

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)  
FOR THE PROPOSED SPECIAL AGRO-INDUSTRIAL  
PROCESSING ZONES (SAPZ) PROGRAM, BAUCHI STATE,  
NIGERIA**

By:

**BAUCHI STATE GOVERNMENT**



Submitted to:

**FEDERAL MINISTRY OF ENVIRONMENT,  
ABUJA, NIGERIA**

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## ACRONYMS AND ABBREVIATIONS

$\mu\text{Sm}^{-1}$	Micron siemen per meter
Al	Aluminium
Ar	Argon
AAS	Atomic Absorption Spectrophotometer
AfDB	African Development Bank
AIH	Agro-Industrial Hub
ATBU	Abubakar Tafawa Balewa University
ATC	Agricultural Transformation Centre
Ba	Barium
BASG	Bauchi State Government
BOD	Biochemical Oxygen Demand
BSADP	Bauchi State Agricultural Development Program
BSEPA	Bauchi State Environmental Protection Agency
BTS	Base Transceivers Station
Ca	Calcium
Cd	Cadmium
CEC	Cation Exchange Capacity
CFC	Chlorofluorocarbon
Cfu/g	Colony forming units per gramme
CH <sub>4</sub>	Methane
CL <sup>-</sup>	Chlorine ion
CLS	Core Labor Standards
Cm	Centimeters
CO	Carbon (II) Oxide
Co	Cobalt
COD	Chemical Oxygen Demand
Cond.	Conductivity
COx	Oxides of Carbon
Cr	Chromium

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CSR	Corporate Social Responsibility
Cu	Copper
dB(A)	decibel (Scale A)
DCD	Development Control Department
DO	Dissolved Oxygen
DS	Dissolved Solids
E&S	Environmental and Social
EA	Environmental Audit
EAR	Environmental Audit Report
Ec	Electrical Conductivity
EIA	Environmental and Impact Assessment
EIB	European Investment Bank
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMP	Environmental Monitoring Plan
EMS	Environmental Management Systems
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
Fe	Iron
FEPA	Federal Environmental Protection Agency
FGDs	Focus Group Discussion
FGN	Federal Government Nigeria
FMAFS	Federal Ministry of Agriculture and Food Security
FMEEnv	Federal Ministry of Environment
FMF	Federal Ministry of Finance
FNL	Fahamu Nigeria Limited
FTZ	Free Trade Zones
g	gramme
GDP	Gross Domestic Product
H <sub>2</sub> S	Hydrogen Sulphide

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HIA	Health Impact Assessment
HIV\AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HSE	Health Safety and Environment
IsDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IGREENFIN	Inclusive Green Financing initiative
ILO	International Labour Organization
ISO	International Organization for Standardization
ISS	Integrated Safeguard System
IUCN	International Union for Conservation of Nature and National Resources
K	Potassium
Kg	Kilogramme
KHz	Kilohertz
Km/hr	Kilometre per hour
KN/m <sup>2</sup>	Kilonewton per square metre
KPA	Kilopascal
KVA	Kilo Volts (amp)
LC	Least Concerned
LGA	Local Government Area
m	Meter
m/s	Meter per second
MDAs	Ministries, Departments and Agencies
MDG	Millennium Development Goals
Mg/Kg	Milligram per kilogram
mg/l	Milligram per litre
MHz	Mega Hertz
ml	Millimeter
Mn	Manganese
Na	Sodium

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NAF	Nigerian Air Force
NAFDAC	National Agency for Food and Drug Administration and Control
NBS	National Bureau of Statistics
NCO	National Coordination Office
ND	Not Detected
NE	North East
NGO	Non- Governmental Organization
NH <sub>3</sub>	Ammonia
Ni	Nickel
NO	Nitrogen Oxide
NO <sub>3</sub> <sup>-</sup>	Nitrate ion
NO <sub>x</sub>	Oxides of Nitrogen
NPC	National Population Commission
NTU	Nephelometric Turbidity Unit
°C	Degree celsius
OP	Operational Policies
PAD	Project Appraisal Document
PAPs	Project Affected Persons
PAR	Programme Appraisal Report
Pb	Lead
PCB	Polychlorobiphenyls
pH	Hydrogen Ion Concentration
pH	Hydrogen Ion Concentration
PO <sub>4</sub> <sup>-</sup>	Phosphate ion
PPE	Personal Protective Equipment
R&D	Research and Development
SAPZ	Special Agro-industrial Processing Zones
SCOPE	Scientific Committee on the Problems of the Environment
SEP	Stakeholder Engagement Plan
SMART	Measurable, Achievable, Relevant and Time-Based

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SHE	Safety Health and Environment
SIA	Social Impact Assessment
SO <sub>2</sub>	Sulphur Oxide
SOM	Skidmore, Owings & Merrills
SON	Standard Organisation of Nigeria
SO <sub>x</sub>	Oxides of Sulphur
SP	Suspended particle
SPM	Suspended particulate matter
STD	Sexually Transmitted Diseases
TDS	Total Dissolved Solids
THC	Total Hydrocarbon
THC	Total Hydrocarbon Content
TOC	Total Organic Compound
ToR	Terms of Reference
TSP	Total Suspended Particles
VOC	Volatile Organic Compound
WHO	World Health Organization
Zn	Zinc



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## EXECUTIVE SUMMARY

### ES.1 Background Information

The Federal Government alongside the African Development Bank (AfDB), the Islamic Development Bank (IsDB) and the International Fund for Agricultural Development (IFAD) has launched the Special Agro-industrial Processing Zones (SAPZ) initiative for Nigeria. It is driven by the Federal Ministry of Agriculture and Food Security (FMAFS) in collaboration with the State Governments, development partners, relevant Federal Ministries, Departments and Agencies (MDAs) and Private Investors to develop Agro-processing clusters in areas of high agricultural production across the country.

The SAPZ launch is focused on reinforcing Nigeria's commitment to significantly reform its agricultural sector, create jobs, attain food security, and generate economic revenue. The project is an integrated development initiative designed to physically concentrate agro-processing activities at scale in order to leverage and harness the high agricultural potentials of the State. The SAPZ will fast-track the ongoing industrialisation of the State by boosting productivity and by integrating the production, processing and marketing of carefully selected commodity value chains that will enable agricultural producers, processors, aggregators and distributors to operate in the same environment.

The SAPZ is designed to develop multiple clusters of agricultural transformation centres, and added that they would have functional infrastructure including road networks, power, water, communication facilities, and others to attract private investments. The SAPZ entails the development and operation of agro-industrial processing clusters in areas of high food production across the country, to improve food and nutrition security, to reduce post-harvest losses, create jobs for women and youth, as well as create wealth for the rural community. The SAPZ is focused on building rural resilience building rural communities where people can grow, produce small-scale agriculture and improve those outputs along the value chain to have rural, sustainable, vibrant communities.

Fahamu Nigeria Limited (FNL) was appointed as a Consultant to conduct an Environmental and Social Impact Assessment (ESIA) in accordance with the Nigerian Environmental Impact Assessment Act No 86 of 1992 amended as EIA Act Cap E12 Law

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of the Federal Republic of Nigeria (LFN) 2004, in compliance with Terms of Reference (ToR), in compliance with the African Development Bank (AfDB), SAPZ's Environmental and Social Management Framework (ESMF), and the National Legislation. This process aims to identify the environmental and social impacts arising from project activities during the construction and operation phases, determine mitigation measures via Environmental and Social Management Plan (ESMP) to prevent or minimize potential impacts and risks, create a Stakeholder Engagement Plan (SEP) to ensure effective stakeholder participation in the process, and prepare Environmental and Social (E&S) management plans for guiding contractors' environmental and social performance during the project's construction period. The ESIA covers the entire life cycle of the proposed Project i.e. pre-construction, construction, commissioning, operation and decommissioning and it shall be carried out in line with the relevant requirements of the Federal Ministry of Environment (FMEnv).

## **ES.2 The Proposed Project**

The Special Agro-Industrial Processing Zones (SAPZ) program is a flagship African Development Bank initiative. The zones bring together the production, processing, storage, transport, and marketing of commodities. The program has four broad components:

1. support for the development of enabling climate-adapted infrastructure for agro-industrial hubs;
2. improving agricultural productivity and enterprise development to enhance value chains and job creation in the SAPZ catchment areas;
3. supporting agro-industrial zone policy and institutional development,
4. program coordination and management.

Given Nigeria's enormous potential for agriculture, the SAPZ program will help strengthen the country's agricultural supply chain. It supports sustainable agro-industrial development and unlocks the country's agriculture sector to promote industrialization by developing value chains for strategic livestock and crops, including rice, cassava, and

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tomatoes. The program will enhance the competitiveness of key selected value chains. It will achieve this through increased production, aggregation, and processing activities driven by private-sector investments. About 1.5 million households are expected to benefit directly throughout the agricultural value chain. This includes private agribusinesses, agro-processors, smallholder farmers, agripreneurs, and agro-dealers. SAPZs will create at least 400,000 direct jobs, and a further 1.6 million indirect jobs during construction and the operational phase. Micro, small, and medium enterprises, including factories, along the value chain will create most of the jobs, along with tenant industries in the agro-industrial hubs.

The SAPZ will be made up of two building blocks which include:

1. Agricultural Transformation Centre (ATC)
2. Agro-Industrial Hub (AIH)

### **1. Agricultural Transformation Centre (ATC)**

The ATCs are designed to link smallholder farmers to the agro-processing hub and are centres strategically located in high-production areas, to serve as aggregation points to accumulate products from the community to supply the agro-processing hub for further value addition or to send them to centers of great demand for distribution and retail to consumers.

### **2. Agro-Industrial Hub (AIH)**

The Agro-Industrial Hub will be supported by a network of compact and efficient Agricultural Transformation Centres (ATCs) that will coordinate farmers, their cooperatives and clusters' production (land preparation, planting and input supply), harvesting, agglomeration (primary on-farm storage, preservation and processing), and marketing, activities. The hub will include the installation of various crop-processing factories for several commodities.

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### ES.3 Project Location and Description

The proposed Agro-Industrial Hub (AIH) Centre is located at Gubi, Bauchi Local Government Area (LGA) of Bauchi State, Nigeria. The site is about 20km from Bauchi township. The total land area is 150 hectares along Bauchi-Kano expressway within Latitudes 10°28'23"N - 10°28'11"N and Longitudes 9°47'19"E - 9°45'54"E. The Agro-Industrial Hub is a dedicated area of the SAPZ project where industrial activity is planned to be concentrated along with several other support facilities. It is located centrally along the Bauchi – Kano Road, about 8km west from the Gubi Dam and about 4.6km north to Sir Abubakar Tafawa Balewa International Airport. There is the presence of NAF Base quarters about 350m close to the site. The selected site covers a land area of 150 hectares on predominantly greenfield site with ample space for potential expansion of the Processing Hub. It is relatively flat with a gently undulating terrain which facilitates natural drainage through gravitational flow southeastwards of the site where the site is at its lowest altitude of 410m, a difference of about 100m from the highest point of 510m northward of the site. It takes access from the Bauchi -Kano Road (a dualized double-lane road to accommodate the traffic set to be generated by the hub).

The proposed ATCs centers are distributed in each of the three (3) senatorial zones of Bauchi State with their value chain commodities as highlighted in Table The three (3) Senatorial Zones which are North, South and Central zones represents each of the ATC centres.

The North zone represent Azare community in Katagum LGA with a total landtake of 34.24ha; South zone represent Alkaleri and Galam communities in Alkaleri and Dass LGAs with a total landtake of 6ha and 19.16ha respective; while the Central zone represent Rampa community in Darazo LGA with a total landtake of 15.17ha. The proposed ATC centers are identified based on the availability and connectivity in the identified locations.

**Table 1: Proposed ATCs location and Priority Value Chains**

S/N	Host communities	Zone	LGA	Priority Value Chains	Landtake (hectare)
1.	Azare	North	Katagum LGA	Rice, Sorrel (Zobo) and Sesame	34.24ha
2.	Rampa	Central	Darazo LGA	Sorghum, Millet and Groundnut	15.17ha
3.	Alkaleri	South	Alkaleri LGA	Cassava and Maize	6ha
4.	Galam	South	Dass LGA	Rice and Acha	19.16ha

Source: Field work, 2024

## ES.4 ESIA Objectives

The key objectives of this ESIA study are to generate environment and social baseline information within the study environment and affected communities before the implementation of this project implementation. In line with statutory requirements for environmental protection in Nigeria. Also to assess the potential environmental and social impacts of the proposed works as described in the scope of work and prepare an Environmental and Social Impact Assessment (ESIA) that will include detailed Environmental and Social Management Plans (ESMP) along all value chains.

