroy all forms of microbial life and achieve complete sterilization of infectious materials before disposal in the municipal waste steam. In comparison with other waste treatment methods, such as incineration, the process is cleaner and more environmentally friendly because no hazardous emissions are produced and no chemicals or radiation is used;
- Dispose pharmaceutical waste from medicines that can be safely diluted through the sewerage system;
- Make necessary arrangements with suppliers to return other expired or contaminated pharmaceutical products;
- Treat and dispose of all chemical waste according to the specifications formulated for each individual product;

6.4 Positive Enhancements Measures in the Operational Phase of Construction

6.4.1 Stimulating/Boosting of Local Economy

Enhancement measures include the following:

- Extend operations and maintenance procurement opportunities to the local people;
- Give the local people priority during employee recruitment;
- Patronize local service vendors; and
- Improve healthcare services by establishing charitable trust to fund healthcare for patients who are too poor to pay

6.4.2 Skill Acquisition and Training from Operations

Enhancement measures include the following:

- Introduce networking events through workshops, seminars and lectures to bring students and health personnel up to date with current health issues and to get ideas from others;
- Provide regular sponsored professional training opportunities to personnel to ensure that they are up-to-date with latest medical advancement; and

- Ensure skill acquisition training is giving to maintenance personnel during routine maintenance work.

6.4.3 Climate Change Mitigation

Enhancement measures are as follows:

- Renewable energy technologies shall be used to complement other energy sources in the hospitals;
- Specification of materials and/or components will be undertaken by specifying the use of energy efficient equipment and lighting during maintenance operations;
- Rainwater harvesting systems shall be installed at the medical college and hospitals; and
- Solar energy capturing shall also be installed at the medical college and hospitals.

6.4.4 Improved health of citizens of Sokoto State

Enhancement measures for this impact include the following:

- Establish a comprehensive health insurance programme for both the public and private sector in the State;
- Provide free/low cost basic immunization and vaccination services in the State; and
- Enforce strict compliance with the Public Health Act within Sokoto State.

6.4.5 Creation of employment

- Give priority to the people in the project area during employee recruitment; and
- Ensure that training opportunities are extended to them.

6.4.6 Contribution to gender equality

- Remove all barriers to women participation during recruitment and training of operational personnel; and
- Implement Gender affirmative during training and promotion exercises.

6.4.7 Aesthetics Impact on its immediate environment

- Ensure that the physical structures of the medical college and hospitals are well maintained and kept clean and well-painted; and
- Ensure that the lawns and gardens are well-maintained and kept.

6.4.8 Saving of foreign exchange from medical tourism

Provide good and sustainable social and economic infrastructure, such as good and efficient transport system, ICT, etc., especially within the State Capital, such that medical vacation/leisure tourists can be attracted to the State; and

Provide a good and efficient security and policing system to create a peaceful and low-crime environment.

6.4.9 Increased Potential for Industrial Development

- Provide incentives for local businesses;
- Provide tax waivers/holidays to alien businesses; and
- Modify Government procedures to be more transparent and simpler to facilitate establishment of industries and promote ease of doing business.

Tables 6.1, 6.2, 6.3 and 6.4 presents the identified impacts and their mitigation/enhancement measures for the Pre-construction, Construction, Operations and Decommissioning phases of the proposed project.

Table 6. 1: Mitigation/Enhancement measures for the Preconstruction Phase

S/No.	Identified Impact	Mitigation/Enhancement Measures
1.	Temporary employment and increase in income	Enhancement measures are as follows: I. Give priority to people from the project area during recruitment of employees; II. 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;
2.	Boost in Local Trading Activities	The enhancement measure for this impact is to encourage pre-construction employees to patronize local traders and service providers from the immediate project communities
3.	Occupational Hazards	I. Provide all field workers with armed security personnel to ensure their safety against kidnappers and other criminals; II. All field workers must use appropriate PPE at all times; III. All drivers engaged during field work must be well-trained and must follow all traffic rules and regulations; and IV. 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.
4.	Exposure to STIs and COVID 19	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.

Table 6. 2: Mitigation/Enhancement measures for the Construction Phase

S/No.	Identified Impact	Mitigation/Enhancement Measures
1.	Loss of Farmlands	i. Assist farmers with alternative farmlands within the land owned by the Sokoto State University; or ii. Give the farmers financial assistance to hire or acquire farmlands elsewhere ; and iii. Allow the farmers to harvest their crops before initiating construction activities.
2.	Reduction of Abundance and Species of Fauna and Flora	iv. Contractor shall avoid unnecessary clearing of vegetation; v. Contractor shall limit movement of heavy machinery to designated routes and construction areas; vi. Contractor shall plan and execute all earthworks with due diligence; vii. Contractor shall ensure that alien plants are not introduced into the area by using an integrated alien plant species control programme; and viii. Contractor shall revegetate exposed areas as soon as possible
3.	Soil and Water Pollution from Construction Equipment	Contractor shall: ix. Provide suitable material for absorption of oil spills from construction equipment; x. Restrict servicing and repair of machinery and equipment to designated workshops on the construction site to avoid oils contaminating the soil and water of the project area; xi. Shall make sure oils or chemical wastes are disposed of in accordance with best practice and relevant laws; and xii. Shall ensure lubricants and engine oils are stored in a manner that prevents spillage into the environment.
4.	Disruption of Road Traffic and Increased Risk of Traffic Accident	xiii. Contractor shall: xiv. Ensure the use of safety signage, signals and alarms during transportation of construction equipment; xv. Ensure the use of well-trained and experienced construction drivers; xvi. Ensure that vehicles to be used for construction work are in good quality; xvii. Ensure low driving speeds when transporting equipment; and xviii. Ensure that manual traffic control is employed using flagmen to control traffic at the construction site as may be required.

Table 6.2: Continued

S/No.	Identified Impact	Mitigation/Enhancement Measures
1.	Air Pollution	i. Contractor shall cover fine aggregate stockpiles and truck loads to avoid being blown by wind; ii. Contractor shall enforce lower driving speeds along roads to and in the construction site; iii. Contractor shall make sure that his equipment and vehicles are well-maintained, in good condition and have minimal emissions; and iv. Contractor shall ensure regular watering of the project site to suppress dispersion of dust.
2.	Noise and Vibration	i. Contractor shall maintain construction equipment regularly in accordance with the manufacturer's specifications; ii. Contractor shall execute all works by timing them so that they do not become a nuisance to the staff and students of the university and to the general public; iii. Contract shall locate noisy plants/generators far away from sensitive receptors in the vicinity of the project site; iv. Contractor shall prevent employees from working at night; v. Contractor shall provide and enforce the use of ear plugs/muffs by operators of noisy construction equipment; and vi. Construction vehicles and equipment noise shall be reduced using properly sized and maintained mufflers and engine silencers and equipment should also be turned off when not in use.
3.	Public Health and Occupational Hazards	i. Contractor shall: ii. Ensure strict adherence to COVID 19 protocols, e.g. hand washing, hand sanitizing and social-distancing at construction work zones; iii. Sensitize construction workers on methods of prevention on HIV/AIDS, COVID-19 before commencement of construction work; iv. Sensitize construction workers on the need to respect and maintain good relationship with project host communities; v. Ensure Occupational Health and Safety (OHS) requirements are observed at all times during construction work on site; vi. Ensure enhanced safe driving by all construction drivers; vii. Secure all hazardous construction sites (material sites and construction areas) from public access to ensure safety, using caution tapes and barricades.

Table 6.2 Continued

S/No.	Identified Impact	Mitigation/Enhancement Measures
	Public Health and Occupational Hazards	i. Develop and implement an Occupational Safety and Health (OSH) Management System which is in line with Nigerian Factory Act and other relevant legal provisions; ii. Project Contractor shall develop and implement a Health Safety and Environment (HSE) training during the induction of all construction workers and during toolbox meetings; iii. Ensure that all guidelines and safety regulations for installation of equipment are strictly followed during equipment installation iv. Ensure that fire-fighting equipment, first-aid stations and medical ambulance service and appropriate personnel are provided throughout the duration of the construction phase; v. Provide adequate portable/temporary toilet facilities for construction employees on site;Provide waste receptacles/bins at appropriate locations on the construction site for waste management vi. Ensure that every employee working at the project site is provided with appropriate and adequate PPE; and vii. Ensure educating employees on the detrimental effects of drug and alcohol abuse.
4.	Gender Gaps and Vulnerable Groups	i. In order to ensure effective participation of women and vulnerable groups and prevent other forms of discrimination, the following mitigation measures are proposed: ii. 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 given recruitment opportunities; iii. 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; iv. Construction employees shall be strongly discouraged from taking advantage of vulnerable women and girl-child and from sexually abusing them; and v. The contractor's recruitment team shall give Persons with Disabilities (PWDs) opportunities to participate in project implementation.

Table 6.2 Continued

S/No.	Identified Impact	Mitigation/Enhancement Measures
5.	Waste Generation	Contractor shall: i. Provide waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage on the construction sites; ii. Ensure a comprehensive daily house-keeping in storage and construction areas; iii. Use the strategy of waste reduction, re-using and recycling as much as possible throughout the construction phase; iv. Manage hazardous waste separately; and v. Ensure that all construction and other wastes shall be managed by a registered and certified Waste Vendor in the State.
6.	Stimulation of local economy	i. The contractor shall unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in construction procurement activities; ii. Food and other requirements of the construction workers shall be provided by people from the host communities; and iii. The Project Contractor shall source for as many materials required for construction purposes as possible locally, before resorting to importation;
7.	Employment of Locals Leading to Increased Income	i. Project Contractor shall give preference to people of the project area during recruitment of construction workers; and Project Contractor shall whenever possible, source for expert employees locally first, then regionally and nationally before engaging international experts.
8.	Capacity Building for the Local People	i. Project Contractor shall give construction employees especially unskilled ones on-the-job capacity acquisition/building training to enhance their capacities in current project job and for subsequent jobs after completion of current project; and ii. Project Contractor shall formally certify their capacities and competences and recommend them for employment in his subsequent project or for employment by other contractors or labour employers.