## ES.5 ESIA Scope of Work

The scope of study includes:

- Review existing ESMF prepared for SAPZ and incorporate AfDB requirements into the operationalization of the ESIA final report and ESMP developed;
- Review Environmental Safeguards instruments of the World Bank Safeguards policies triggered by the project;
- Describe the proposed project by providing a synthetic description of the project relevant components and presenting plans, maps, figures and tables;
- Review of national and international environmental regulations guiding the project;
- Consultations with regulators and other relevant stakeholders concerned with the proposed project;

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- Extensive and comprehensive literature review specific to the project site to obtain background information on the environmental characteristics of the area;
  - Impact identification, prediction, interpretation and evaluation from project activities;
  - Development of an effective mitigation/ ameliorative measures and monitoring programmes for significant impacts;
  - Development of comprehensive Environmental Management Plan covering the project life cycle;
  - Development of best conceivable plans for restoring the environment after decommissioning of the proposed project
  - EIA reporting following Federal Ministry of Environment (FMEnv) guidelines and procedures as well as public disclosure.

## **ES.6 Approaches and Methodology**

A multidisciplinary approach was employed in order to holistically address all pertinent aspects of the proposed project on the bio-physical and socio-economic environment. Accordingly, the bio-physical and socio-economic environment of the proposed project was characterized and assessed using a number of survey instruments, field studies including broad-based community consultations to determine the likely environmental and social impacts of the proposed project and thereafter formulated specific, measurable, achievable, relevant and time-based mitigation measures (SMART).

## **ES.7 Administrative and Legal Framework**

The EIA study was carried out in accordance to FMEnv's relevant policies, laws, regulations and guidelines, particularly the EIA Procedural Guidelines. The applicable legal and administrative framework, including the relevant international standards and guidelines to the Project and the EIA study, includes, amongst others:

- National Policy on the Environment, 2016
- Environmental Impact Assessment (EIA) Act. Cap E12, LFN 2004.



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- The Nigerian Urban and Regional Planning Act Cap N138, LFN 2004
  - National Environmental Standards and Regulations Enforcement Agency (NESREA) Act, No. 25, 2007
  - Land Use Act, Cap L5, 2004
  - National Environmental Protection (Effluent Limitations) Regulations (S.1.8) 1991;
  - National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) (S.1.9) 2004;
  - National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations (S.1.15) 1991;
  - Guidelines and Standards for Environmental Pollution Control in Nigeria 1991;
  - Sectoral Guidelines for EIA 1995
  - Harmful Wastes (Criminal Provisions) Act No. 42, 1988;
  - Environmental Impact Assessment Procedural Guidelines 2011;
  - National Guidelines and Standards for Water Quality 1999
  - National Guidelines on Environmental Management Systems (EMS) 1999
  - National Guidelines on Environmental Audit in Nigeria 1999.
  - Bauchi State Ministry of Environment
  - Bauchi State Environmental Protection Agency (BASEPA) Edict No.3, 1997
  - Bauchi State Ministry of Environment and Forestry
  - Bauchi State Ministry of Lands and Housing
  - Bauchi State Ministry of Water Resources
  - Standards Organization of Nigeria (SON) Act CAP 412 LFN 1990
  - Nigeria Export Processing Zones Act (CAP N107 LFN 2004)
  - Nigerian Investment Promotion Commission (NIPC) Act, 1995
  - UN Framework Convention on Climate Change, 1992
  - African Convention on the Conservation of Nature and Natural Resources
  - WHO Health and Safety Component of EIA, 1982
  - WHO Health for All Strategy and Policy, 1978
  - SAPZ's Policy on Safety Health and Environment
  - World Health Organisation (WHO) Health and Safety Component of EIA (1987)

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- International Union for Conservation of Nature and Natural Resources;
  - Basel Convention on the Control of Trans-Boundary Movements of Hazardous wastes and their Disposal
  - Convention concerning the protection of the World Cultural and National Heritage Sites (World Heritage Convention)
  - The Rio Declaration on Environment and Development
  - United Nations Guiding Principles on the Human Environment

### **International Standards**

The international safeguard policies to be applied here are Operational Policies (OP) of the World Bank. These policies contain the statements of the World Bank regarding the manner of implementation of development projects being financed by it and demonstrates its commitment to the eradication/reduction of poverty and promotion of social equality in the world.

### **AfDB Integrated Safeguards Systems**

The AfDB's Integrated Safeguards System (ISS) is a set of policies, procedures, and guidelines established to identify, assess, and mitigate potential E&S risks and impacts associated with the Bank's funded projects and programs. The ISS were designed to ensure that the Bank's investments promote sustainable development and do not harm people or the environment. The updated ISS (April 2023) are comprised of the following:

- AfDB's Vision for Sustainable Development
- AfDB's E&S Policy
- Ten E&S Operational Safeguards (OS)
- E&S Guidance Notes (ISS Guidance notes)

There is a significant overlap between the AfDB operational safeguards and the IFC PSs; nevertheless, as the AfDB safeguards are also relevant to this Project the assessment of E&S performance is also assessed against these. A summary of the AfDB Safeguards is provided in Table below:

AfDB Safeguard	Description
E&S OS 1 (Assessment and Management of Environmental and Social Risks and Impacts)	<p>The aim of this overarching OS, along with the nine other Oss that complement it, is to mainstream E&amp;S considerations; including those related to climate change vulnerability; into Bank operations and thereby contribute to sustainable development in Africa.</p> <p>An ESIA study carried out under this OS helps to determine the scope and extent to which other OSs are addressed. It sets out the Borrower's (or Project's) responsibilities for assessing, managing, and monitoring E&amp;S risks and impacts associated with each stage of an operation/project supported by AfDB.</p> <p>This OS, together with OS10 (Stakeholder Engagement and Information Disclosure) provide the overall process framework for the E&amp;S assessment and management of AfDB financed operations at project level.</p>
E&S OS 2 (Labour and Working Conditions)	<p>The objectives of OS2 are as follows: protect workers' rights; promote safety and health in the workplace; promote the fair treatment, non-discrimination, and equal opportunity of project workers; protect project workers, including vulnerable workers; prevent the use of all forms of forced labour and child labour; support the principles of freedom of association and collective bargaining of project workers, provide project workers with accessible means to raise workplace concerns; and enquire that the Bank, and national competent authorities as appropriate, be informed promptly of any material adverse impacts and events relating to labour protection and health and safety at the workplace. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 3 (Resources Efficiency and Pollution Prevention and Management)	<p>OS3 sets out the requirements to address resource efficiency and pollution 36 prevention and Management throughout the project life cycle in a manner consistent with Good International Industry Practice (GIIP). Throughout the different phases of the project's lifecycle—planning and design, construction, commissioning, operations, and decommissioning—the project is required to assess and evaluate resource-efficiency and pollution-prevention techniques and implement them, taking into consideration their technical and financial feasibility and cost-effectiveness. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 4 (Community Health, Safety and Security)	<p>This OS addresses potential risks and impacts on communities that may be affected by project activities. Occupational health and safety (OHS) requirements for project workers are set out in OS2, and measures to avoid or minimize impacts on human health and the environment due to existing or potential pollution are set out in OS3. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 5 (Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement)	<p>The objectives of OS5 are to: avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative project designs have been explored; ensure resettlement plans and activities are informed by social assessments (including gender issues); avoid forced evictions; mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use; improve living conditions of poor or vulnerable persons who are physically displaced by the project; establish a mechanism for monitoring the performance and effectiveness of involuntary resettlement activities which result from project activities; conceive and execute resettlement activities as sustainable development programs; and ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected. The applicability of OS5 is established during the ESIA described in OS1</p>
E&S OS 6 (Habitat and Biodiversity Conservation & Sustainable Management of Living)	<p>This OS outlines the requirements for the Project to (i) identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats, and (ii) observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services. The applicability of OS6 is</p>

Natural Resources)	established during the ESIA as described in OS1.
E&S OS 7 (Vulnerable Groups)	OS7 contributes to poverty reduction and sustainable development by ensuring that projects supported by the Bank enhance opportunities for vulnerable groups to participate in, and benefit from, the development process in ways that do not threaten their unique cultural identities and well-being. The applicability of OS7 is established during the ESIA as described in OS1
E&S OS 8 (Cultural Heritage)	This OS sets out general provisions on risks and impacts to cultural heritage from project activities. OS7 sets out additional requirements for cultural heritage in the context of vulnerable groups and highly vulnerable rural minorities including Indigenous Peoples (IPs). The applicability of this OS is established during the ESIA described in OS1.
E&S OS 9 (Financial Intermediaries (FIs))	The objectives of this OS are to: set out how the FI will assess and manage environmental and social risks and impacts associated with the subprojects it finances; promote good environmental and social management practices in the subprojects the FI finances; o promote good environmental and sound human resources management within the FI; support the adoption of best practice standards in corporate governance, business management and corporate responsibility by enterprises supported by the Bank based upon the requirements of OSs 1 through 10, as appropriate; and encourage the consideration of environmental and social governance issues in capital market institutions such as development finance entities and stock exchanges.
E&S OS 10 (Stakeholder Engagement and Disclosure of Information)	This OS therefore recognizes the importance of open and transparent engagement between the project and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation. OS10 applies to all Bank Group’s funded operations. The project will engage with stakeholders as an integral part of the project’s ESIA and project design and implementation, as outlined in OS1

## ES.8 Project Justification, Alternatives and Benefits

### Needs for the Project

Nigeria is the most populous country on the African continent with over 223,000,000 million people, and a population growth estimated at 2.41% per year. Like other middle-income countries, Nigeria faces significant and persistent poverty and inequality. Major factors contributing to rural poverty include low agricultural production and productivity, limited opportunities for value-addition, challenges of marketing capacity, poor yields in quality and quantity, and significant deficits in support systems such as infrastructure,

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access to productivity-enhancing inputs, financial backing, commercial orientation, and effective policies, as well as environmental degradation and the effects of climate change. With the launch of the Special Agro-industrial Processing Zone (SAPZ) programme, Nigeria can, in less than a decade, banish food insecurity, while radically improving export earnings from agriculture, creating millions of lucrative agro-industrial jobs and opportunities for its citizens. The SAPZ is the flagship for Nigeria's agriculture, which entails the development and operation of agro-industrial processing clusters in areas of high food production across the country, to engender competitiveness in agro-industrial production and processing that is critical to further unlock the potential of Nigeria's agriculture, to improve food and nutrition security, to reduce post-harvest losses, create jobs for women and youth, as well as create wealth for the rural community.

## **ES.9 Value of the Project**

The African Development Bank (AfDB), with support from other development partners, has launched \$520 million Special Agro-Industrial Processing Zones (SAPZs) in Nigeria with seven States as pioneer beneficiaries. The African Development Bank is providing \$210 million for the development of the SAPZs in Nigeria, in partnership with the Islamic Development Bank (IsDB) which is co-financing with \$150 million, and with the International Fund for Agricultural Development (IFAD), which is co-financing with \$160 million.

## **ES.10 Envisaged Project Sustainability**

This proposed development project shall be sustained in broad and diverse ways. There will be harmonization and balance between this project and the social, environmental, socio-economy of the project area of Bauchi State, and the entire country. Bauchi State Government intends to achieve the project sustainability by ensuring that the project environment is not abused; that the project meets the viability content of the feasibility earlier carried out; and that the project is integrative in the sense that social harmony will be enhanced among Nigerian occupants of the project; that technically, the project shall

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be executed using the best available technology in urban development, with regards to professionals, materials, construction, equipment, finishing, etc.

### **ES.11 Project Options and Alternatives**

Project options and alternatives were well analyzed by the project proponent and her arrays of consultants and investors; haven decided to go ahead with the project option, a number of alternatives were also analyzed; alternative site/location, technology, waste management, materials, design and implementation schedule. In the end time tested technology, waste management, materials based on experience and quality were chosen. Since the site have been provided without encumbrances from governments at all levels and the community, no further alternative decision than to proceed with the project was acceptable by the proponent.

### **ES.12 Project Description**

The main project activities associated to the development of the SAPZ project include pre-construction works and mobilization of equipment and machineries, site clearance, excavation and earth works, construction of roads, green spaces, specialized infrastructure, zone specific infrastructure, industrial zone for target sectors, specialized agro-infrastructure zone, logistic zone, institutional zone, residential zone, multi-facility complex, amenities and utilities zone, transportation and logistics zone and greenery and walkways.

#### **Project components**

The Agro-Industrial Hub is designed to encompass a diverse array of facilities and services. It is planned to include Industrial use (multi-products processing zone, clustered processing zone); Logistics and Warehousing (warehouse, cold storage, open yard, truck parking); non-industrial use (residential, commercial, social amenities, offices, support services). Additionally, it will feature a wastewater treatment facility, a solid waste facility area, two areas dedicated to administrative and social facilities, truck parking lots, and technical infrastructure areas. Also, provision of range of services including

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electricity, heat, utility water for irrigation, wastewater treatment, telecommunications, and solid waste management.