Table 6. 3: Mitigation and Enhancement Measures in the Operational Phase

S/No.	Identified Impacts	Mitigation/Enhancement Measures
1.	Noise from Generators and Hospital Equipment	Hospital and College Management shall: i. Select and procure low noise equipment for the hospitals; ii. Muffle unavoidable high noise equipment with effective silencers; iii. Locate high-noise equipment far away from classrooms, wards and other sensitive receptors and whenever possible enclose such equipment in sound-proof enclosures; iv. Employees working in noisy areas shall be provided with ear plugs to muffle noise from equipment; and v. High vibration equipment shall be dampened to reduce vibrations.
2.	Soil and Water Pollution	Medical College and hospital Management shall: i. Ensure that waste collection and disposal facilities including waste bins, and septic tanks for sewage are provided at the hospitals; ii. Ensure that hazardous waste such as those from cells/accumulators shall be treated with due care and managed by accredited waste vendors following appropriate procedures; and iii. Ensure that maintenance workshops shall use proper oil interceptors to collect spilled oil and other hazardous chemicals.
3.	Risk of Fire Outbreak	Management of College and hospitals shall: i. Ensure that all flammable materials such as LPG cylinders, chemical solvents and fuels are stored appropriately away from open flames and other sources of ignition; ii. Ensure that fire-fighting equipment such as fire-trucks, fire hydrants and extinguishers are provided and stationed strategically in appropriate locations; iii. Ensure that all employees and students are trained on fire and general emergency response preparedness; and iv. Ensure that fire drills are carried out regularly to prepare employees and students on emergency response procedures.
4.	Occupational Accidents	Management of medical college and hospitals shall: i. Ensure that warning signs and symbols are conspicuously displayed in hazardous environments and on hazardous equipment; ii. Restrict access to hazardous equipment to trained personnel only; iii. Ensure that the safety rules and regulations for operation of laboratory and hospital machineries and equipment are strictly enforced; iv. Ensure that relevant PPE are always used for work and training sessions at the college and hospitals; and First-aid stations shall be provided in strategic locations.

Table 6.3 Continued

S/No.	Identified Impacts	Mitigation/Enhancement Measures
5.	Public Health and Safety	Management of medical college and hospitals shall: i. Sensitize staff and students on issues of public health such as HIV/AIDs and Covid-19 prevention measures; ii. Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the hospitals and college at all times; iii. Ensure that good house-keeping is also maintained at all times; iv. Provide a round-the-clock armed security personnel at the medical college and all the hospitals to screen all entering and leaving persons; v. Provide dedicated lines of communication with the security personnel at the s to ensure efficient communication in times of crisis; and vi. Design and popularise a security response procedure to be deployed at the instance of a security breach.
6.	Generation of Healthcare Risk Waste	Management of medical college and hospitals shall: i. Ensure that all clinical wastes are autoclaved; ii. Ensure that an integrated autoclave-shredder are provided for treatment of infectious waste, including sharps and pathological waste; iii. Ensure that shredding is combined with the application of pressurized heated steam to destroy all forms of microbial life and achieve complete sterilization of infectious materials before disposal. This process is cleaner and more environmentally friendly because no hazardous emissions are produced and no chemicals or radiation is used; iv. Ensure that pharmaceutical waste from medicines that can be safely diluted are disposed through the sewerage system; v. Ensure that necessary arrangements are made with suppliers to return other expired or contaminated pharmaceutical products; and vi. Ensure that all chemical waste are treated and disposed of according to the specifications formulated for each individual product.
	Stimulating/Boosting of Local Economy	To enhance this positive impact Management of medical college and hospitals shall: i. Extend operations and maintenance procurement opportunities to the local people; ii. Give the local people priority during employee recruitment; and iii. Patronize local service vendors.

Table 6.3 continued

S/No.	Identified Impact	Mitigation/Enhancement Measures
	Skill Acquisition and Training Opportunities	Enhancement measures to be carried out by Management of medical college and the hospitals include the following: i. Introduce networking events through workshops, seminars and lectures to bring students and health personnel up to date with current health issues and to get ideas from others; ii. Provide regular sponsored professional training opportunities to personnel to ensure that they are up-to-date with latest medical advancement; and iii. Ensure skill acquisition training is giving to maintenance personnel during routine maintenance work.
	Climate Change Mitigation	Enhancement measures to be carried out by Management of medical college and hospitals are as follows: Renewable energy technologies such as solar energy capturing shall be used for lighting and other suitable applications to complement conventional energy sources; Specification of materials and/or components will be undertaken by specifying the use of energy efficient equipment and lighting during maintenance operations; and Rainwater harvesting systems shall be installed at the medical college and hospitals.
	Improved health of citizens of Sokoto State	Enhancement measures for this impact include that Sokoto State Government shall: i. Establish a comprehensive Health Insurance Programme for both the public and private sector in the State; ii. Provide free/low cost basic immunization and vaccination services in the State; and iii. Enforce strict compliance with the Public Health Act within the State.
	Creation of employment	Sokoto State Government shall give priority to the people in the project area during employee recruitment and Ensure that training opportunities are extended to them.
	Contribution to gender equality	The Sokoto State Government shall remove all barriers to women's participation during recruitment and training of operational personnel and implement Gender affirmative during training and promotion exercises.

Table 6.3 Continued

S/No.	Identified Impact	Mitigation/Enhancement Measures
	Aesthetics Impact on its immediate environment	Management of the medical college and hospitals shall enhance this positive impact by: i. Ensuring that the physical structures of the medical college and hospitals are well maintained and kept clean and well-painted; and ii. Ensuring that the lawns and gardens are well-maintained and kept.
	Saving of foreign exchange from medical tourism	Sokoto State Government shall enhance this positive impact by: i. Providing good and sustainable social and economic infrastructure, such as good and efficient transport system, ICT, etc., especially within the State Capital, such that medical vacation/leisure tourists can be attracted to the State; and ii. Providing a good and efficient security and policing system to create a peaceful and low-crime environment.
	Increased Potential for Industrial Development	Sokoto State Government shall enhance this impact by: i. Providing incentives for local businesses; ii. Providing tax waivers/holidays to alien businesses; and iii. Modifying Government procedures to be more transparent and simpler to facilitate establishment of industries and promote ease of doing business.

CHAPTER SEVEN: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1 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.

7.2 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.

7.3 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 s; and
- Incorporating all safety provisions in the project design and construction.

7.4 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 in the construction phase through the provision of adequate and safe working conditions and tools.

Specifically, the act stipulates the following:

- Construction employees should be protected from rain, heat, excessive cold, solar radiation, atmospheric pollution;
- Construction employees should be provided with sufficient free circulation of fresh air and free space for movement;
- Construction employees 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;
- Construction employees 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.
- Construction employees should be provided with first aid boxes in the small sections and clinic for their medical care and emergencies; and
- Construction employees should be appropriately trained on the use of equipment they are to work with.

7.5: 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.

7.5.1 The Resident Engineer

The Engineer is to:

- 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 s 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.

7.5.2 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 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 the Environmental Consultant 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 the project areas are cleared of construction waste, graded and re-vegetated

7.5.3 Environmental and Safety Officer

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 compliance 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 employees are provided with relevant Personal Protective Equipment;
- Advise on the removal of person(s) and/or equipment not complying with environmental requirements;
- Recommend 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.

7.5.4: 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.

7.5.5: Sokoto State Ministry of Environment (SSMEnv)

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

7.5.6: The General Public

The 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. The negative impacts may include water, air and noise pollutions, 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 public has an informal obligation to inform the Contractor about new developments or other issues of concern to them as early as possible.

7.5.7 Supervising Engineer

The supervising Engineer will be a staff of State ministry of Health/Works, who will collaborate with E&S Expert, FMEnv and SOSMEnv 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 Health/Works 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.

7.6 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 proferred and communicated to the project proponent for vetting and approval by FMEnv, before the contemplated change/modification.

7.7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Tables 7.1, 7.2 and 7.3 respectively summarize the ESMP for the Pre-Construction, Construction and Operations phases of the project.

Table 7. 1: ESMP for the Pre-Construction Phase

S/No.	Receptor	Project Activity	Impact	Mitigation	Responsibility
1.	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
2.	Community	Preconstruc-tion operations	Boost in Local Trading Activities	The enhancement measure for this impact is to encourage pre-construction employees to patronize local traders and service providers from the immediate project communities	Contractor
3.	Construction workers	Preconstruc-tion operations	Occupation al 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.	Contractor
4.	Construction workers	Preconstruc-tion operations	Exposure to STIs and COVID 19	Preconstruction employees shall 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.	SOSG/ Precostruction Consultant

Table 7. 2: ESMP for the Construction Phase

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
1.	Site setting out	Community	Loss of Farmlands	➢ Assist farmers with alternative farmlands within the land owned by the Sokoto State University; or ➢ Give the farmers financial assistance to hire or acquire farmlands elsewhere ; and Allow the farmers to harvest their crops before initiating construction activities.	SOSG
2.	Site Clearing	Project site	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
3.	Site Clearing	Project site	Reduction of abundance and species of fauna and flora	➢ 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; and ➢ Re-vegetate exposed areas	Contractor

Table 7.2 Continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
4.	Maintenance of construction equipment	Host Environment	Soil and Water Pollution	➢ Provide suitable material for absorption of oil spills from construction equipment; ➢ Servicing and repair of machinery and equipment shall be restricted to designated workshops to avoid oils contaminating the soil and water of the project area; ➢ The contractor shall make sure oils or chemical wastes are disposed of in accordance with best practice and relevant laws by an accredited waste vendor; and ➢ Lubricants and engine oils must be stored in a manner that prevents spillage into the environment.	Contractor
5.	Movement of construction vehicles	Host communities	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 used in construction work are in good condition; ➢ Ensure low driving speeds when transporting equipment; and ➢ Manual traffic control may be employed in which case flagmen would be required to control traffic along roads to construction site as may be required	Contractor
6.	Movement of construction materials	Host communities	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	Contractor

Table 7.2 Continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
	Movement of construction materials	Host communities	Adverse air quality	The contractor should also make sure that his equipment and vehicles are well-maintained, in good condition and have minimal emissions.	Contractor
7.	Operating construction vehicles and machineries	Host community	Noise and Vibration	➢ The Contractor shall maintain his construction equipment regularly in accordance with the manufacturer's specifications; ➢ The Contractor shall execute all works so that they do not become a nuisance to the residents of the project area and to the general public; ➢ The Contractor shall locate noisy plants and equipment far away from sensitive receptors; ➢ Construction employees shall be prevented from working at night; ➢ Contractor shall provide and enforce the use of ear plugs/muffs by operators of noisy construction equipment; ➢ Construction vehicles and equipment noise would be reduced using properly sized and maintained mufflers and engine silencers; and All equipment should also be powered off when not in use.	Contractor

Table 7.2 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
8.	Construction activities and conduct of workers	Employees/ host communities	Public Health and Occupational Hazards	➢ Contractor shall ensure strict adherence to COVID 19 protocols, e.g., hand washing, hand sanitizing and social distancing at work environment; ➢ Contractor shall sensitize construction workers on methods of prevention of HIV/AIDS, COVID-19 and other STIs upon commencement of works; ➢ Contractor shall sensitize construction workers on the need to respect and maintain good relationship with project host communities; ➢ Contractor shall ensure Occupational Health and Safety (OHS) requirements are observed at all times during construction at work areas at the construction sites; ➢ Contractor shall ensure enhanced safe driving by all construction drivers; ➢ Contractor shall secure all construction areas (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; ➢ Project Contractor shall ensure that all guidelines and safety regulations for installation of equipment are strictly followed during equipment installation;	Contractor

Table 7.2 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
9.				➢ Project Contractor shall ensure that fire-fighting equipment, first-aid stations and medical ambulance service and appropriate personnel are provided throughout the duration of the construction phase; ➢ Contractor shall provide adequate toilet facilities/mobile toilets for construction employees; ➢ Contractor shall provide waste bins at appropriate locations for waste collection; ➢ 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.	
10.	Women, children and PWDs	Employee recruitment	Social inequalities	➢ Prior to project implementation, recruitment team shall remove barriers to women's participation in the execution of the project by having transparent recruitment procedures and ensuring that women are also part of the recruitment process; ➢ Deliberate efforts shall 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 shall be discouraged from taking advantage of vulnerable women and girl-child and from sexually abusing them; and Persons with Disabilities (PWDs) shall be given opportunities to participate in project implementation.	Contractor

Table 7.2 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
11.	Waste Management	Project area	Air/water/water pollution	➢ Waste disposal facilities including waste bins, toilet facilities and septic tanks for sewage shall be provided in the construction sites; ➢ The contractor should ensure comprehensive daily housekeeping in storage and construction areas; ➢ The strategy of waste reduction, re-using and recycling shall as much as possible be implemented throughout the construction phase; ➢ Hazardous waste shall be handled and managed separately; and Construction and domestic waste as well as sewage shall be disposed of appropriately	Contractor
12.	Procurement of construction materials and catering/ other services	Local economy	Stimulation of local economy /Increased Revenue	➢ Project Contractor shall unbundle large procurement contracts into smaller ones so that members of the project host communities can participate in procurement activities; ➢ Whenever possible, food and other needs of the construction workers shall be provided by people from the host communities; ➢ The Project Contractor shall source for as many materials 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.	Contractor

Table 7. 3: ESMP for the operational phase

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
1.	Operational activities	Project area and nearby communities	Noise and vibration emissions	➢ Low noise equipment and machineries shall be selected and procured for the hospitals and medical college; ➢ 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 hospitals and medical college shall be provided with earmuffs to muffle noise from equipment; and ➢ High vibration equipment shall be dampened to reduce vibrations.	Management of the hospitals and medical college
2.	Operational activities	Project area and nearby communities	Soil and Water Pollution	➢ Medical College and hospital Management shall: ➢ Ensure that waste collection and disposal facilities including waste bins, and septic tanks for sewage are provided at the hospitals; ➢ Ensure that hazardous waste such as those from cells/accumulators shall be treated with due care and managed by accredited waste vendors following appropriate procedures; and ➢ Ensure that maintenance workshops shall use proper oil interceptors to collect spilled oil and other hazardous chemicals.	Management of the hospitals and medical college
3.	Operating electric machines	Construction employees	Electrocution risks	➢ High voltage areas shall be well secured and safety/warning shall be boldly written and fixed to demarcate high voltage zones; ➢ High voltage zones shall be made off-limits to unauthorized personnel; ➢ Maintenance work shall be carried out by certified authorized personnel; and	Management of the hospitals and medical college

Table 7.3 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
				➢ Use of relevant PPEs by operations and maintenance personnel shall always be mandatory.	Management of the hospitals and medical college
4.	Operating the hospitals and learning activities in the medical college	Employees of the hospitals and medical college	Risk of fire outbreak	➢ Fire-fighting equipment shall be provided and stationed strategically in appropriate locations within the hospitals and medical college; ➢ All employees and trainees at the hospitals and medical college shall be trained on fire and general emergency response preparedness; ➢ Fire drills shall be carried out regularly at the hospitals and medical college to prepare all employees and trainees on emergency response procedures.	Management of the hospitals and medical college
5.	Operating the hospitals and learning activities in the medical college	Employees of the hospitals and medical college	Occupational accidents	➢ Warning signs and symbols shall be 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 machineries and equipment are strictly enforced; ➢ Ensure that relevant PPE are used at all times for work and trainings in the hospitals and Medical College; ➢ First-aid stations shall be provided in all laboratories in the Medical College; and ➢ Ensure that medical ambulance is always on standby at the college for prompt evacuation of accident victims.	Hospitals and Medical College Management
6.	Operating the hospitals and learning activities in the medical college	Employees of the hospitals and medical college	Public health and safety risks	➢ Sensitize staff and students on issues of public health such as malaria, cholera, HIV/AIDs and Covid-19 prevention measures; ➢ Equip the hospitals with an integrated autoclave-shredder to treat infectious waste, including sharps and pathological waste;	Hospitals and Medical College Management

Table 7.3 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
7.	Operating the hospitals and learning activities in the medical college	Employees of the hospitals and medical college as well as the communities in the project area	Public health and safety risks	➢ Combine shredding with the application of pressurized heated steam to destroy all forms of microbial life and achieve complete sterilization of infectious materials before disposal to the municipal waste steam; ➢ Autoclave clinical waste to mitigate its healthcare risk impact. ➢ Dispose pharmaceutical waste from medicines that can be safely diluted through the sewerage system ➢ Make necessary arrangements with suppliers to return other expired or contaminated pharmaceutical products; ➢ Treat and dispose of all chemical waste according to the specifications formulated for each individual product;Ensure that hygienic environments are maintained in toilets, food canteen, offices and general environment of the hospitals and college at all times; ➢ Ensure that good housekeeping is also maintained at all times; ➢ Provide a round-the-clock armed security personnel at all the hospitals and the college to screen all entering and leaving persons; ➢ Provide dedicated lines of communication with the security personnel 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.	Hospitals and Medical College Management

Table 7.3 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
8.	Operating the hospitals and learning activities in the medical college	Employees of the hospitals and medical college as well as the communities in the project area	Generation of Healthcare Risk Waste	➢ Management of medical college and hospitals shall: ➢ Ensure that all clinical wastes are autoclaved; ➢ Ensure that an integrated autoclave-shredder are provided for treatment of infectious waste, including sharps and pathological waste; ➢ Ensure that shredding is combined with the application of pressurized heated steam to destroy all forms of microbial life and achieve complete sterilization of infectious materials before disposal. This process is cleaner and more environmentally friendly because no hazardous emissions are produced and no chemicals or radiation is used; ➢ Ensure that pharmaceutical waste from medicines that can be safely diluted are disposed through the sewerage system; ➢ Ensure that necessary arrangements are made with suppliers to return other expired or contaminated pharmaceutical products; and Ensure that all chemical waste are treated and disposed of according to the specifications formulated for each individual product.	
9.	Maintenance operations	Physical and human environments of the project area	Pollution and public health risks	➢ Hazardous waste such as those from cells/accumulators should be segregated and treated with due care and following appropriate safety procedures; ➢ All wastes should be disposed of following appropriate procedures; and ➢ Maintenance workshops should have proper oil interceptors to collect spilled oil and other hazardous chemicals.	Centre Managers
10.	Recruitment of operations employees	Host communities	Reduction in crime rate	➢ Give preference to the people of the project area when recruiting for employees; ➢ People from the project area are shall be given opportunity to provide essential services such as food and transportation to employees; and	SOSG

Table 7.3 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
				➢ Sokoto State Government should support local security arrangements operated by vigilante groups in the project area.	
11.	Host communities	Operating the hospitals and the college	Stimulating/Boosting of Local Economy	➢ Extend operations and maintenance procurement opportunities to the local people; ➢ Give the local people priority during employee recruitment; and ➢ Patronize local service vendors.	Management of medical college and hospitals shall
12.	Host communities	Operating the hospitals and the college	Climate change mitigation	➢ Renewable energy technologies shall be used in the hospitals and the college such as for lightening and in other applications; ➢ Specification of materials and/or components will be undertaken by specifying the use of energy efficient equipment and lighting; and ➢ Rainwater Harvesting systems should be installed in the hospitals and the college	SOSG
13.	Communities in Sokoto State	Operating the college and hospitals	Skill Acquisition and Training Opportunities	➢ Introduce networking events through workshops, seminars and lectures to bring students and health personnel up to date with current health issues and to get ideas from others; ➢ Provide regular sponsored professional training opportunities to personnel to ensure that they are up-to-date with latest medical advancement; and ➢ Ensure skill acquisition training is giving to maintenance personnel during routine maintenance work.	Management of medical college and the hospitals

Table 7.3 continued

S/No.	Project Activity	Receptor	Impact	Mitigation	Responsibility
14.	Operating the hospitals and medical college	Communities in the project's extended area of influence	Enhanced health status of communities	➢ Establish a comprehensive Health Insurance Programme for both the public and private sector in the State; ➢ Provide free/low cost basic immunization and vaccination services in the State; and ➢ Enforce strict compliance with the Public Health Act within the State.	SOSG
15.	Operating the hospitals and medical college	Communities in the project's extended area of influence	Contribution to gender equality	Remove all barriers to women's participation during recruitment and training of operational personnel and implement Gender Affirmative Action during training and promotion exercises.	SOSG
16.	Erecting, landscaping and maintenance of the buildings	Communities in the project's extended area of influence	Aesthetics Impact on its immediate environment	➢ Ensuring that the physical structures of the medical college and hospitals are well maintained and kept clean and well-painted; and ➢ Ensuring that the lawns and gardens are well-maintained and kept.	Management of the medical college and hospitals
17.	Operating the hospitals and medical college	Communities in the project's extended area of influence	Saving of foreign exchange from medical tourism	➢ Providing good and sustainable social and economic infrastructure, such as good and efficient transport system, ICT, etc., especially within the State Capital, such that medical vacation/leisure tourists can be attracted to the State; and ➢ Providing a good and efficient security and policing system to create a peaceful and low-crime environment.	SOSG
18.	Operating the hospitals and medical college	Communities in the project's extended area of influence	Increased Potential for Industrial Development	➢ Providing incentives for local businesses; ➢ Providing tax waivers/holidays to alien businesses; and ➢ Modifying Government procedures to be more transparent and simpler to facilitate establishment of industries and promote ease of doing business.	SOSG

7.8 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 medical college, depending on proper maintenance, is 50 years. This, in effect, means that the medical college will be expected to be fully operational for at least 50 years, and may be more, if they are still in good shape.

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 college building would then be determined.