### **Infrastructural design of the proposed AIH**

The description of the AIH, product mix and facility configuration

- Water Treatment Plant (WTC), Solid Waste Management (SWM), compressor/chiller/boiler networks, gas distribution, sewer network, communication network, street lighting, wastewater network, electrical substation, etc.
- Logistics (loading and unloading yards, packaging halls, transportation hubs, cargo handling centres, raw material collection and storage halls, finished goods storage, packaging and labeling, procurement centre, etc), quality control labs, QA/QC labs; and
- Institutional (fuel station, retail space, custom and security, weigh bridge, canteen, fire station, etc).

### **Residential Zone**

- Multi formatted housing, guest houses, place of workshop, school, crèche, public amenities, playground, polyclinic, retail space, etc.

### **Greenery and Walkways**

- Green belt along the boundary, lawns and parks, tree plantation along the proposed roads, internal walkways, etc.
- Buildings

The following amenity and utility buildings form a part of the processing zone, which must be centralized:

- Administration including Research and Development (R&D) centre, display centre and disaster management centre
- An information kiosk and market intelligence cell
- Certification lab and QA & QC lab
- Extension centre

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- Training centre including incubation centre
  - Warehouse
  - Customs and security
  - OHT/UGS/WTP
  - Substation
  - SWM plant for hazardous waste and non-hazardous waste
  - STP
  - Truck layby weighbridge and fuel station, and
  - Other utilities including a fire station, workshop and equipment shed.
- Non-processing zone in AIH

The following amenity buildings form a part of the non-processing zone.

- School and crèche
- Playground
- Polyclinic
- Retail space
- Place of worship
- Residential blocks (2 & 3 BHK apartments, male & female dormitories) and Public amenity

### **ATC proposed Plan**

The master planning exercise for ATC shall be conducted based on the following considerations:

- Commodities handled within each of the ATC and the estimated number of ATCs
- Commodity volume expected considering the production and surplus available in the catchment area of each ATC including seasonality of storage and storage requirements.
- Availability of agribusiness, social and commercial infrastructure.
- Availability of support facilities

The sustenance of the proposed AIH is solely dependent on the continuous inflow of raw materials. In this regard, it is prudent to obtain the raw materials outside the influence

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zone (200km radius from AIH) boundaries as well. The tentative location of the ATCs was shortlisted based on the following factors:

- The extent of the agricultural land in the procurement area within a 200km radius
- The extent of the mixed vegetation type of land parcels;
- Connectivity and access from the nearest existing road network;
- Distance from the proposed AIH; and
- The radius of the influence of each ATC

## **Utility Infrastructure**

### **Power**

Bauchi State generally relies on power supply from the national grid which is transmitted and managed along transmission lines and stations. The most conventional source of power for Bauchi SAPZ project is reliance on the national grid. Alternative sources of power are also recommended. SAPZ project will collaborate with national distribution companies, to purchase and distribute electricity within the project area. To enhance sustainability and reduce reliance on conventional energy, the project shall outline specific investments in renewable energy generation. It shall propose partnerships with private companies, Independent Power Producers (IPPs), to install and operate renewable energy plants, including a wind power plant and a solar hybrid power plant system. Additionally, as part of this investment plan, it will include a biogas electrical generation plant fueled by organic waste from greenhouses.

### **Water**

Water is one of the most essential resources for agricultural production. The water sources available to the SAPZ include rainwater, surface water, and underground water. The amount of rainfall and precipitation are sufficient for intensive and specialized farming. However, for industrial agricultural activities that require constant supply of water with no dry season shortages; hence alternative sources of water are necessary for irrigation. Irrigation options include the use of underground water through drilling of boreholes, implement rainwater harvesting from the roofs or the collection of surface water from accessible water bodies. The future plans include construction of a new Dam

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at the AIH project site connecting from the Kuhu stream. It will serve as its primary source of water and is a potential source of hydroelectric power. This connection aims to reduce reliance on groundwater extraction. By integrating both local groundwater and natural rainwater sources, this comprehensive strategy enhances the project's sustainability and its adaptability to fluctuating water demands.

### **ES.13 Baseline Data of the Study Area**

Site visits were carried out from 26th to 27th April 2024, to collect primary data relevant to the site assessment and for the generation of baseline information used in assessing potential impacts. The areas visited were the proposed Agro Industrial Hub at Gubi and the ATCs in Azare, Rampa, Alkaleri and Galam communities in Bauchi State. During the site visit, site assessment was carried out (strengthened by secondary data gotten from desk studies), samples for environmental assessment were collected, socio-economic data was collected through administration of questionnaires and conduction of semi-formal interviews, and stakeholder meetings were held.

The sampling strategy for this study was based on the report of site verification exercise by FMEnv dated 27<sup>th</sup> April, 2024; fourteen (14) sample locations and one (1) control were measured for air quality and noise level and soils, one (1) sample was taken for surface water and sediment, and two (2) were taken for groundwater. Data gathering took place between 26<sup>th</sup> and 27<sup>th</sup> April, 2024. Both primary and secondary data resources were relied upon for the report. The primary data were those sourced during field exercise: sampling for in-situ and ex-situ analysis, consultation, interviews and questionnaire administration; secondary data and information were sourced through desktop, National Bureau of Statistics (NBS), World Health Organisation (WHO), National Population Commission (NPC), Bauchi State government websites.

The baseline characteristics of the project environment were determined from site reconnaissance and site visits. In-situ measurements were done with portable, handheld, calibrated equipment and tools; ex-situ measurements were done at Abuja Environmental Protection Board (AEPB) Laboratory, Abuja. Socio-economic data were sourced by

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direct interview, questionnaire distribution, consultation with community members and stakeholders.

### **Weather and Meteorology**

Information on the climate and meteorology of the study area was obtained from Nigerian Meteorological Agency of the Federal Ministry of Aviation, Abuja. The study area is located in the semi-arid climatic zone of Nigeria and characterized by two distinct seasons which are the hot dry season and a cool rainy season. Generally, Nigeria's climate is characterized by the dry and wet conditions associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator. The Inter-Tropical Convergence Zone (ITCZ) appears as a band of clouds, usually thunderstorms that circle the globe near the equator and Nigeria is located just north of the equator.

Mean daily maximum temperatures range from 29.2°C in July and August to 37.6°C in March and April. The mean daily minimum ranges from about 11.7°C in December and January to about 24.7°C in April and May. The sunshine hours range from about 5.1 hours in July to about 8.9 hours in November. Indeed, October to February usually record the longest sunshine hours in the state.

In Bauchi State, the average yearly rainfall varied from 0.24 mm in February, the lowest month of the year, to 299.88 mm in August, the highest month of the year. The rain was observed to be highest in the months of August, when the peak rainfall is observed and drops to 186.76 mm in the month of September. The mean yearly maximum and minimum temperatures for the State throughout the same climatic period as reported by NIMET. The maximum monthly average is 37.12°C, recorded in the month of April. During field work, temperature was as high as 42.7°C with the lowest being 34.9°C.

### **Air and Noise Quality**

Fifteen (15) different locations including control were considered for measured of air quality, both within and outside the proposed Gubi-AIH project site. Measurements were conducted on the 27th of April 2024, which is for dry season. Ambient noise level measurements were also carried out. These measurements were done in situ using Extech

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Digital Sound Level Meter at fifteen points including control. Particulates in sizes of P.M2.5 and P.M10 were detected in all the locations measured. The concentrations ranged between 7ppm and 11ppm, and recording a mean value of 9.5ppm for P.M2.5; and between 9ppm and 13ppm and recording a mean value of 11.5ppm. PM2.5 is more likely to travel into and deposit on the surface of the deeper parts of the lung, while PM10 is more likely to deposit on the surfaces of the larger airways of the upper region of the lung. Particles deposited on the lung surface can induce tissue damage, and lung inflammation. Measured concentrations of both PM2.5 and PM10 were within withing the FMEnv limit of 250ppm at all the points measured.

### **Geology of the Area**

The proposed AIH project site in Bauchi is located in northeastern Nigeria. This area has a diverse geological composition due to its location within the Chad Basin and the transition zone to the Basement Complex: the Basin Complex, Basement Complex, Volcanic Activities, Mineral Resources, and Structural Features. Basement complex dominates the southern part, basically around the Jos Plateau, and comprised of older crystalline rocks such as granite, gneiss, and schist which often form rugged terrain and are associated with mineral deposits like tin, columbite, and tantalite. Various activity has occurred in the state, particularly around the Jos Plateau region which has resulted to ancient volcanic rocks and associated geological features like lava flows and volcanic ash deposits.

### **Soil Study**

A total of thirty (30 Nos) soil samples were collected within the proposed project site and one (1No) control soil sample. At each sampled point, soil samples were collected at two depths (0-15cm for top soil and 16-30cm for sub soil). This operation was carried out with the aid of stainless steel Dutch auger. Each sample was collected in aluminium foil, labeled appropriately, and stored in a cooler. The samples were then transported to Abuja Environmental Protection Board Laboratory (accredited by FMEnv.) in Asokoro District of Abuja. The physico-chemical characteristics of soil samples obtained from thirty (30)

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points and one (1) control point within the study area after in-situ/laboratory measurement and analyses is summarized

### **Surface and Groundwater study**

One (1) sample was collected from the stream for analysis to determine the physico-chemical factors, trace metal contents, microbiological status and productivity of the stream. Concentrations of pH, temperature, conductivity and total dissolved solids (TDS) were determine in-situ. Others parameters were analysed in the laboratory. They amongst others includes turbidity, nitrate, sulphate, chloride, BOD5, COD, Oil and Grease and various heavy metals etc.

Ground water sample were typically collected from a hand-dug well in Kuhu and from the discharge line of a borehole in Malmo communities which are closest to the proposed AIH project site. These samples were collected using 750ml plastic bottles, labeled appropriately, preserved on an ice pack and transported to AEPB Laboratory in Abuja for laboratory analysis.

### **Vegetation**

The vegetation cover of the study area is typical of Sudan savannah, comprising of shrubs, grassland and trees, the vegetation cover is floristically diverse, with few tree species and short shrubs.

## **ES.14 Socio-Economic Environment**

The immediate host communities are Kuhu, Malmo and Gubi. The people of the communities are agrarian where people involved in crop farming (cultivation and growing of crops) rearing of livestock, preservation of farm produce, as well as producing and maintaining of crops and farmland. The people engage in farming activities for a livelihood because of their vast fertile land. Different varieties of crops are produced in the area including rice, millet, sorghum, cowpea, groundnut, and soybeans. Furthermore, livestock such as cattle, sheep, and goats are produced in the area. The dominant language in the community is Hausa and Fulani Tribes. Meanwhile the Hausas are more in number. While Islam is the dominant religion of the people.

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The majority of the local population are Muslim with only a small number identified as Christian. Christian households were found in Gubi community accounted for just 3%.

Educational attainment in the Project location is generally low, with a large number of survey respondents having no education and unable to read or write. The highest levels of education were found in Gubi, with 5% of respondents obtaining some form of tertiary education and a further 30% completing SSCE. Gubi also had fewer residents with no education (18%) and no residents that have only attended kindergarten.

The lowest levels of education attainment were found in Kuhu and Malmo, where two thirds of respondents (61%) have no education and an additional 19% stopped schooling at primary school level. No one has a tertiary education and just 1% have some sort of vocational training.

Religious education is important in most settlements around the Project location with an average of 16% of respondents attending a Qur'anic school. The settlement of Kuhu reported the highest level of attendance for religious schooling, with 45% of respondents attended Qur'anic school located inside the community.

The rural nature of the project area, land is primarily used for crop farming and livestock rearing. Cropping is mostly mixed, and typically cultivated crops include maize, rice, millet, and guinea corn. Slash and burn is used for site clearing, with areas of regeneration used to feed livestock.

Being an agrarian community, farming is the predominant occupation within the proposed project area. Farming activities cut across all age groups and gender; majority of the inhabitants who are in government employment are also involved in farming during farming seasons as a means of supplementing their earnings from their various paid employment. Some of the crops grown include; guinea corn, maize, and tomatoes, sweet pepper, cucumber among others.

### **Community Consultations/Stakeholder Engagement**

The consultations served to provide stakeholders with information about the Project and to gather information important to the ESIA. Stakeholder engagement is an ongoing process of sharing project information, understanding stakeholder concerns, and building

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relationships based on collaboration. Stakeholder engagement is an all-inclusive, interactive, systematic and continuous process, spanning the entire life cycle of a project, in which stakeholders are engaged as active partners in establishing the priorities and focus of a project, and not treated merely as the passive recipients of the project when completed.