Since the proposed project is not expected to be decommissioned soon 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 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, to effectively manage these impacts. The plan must include management measures to mitigate unavoidable negative impacts to acceptable levels. Similarly, any potential positive impacts, e.g., job creation must also be managed 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.

7.8.1: Rehabilitation of Construction Activities

Temporary concrete structures at the college site 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 of the affected area must also be carried out.

7.8.2 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.

7.8.3 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.

7.8.4: 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.

7.9 ENVIRONMENTAL MONITORING PROGRAMME

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 stipulated as mitigation/enhancement measures in the ESMP. 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 the responsibility of ensuring that the proposed mitigation measures are properly implemented during the various phases of the project.

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

Environmental monitoring is an essential component of project implementation. It facilitates and ensures the follow-up of implementation of the proposed mitigation measures as specified in the ESMP. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Monitoring Requirements

A monitoring program requires several 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 commitment to monitoring, reporting mechanism including feedback on monitoring results and recommendations.

Table 7. 4: Monitoring programme for the preconstruction phase

S/ No.	Project Activity	Impact	Management Action	Objectives	Time-frame	Monitor. Parameter	Respons-ibility
1.	Short-term Employment	Creation of employ-ment	➢ 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/ SOSMEnv
2.	Purchases and procurement of services by preconstruc-tion field workers	Boost in local trading activities	➢ Encourage pre-construction employees to patronize local traders and service providers from the immediate project communities.	To stimulate trading activities in the project communities	During pre-construction field work	Interviews with local traders and service providers	FMEnv/ SOSMEnv
3	Pre-construction field work	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 mitigate occupational hazards on pre-construction employees	During field work in the pre-construction phase	Physical appearance of constructio-n employees in the field	FMEnv/ SOSMEnv

4.	Preconstruc-tion field work	Exposure to STIs and COVID 19	Preconstruction employees shall 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.	To safeguard the health and safety of field workers	During Preconstruc-tion field work	Evidence of sensitizatio, such as toolbox meeting attendance	FMEnv/ SOSMEnv

Table 7. 5: Monitoring programme for the construction phase

S/ No	Project Activity	Impact	Management Action	Objectives	Time-frame	Monitor. Parameter	Respons-ibility
1.	Taking over the farmland as the project site by the contractor	Loss of Farm-lands	➢ Provide alternative farmlands for staff of the institutions previously using the proposed project sites as farms; and If there are no alternative farmlands available within the university, encourage (financially) the farmers using the site as farmland to get farmlands outside the institutions.	To minimize socio-economic disruptions on the lives of farmers	Before commence-ment of constructio n work	Interaction with the farmers	FMEnv/ SOSMEnv
2.	Site Clearing	Introducti on of Alien Invasive Species (AIPs)	➢ An integrated alien plant species control programme shall be complied with by the contractor.	To ensure that alien plant species are not introduced into the site	During site clearing	Supervision of decontamin-ation procedures of equipment	FMEnv/ SOSMEnv / HSE Consultant

Table 7.5 continued

S/ No	Project Activity	Impact	Management Action	Objectives	Time-frame	Monitor. Parameter	Responsibi-lity
3.	Site Clearing	Reduction in abundance and species of fauna and flora	➢ Construction scheduling must include rehabilitation of disturbed areas with replanting of local species as soon as possible; and ➢ Avoid unnecessary clearing of vegetation.	To minimize bio-diversity loss	During site clearance	Physical condition of cleared site	FMEnv/ SOSMEnv/ HSE Consultant
4.	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; and ➢ Re-vegetate exposed areas	To minimize soil erosion of exposed soil	During site clearance	Physical condition of the site	FMEnv/ SOSMENV / HSE Consultant
5.	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 best practice and relevant laws; and Lubricants and engine oils must be stored in a manner that prevents spillage into the environment.	To avoid oils contaminating the soil and water of the project area	Monthly throughout the construction period	Monitoring effluent water quality on site	FMEnv/ SOSMEnv/ HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
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 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/ SOSMEnv/ HSE Consultant
5.	Movement of construct-ion 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.	Minimize dust generation and to comply with stipulated Air Quality Standards	Monthly throughout the construction period	Visual observation and in-situ measurement of air quality on site	FMEnv/ SOSMEnv /HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
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 university and to the general public; ➢ Locate noisy plants/generators far away from sensitive areas; ➢ Construction employees should be prevented from working at night; ➢ Provide and enforce use of ear plugs/muffs by operators of noisy construction equipment; and ➢ Noise from Construction vehicles and equipment shall be reduced using properly sized mufflers/engine silencers. Equipment shall also be powered off when not in use.	To minimize noise and vibration	Weekly throughout the construction period	Physical inspection of equipment and noise measurement throughout the construction period	FMEnv/ SOSMEnv/ HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time-frame	Monitor. Parameter	Responsibi-lity
7.	Construct-ion 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.	To safeguard health and safety of construction employees and the public	Weekly	Physical inspection of work areas and construction personnel and relevant records of sensitization such as attendance of toolbox meetings	FMEnv/ SOSMEnv and the Supervising HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
	Construct-ion activities and conduct of workers	Public Health and Occupational Hazards	➢ 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 a 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 laboratories and lecture halls should be appropriately designed with emergency fire-exits; ➢ Provide adequate toilet facilities for construction employees;	To safeguard health and safety of construction employees and the public	Weekly	Physical inspection of work areas and construction personnel and relevant records of sensitization such as attendance of toolbox meetings	FMEnv/ SOSMEnv and the Supervising HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
	Construct-ion activities and conduct of workers	Public Health and Occupational Hazards	➢ Provide waste bins at appropriate locations for waste management; ➢ Project Contractor shall ensure that every employee working at the project site is provided with relevant and adequate PPE; and ➢ Project Contractor shall ensure educating employees on the detrimental effects of drug and alcohol abuse.	To safeguard health and safety of construction employees and the public	Weekly	Physical inspection of work areas and construction personnel and relevant records of sensitization such as attendance of toolbox meetings	FMEnv/ SOSMEnv and the Supervising HSE Consultant
8.	Employee recruitment	Social inequalities	➢ Recruitment team shall remove barriers to women's and People with Disabilities (PWDs) participation in the project execution by having transparent recruitment procedures that ensure that women and PWDs are also part of the recruitment process; ➢ Deliberate efforts shall be made to involve women and PWDs at various stages of the project implementation, which may be for example by allowing them to run catering services for the construction employees; and	To improve social and economic well-being of women and PWDs	Monthly throughout the construction period	Frequent visitations and personal interviews with women and PWDs	FMEnv/ SOSMEnv/ HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
			Construction employees shall be discouraged from taking advantage of vulnerable women and girl-child and from sexually abusing them;	To improve social and economic well- being of women and PWDs	Monthly throughout the construction period	Frequent visitations and personal interviews with the women and PWDs	FMEnv/ SOSMEnv/ HSE Consultant
9.	Construct-ion activities	Mismanage-ment of waste	➢ Waste disposal facilities including waste bins, toilet facilities and septic tanks/mobile toilets shall be provided in the construction sites; ➢ The contractor shall ensure a comprehensive daily house-keeping in storage and construction areas; ➢ The strategy of waste reduction, re-using and recycling shall as much as possible be implemented throughout the construction phase; ➢ Hazardous waste shall be handled and managed separately; and ➢ All waste categories shall be managed appropriately by an accredited waste vendor to be procured by the contractor	To prevent pollution and preserve public health	Monthly throughout the construction period	Physical conditions of the construction sites, offices, and contractor's yard	FMEnv/ SOSMEnv/ HSE Consultant

Table 7.5 continued

S/No	Project Activity	Impact	Management Action	Objectives	Timeframe	Monitor. Parameter	Responsibi-lity
10.	Supplies of construct-ion materials and goods and services demanded by the construct-ion 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 shall be provided by people from the host communities; ➢ The Project Contractor shall source for as many materials 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.	To create jobs for the project communities and improve their socio-economic status	Monthly throughout the duration of construction activities.	Interviews/ interactions with the project communities to ascertain the level of compliance by the contractor	FMEnv/ SOSMEnv/ HSE Consultant

Table 7. 6: Monitoring programme for the operational phase

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
1.	Operational activities	Noise and vibration pollution	➢ Low noise equipment and machineries shall be selected and procured for the hospitals and Medical College; ➢ 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 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 and positioning of noise and vibration making machineries	FMEnv/ SOSMEnv/
2.	Operational activities	Soil and Water Pollution	➢ Medical College and hospital Management shall: ➢ Ensure that waste collection and disposal facilities including waste bins, and septic tanks for sewage are provided at the hospitals; ➢ Ensure that hazardous waste such as those from cells/accumulators shall be treated with due care and managed by accredited waste vendors following appropriate procedures; and ➢ Ensure that maintenance workshops shall use proper oil interceptors to collect spilled oil and other hazardous chemicals.	To prevent soil and water pollution and safeguard the health and safety of the project communities	Biannually	Physical condition of the hospitals and medical college	FMEnv/ SOSMEnv/

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
3.	Operating electric machines	Electrocution Risks	➢ High voltage areas shall be well secured and safety warning signage of the dangerous/high voltage shall be boldly posted 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 always ensuring the use of relevant PPEs by operations and maintenance personnel	To minimize electrocution risks	Biannually	Physical planning of high-voltage area and presence and nature of safety signage and inspection of PPE usage by personnel	FMEnv/ SOSMEnv/
4.	Operations and skills acquisition activities	Risk of Fire Outbreak	➢ Fire-fighting equipment shall be provided and stationed strategically in appropriate locations; ➢ All employees and students at the hospitals and medical college shall be trained on fire and general emergency response preparedness; ➢ Fire drills shall be carried out regularly to prepare all employees and students on emergency response procedures;	To minimize fire hazards	Biannually	Fire-fighting preparedness and interviews with personnel on fire-safety preparedness and drills performed	FMEnv/ SOSMEnv/

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
4.	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; and ➢ Ensure that relevant PPE are always used for work and trainings in the hospitals and college.	To minimize occupational accidents and incidents	Biannually	Physical planning of laboratories and provision of safety signage and PPEs, First-Aid kits as well as enforcement of safety procedures during training/teaching sessions	FMEnv/ SOSMEnv/
5.	Interaction amongst community members and trainees	Public health, safety and security risks	➢ Sensitize staff, students 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 hospitals and college at all times; ➢ Ensure that good housekeeping is also maintained at all times; ➢ Provide a round-the-clock armed security personnel to guard the hospitals and Medical College sites;	To minimize public health, safety and security risks	Biannually	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/ SOSMEnv/