Information disclosure and consultation will be carried out throughout the preparation period, construction period and operation period of the project, by laying primary focus on the requirements (inclusiveness) of directly affected and vulnerable groups, such as the elderly, women, physical challenged, etc. The list of categories of stakeholders consulted are the Federal Ministry of Environment, Katsina State Ministry of Environment, Katsina State Ministry of Agriculture & Livestock Development.

The following were also identified as stakeholders consulted

- The paramount traditional Ruler in the identified Communities.
- The Council of Chiefs in the Communities.
- The Women Leader.
- The Representatives of the Youths.
- The Representative of the farmers.
- All the Project Affect People within the SAPZ project.
- The Honourable Councillor representing the political wards within the host communities
- The Representative of the host Local Government Areas

## **ES.15 Potential and Associated Impacts of the Project**

### **Positive Project Impacts**

- Provision of accommodation
- Increase in Income from Transportation
- Increase in Income from Employment
- Project Supporting Income Generating Service Activities
- Increased Trading of Local and National Materials

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## Skills Acquisition and Training for Workers from Local Communities

### **Negative Impacts**

#### ➤ ***Influx Related Impacts***

- Increase in price of goods and services mostly during construction
- Changes in social and cultural structure/situation
- Increase in social pathologies (crime, prostitution and others)
- Interference with archaeological and cultural resources

#### ➤ ***Surface Water***

Surface water contamination will arise from a number of sources including the following:

- Wash down of equipment during construction and operations
- Run off from the site during site preparation and construction
- Sanitary waste discharges from construction camp
- Oil leaks from machinery and vehicles

#### ➤ ***Groundwater***

Groundwater resources within the project area support the fresh water habitats in the area and are a source of drinking water. Identified sources of contamination include wash-down from equipment during site preparation and construction.

#### ➤ ***Noise and Air Pollution***

There will be increased noise and air pollution during general site preparation and construction activities such as movement of workers and materials, operation of combustion engines and various work site machinery.

#### ➤ ***Solid and Liquid Wastes***

Pre-operations activities will lead to generation of solid and liquid wastes, which have the potential to exacerbate the existing poor waste management condition in most of the project areas. Excavated materials also need to be handled properly to avoid environmental pollution.

#### ➤ ***Heavy Plant Operations***

Adverse impacts associated with plant operations include: Increased air emissions, increased ambient noise and Increased effluent discharge into the water bodies



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### ***Public and Community Health***

Public and community health impacts of the project are mostly pollution- related such as air emissions and noise, and those associated with influx.

Influx related impacts of concern are traffic, psychosocial factors, accidents spills and fires.

#### ➤ ***Occupational Health***

A number of potential and associated occupational health impacts were also identified. These include: Over-exertion, Slips and Falls, Working at Heights, Struck by Objects, Moving Machinery, Confined Spaces, Excavations, chemicals and dust.

#### ➤ ***Cumulative Impacts***

Cumulative impacts of concern are those associated with air emissions, ambient noise, and effluent discharge.

## **ES.16 Mitigation Measures**

### **Mitigation for Influx Related Impacts**

- Employ casual, unskilled labour primarily from local communities;
- Give priority consideration to qualified local communities for hiring of workers;

### **Mitigation for Transportation Impacts**

- Ensure that as much as possible, all heavy duty trucks working on the project move at off peak hours;
- Implement a Journey Hazard Management Plan for both road and water transportation associated with the project;

### **Mitigation for Impacts on Surface Water**

- Store oil and grease and other chemicals in leak proof containers within an effective contained area;
- Construct drainage lines where necessary on the site;
- Ensure that runoff from the site is channeled through sediment/ silt traps before discharge into nearby water bodies;

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### **Mitigation for Physical and Economic Displacement**

- Notify potentially affected persons of project activity and affected routes;
- Implement livelihood compensation and enhancement programme for any project affected persons (PAP). The program shall also include a grievance mechanism.
- Integrate the people on the project

### **Mitigation for Vibration and Noise Impacts**

- Adopt noise attenuation measures such as installation of acoustic mufflers on large engines and equipment;
- Provide sound-insulated control rooms with noise levels below 60 dBA;
- Provide hearing protection to all workers on site; and

### **Mitigation for Air Emission Impacts**

- As much as possible ensure the use of modern equipment that minimize emission of air pollutants; service equipment regularly.
- Ensure that excavation, handling and transport of erodible materials shall be avoided under high wind conditions;
- Where possible, ensure that soil stockpiles shall be sheltered from the wind;

### **Mitigation for Solid Waste Impacts**

- Pursue a waste minimization and utilization strategy;
- Engage government-approved and reputable waste management firms in waste handling and disposal;

### **Mitigation for Liquid Wastes and Discharge impacts**

- Ensure sewage generated at the temporary construction camps is collected in a closed system comprising a conservancy tank to separate solid materials from liquid wastes. The liquids would then be piped to a holding tank;
- Ensure that the Contractor(s) on-site engage the service of a certified third-party waste disposal contractor to collect waste from the tanks on a regular basis and treat the sanitary waste offsite;

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### **Mitigation for Health Impacts of Sanitary and Solid Waste**

- Implement a Contractors Sanitation Plan for the project;
- Require its contractors to provide HSE induction training to all workers engaged on the project.

### **Mitigation for Communicable and Non-Communicable Diseases impacts**

- Conduct periodic health awareness campaigns for STDs especially AIDS, and support safe sex initiatives;
- Provide adequate medical facilities for all construction workers.

### **Mitigation for Psychosocial Impacts**

- Inculcate induction training into employment programme to intimate new intake with the culture and religious belief of the people;
- Maintain and implement a Drug and Alcohol Policy for all aspects of the project,
- Support anti-drug crusades and campaigns in the area;

### **Mitigation for Occupational Health Impacts**

- Requires that all its Contractors develop and implement HSE Plans for their activities;
- Review all contractor HSE plans prior to contract award;
- Ensure all contractors staff are trained on basic safety procedures and emergency response procedures and environmental issues;
- Require that contractors maintain emergency and first aid facilities at strategic locations throughout the project area;

### **Mitigation for Moving Machinery impacts**

Project managers shall require that contractors implement the following prevention and protection measures for all work areas with exposure to hazards of moving *machinery*:

- Plan segregate location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes;
- Establish and enforce speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic;
- Ensure moving equipment is outfitted with audible back-up alarms;

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## **ES.18 Environmental Management Plan (EMP)**

The goal of this EMP is to ensure full compliance with project's HSE Policy and with mitigation and other commitments made in the ESIA. It outlines the actions necessary to attain this goal, and describes the means, time frames, and designation of responsibility required for compliance and conformance. The project managers shall execute the comprehensive EMP to achieve health, safety, and environmental (HSE) regulatory compliance objectives, institutional responsibilities and other related commitments for the proposed activities.

### **Estimated cost for the required ESMP actions**

Generally, this ESMP provides a roadmap for implementation of enhancement and mitigation measures of the impacts identified by this ESIA. It comprises of the expected effectiveness of the proposed mitigations measures, the frequency of which they are to be applied, the responsible parties involved, and the minimum estimated cost for the required actions as presented in chapter seven. The estimated cost summary for the ESMP implementation are as follows:

1. Environmental and Social Management Plan for the proposed HUB Project  
₦150,000,000.00
2. Environmental and Social Management Plan for the proposed ATC Projects  
₦66,500,000.00
3. Proposed Training Program for the Implementation of ESMP ₦53,000,000.00

## **ES.19 Decommissioning Plan**

Before decommissioning, project managers shall develop plans that include the following:

- Identification of components of the project that shall be removed;
- The choice of environmentally sound methods for removal, re-use, recycling or disposal of special wastes that may arise from the decommissioning process;

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- Expressly outline the time frame/schedule for the decommissioning and post-decommissioning process, and communicate the same to BSEPA and other relevant regulatory agencies as well as the affected or concerned persons and groups;

## **ES.20 Conclusion**

### **Conclusions and Recommendations**

Based on the assessments, the Katsina SAPZ Project is predicted to have economic and social positive impacts at the site preparation, site development, and operational stages which include job creation, improvement of local economy, profitable use of land and land resources, capacity building, communal participation, capacity building, increased infrastructure development, reduced loss of farm yield, increase in revenue generation, attraction of FDIs, contribution to FOREX, increased urbanisation, CSR to host community, improvement in food security, and improvement of state's brand. Recommendations to enhance these positive impacts are contained in the report.

On the other hand, the negative impacts predicted by the assessment are mostly environmental and social. They include impacts on the ecosystem, pollution, waste generation, increase in storm water run-off, predisposition of soil to erosion, risk of accidents, noise generation, traffic generation, increased pressure on community infrastructure, increased risk of diseases, occupational/industrial hazards to workers, increased water demand, increased power demand, increased risk of gender based violence and harassment, increased risk of crime and juvenile delinquency, threat to community culture, and risk of child labour. Mitigation measures to mitigate these negative impacts are proposed in the report.

The ESIA also proposes the following recommendations:

1. The establishment of adequate institutional capacity, including the recruitment and training of a competent Environmental Control Officer, to ensure compliance with

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the proposed ESMP as well as the daily operations during the site preparation and development stages of the Processing Hub and to form part of the Hub Management during the operation stage.

2. The conduction of Resettlement Action Plan for the proposed ATCs located in Azare community of Katagum LGA, Rampa community of Darazo LGA, Alkaleri community of Alkereli LGA and Galam community of Dass LGA, Bauchi State.
3. The requirement of all other farm holdings and industries that shall operate within the SAPZ to present site-specific EIA reports in accordance with national legislations.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background Information

The Federal Government of Nigeria recently launched the Nigeria Special Agro-Industrial Processing Zones (SAPZ) programme to achieve greater economic diversification and promote long-term sustainable development. The SAPZ programme is a five-year programme, being implemented by the Federal Government of Nigeria (FGN) in partnership with the African Development Bank (AfDB), the International Fund for Agricultural Development (IFAD), Islamic Development Bank (IsDB), State Governments and Private Investors in the participating States.

The SAPZ programme is designed to develop multiple clusters of Agricultural Transformation Centres (ATCs) and Agro-Industrial Hubs (AIHs) within major clusters of high agricultural production, where functional infrastructures like roads, power, water, communication are provided to attract private investment into modern agro-processing and value addition to locally produced crops, livestock and related agribusiness activities. The SAPZ programme is aligned with the national policies and priorities. It seeks to sustainably contribute to poverty alleviation, hunger and inequality while providing opportunities for economic diversification, job creation, building climate resilience and improved livelihoods in Nigeria. It will contribute to rural infrastructure development, improved access to agricultural markets, increased farm productivity, adoption of modern agricultural technology as well as smart climate agricultural production and processing practices. Additionally, it will also contribute to increased value addition in agro-processing, increased skills acquisition and job creation, for all actors along the value chain, including the smallholder farmers (out growers), women and youth. This is in compliance with the Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004, the World Banks Operational Policy 4.01: Environmental Assessment (1999, revised April 2012) among others. An Environmental and Social Impact Assessment (ESIA) study becomes an obligation for the approval of the proposed SAPZ project. In view of

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the above, Bauchi State Government (BASG) engaged Fahamu Nigeria Limited - an Environmental Consulting Company duly registered and accredited by the Federal Ministry of Environment (FMEnv) to carry out a comprehensive Environmental and Social Impact Assessment (ESIA) for the proposed SAPZ project in Bauchi State.

## **1.2 Project Components**

The SAPZ has three components as captured by the Project Appraisal Document (PAD) and the Environmental & Social Management Framework (ESMF). The project components and key activities under each of them are:

### ***Component 1- Infrastructure Development and Management for Agro- Industrial Hubs***

The SAPZ programme will comprise of an Agro-Industrial Hub (AIH) and a number of Agricultural Transformation Centres (ATCs), strategically located within the production area to serve as aggregation points to accumulate products from the community to supply the AIHs for further value addition or send to Centres of great demand for distribution and retail to consumers. During this Phase, the FGN and AfDB will support the set-up of the AIHs. Support for this component is AfDB- led and fully developed in the AfDB's Programme Appraisal Report (PAR).

### ***Component 2- Agricultural Productivity, Production, Market Linkages and Value Addition in SAPZ Catchment Areas***

Under this component, SAPZ's objective is threefold: (i) support smallholder farmers(out growers) and small operators to increase their productivity and capacity to add value to raw materials on a profitable and environmentally sustainable basis; and (ii) link them to the additional market outlets offered by the AIHs, off-takers supplying the local and national market who operate in the target area, and small processors/traders supplying the local markets, including primary processors operating in the ATCs; iii) enhance the resilience and adaptive capacity of smallholder farmers to climate change. Activities under component 2 will be organized around three sub-components: (2.1) Agricultural market linkages and value addition; (2.2) Smallholder productivity enhancement; and



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(2.3) Access to finance and financial inclusion, including access to green agricultural investments facilitated through Inclusive Green Financing initiative (IGREENFIN) to support farmers in adopting and implementing climate change adaptation and best mitigation practices and solutions.

### ***Component 3- Policy and Institutional Development Support***

The objective of component 3 is to support the development of enabling policies, legislation, and regulation for SAPZs in Nigeria to create conducive business environment for private sector investment and to address inefficiencies and market failures in agricultural value chains. AfDB will support the development of enabling policies and regulatory framework for Agro-Industrial Zones. Through support for the setup of Commodity Alliance Forums, IFAD will focus on: i) facilitating local policy dialogue and influencing local investments for inclusive and conducive market linkages; ii) strengthening quality control, grading and standardization systems; and iii) supporting the establishment and strengthening of community conflict management mechanisms for sustainable investments. Under this component, IGREENFIN II funding will also promote policy dialogue and advocacy to support the creation of an adequate policy framework for green agriculture projects, to increase commercially bankable projects, and to ensure sustainability.

### ***Component 4 - Programme Coordination and Management***

This component will ensure that the programme is efficiently and effectively managed to achieve expected results.

## **1.3 The Proponent**

Bauchi State Government is the proponent of the proposed SAPZ programme driven by Ministry of Agriculture, Bauchi State. The State is an agrarian State with vast fertile soil as an added advantage for agricultural production. The major crops include maize, rice, millet, groundnut and guinea corn. Irrigation farming is practiced and supported by the use of Waya dam in Bauchi Local Government Area. Cattle and other livestock are also

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reared in the State. Bauchi State is among the 22 States of the Federation that have submitted expressions of interest to be hosted and assessed for onboarding onto the second phase of the SAPZ Programme.

#### **1.4 Geographic Location and Description of Bauchi State**

Bauchi State was created in 1976 and covers an area of 66,510 square kilometres. The State shares border with Yobe State to the North-East, Jigawa State, to the North-West, Kano and Kaduna States to the West, Plateau and Taraba State to the South and Gombe State to the East. It lies within the tropical climatic zone with marked wet and dry season with Average Annual rainfall depth varying from 700mm to 1300mm. Bauchi is basically composed of crystalline rocks in Nigeria basement complex. The proposed designated land for the SAPZ AIH project was the famous Gubi Dairy farm which was popularly called Gidan Madara. The total land size for the Gubi Dairy Farm project was 800 hectares, which was meant to serve as ranching farm and same time house the milk and meat production. The Dairy farm operated between 1981 – 1992 and collapsed in the 1990. As the result of poor management and change from civilian to military rule, the farm did not record any meaningful profit, but just deficit and that contributed to its total collapse in operation, and later folded up. This phase of the project represents the Phase 2 of the SAPZ Project and accounts for an area of 150ha out of the 800ha of land belonging to Gubi Dairy Farm.

The proposed ATCs centers are distributed in each of the three (3) senatorial zones of Bauchi State with their value chain commodities as highlighted in Table The three (3) Senatorial Zones which are North, South and Central zones represents each of the ATC centres. The North zone represent Azare community in Katagum LGA with a total landtake of 34.24ha; South zone represent Alkaleri and Galam communities in Alkaleri and Dass LGAs with a total landtake of 6ha and 19.16ha respective; while the Central zone represent Rampa community in Darazo LGA with a total landtake of 15.17ha. The proposed ATC centers are identified based on the availability and connectivity in the identified locations.

**Table 1: Proposed ATCs location and Priority Value Chains**

S/N	Host communities	Zone	LGA	Priority Value Chains	Landtake (hectare)
1.	Azare	North	Katagum LGA	Rice, Sorrel (Zobo) and Sesame	34.24ha
2.	Rampa	Central	Darazo LGA	Sorghum, Millet and Groundnut	15.17ha
3.	Alkaleri	South	Alkaleri LGA	Cassava and Maize	6ha
4.	Galam	South	Dass LGA	Rice and Acha	19.16ha

Source: Field work, 2024



Figure 1.1: Map of Nigeria showing Bauchi State and the Project location





Figure 1.2: Satellite image of the proposed AIH Site

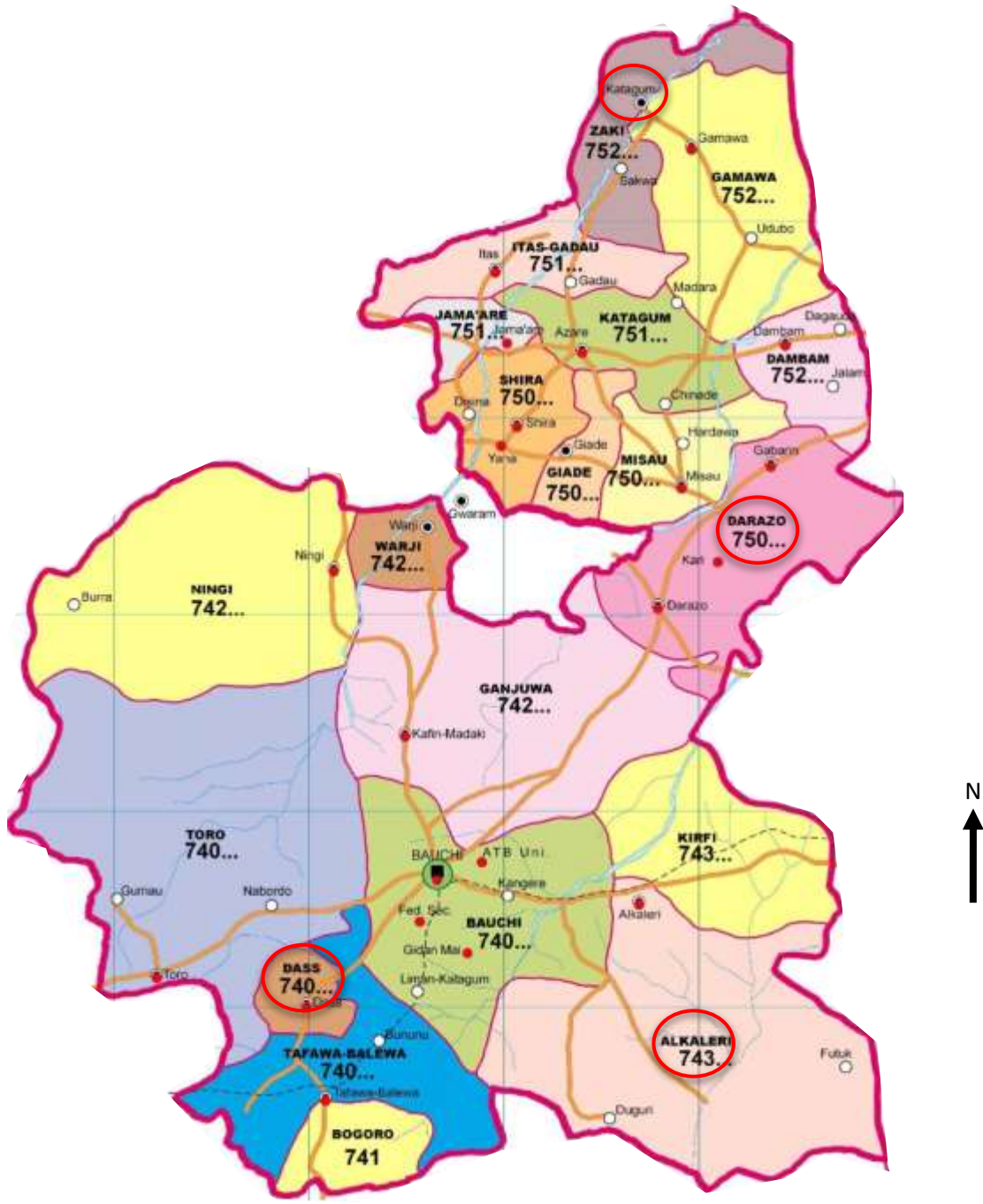


Figure 2. Map of Bauchi State showing LGAs and the proposed ATC's project locations highlighted in red

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## 1.5 ESIA Objectives

The key objectives of this ESIA study are to generate environment and social baseline information within the study environment and affected communities before the implementation of the project. In line with statutory requirements for environmental protection in Nigeria, the proposed ESIA study has been carried out:

- To gather all necessary data from secondary sources, field survey and sampling on socio-economic, health, biophysical and cultural components of the host communities for establishing the environmental baseline condition of the project area.
- To assure the Federal, State and Local Governments as well as stakeholders, that proactive environmental actions shall be incorporated in project design, installation, construction and operation phases of the project;
- To identify all environmental aspects of the proposed project that may interact positively or negatively with the environment;
- To make appropriate recommendations to prevent, reduce or control identified potential and associated impacts;
- To develop Environmental Management Plan (EMP) and procedures for effective and proactive environmental management throughout the project life cycle;
- To achieve a positive mutual trust and understanding between host communities and the proponent.
- To achieve positive public perception about this project through effective communication as a necessary tool to avoid conflicts (legal and physical).
- To comply with all the relevant sections of national and international environmental laws, regulations and guidelines on project development.
- To provide all necessary data/ evidence that will form basis for the preparation of the Environmental Impact Statement (EIS) of the project.

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## 1.6 ESIA Scope of Work

The scope of study includes:

- Project screening and site visit;
- Preparation of Terms of Reference (ToR) in accordance with regulatory guidelines;
- Review of national and international environmental regulations guiding the project;
- Consultations with regulators and other relevant stakeholders concerned with the proposed project;
- Extensive and comprehensive literature review specific to the project site to obtain background information on the environmental characteristics of the area;
- Impact identification, prediction, interpretation and evaluation from project activities;
- Development of an effective mitigation/ ameliorative measures and monitoring programmes for significant impacts;
- Development of comprehensive Environmental Management Plan covering the project life cycle;
- Development of best conceivable plans for restoring the environment after decommissioning of the proposed project
- EIA reporting following Federal Ministry of Environment (FMEnv) guidelines and procedures as well as public disclosure.

## 1.7 Approach and Methodology

The methodology for the preparation of the ESIA was in line with the World Bank Safeguard Policies - Operational Policy on Environmental Assessment (OP/BP 4.01) as well as the Nigerian Environmental Assessment guidelines and procedures. The preparation of the ESIA was specifically guided by the Environmental and Social Management Framework (ESMF) prepared for the SAPZ project. A multidisciplinary

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approach was employed in order to holistically address all pertinent aspects of the proposed project on the biophysical and socio-economic environment of the project area. A summary of blend investigative method used to acquire the socio-economic data is as follows:

- Review of existing data;
- Reconnaissance survey to identify project affected communities and to alert community's leaders on the activities of the proposed project;
- In-depth interviews with leaders of communities as well as key investors in the value chains segments of the project areas;
- Focus Group Discussion (FGDs) with men, women, youths and project affected persons in the focal communities;
- Field observations using strategic instruments and devices to record and note observations and detections by the consultants and interviewers;
- Structured questionnaire to acquire needed baseline information and perceptions of people using simple random sampling techniques;
- Population assessment using combined field survey and 2006 census figures by the National Population Commission (NPC).

Well designed and sectionalized questionnaires were administered to households within the project communities and from it the socio-economic status of the people was deduced after analysis. A typical questionnaire has plain questions, which comprises issues of existing livelihood opportunities, income, gender characteristics and other demographic, physical and social infrastructure. Series of consultations were also held with stakeholders on issues of traditional administrative system, existing formal and informal redress mechanisms; concerns of the project affected persons using Focused Group Discussion (FGD). The minutes of the consultations were written and presented in the Annexure. All the communities and villages affected by the projects were considered in the socio-economic studies.

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## **1.8 EIA Procedural Guidelines**

This procedure prescribes the steps to be followed in the EIA process from project conception to commissioning and post commissioning impact mitigation, to ensure that the project is implemented with maximum consideration for environment. This ESIA study was conducted in compliance with this guideline. The Federal Ministry of Environment (FMEnv) developed guidelines to be used by project proponents in conducting ESIA, in compliance with the EIA Act. Accordingly, the EIA process, illustrated in Figure 1.3 shall be followed sequentially as outlined in the procedural guideline.