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
			➢ Provide dedicated lines of communication with the security personnel at the s 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.	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 ➢ Workshops should have proper oil interceptors to collect spilled oil and other hazardous chemicals;	To minimize risks from hazardous waste	Biannually	Evidence of proper waste management	FMEnv/ SOSMEnv/
	Operating the hospitals and the medical college	Generation of Healthcare Risk Waste	➢ Ensure that all clinical wastes are autoclaved; ➢ Ensure that an integrated autoclave-shredder are provided for treatment of infectious waste, including sharps and pathological waste;	To minimize risks from Healthcare Risk Waste	Biannually	Evidence of proper Healthcare Risk Waste management	FMEnv/ SOSMEnv/

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
	Operating the hospitals and the medical college	Generation of Healthcare Risk Waste	➢ Ensure that shredding is combined with the application of pressurized heated steam to destroy all forms of microbial life and achieve complete sterilization of infectious materials before disposal. This process is cleaner and more environmentally friendly because no hazardous emissions are produced and no chemicals or radiation is used; ➢ Ensure that pharmaceutical waste from medicines that can be safely diluted are disposed through the sewerage system; ➢ Ensure that necessary arrangements are made with suppliers to return other expired or contaminated pharmaceutical products; and ➢ Ensure that all chemical waste are treated and disposed of according to the specifications formulated for each individual product.	To minimize risks from hazardous waste	Biann-ually	Evidence of proper waste management	FMEnv/ SOSMEnv/
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 ; and	To enhance job provision to members of the project communities	Biannually	Employment and procurement records	FMEnv/ SOSMEnv

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibility
			The State Government should support local security arrangements operated by vigilante groups in the project area.				
	Operating the hospitals and the college	Stimulating/ boosting of the local economy	➢ Extend operations and maintenance procurement opportunities to the local people; ➢ Give the local people priority during employee recruitment; and ➢ Patronize local service vendors.	To boost the economy of the project area by providing employment and creating wealth	Biannually	Interview/ interactions with the host communities	FMEnv/ SOSMEnv
	Operating the hospitals and the college	Climate change mitigation	➢ Renewable energy technologies shall be used in the hospitals and the college such as for lightening and in other applications; ➢ Specification of materials and/or components will be undertaken by specifying the use of energy efficient equipment and lighting; and ➢ Rainwater Harvesting systems should be installed in the hospitals and the college	To mitigate climate change	Biannually	Physical inspection of the hospitals and Medical College	FMEnv/ SOSMEnv
	Operating the college and hospitals	Skill acquisition and training opportunities	➢ Introduce networking events through workshops, seminars and lectures to bring students and health personnel up to date with current health issues and to get ideas from others; ➢ Provide regular sponsored professional training opportunities to personnel to	To enhance the skill and productivity of the staff and students and communities in the project area	Biannually	Interview/ interactions with the staff and students of the hospitals and the medical college	FMEnv/ SOSMEnv

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
			➢ ensure that they are up to date with latest medical advancement; and ➢ Ensure skill acquisition training is giving to maintenance personnel during routine maintenance work.				
	Operating the hospitals and medical college	Enhanced health status of communities	➢ Establish a comprehensive Health Insurance Programme for both the public and private sector in the State; ➢ Provide free/low cost basic immunization and vaccination services in the State; and ➢ Enforce strict compliance with the Public Health Act within the State.	To enhance the health and welfare of the communities in the immediate and extended project area	Biannually	Interview/ interactions with the people in the project area	FMEnv/ SOSMEnv
	Operating the hospitals and medical college	Contribution to gender equality	Remove all barriers to women's participation during recruitment and training of operational personnel and implement Gender Affirmative Action during training and promotion exercises.	To reduce gender gaps and social inequalities in the project area	Biannually	Interview/ interactions with women employees and other members of the communities	FMEnv/ SOSMEnv
	Erecting, landscaping, and maintenance of the buildings	Aesthetics Impact on its immediate environment	➢ Ensuring that the physical structures of the medical college and hospitals are well maintained and kept clean and well-painted; and ensuring that the lawns and gardens are well-maintained and kept.	To enhance the aesthetics value of the project area	Biannually	Physical inspection of the premises of the hospitals and Medical College	FMEnv/ SOSMEnv

Table 7.6 continued

S/No	Project Activity	Impact	Management Action	Objectives	Time frame	Monitor. Parameter	Responsibi-lity
	Operating the hospitals and medical college	Saving of foreign exchange from medical tourism	➢ Providing good and sustainable social and economic infrastructure, such as good and efficient transport system, ICT, etc., especially within the State Capital, such that medical vacation/leisure tourists can be attracted to the State; and ➢ Providing a good and efficient security and policing system to create a peaceful and low-crime environment.	To attract local and foreign medical and leisure tourists by providing a safe and efficient environment that is advanced in healthcare delivery	Biannually	Physical condition and availability of enabling infrastructure in Sokoto and its satellite towns	FMEnv/ SOSMEnv
	Operating the hospitals and medical college	Increased Potential for Industrial Development	➢ Providing incentives for local businesses; ➢ Providing tax waivers/holidays to alien businesses; and ➢ Modifying Government procedures to be more transparent and simpler to facilitate establishment of industries and promote ease of doing business.	To attract local and foreign investors by providing a safe and efficient environment that is advanced in healthcare delivery	Biannually	Interactions with potential investors	FMEnv/ SOSMEnv

7.10 WASTE MANAGEMENT PLAN

The proposed waste management plan has the objective of progressive reduction of wastes with the target of minimizing overall emissions/discharges. The plan also has the objective of implementing waste segregation aimed at enhancing recycling, as well as ensuring that contractors are responsible for effective waste handling and disposal, which shall be monitored by the project consultant.

7.10.1 Waste Handling Guidelines

For proper handling and disposal, wastes shall be well defined at source and transmitted along to the final disposal points. Contractor's personnel shall define and document all waste generated in the course of work in a monthly waste stream report, which shall be used to track/monitor wastes generated from the construction site. Basic information that must be provided as a minimum for adequate definition of waste management include:

i. Waste prevention
ii. Waste type identification
iii. Waste minimization/Reduction
iv. Waste segregation
v. Recycling point and work execution
vi. Waste disposal and
vii. Hazardous waste requirements.

7.10.2 Waste Type Identification

The major categories of wastes envisaged from the project execution are outlined as follows:

Solid wastes: These include felled vegetation/trunks, obsolete equipment and tools, excessive/unused concretes and debris from civil works, hips of sand generated from the earth works, woods from crates, metals, papers, printer cartridges and other office equipment scraped which are due to be removed during site clean-up,

Domestic waste: This comprises of waste generated from the kitchen, packing materials, boxes, plastics, etc.

Liquid wastes: These include non-hazardous waste generated from work construction sites e.g. lubes, lubricants, sanitary water, paints etc.

Gaseous wastes: These include combustion products from construction engines, welding gas, natural gas leaks, hydrocarbons etc.

Hazardous waste: These are gaseous, liquid or solid wastes, which due to quantity, physical, chemical or infectious characteristics have the potential to harm human health or environment when improperly handled, stored, disposed, transported or treated e.g. acids, lead phenols, etc. Hazardous waste produced as part of the construction activities should be properly collected and disposed at an appropriate licensed facility by a licensed waste vendor.

7.10.3 Waste Minimization / Reduction

Waste minimization implies reduction to the greatest extent possible of the volume or toxicity of waste materials. The four principles of waste minimization- reduce, reuse, recycle and recover- shall be adopted as applicable. The key elements of the four waste minimization/management principles practices are outlined.

Minimization - Reduce through process modification / design change, material elimination, inventory control and management, material substitution or improved housekeeping.

Reuse - Chemical /Oil containers.

Recycle - Recycle scrap materials, Recycle paper for other purposes suitable for the project. Recover - Waste lubricating oil for energy recovery, excess earth and other wastes that may be useful in the course of the work can be recovered.

7.10.4 Waste Segregation

Waste generated will be sorted and segregated at source to avoid mixing of incompatible waste materials, in accordance with Nigeria regulations. Seperate, suitable waste storage facility for toxic and hazardous waste will need to be set up in collaboration with the service providers to ensure that the waste is safely stored, collected, transported and treated/disposed of. The Contractor shall obtain and provide proof, to the Resident Engineer, of compliance with all necessary approvals from government and/or local authorities for waste management. A recycling point shall be established, clearly identifying which waste should go in which skip,

either with signs/pictures or by colour coding the skips. The main solid and hazardous and waste segregation types are:

- Food waste
- General waste (e.g. plastic, paper, card)
- Hazardous waste (e.g. paint/fuel/oil cans, PCBs, oily rags, contaminated soil, etc.)
- Concrete waste (just dry concrete – breezeblock or spilled concrete material)
- Metal waste (e.g. rebar, girders or similar) has a good re-sale value, so should be segregated into separate skip
- Timber waste (e.g. from form works or crates)
- Green waste (typically vegetable cuttings)

7.10.5 Waste Prevention

The Contractor shall maintain a tidy site by implementing good housekeeping, which can reduce waste generation. There shall be storage of construction material at site in a safe and responsible manner to preserve the quality and in turn minimize waste. Where possible, materials will be ordered in bulk – to reduce packaging

Plastic drums, empty plastic bottles, scrap metal, batteries, wastepaper and waste oil will be segregated on site and send to recycling. The Contractor will re-use as many materials on site as practicable.

Sub-contractors shall be encouraged to take away and re-use surplus materials in the same or other projects if practicable

7.10.6 Recycling Point and Work Execution

The Contractor is bound to observe the following requirements:

- An adequate number of containers (skips, bins or similar) will be strategically placed throughout the construction areas and temporary facilities.
- The waste containers will be regularly collected and taken to the main waste storage area. The Contractor's environmental officers will ensure that waste containers that are filled up are removed from site and that waste containers are not allowed to overflow.
- Containers will be regularly inspected. Waste receptacles will be kept securely closed during accumulation (except for opened trash skips) and storage, except when it is

necessary to add waste, and will be tightly sealed prior to transportation from generation area.