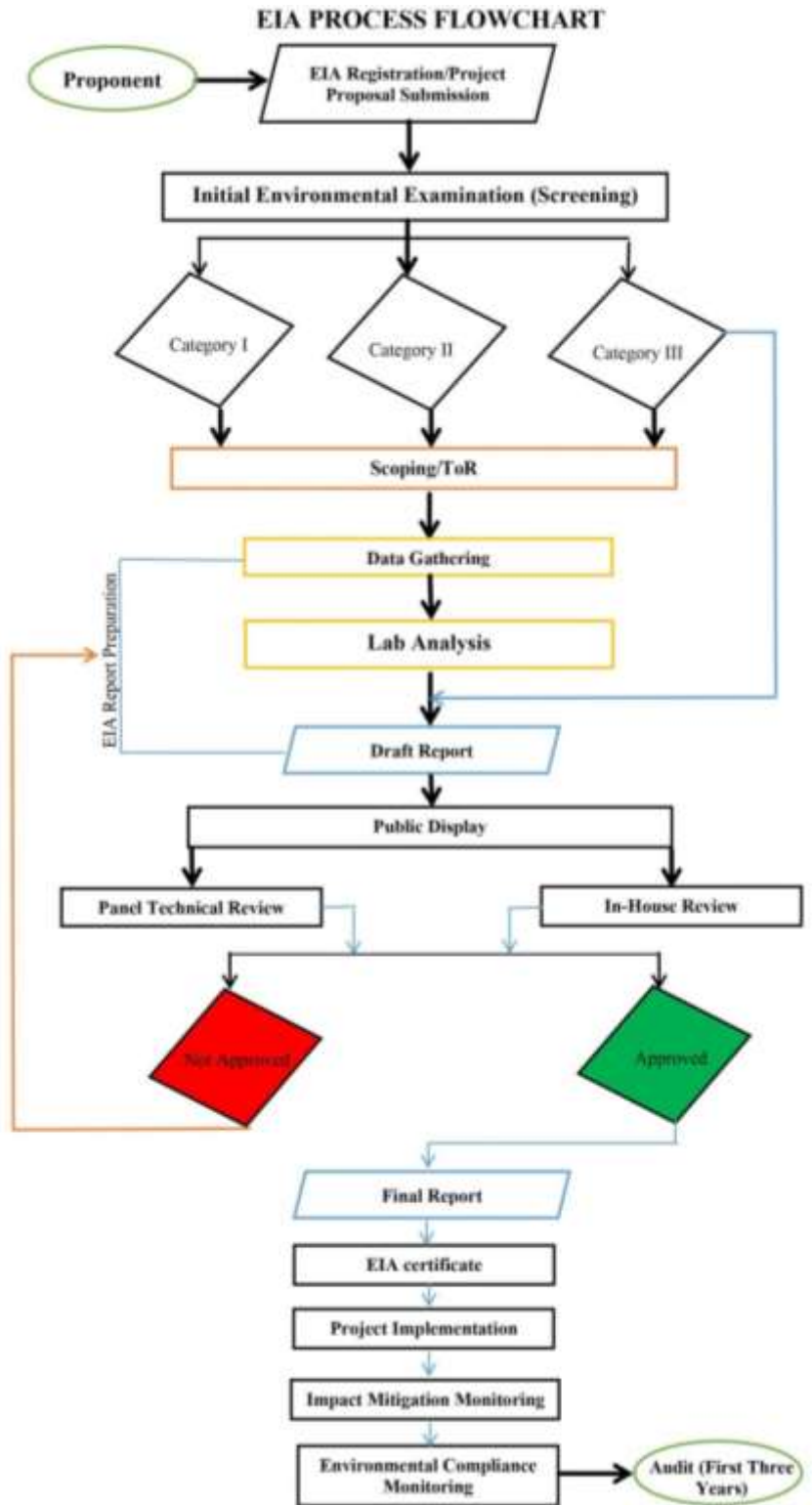


Figure 1.3: Overview of EIA Process in Nigeria

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## **1.9 Administrative Institutions and Legal Framework**

The study was carried out in accordance with the regulations, guidelines and standards of the Federal Ministry of Environment, Bauchi State legislations on the environment and all other applicable National legislations, and International Agreement and Convention to which Nigeria is a signatory. The synopsis below is some of the legal and administrative instruments on which the preparation of this ESIA was premised.

### **1.9.1 National Environmental Legislation**

In Nigeria, there are several national laws, regulations and standards, which seek to protect the natural environment and assure sustainable development in the country. A number of these regulatory instruments were developed following the Koko toxic waste episode of 1987, which led to the promulgation of the Harmful Waste Act No. 42 of 1988 and the establishment of the Federal Environmental Protection Agency (FEPA). Laws establishing some government agencies also contain provisions to ensure environmental protection as development progresses.

### **1.9.2 Federal Ministry of Environment Regulations**

The Federal Government of Nigeria promulgated the Federal Environmental Protection Agency (FEPA) by Act No. 58, 1988, CAP. E12 L.F.N. 2004. The Act establishes the Federal Environmental Protection Agency with the responsibility of protecting and preserving the environment, monitoring and assisting in the enforcement of environmental laws and co-operating with relevant authorities on matters and facilities relating to environmental protection. The Federal Ministry of Environment, (FMEnv) upon establishment in 1999, took over the powers and functions of the Federal Environmental Protection Agency (FEPA).

The Minister for Environment is empowered to establish standards in certain environmental areas like water quality, effluent limitations, air quality, atmospheric protection, ozone protection, noise control, and control of hazardous and waste removal methods by virtue of the provisions of the defunct FEPA. In exercise of its power, the

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Ministry had since made about 20 Guidelines by way of Regulations for different aspects of environmental protection and preservation.

***National Policy on the Environment***

Environmental management in Nigeria is based on the National Policy on the Environment (1989), revised in 1999 and 2017. The Policy states that Nigeria is committed to safeguarding the country's natural and built environment for the use of present and future generations. This commitment demands that efficient resource use and the reduction of environmental impacts be a core requirement of all developmental activities. The strategic objective of the Policy is to coordinate environmental protection and natural resources conservation for sustainable development.

***National Guidelines and Standards for Environmental Pollution Control in Nigeria, 1991***

This represents the basic instrument for monitoring and controlling industrial and urban pollution.

***S. I. 9 National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991***

This imposes restrictions on the release of toxic substances into the environment and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries.

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

This Statutory Instrument regulates the collection, treatment and disposal of solid and hazardous wastes from municipal and industrial sources and gives a comprehensive list of chemicals and chemical waste by toxicity categories

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### ***EIA Act CAP E12 LFN 2004***

The EIA Act is the primary Act governing EIA studies in Nigeria. It was promulgated to enable the prior consideration of an EIA on specified public or private projects. The Act sets out the procedure to be followed and methods to be used in undertaking an EIA.

Section 2(2) of the Act requires that where the extent, nature, or location of the proposed Project or activity is such that it is likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act.

Section 55 of the EIA Act provides for the maintenance of a Public Registry to facilitate public access to records relating to environmental assessments. Public review to which interested members of the public are invited to provide comments on the EIA of a proposed project is a key part of the approval process by the Federal Ministry of Environment.

### ***National Environmental Impact Assessment Procedural and Sectoral Guidelines***

In response to the promulgation of the EIA Act, the Federal Ministry of Environment developed National EIA Procedural Guidelines and other sets of guidelines on various sectors of the national economy. Applicable to this study is the EIA Sectoral Guidelines for Agricultural Sector.

The guidelines have been developed by the Federal Ministry of Environment to assist proponents in conducting a detailed environmental and social assessment of all new major projects within the agricultural sector in Nigeria. This EIA study has taken into consideration the relevant provisions of the guidelines, including the applicable mitigation measures.

### **1.9.3 National Environmental Standards and Regulations Enforcement Agency (NESREA) Act, 2007**

Administered by the Ministry of Environment, the National Environment Standards and Regulations Enforcement Agency (NESREA) Act of 2007, repealed the Federal Environmental Protection Agency (FEPA) Act. It is the embodiment of laws and

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regulations focused on the protection and sustainable development of the environment and its natural resources. The following sections are worth noting:

- Section 7 provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitoring and regulatory measures.
- Section 8 (1)(K) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution and sanitation.
- Section 27 prohibits, without lawful authority, the discharge of hazardous substances into the environment. This offence is punishable under this section, with a fine not exceeding, N1, 000,000 (One Million Naira) and an imprisonment term of 5 years. In the case of a company, there is an additional fine of N 50,000, for every day the offence persists.

This project will comply with NESREA regulations, including conducting EIA, environmental audit every three years after commissioning, obtain permit before disposing hazardous wastes, etc.

#### Regulations (under NESREA) - National Effluent Limitation Regulations

- Section 1 (1) requires industry facilities to have anti-pollution equipment for the treatment of effluent.
- Section 3 (2) requires a submission to the agency of a composition of the industry's treated effluents.
- National Environment Protection (Pollution Abatement in Industries and Facilities producing Waste) Regulations (1991).
- Section 1 Prohibits the release of hazardous substances into the air, land or water of Nigeria beyond approved limits set by the Agency.
- Section 4 and 5 requires industries to report a discharge if it occurs and to submit a comprehensive list of chemicals used for production to the Agency.

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## **National Environmental Regulations**

Section 34 of the NESREA Act, 2007 empowers the Minister of Environment to make regulations for safe and sustainable environment. In exercise of this power, the minister issued the national environmental regulations covering all sectors of development. The regulations relevant to the project are as follows:

- National Environmental Protection (Effluent Limitation) Regulations, 1999, makes it mandatory for industries to install anti-pollution and pollution abatement equipment on site. The regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the environment.
- National Environmental Protection (Management of Solid and Hazardous Waste) Regulations, 1999, defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, and landfills. It describes the hazardous substances tracking program with a comprehensive list of acutely hazardous chemical products and dangerous waste constituents. It also states the requirements and procedure for inspection, enforcement and penalty.
- Pollution Abatement in Industries Generating Wastes Regulations imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency planning by industries, submission of lists and details of chemicals used by industries to FMEnv, permits for the storage and transportation of harmful or toxic waste and the waste generator's liability.

The Act also provides regulations on strategies for waste reduction, permissible limits of discharge into public drains, protection of workers and safety requirements, environmental audit (or environmental impact assessment for new industries) requirements and penalties for contravention.



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#### **1.9.4 The 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 project shall be implemented in line with requirements of this Act, including obtaining development permit from Bauchi State Government.

#### **1.9.5 Water Resources ACT, CAP W2, LFN 2004**

The Water Resources Act is targeted at developing and improving the quantity and quality of water resources. The following sections are pertinent: Section 5 and 6 provides authority to make pollution prevention plans and regulations for the protection of fisheries, flora and fauna. Section 18 makes offenders liable, under this Act, to be punished with a fine not exceeding N2000 or an imprisonment term of six months. He would also pay an additional fine of N100 for everyday the offence continues.

#### **1.9.6 Land Use Act Cap L5, 2004**

Land Use Act No. 6 was enacted in 1978 (revised in 1990 and 2004). The Act vests all land in the urban areas of each state under the control and management of the governor of the state. The governor of the state holds the land in trust for the people of the state and is solely responsible for the allocation of land in all urban areas to individuals who reside in the state and to organizations for residential, agricultural and commercial purposes. All other land in the state subject to conditions under the Land Use Act is under the control

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and management of the local government. The Act divests traditional owners of land and vests such land in the state governor for the benefit and use of all Nigerians. It provides the processes through which land may be acquired by the Federal Government.

### **1.9.7 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. 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.

The project will generate wastes including construction wastes and transformer oils at substations and other harmful wastes. These wastes shall be handled, treated, and disposed of in accordance with the relevant requirements of this Act.

### **1.9.8 The Forestry Act**

The principal legislation in force for the regulation of the forest sector is the Forestry Act 1958. The Forestry Act CAP 51 LFN of 1994 prohibits any activity that may lead to the destruction of or cause injury to any forest products, forest growth or forest property. The project area does not fall within any protected or reserved forest.

### **1.9.9 The Endangered Species Act, CAP E9, LFN 2004**

This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction as a result of over exploitation. These sections are noteworthy:

- Section 1 prohibits, except under a valid license, the hunting, capture or trade in animal species, either presently or likely, in danger of extinction.
- Section 5 defines the liability of any offender under this Act.

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- Section 7 provides for regulations to be made necessary for environmental prevention and control as regards the purposes of this Act.

Certain sections of the line route of this project, will pass through natural areas that serve as wildlife habitats which will be impacted by the project. Hence, the project activities shall be carried out to comply with relevant provisions of this Act.

#### **1.9.10 The Factories Act, 1987 (Factory Act cap 126, LFN, 1990)**

The factories Act, as contained in the Laws of the Federation of Nigeria 1990, seeks to legislate, and regulate the conduct of health and safety in the Nigerian workplaces. It was enacted in June 1987 with the desire to protect the workers and other professionals against exposure to occupational hazards. The director of factories at the Federal Ministry of Employment, labor and productivity is responsible for the administration of the provisions or requirements of this Act. Section 13 allows an inspector to take emergency measures or request that emergency measures be taken by a person qualified to do so, in cases of pollution or nuisances.

This Act deals with working conditions at work sites, including construction sites, such as the type to be undertaken under the Project. Hence, the occupational health and safety requirements applicable to construction sites, as well as other work sites to be used by the project shall be subjected to the provisions of this Act.

#### **1.9.11 Labour Act - CAP. L1 L.F.N. 2004**

This Act deals with labour issues, including payment of wages, recruitment, discipline, employee welfare, employment of women and child labour. Sections 54 to 58 which deal with employment of women, prescribed period of absence from work for nursing mothers and allows her half an hour twice a day during her working hours to attend to the baby for a period of up to six months after she resumes work. Section 55 also exempted women from night work, except when they are employed as nurses. Sections 59-64 deal with employment of young people.

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### **1.9.12 Public Health Law CAP 103 LFN 1990**

Public Health Law (L.N47 of 1955, Cap 103) provides justification for the execution of developmental projects under guidelines that promote health by protecting the environment and safeguarding the health of humans.

### **1.9.13 Workers' Compensation Act, 1987**

The Act to make provisions for the payment of compensation to workmen for injuries suffered in the course of their employment. The compulsory insurance covers employees for injury or death resulting in the course of work or in work places. All types of workers are covered including working under a contract of service or apprenticeship with an employer, whether by way of manual labour, clerical work or otherwise, and whether the contract is expressed or implied, is oral or in writing. The project will employ both skilled and non-skilled labour and shall be subject to this law as applicable.

### **1.9.14 Child Rights Act 2003**

The Child's Rights 2003 was enacted by the National Assembly of the Federal Republic of Nigeria, 31st July 2003. It is 'AN ACT TO PROVIDE AND PROTECT THE RIGHTS OF A NIGERIAN CHILD; AND OTHER RELATED MATTERS.' Focuses mainly on survival which includes the rights of the child to life, good health, balance nutrition and related matters, Key Household Practices (KHHP).

- **Development**, which include the development of the child, spirit, soul and body
- **Protection**, which include protection of the child from child labour, child trafficking, ritual killing, sexual, physical, emotional abuses and neglect.
- **Participation**, which include the right of the child to be involved in matters that concerns them.

### **1.9.15 National Gender Policy 2006**

The main goals of this policy are:

- Commitment to gender mainstreaming as a development approach and tools for achieving the economic reform agenda, evidence based planning, value re-orientation and social transformation.

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- Recognition of gender issues as central to and critical to the achievement of national development goals and objectives and a requirement for all policies to be reviewed to reflect gender implications and strategies as contained in the gender policy and implementation modalities specified in the National Gender Strategic Framework;
  - Realization that effective and results focused policy implementation demands a cooperative interaction of all stakeholders. Promotion and protection of human rights, social justice and equity.

#### **1.9.17 Federal Ministry of Agriculture and Food Security (FMAFS)**

The Federal Ministry of Agriculture and Food Security (FMAFS), formerly known as the Federal Ministry of Agriculture and Rural Development (FMARD), was established in 1966 with a clear vision to ensure food security and promote agricultural sustainability in Nigeria. With a focus on empowering farmers, facilitating market access, and promoting sustainable practices, we strive to cultivate a resilient and prosperous agricultural sector.

The Federal Ministry of Agriculture and Food security is responsible for the formulation and implementation of policies and strategies in the Nigeria's agricultural sector, to sufficiently provide food for an increasing population, adequate supply of raw materials to a growing industrial sector, effectively expand the market for crop, livestock, agro and agro-allied products, continually create employment opportunities, and to widely diversify the economy, for national development.

The Ministry provides resources to the sector for the implementation of various projects and programmes. The efforts is complemented with the support and funding from donor partners in the implementation of various agricultural projects and programmes in the country.

#### **1.9.16 Federal Ministry of Agriculture and Rural Development (FMARD)**

The Federal Ministry of Agriculture and Rural Development (FMARD) has the administrative power to regulate agricultural research, agriculture and natural resources, forestry and veterinary research all over Nigeria. Since its establishment in 1966, the Ministry has been mandated to optimise agriculture and integrate rural development for

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the transformation of the Nigerian economy, attain food security, and position Nigeria as a net food exporter for socio-economic development.

To carry out its mandate, the Ministry develops and implements policies that are directed toward the key areas of interest in the agricultural sector. These policies are the synthesis of the framework and action plans of the Government designed to achieve overall agricultural growth and development.

The current agricultural policy being adopted by FMARD is the Agriculture Promotion Policy (2016-2020).

### ***Agriculture Promotion Policy (2016-2020)***

The Agriculture Promotion Policy (APP), also referred to as The Green Alternative, is the outcome of an intensive consultative process between November 2015 and April 2016, which involved multiple stakeholders.

The Agriculture Promotion Policy (APP) Policy is founded on the following guiding principles:

- Agriculture as a business– focusing the policy instruments on a government-enabled, private sector-led engagement as the main growth driver of the sector.
- Agriculture as key to long-term economic growth and security—focusing policy instruments to ensure that the commercialization of agriculture includes technologies, financial services, inputs supply chains, and market linkages that directly engage rural poor farmers because rural economic growth will play a critical role in the country's successful job creation, economic diversity, improved security and sustainable economic growth.
- Food as a human right – focusing the policy instruments for agricultural development on the social responsibility of government with respect to food security, social security and equity in the Nigerian society; and compelling the government to recognize, protect and fulfil the minimum degree of freedom of the people from hunger and malnutrition.
- Value chain approach – focusing the policy instruments for enterprise development across successive stages of the commodity value chains for the

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development of crop, livestock and fisheries sub-sectors, namely input supply, production, storage, processing/utilization, marketing, and consumption.

- Prioritizing crops – focusing policy on achieving improved domestic food security and boosting export earnings requires a measure of prioritization.
- Market orientation– focusing policy instruments on stimulating agricultural production on a sustainable basis, and stimulating supply and demand for agricultural produce by facilitating linkages between producers and off-takers, while stabilizing prices or reducing price volatility for agricultural produce through market-led price stabilization mechanisms (commodity exchanges, negotiated off-take agreements, extended farm-gate price undervalue chains coordination mechanisms, agricultural insurance, etc.).
- Factoring Climate change and Environmental sustainability – focusing policy instruments on the sustainability of the use of natural resources (land and soil, water and ecosystems) with the future generation in mind while increasing agricultural production, marketing, and other human activities in the agricultural sector.
- Participation and inclusiveness – focusing instruments on measures to maximize the full participation of stakeholders, including farmer's associations, cooperatives, and other groups, as well as Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs), Civil Society Organizations (CSOs), development partners and the private sector.
- Nutrition-sensitive agriculture– focusing policy instruments on addressing the issues of stunting, wasting, underweight and other manifestations of hunger and malnutrition with particular reference to the vulnerable groups, which include children under 5, nursing mothers and persons with chronic illness and disabilities.
- Agriculture's Linkages with Other Sectors– focusing policy instruments on the connected relationship between agriculture and other sectors at federal and state levels, particularly industry, environment, power, energy, works and water sectors.

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### **1.9.17 National Agricultural Land Development Authority Act, 1992**

This Act established the National Agricultural Land Development Authority with the following objectives:

- Provide strategic public support for land development which presently constitutes a major infrastructural development bottleneck hindering the development of viable economic farm holdings;
- Promote and support optimum utilization of Nigeria's rural land resources for accelerated production of food and fibre;
- Encourage and support economic-size farm holdings and promote consolidation of scattered fragment holdings to generate net income from agriculture which is aimed at sustaining living standards above the poverty line and thereby narrow rural-urban income inequalities;
- Provide gainful employment opportunities for rural people, raise rural incomes and improve on the general living standards in rural areas;
- Expand productive capacity in agriculture and regain export capability in traditional and non-traditional crops;
- Contribute significantly towards the attainment of a national food and fibre self-reliance, self-sufficiency and national food security through optimum utilization of available abundant land resources which ensures minimum soil and environmental degradation, while simultaneously promoting sustainable agriculture;
- Facilitate appropriate cost-effective mechanization of agriculture.

### **1.9.18 Standards Organization of Nigeria (SON) Act CAP 412 LFN 1990**

This organization was established to do the following:

- to organize tests and do everything necessary to ensure compliance with standards designated and approved by the Council;
- to undertake investigations as necessary into the quality of facilities, materials and products in Nigeria, and establish a quality assurance system including certification of factories, products and laboratories;



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- to ensure reference standards for calibration and verification of measures and measuring instruments;
  - to compile an inventory of products requiring standardization;
  - to comply with Nigerian standards specifications;
  - to foster interest in the recommendation and maintenance of acceptable standards by industry and the general public;
  - to develop methods for testing of materials, supplies and equipment including items purchased for use of departments of the Government of the Federation or a State and private establishments;
  - to register and regulate standard marks and specifications;
  - to undertake preparation and distribution of standards samples;
  - to establish and maintain such number of laboratories or other institutions as may be necessary for the performance of its functions under this Act;

#### **1.9.19 Nigerian Free Trade Zone Act No. 63, 1992**

In 1992, the Nigerian Free Zone Act (Act No. 63 of 1992) was passed establishing the Nigerian Export Processing Zone Authority (FMAFS). Free Trade Zones (FTZ), are expanses of land with improved ports and/or transportation, ware housing facilities, uninterrupted electricity and water supplies, advanced telecommunications services and other amenities to accommodate business operations. Under the FTZ system, enterprises are exempted from customs duties, local taxes, and foreign exchange restrictions, and qualify for incentives—tax holidays, rent-free land, no strikes or lockouts, no quotas in European Union (EU) and United State (US) markets, as long as end products are exported (although some portion can be sold in the domestic market). The FMAFS is responsible for the regulation of FTZ operations. Its tasks involve policy formulation, licensing and monitoring. The zones are governed by the FTZ Act which stipulates that an extensive EIA must be carried out before the commencement of any major projects. Under Section 8 of the Act [Nigeria Export Processing Zones Act 63, 1992], approved enterprises operating within Free Zones shall be exempted from all Federal, State and

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Local Government taxes, levies and rate. Section 18 (1) further provides that all legislative provisions pertaining to taxes shall not apply within Free Zones.

#### **1.9.20 Nigeria Export Processing Zones Act (CAP N107 LFN 2004)**

The institutional framework that governs the establishment of SAPZ programme falls under the jurisdiction of Nigeria Export Processing Zones Authority. “In exercise of the power conferred upon it by section 27 of the Nigeria Export Processing Zones Act, CAP N107 LFN 2004 and of all other power enabling it in that behalf, Nigeria Export Processing Zones Authority with the approval of the Honorable Minister of Industry Trade and Investments”. The following objectives of these regulations will apply to the SAPZ programme:

- Complement and enhance the provisions of the Nigeria Export Processing Zones Act, 2004;
- Provide details of regulatory and supervisory requirements necessary to promote efficient and profitable operations in Nigeria’s Free Trade Zones;
- Facilitate the attainment of goals for which Free Trade Zones are established in Nigeria;

These regulations shall take precedence over the Investment Procedures, Regulations and Operational Guidelines for free zones in Nigeria, 2004.

#### **1.9.21: National Climate Change Policy for Nigeria (2021 – 2030)**

The Federal Executive Council approved a comprehensive strategy policy on climate change: the overarching objective of the policy is to promote low-carbon, high-growth economic development and build a climate-resilient society through the achievement of the following targets.

- o Implement mitigation measures that will promote low carbon as well as sustainable and high economic growth;
- o Enhance national capacity to adapt to climate change;
- o Raise climate change-related science, technology and R&D to a new level that will enable the country to better participate in international scientific and technological cooperation on climate change;

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- Significantly increase public awareness and involve private sector participation in addressing the challenges of climate change; and
  - Strengthen national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional framework for climate change governance

### **1.9.21: National Action Plan on Gender and Climate Change (2020)**

This National Action Plan, based on a series of informed consultations with different stakeholders, using inclusive participatory approaches (Government Ministries, Departments and Agencies, women, youth, farmers, persons with disability, elderly persons), moves from the need to guide the implementation of gender and climate change-related policies, strategies, programmes, negotiations and actions at Federal, State and Local Government levels, as the negative impact of climate change is considered a serious threat to the social and economic realities of people, especially women, living in Nigeria.

This Action Plan covers the period 2020-2025 and its priority sectors include: Agriculture, Forestry and Land Use; Food Security and Health; Energy and Transport; Waste Management; Water and Sanitation. The implementation of the Action Plan will be governed by a participatory research involving the government at all levels, academic and research institutions, women and youth groups, private sector and other non-state actors, as well as development partners. In line with Nigeria's intention to empower and respond to the needs of women in the context of climate change, this National Action Plan focuses on effective strategies for integrating gender into the implementation of national climate change initiatives, including the Paris Agreement and the Nationally Determined Contributions (NDC). The Action Plan presents milestones for ensuring that in building a climate-resilient Nigeria, the important and critical roles of women, youth and other vulnerable groups are carried along in the implementation of relevant national policies and strategies.