- Containers will not be opened, handled or stored in a manner, which may rupture the container or cause it to leak.
- Containers will be lifted using only the designated lifting points.
- The storage containers will be of sufficient size and number to contain all solid wastes generated between collections.
- The contractor will store waste appropriately, depending on the type of waste being stored, with a sufficient number of skips/storage areas for the different wastes.
- All food waste will be properly stored in containers with closed metal or hard plastic tops to minimize the possibility of vermin infestation or odour emanating.
- All light waste skips (particularly, those for plastic/cardboard) should have covers (tarpaulin/netting) in order to stop light wastes from being blown around site by the wind.
- General waste storage on bare ground is not permitted.
- Place a bucket with sand near staff canteen or mess hall, for safe disposal of cigarette butts. Cigarette butts contain toxins and must not be left on the ground.
- Wood should be stored separately (either in skip or fenced off area), but not allowed to grow to bonfire size, where it could have safety risks.
- Inert construction waste will be segregated into combustible and non-combustible. Flammable substances will be kept away from sources of ignition.
- Old tyres are a fire hazard. Stockpiling of used tyres shall be forbidden, they must be taken to a tyre recycling system or landfill for disposal.
- Segregated, dedicated waste skip or fenced off area just for storing dry concrete (breezeblocks or spilled concrete materials), ensuring that wet concrete sludge is not stored with it.
- Remove any plastic from the concrete (e.g. plastic used to contain any drips when pouring) before placing within waste pile.
- Waste sorting area: If the dumped waste is likely to contain food or hazardous wastes, then the sorting area should have a base made of hardstand (e.g. impermeable concrete) to stop any potential contamination of the ground or ground water. The sorting area should be contained tightly with hoardings and/or green netting to stop any windblown

waste from escaping from the area and impacting other activities, and the sorting area (as well as any skips, bins or waste piles) will be at least 30m away from any water bodies.

7.10.7 Waste Disposal

All debris, spoil materials, and other wastes shall be cleared regularly from the site and disposed of at approved dump sites operated by designated waste disposal vendors/authorities. Instructions on material safety handling sheet shall be strictly adhered to and shall form the basis for the disposal of wastes related to such products. Wastes in transits shall be accompanied and tracked by waste disposal notes. The note shall contain such information as date of dispatch, description of wastes, waste quantity, container type, designated disposal site and method, consignee name, means of transport and confirmation of actual disposal time and date. Special attention will be accorded to equipment removed from the sites and also drums of engine oil that might contain PCBs; these are to be transported to a site approved by the client for safe storage and subsequent testing prior to disposal. Waste management audit of facilities shall be carried out in consultation with the RE/Consultant's environmental team, and findings shall be properly documented and followed up. Accommodation, catering services areas and work site shall maintain acceptable standard of hygiene and good housekeeping. The following bad conducts should be closely checked against during the various phases of the project;

- No waste should be randomly dumped on site or buried within the temporary or permanent sites.
- No waste should be burnt on site.
- Waste generated during work activities, must be fully contained and disposed of appropriately once ashore.
- No waste is to be disposed overboard.
- Hazardous waste will only be disposed of in the area designated by the competent authority. It will remain segregated and in the labelled storage containers.
- Incompatible hazardous wastes will not be transported together.

7.10.7 Hazardous Waste Requirements

Hazardous wastes produced during the project implementation will be segregated and confined to a special purpose storage area. The following are the requirements for managing hazardous materials throughout the life span of the project;

- Fire prevention systems and pollution control equipment will be provided for storage facilities where necessary, to prevent fire or the release of hazardous materials to the environment.
- Containers intended for hazardous waste disposal will not be used for other purposes unless they are specifically labelled for that purpose.
- Rusty, dented or defective containers for waste accumulation or storage will not be used.
- Different types of hazardous waste will be stored separately to avoid adverse chemical reactions and facilitate eventual treatment.
- Hazardous waste will be retained in a secure area with an impervious bunded base.
- Unused liquid paint cannot be disposed of with general waste, only completely dried-out paint residue tins / drums may be disposed of with other solid waste. Drain used oil or fuel filters of the residual liquids by placing them on a mesh rack in a tray or drum. The drained filter can then be disposed of as scrap metal. The drained oil or fuel must be collected by a waste oil recycling contractor.
- Store used batteries on a concreted surface or metal / hard plastic tray. This is due to their acid content.
- Hazardous waste must be stored separately from non-hazardous waste and away from source of ignition.
- Hazardous chemical will be stored and handled in accordance with the manufacturer's Material Safety Data Sheet.
- Spill prevention measures will be adhered to by the Contractor, who will maintain a register of all hazardous waste and disposal method.

7.10.8 Chemical/Oil Spill Management and Treatment Procedure

In the unlikely event of a chemical spill, the area shall be ventilated (if indoors) and an onsite Lab technician shall be contacted.

If there is a spill of Polycyclic Aromatic Compounds (PACs) or oil onto the ground it will be immediately contained using earth bunds to prevent it entering water. The spilt PAC or oil should be recovered if possible and placed in polyethylene containers. If the spilt PAC or oil cannot be recovered, it should be mixed with a volume of soil equal to at least ten times the volume of spilt PAC or oil and buried in dry soil.

If there is a spill of PAC into ponded water, discharge from the pond to natural water should be prevented. The pH of the water should be tested and if below pH 5.8 it should be treated with lime to increase the pH before discharge. If there is a spill of PAC or oil into flowing water:

- The volume of the spill should be recorded.
- If possible the water and spilt PAC or oil should be pumped into a bund or pond until all the spilt PAC or oil has been removed from the watercourse.
- If the PAC or oil cannot be removed from the watercourse any downstream users should be identified and advised. In association with the RE an action plan will be developed.

No chemicals shall be stored onsite, other than that contained in the chemical reservoir. A small bund will be constructed around the flocculation shed to ensure all spills are contained.

The flocculation shed will have a Hazchem sign attached to the outside, with appropriate information clearly visible including a 24hr emergency phone number.

7.10.9 Chemical and Hazardous Material Management

Diesel, petrol and oil, or “fuels” and liquid chemicals, such as thinners, solvents, paints, glues, acids, fertilizers and pesticides, must be stored in such a way that environmental harm does not result, nor is likely to result. The reference to “chemicals” here also includes unused chemicals, liquid mixtures made from dry chemicals and water or other liquids, and residues from chemical use (for example, the wash fluids resulting from cleaning of paint brushes). The reference to “fuels” here also includes waste fuels, such as waste oil, and waste emulsions (i.e. mixtures) of water and fuels.

Secondary Containment Requirements

Secondary containment is an additional impermeable device (such as a metal tray or a concrete bund) to hold a hazardous material and contain any spillage from its receptacle in the instance of a failure.

Fuel Tanks

The contractor should ensure that fuel tanks are double-skinned. A double-skinned tank has a primary tank with another "skin" placed around it with a very small gap (interstitial space)

between the two, thus allowing any leaked product (following a failure in the primary tank) to be contained in the outer tank.

- Double-skinned tanks are required to have a sight gauge or view glass within the outer tank so that it can be easily ascertained if the primary tank has failed. A metal drip tray should also be provided,
- The contractor shall ensure that the container is not stored directly on the soil, and should be on a level, hard standing surface,
- The contractor shall ensure the container is positioned on a concrete plinth within a secondary containment system (bund or drip tray) to catch any oil leaking from the container or its ancillary pipework and equipment,
- Bulk storage vessels should be checked to ensure integrity before use.
  - Bulk storage vessels will be integrity tested before use. A record of this test will be maintained on site.
  - For steel tanks in open bunds, a minimum distance of 750 mm between the tank and the bund wall and 600 mm between the tank and the base is recommended to allow access for external inspection.

Metal Drip Trays and Catchment Trays

All stationary diesel and petrol operated construction equipment, including power generators, are to have impervious catchment trays or drip trays placed beneath them during operation.

- These impervious drip trays (usually made of metal) that are of a sufficient size to contain any breach of primary containment.
- Trays are large enough to extend beyond the outline of the object, The contractor shall place metal catchment trays under any static plant or equipment containing fuel or other hazardous liquids.
- Any spillages into the metal drip trays will be treated as hazardous waste and collected for safe disposal by an approved waste contractor.
- Any debris (dust, rubbish, water) that falls into the metal tray or any hazardous liquid that leaks will be treated as hazardous waste as well.
- If extensive dripping occurs, equipment shall be sent for maintenance, Oil stored in mobile bowsers is also required to be bunded or in metal catchment trays.

- Metal drip trays will be provided for smaller chemical and fuel storage areas.
- Drums, containers and tanks must be placed a sufficient distance in from the edge of the storage area, such that fuel will be prevented from leaking directly to unsealed surfaces or into waterways in the case of a puncture or drums/ containers falling over.
- The contractor shall place any container holding hazardous liquids taken to a worksite for use within a catchment tray in order to prevent leaks, spills or overflow contaminating the surrounding area.
- On the construction site, refueling, oil changing and light maintenance will be undertaken using drip trays. This will prevent any release of materials from accidental spills into the underlying soil and groundwater. Metal impervious drip trays must be used during maintenance work or emergency servicing on site so as to catch any spills. They must be provided at the time of fuel delivery to catch any oil that could be lost during the coupling and decoupling of the delivery hose.

Concrete Washout

The washout of concrete equipment (concrete ready-mix trucks; concrete pumper trucks; concrete hand mixers and similar) have the potential to release contamination into the soil, groundwater and waterways. All drainage from concreting activities must be controlled.

- Concrete wash out areas shall be only installed with prior approval from RE and Environmental Representative and location will be included within the site compound plan.
    - Washout of concrete trucks shall be performed in designated areas only. This is typically at a concrete batching plant but may occasionally be on site as long as an approved wash-out facility has been constructed.
    - A sign shall be installed adjacent to each washout area to inform concrete equipment operators to utilize the proper areas.
    - Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Concrete mixer trucks should return to the batching plant where their load originated from, for full washing out.
- Concrete trucks are to be washed only at an approved concrete truck washing facility, capable of retaining all excess water, residue and waste. Such facilities will be approved

by the Resident Engineer and Environmental Representative prior to being installed and used on site. The washing of concrete trucks on-site and outside of an approved facility is strictly prohibited and offenders will be denied entry to the site.

- Minimize water used in concrete cleaning by using:
  - Brushes and rags, to remove excess solids, instead of high-pressure hoses
  - Buckets washing
  - Hoses with low volume, high pressure-spray nozzles and handheld trigger controls
- Washout areas shall be cleaned once the washout is 75% full.
- When concrete washout areas are no longer required for the work, the hardened concrete shall be removed and disposed of properly. Materials used to construct these areas shall be removed from the site and disposed of properly.
- Holes, depressions or other ground disturbance caused by the removal of concrete washout areas shall be backfilled.

Concrete washout areas shall be inspected regularly and maintained to provide adequate holding capacity. Maintaining concrete washout areas shall include removing and disposing of hardened concrete and returning the areas to a functional condition.

7.11 TRAFFIC MANAGEMENT PLAN (TMP)

The objective of the Traffic Management Plan prepared for this project is to prevent traffic accidents from occurring, around the construction area or involving the project construction vehicles in some other areas, during the implementation of the project.

Traffic Co-Ordinator, who may be the Engineering Representative is responsible for making sure that the TMP is reviewed and amended when required. The plan must specify the name, signature, contact details and names of appointed banksmen on site. Any person directing traffic on site must be trained and competent and have appropriate personal protective equipment. There shall be a full-time safety administrator, and some traffic and safety management personnel who shall be assigned various responsibilities to ensure total compliance with the traffic management plan.

Sufficient resources will be made available for the implementation of the TMP. Hoarding, barriers, lighting and signs will be procured at start up. As the construction work progresses,

pedestrian and traffic routes will change and barriers, traffic cones and signs will be moved to ensure that there is adequate pedestrian and vehicle separation. Fixed barriers shall be used to separate vehicles from pedestrian walkways and to protect loading and unloading areas on site. Typical resources that shall be used preliminary include: signage (for the site and approach), traffic cones, pedestrian barriers, lighting, site security and wheel wash.

Responsibilities of Project Manager

- The Project Manager is expected to conscientiously adhere to and strictly implement the traffic safety rules and regulations.
- He/She shall actively support the work of safety professionals.
- Regularly arrange for the conduct of safety training for employees, especially construction vehicles and machine operators.

Responsibilities of Project Engineer

- Organize the preparation of safety measures in the plan for traffic safety maintenance.
- Provide traffic safety technical education to construction drivers/employees.
- Organize safety technical training.
- Participate in the investigation and analysis of accidents and put forward improvement measures.

All operators of work-related vehicles or construction plant must be competent, authorised and trained to operate the equipment. The code of conduct of drivers must include not violating traffic regulations; not taking alcoholic drinks.

Before entering the project site, all vehicles must pass a safety inspection. This type of inspection is carried out by the on-site vehicle commander. Vehicles entering the construction site must also be registered.

All relevant temporary works shall be identified and marked-up with traffic management arrangements and their location on site plans:

- site entrance(s) (pedestrian and vehicle)
- site accommodation, if any, and overhead lines traffic routes and vehicle only areas
- storage / loading and unloading areas
- car parking arrangements
- pedestrian walkways

- on site hazards – excavations /overhead lines/ scaffolding / steep slopes

The TMP shall be updated on a regular basis as work progresses and then communicated to relevant onsite contractors and delivery drivers.

The number of vehicle and transport related hazards on site normally vary and depend on the type of work being done and requirements for the work, etc. The contents of the TMP must be circulated to all employees working on site during induction and at any time it is updated through toolbox meetings.

The employee responsible for developing the plan is also responsible for ensuring that the appropriate controls are put in place and are reviewed regularly. When introducing and reviewing controls they should be appropriate to the type of work that is being handled. The controls should be practical and easy to execute e.g. traffic safety cones in low traffic density areas versus fixed barriers in high density traffic areas.

According to the TMP all pedestrian routes should be:

- kept clear and free of tripping hazards
- separated from vehicle routes
- adequately sign-posted
- provided with crossing points that have a clear view

On the other hand, vehicle routes should be;

- separated from pedestrian routes
- designed to discourage reversing
- suitable for the project vehicles with appropriate speed limits
- designed to avoid steep gradients and sharp bends
- designed with ramps, signage and berms as required
- designed to consider loading and unloading areas

Other specific measures include the following:

- Vehicles should undergo preliminary inspections before construction sites are operated, and the operating conditions of equipment should be visually checked every day.
- Routine maintenance of construction vehicles and equipment must be ensured.

- In addition to wearing yellow helmets, traffic management personnel must wear reflective vests.
- Transporters of fine materials must ensure that their operation does not pose a nuisance through the spillage of material or the generation of dust.
- The Contractor shall remedy, at his own expense, dust generation and spillage where it occurs to an acceptable level along the transport routes.
- It is recommended that the load haul of all transport vehicles be covered with tarpaulins during the construction period.
- Deliveries shall be scheduled for off-peak hour traffic time schedules.
- All trucks and vehicles removing spoil from the site shall be covered by tarpaulin to prevent rocks and spoil from falling onto the road surfaces or other vehicles or causing a nuisance to the public.
- Access to and from the site by heavy duty equipment/trucks, shall strictly adhere to the provided access routes during the construction phase of the project, to avoid unnecessary traffic jams.
- Flagmen will be stationed at all strategic areas of the project work zones.
- Vehicle speed limits must be strictly complied with in the project area. The speed limit at the construction site is 5km per hour.
- All drivers who drive vehicles in the project must hold a valid driving license.
- Motor vehicles and trucks on site must be kept in good condition.
- Motor vehicles must give way to heavy equipment and emergency vehicles.
- Parking is only allowed in designated parking lots and spaces; in order to facilitate loading and unloading of materials, parking may be required in other places. The parking lot shall not block the route of emergency equipment at any time.
- If the vehicle is parked in other non-designated parking lots, the key must be left in the vehicle.
- If a motor vehicle traffic accident occurs on the construction site, the accident vehicle shall not be moved until the supervisor and HSE Manager have been notified and the accident scene investigation has been completed.
- If these traffic rules are violated, it may result in the disqualification of the driver from entering the construction site.

- During the intermission of transportation services, vehicles for transporting personnel should drive out of the work area and park in a safe place that does not affect traffic.
- Only company vehicles that transport equipment and materials have the right to enter the work areas, and they can only park during unloading. The driver must ensure that the vehicles and machinery are parked

Emergency Response Procedure

In an emergency, the safety and lives of employees comes first. This means that safety and lives of employees should be given priority before any other thing or consideration. Therefore, when a traffic accident occurs, people should be rescued first. After ensuring that all people who can be rescued have been properly rescued, consideration can then be given to saving valuable equipment.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATION

The Environmental and Social Management Plan (ESMP) for the proposed establishment of Medical College and Equipping of Sokoto State University Teaching Hospital 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 to ensure the success of the implementation of the ESMP for the project.

8.1 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 implemented through the implementation of the Environmental and Social Monitoring Plan designed for the project. The associated and potential impacts of the proposed project identified in the construction phase include adverse air quality, operational/equipment noise as well as soil and water pollution. Other identified potential impacts of the project include generation of construction and domestic wastes and occupational accident hazards 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 has a very high potential for job creation and reduction of disease and enhancing productivity in Sokoto State. The project will contribute foreign exchange savings and gender equality as well as create an aesthetically pleasing site, beautified with landscaping and gardens.

The most significant negative impact of the project in the operational phase is generation of hazardous medical waste and 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, the 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, if the ESMP is strictly implemented and monitored. The project is therefore recommended for an integrated implementation with the Environmental and Social Management Plan.

8.2 RECOMMENDATIONS

To ensure the success of the environmental and social management of the proposed medical college and equipping of Sokoto State University Teaching Hospital and the three (3) Premier Hospitals, the following are recommended:

- Stipulations 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 a need to ensure strict supervision and continuous monitoring by FMEnv, Sokoto State Ministry of Environment, SEPA and the E&S Consultant;
- 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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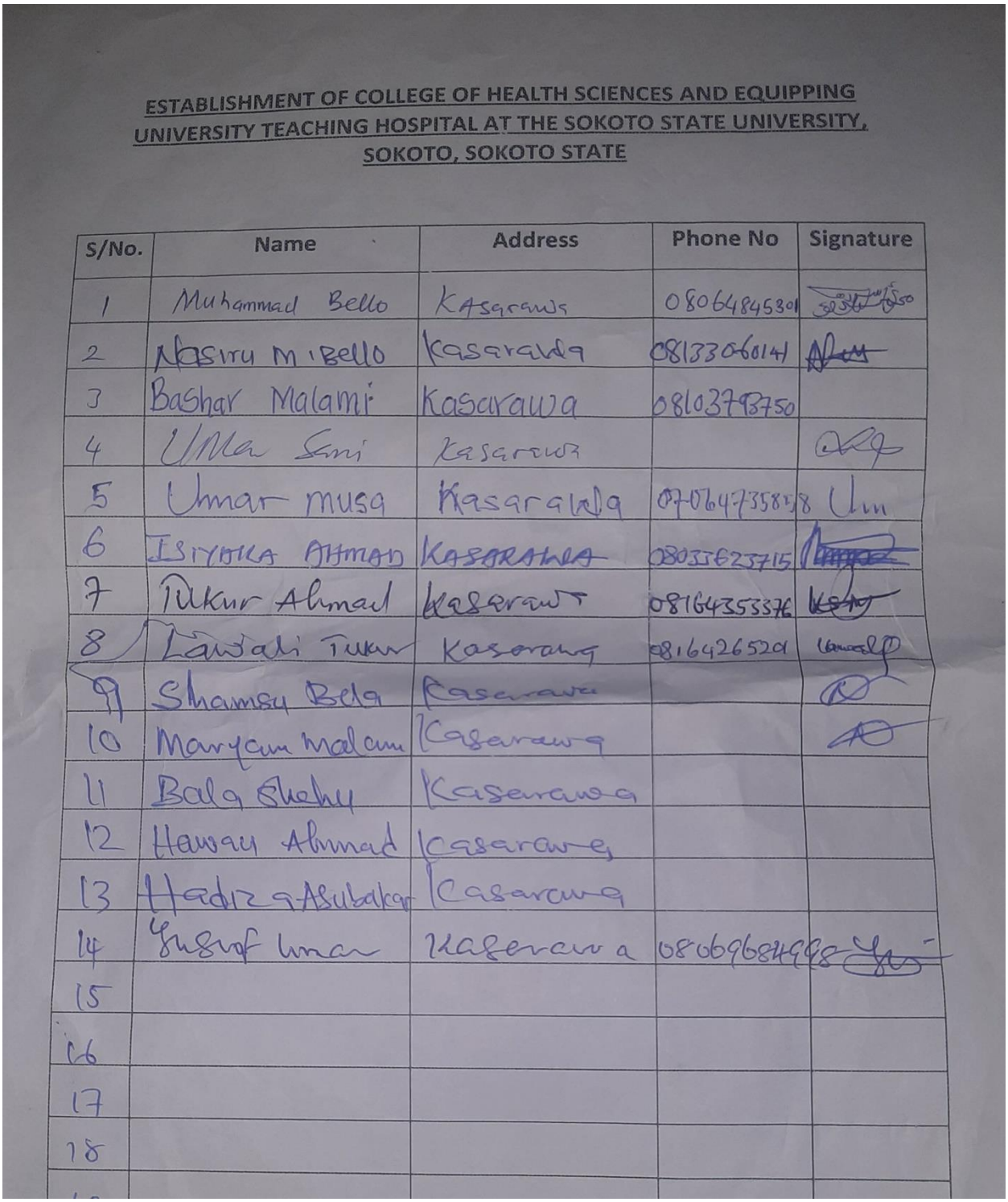
ATTENDANCE FOR STAKEHOLDERS' CONSULTATION MEETINGS



ESTABLISHMENT OF COLLEGE OF HEALTH SCIENCES AND EQUIPPING UNIVERSITY TEACHING HOSPITAL AT THE SOKOTO STATE UNIVERSITY, SOKOTO, SOKOTO STATE

S/No.	Name	Address	Phone No	Signature
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15				
16				
17				
18				

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ATTENDANCE FOR SOCIO-ECONOMIC CONSULTATION

S/N	Name	Address	Phone No.	Signature
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6	ATIYA BELLO	WAMAKKO	07037852689	
7	ABUBAKAR NAGINAGGO	SEPA, Sokoto	07090574731	

SOCIO-ECONOMIC SURVEY QUESTIONNAIRE

FOR

ESTABLISHMENT OF COLLEGE OF HEALTH SCIENCES AND EQUIPPING OF THE SOKOTO STATE UNIVERSITY TEACHING HOSPITAL

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 youcommunity?.....**
15) **Which electricity sources do you use?.....**
16) **What mobile telecommunication networks do you have in your community? ……**
17) **What are the commonly used transport systems 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 existing Post-basic medical training institutions in Sokoto State?

.....

23) What are the prevalent diseases/health problems in your community?

……

24) What are the available advanced health care facilities in your community, e.g, CT Scan, endoscopy,etc?.....

25) What are the major security challenges being experienced in your community?

……...

26) Are there any criminal activities /social vices that take place in your community?.....

27) If yes, what are they?…….....

28) How often do you experience communal and land disputes?

…….....

29) What are the major economic activities in your community?.....

……
……..…

30) What are your fears and expectations on the proposed project?.....

.....

ANALYTICAL RESULTS FOR SOIL AND GROUNDWATER

Our Ref: ROF/LD/A-227/11/2021
Attention:

Mr Charles Ntor
ENARMAC Nigeria Limited
Date: October17, 2021
Sir,

COLLEGE OF HEALTH SCIENCES

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: -

Table 1: Air Quality and Noise

Parameters/units	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	Ctrl 1 Down Stream	Ctrl Upstream
Noise level, d(B) A	43.2	42.1	45.5	43.3	46.1	48.1	42.6	40.7	41.3
SO_X, µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx, µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SPM µg/m^3	12	9	11	12	8	14	17	13	11
NH_3, µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CH_4 µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO_2 µg/m^3	0.02	0.07	0.08	0.05	0.01	0.07	0.02	0.01	0.02
H_2S, µg/m^3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Air Temp (°C)	35.18	35.01	36.04	35.01	35.03	33.14	35.01	35.01	36.04
Wind Speed (m/s)	0.01	0.01	0.04	0.02	0.07	0.01	0.01	0.01	0.04
Relative Humidity (%)	38.3	39.2	42.8	42.9	32.9	42.9	43.8	45.3	41.8

Table 2: Groundwater Results – hand dug well - ESMP for the Construction and Equipping of College of Health Sciences

Samples ID		**BH 1**
Physico-chemical		
	pH	7.80
	TEMP (°c)	29.18
	COND (µs/cm)	155.00
	TDS (mg/l)	142.00
	DO (mg/l)	5.17
	TSS mg/l	2.41
	Turbidity, NTU	5.15
	BOD (mg/l)	2.451
	COD (mg/l)	5.161
	Petroleum Hydrocarbons	
	THC (mg/l)	<0.001
	Nutrient	
	Nitrate (mg/l)	1.37
	Sulphate (mg/l)	55.01
	Ammonium (mg/l)	<0.01
	Phophate (mg/l)	2.41
	Heavy Metals	
	Nickel (mg/l)	<0.001
	Iron (mg/l)	1.015
	Lead (mg/l)	<0.001
	Copper (mg/l)	<0.001
	Chromium (mg/l)	<0.001
	Zinc (mg/l)	<0.001
	Cadmium (mg/l)	<0.001
	Barium (mg/l)	<0.001
	Cobalt (mg/l)	<0.001
	Arsenic (mg/l)	<0.001
	Mercury (mg/l)	<0.001
	Cations	
	Potassium (mg/l)	5.003
	Sodium (mg/l)	3.215
	Magnesium (mg/l)	3.012
	Calcium (mg/l)	3.022
	Microbiology	
	Coliforms	3
	E. coli	0
	Faecalstreptacocci	--
	Straphylococcociaureus	Absent

ANALYTICAL CONCEPT LTD RC:306099
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 3: Soil physico-chemical (WET season) - ESMP for the Construction and Equipping of College of Health Sciences

S/N	FIELD CODE	pH	TOC%	THC (mg/kg)	SO_4	NH_3 - N (mg/kg)	% TOTAL SAND	% TOTAL SILT	% TOTAL CLAY	TEXTURE	Ca (mg/kg)	Mg (mg/kg)	Na (mg/kg)	K (mg/kg)
1	SS1 0-15	7.31	1.02	0.01	0.12	0.02	63.0	10.2	25.8	sandy clay	14.12	13.60	11.23	28.53
2	SS1 15-30	7.81	1.52	0.01	0.21	0.01	72.4	15.9	11.7	sandy	15.61	14.42	24.52	13.02
3	SS2 0-15	7.42	0.10	0.01	1.18	0.03	68.0	19.0	13.0	sandy	13.14	12.23	18.51	12.46
4	SS2 15-30	7.21	0.15	0.01	1.82	0.04	71.5	19.0	9.5	sandy	12.92	14.92	14.21	10.15
5	SS3 0-15	7.31	0.51	0.01	1.14	0.06	71.2	18.0	10.8	sandy	14.65	12.10	11.33	10.41
6	SS3 15-30	7.21	1.11	0.01	2.73	0.07	75.0	9.0	16.0	sandy	16.41	12.51	14.47	18.11
7	SS4 0-15	8.115	1.01	0.01	2.24	0.03	93.4	5.0	1.6	sand	11.15	12.23	17.49	18.32
8	SS4 15-30	7.24	0.11	0.01	3.15	0.04	92.3	2.6	5.1	sand	16.14	12.28	19.45	18.35
9	SS5 0-15	7.12	1.01	0.01	4.11	0.01	78.2	9.5	12.3	sand	17.11	12.21	10.61	18.23
10	SS5 15-30	6.19	0.10	0.01	3.11	0.01	80.0	12.0	8.0	sand	12.15	12.31	18.13	11.3
11	SS6 0-15	7.90	1.14	0.01	4.13	0.12	78.2	9.5	12.3	sand	12.32	12.42	10.14	8.93
12	SS6 15-30	6.12'	0.11	0.01	3.31	0.57	80.0	12.0	8.0	sand	12.13	12.11	18.23	11.97
13	SS7 0-15	7.92'	1.01	0.01	3.01	0.16	78.2	9.5	12.3	sand	12.11	12.12	10.24	18.03
14	SS7 15-30	6.17	0.13	0.01	2.41	0.52	80.0	12.0	8.0	sand	12.10	12.12	18.0	11.3
15	SS 0-15 ctrl	7.01	0.04	0.01	3.42	0.04	58.0	13.0	3.0	sandy	12.11	12.32	14.34	18.92
16	SS 15-30 ctrl	7.32	1.11	0.01	3.29	0.01	85.0	5.3	9.7	sandy	11.01	14.21	17.11	14.08
17	SS 0-15 ctrl	8.14	1.16	0.01	3.72	0.18	29.8	44.3	25.9	loam	11.91	15.11	18.14	11.02
18	SS 15-30 ctrl	7.23	1.25	0.01	3.23	0.18	48.3	5.1	46.6	sand clay	11.31	12.43	10.17	12.43

Table X: Soil physico-chemical (WET season) - ESMP for the Construction and Equipping of College of Health Sciences

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	1.022	1.752	24.882	5.24	0.06	0.04	8.356
2	SS1 15-30	1.152	1.569	20.960	7.768	0.067	0.043	4.526
3	SS2 0-15	1.112	0.373	19.694	9.724	0.080	0.065	1.486
4	SS2 15-30	1.352	1.252	20.888	7.789	0.089	0.045	3.599
5	SS3 0-15	1.162	1.386	19.034	11.69	0.574	0.044	2.203
6	SS3 15-30	1.240	1.266	27.765	6.147	0.179	0.045	5.538
7	SS4 0-15	2.481	0.935	18.665	7.438	0.100	0.064	1.231
8	SS4 15-30	1.039	0.443	26.169	5.239	0.078	0.053	4.552
9	SS5 0-15	1.916	0.589	20.555	6.942	0.085	0.061	2.484
10	SS5 15-30	2.258	1.558	20.195	8.513	0.071	0.069	4.560
11	SS6 0-15	1.126	0.547	20.735	6.944	0.085	0.461	2.284
12	SS6 15-30	2.158	1.511	20.195	8.513	0.471	0.549	4.160
13	SS7 0-15	1.216	0.557	20.495	6.944	0.085	0.061	2.284
14	SS7 15-30	2.158	1.512	20.195	8.513	0.471	0.069	4.510
15	SS 0-15 ctrl1	1.105	1.013	22.055	7.539	0.092	0.071	1.790
16	SS 15-30 ctrl1	1.379	1.325	18.194	8.161	0.069	0.073	3.169
17	SS 0-15 ctrl2	1.913	1.456	21.654	9.310	0.083	0.048	8.371
18	SS 15-30 ctrl2	2.232	1.341	18.674	8.583	0.084	0.047	4.797

Table 4: Soil Microbiology (wet season) - ESMP for the Construction and Equipping of College of Health Sciences

S/N	FIELD CODE	HUB cfu/g X 10^4	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	0.00	2.01
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	2.04
6	SS3 15-30	0.00	0.00	0.00	0.00	3.03
7	SS4 0-15	0.00	0.00	0.00	0.00	1.05
8	SS4 15-30	0.00	0.00	0.00	0.00	1.07
9	SS5 0-15	0.00	0.00	0.00	0.00	3.02
10	SS5 15-30	0.00	0.00	0.00	0.00	1.02
11	SS6 0-15	0.00	0.00	0.00	0.00	3.46
12	SS6 15-30	0.00	0.00	0.00	0.00	2.13
13	SS7 0-15	0.00	0.00	0.00	0.00	2.25
14	SS7 15-30	0.00	0.00	0.00	0.00	2.14
15	SS 0-15 ctrl1	0.00	0.00	0.00	0.00	0.00
16	SS 15-30 ctrl1	0.00	0.00	0.00	0.00	0.00
17	SS0-15 ctrl2	0.00	0.00	0.00	0.00	0.00
18	SS 15-30 ctrl2	0.00	0.00	0.00	0.00	0.00