Concerning the implementation of the linkage between gender issue and climate change in its priority sectors, the Plan defines specific objectives, action steps and timeline,

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indicators, responsible institutions and outcomes. Main objectives regarding Agriculture, Forestry and Land Use are: improving agriculture related infrastructure to adapt to the effects of climate change; enhancing local communities' participation in forestry and agricultural sector; encouraging women to acquire education in agriculture and forestry and increasing their access to land; ensuring gender responsive budgeting. Food Security and Health's objectives focus on: integration of gender and climate change in national health policy and programs; ensuring alternative livelihood opportunities for women affected by climate change in urban and rural settings; promotion of gender sensitive health care delivery services related to climate change; improving disease surveillance programs. Energy sector points out: the need for awareness on the relationship between climate change, energy and gender; the importance of supporting women to gain knowledge in energy technologies; the reduction of emissions of greenhouse gases and the increasing of budget allocation on climate change and gender programs. Waste Management objectives are: integrate climate change and gender in waste management system; promote effective waste management practices in communities; create access to finance women participation in waste management business. Water and Sanitation aims at: building technical capacity of women in water management; increase access to safe drinking water in rural and urban communities; development of gender-based programs for integrated water resources management.

### **1.9.22 Bauchi State Laws**

*Bauchi State Ministry of Environment:* The Bauchi State Ministry of Environment (BSME) was charged with the responsibility of Conservation and Protection of the environment in the State. Some of the core duties of the Ministry include:

- Formulation, enforcing and coordinating policies, statutory rules and regulation on solid waste collection and disposal, general environmental protection, flood control and regulation of the ecological system and all activities related therein, throughout the State.
- Conducting public enlightenment campaign and disseminating vital information on environmental and ecological matters, and to mobilize the inhabitants of all

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areas for effective observance of environmental rules and guidelines, for the purpose of maintaining healthy and safe environment.

- Rendering advisory services and support to all local government in the State in areas of Flood Control, Solid Waste Management, Ecological and Sanitation Matters.
- Preparation of master plan for drainage, solid and liquid waste and general aesthetics, and of annual state of the environment report for the State and transmit same to the Secretariat of the National Council of Environment.
- Monitoring sources of toxic pollutants in Air, Land and Water and initiating measures to ensure pollution-free air, land and water including offering necessary advice to industrial establishments.
- Monitoring the Implementation of Environmental Impact Assessment (EIA) and Environmental Audit (EAu) Reports, guidelines and procedures on all developmental policies and project within the State.
- Preparation of master plans for major cities of the State and developing strategies for settlement patterns with a view to integrating physical planning with economic programmes.
- Obtaining research findings from the relevant Federal and State Agencies for the purpose of policy formulation and dissemination of the supply and usage of water in the State.

This is triggered for solid and liquid waste management including sewer line connection and solid waste disposal.

*Bauchi State Environmental Protection Agency (BASEPA) Edict No. 3 of 1997.* The Bauchi State Environmental Protection Agency (BASEPA) is an agency under the supervision of the Bauchi State Ministry of Environment established by an edict No 10 of 1994 as amended by Edict No. 3 of 1997. BASEPA is responsible for regulation of urban environmental sanitation, environmental protection, biodiversity conservation and the sustainable development of the State's natural resources. The Agency is also responsible for the implementation of all environmental policies towards protection, sustenance and

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development of the environment in the State. The Agency sets environmental quality standards and ensures compliance with pollution control measures in the State. This is triggered, within the purview of BASEPA.

The mandate of BASEPA with respect to environmental protection and waste management in Bauchi metropolis is enshrined in the Edict No. 3 of 1997. The Edict empowers BASEPA as the sole agency responsible for all matters relating to environmental protection, sanitation and environmental research and policy. Section 9 (5) of BASEPA edict specifically state the function of the agency to include regulating, directing and controlling of the throwing, dumping or disposal of refuse negligently in the whole State. As the custodian of the environment in the whole State, BASEPA is responsible for the management of solid waste in residential and commercial areas. The Edict also empowers the agency to enter into agreement with any public or private organization and individuals to develop, utilize, coordinate and share environmental monitoring programmes and biological effects of various activities on the environment. This is triggered, within the purview of BASEPA.

*Bauchi State Ministry of Environment:* This Ministry was set up to protect and develop the general environment of the State. Other duties as outlined include:

- Monitor the Implementation of ESIA guidelines and procedures on all developmental projects in the State;
- Monitor and regulate disposal of solid, gaseous, and liquid wastes from facilities;

Monitor air, water, land and soil in the State to determine pollution levels; and

- Establish penalties for persons obstructing personnel of the ministry in the performance of their duties.

*Bauchi State Ministry of Lands and Housing:* The ministry ensures efficient and effective land resource management, which promotes equitable access, enabling environment for land delivery, land information and ability to contribute to sustainable socio-economic development of the State.

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*Bauchi State Water & Sewage Corporation (BSW&SC):* The Bauchi State Water & Sewage Corporation (BSW&SC) is responsible for water supply in urban areas, which include the State capital and the other 19 local government headquarters. BSW&SC oversees the operation of Gubi dam particularly the water treatment and supply, thus ensuring that all activities are fully documented.

*Bauchi State Ministry of Water Resources:* The mandate of the Ministry includes formulation of water resources policies; implement or monitor government policies on water resources; management of Water Resources information systems for the State including sourcing, analyzing, storing and dissemination of information; setting standards, regulating, supervising and controlling the use of all Water Resources in the State; overseeing Parastatals under it (Bauchi State Rural Water Supply and Sanitation Agency). Thus, the overall activities relating to Gubi fall under the jurisdiction of this ministry.

*Bauchi State Ministry of Justice:* In order to ensure orderliness, human activities are regulated through set of rules designed and enforced with corresponding rewards and penalties. The State Ministry of Justice, with respect to this project is a service provider in the area of administration of Justice and contract agreements. Generally, the Ministry is an office of government responsible for legal administration of laws of the land.

*Bauchi State Ministry of Local Government and Chieftaincy Affairs:* The Ministry has responsibility for policy formulations and coordination for the third-tier of Government and by extension, the Emirate Councils. The Ministry provides qualitative service delivery that is reform driven at the third-tier of government for a sustainable grassroots development.

*Bauchi Local Government Areas:* Statutory function of refuse management is domiciled with the Local Government Councils under their primary healthcare departments as contained in Act No 12 of 1989. Local Government Areas being the constitutionally recognized third tier of government in Nigeria also ensure economic planning and

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development of the communities under their area of influence. The common interest of these communities, traditional association and administrative convenience of the communities is equally administered by the local government councils. Considering that there is no development that is devoid of waste generation and health/ safety implication. Bauchi Local Government Area, in this case has a role to play.

### **1.9.23 International Guidelines and Conventions**

In addition to the national laws/regulations, Nigeria is signatory or party to several international conventions and treaties that support the use of EIA as the key tool for achieving environmentally sustainable development. The EIA shall be guided by the international environmental and social regulations from IFC/World Bank where applicable. All other relevant international guidelines and conventions, and industry best management practices shall also apply, including the international financing community. The international conventions, to which Nigeria is a signatory, relevant to this project are as follows:

- African Convention on the Conservation of Nature and Natural Resources
- Convention on Biological Diversity
- Endangered Species (Control of International Trade and Traffic)
- Conservation of Migratory Species of Wild Animals (1973)
- Convention to Combat Desertification (1994)
- United Nation Framework Convention on Climate Change (UNFCCC) 1992.
- International Union for Conservation of Nature and National Resources (IUCN) Guideline, 1996.
- The “Equator Principle”
- World Bank Operational Policies.
- Public Health Legislations and Regulations.
- The Rio Declaration on Environment and Development
- The Kyoto protocol, Montreal Protocol on Substances that Deplete the Ozone Layer, 1987.



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- The African Convention on the Conservation of Nature and Natural Resources, 1968.
  - Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)
  - Human and People's Rights on the Rights of Women in Africa in 2005
  - Civil and Political Rights Covenant
  - Economic, Social and Cultural Rights Covenant
  - Convention on the Elimination of All Forms of Violence against Women
  - ILO Occupational Safety and Health Convention, 1981.

#### **1.9.23.1 ILO Conventions and Core Labour Standards**

The International Labour Organization (ILO) is a tripartite organization consisting of trade unions, governments and companies, and is part of the United Nations system. In 1998, the ILO produced the Declaration on Fundamental Principles and Rights at Work. In the Declaration, ILO Member States including Nigeria agreed that they should all respect, promote, and realize core labour standards (whether they have been ratified or not).

The core labour standards consist of five standards, laid out in eight conventions:

- Freedom of association and the effective recognition of the right to collective bargaining (Convention No. 87 & No. 98)
- The elimination of all forms of forced and compulsory labour (Convention No. 29 & No. 105)
- The effective abolition of child labour (Convention No. 138 & No. 182)
- The elimination of discrimination in respect of employment and occupation (Convention No. 100 & No. 111)

BASG as well as its Contractors shall comply with these requirements, as well as the following internationally recognized labour rights: the right to a living wage based on a regular working week that does not exceed 48 hours; humane working hours with no

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forced overtime; a safe and healthy workplace free from harassment; and a recognized employment relationship with labour and social protection.

### **1.9.23.2 The African Development Bank Group's (AfDB) Integrated Safeguard System**

In 2013 the African Development Bank Group updated their policy on Involuntary Resettlement and created an Integrated Safeguard System (ISS) to improve clarity, coherence and consistency as well as overall operational effectiveness. Resettlement is covered under Operational Safeguard 2 (Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation), which includes comprehensive notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasises the need to maintain social cohesion, community structures, and the social interlinkages that common property provides. It furthermore stresses the importance of improving living conditions for PAPs through a RAP. OS 2 has the following specific objectives to:

- avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after having explored all other alternative project designs;
- ensure that displaced people are meaningfully consulted and given opportunities to participate in the planning and implementation of resettlement programmes;
- ensure that displaced people receive significant resettlement assistance under the project, so that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved beyond pre-project levels;
- mitigate the negative impacts of displacement and resettlement, actively facilitate social development and establish a sustainable economy and society; and
- set up a mechanism for monitoring the performance of involuntary resettlement programmes and remedying problems as they arise so as to safeguard against ill-prepared and poorly implemented resettlement plans.

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#### **1.9.23.3 International Finance Corporation (IFC)**

The IFC's Performance Standard 5: Land Acquisition and Involuntary Resettlement recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land and has the following key objectives:

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- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
  - To avoid forced eviction;
  - To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
  - To improve, or restore, the livelihoods and standards of living of displaced persons, and
  - To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

Involuntary resettlement in IFC PS 5 refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or means of livelihood) as a result of project-related land acquisition. Resettlement is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition which results in displacement. Where it is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities must be carefully planned and implemented.

### **IFC Performance Standards for Investment**

The Eight Performance Standards established by IFC for the life of an investment include:

Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

Performance Standard 2: Labour and Working Conditions

Performance Standard 3: Resource Efficiency and Pollution Prevention

Performance Standard 4: Community Health, Safety, and Security

Performance Standard 5: Land Acquisition and Involuntary Resettlement

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Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Performance Standard 7: Indigenous Peoples

Performance Standard 8: Cultural Heritage

#### **1.9.23.4 European Investment Bank (EIB) Environmental and Social Handbook**

The EIB’s Environmental and Social handbook was updated in December 2013. Section 6 - Volume 1 covers Involuntary Resettlement and Section 7 has a focus on Vulnerable People. The principles of EIB are broadly consistent with those of AfDB and IFC. There is specific emphasis on citizen’s rights to justice and access to information, in line with the Aarhus Convention. EIB also expressly states the principle of choice, namely that the project proponent is “required to offer to the affected persons an informed choice of either compensation in kind (land-for-land; land plot and house to replace affected land plot and house) or monetary compensation at the outset.”

#### **Comparison of Relevant National Legislation and International Standards**

Table1 provides a broad comparison of the EIB, AfDB and IFC standards for resettlement with the relevant Nigerian legislation.

**Table2: Comparison of Nigerian Law and Good International Practice of the AfDB, IFC and EIB for Resettlement**

<b>Category</b>	<b>Nigerian Legislation</b>	<b>AfDB ISS</b>	<b>IFC PS5</b>	<b>EIB E&amp;S Handbook</b>
<b>Minimise Land Take And Involuntary Resettlement</b>	Explore all viable alternative project design options to ensure minimization of impacts (Land Use Act of 1978)	Project proponent to consider feasible alternative project designs, including re-siting and re-routing, to avoid or minimize physical or economic displacement.	Avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.	Project-induced involuntary resettlement should be avoided by analyzing alternative project designs and locations.
<b>Consultation and Disclosure</b>	A notice of acquisition is usually prepared by the Ministry of Lands, in conjunction with the survey description. This notice is then published in two newspapers (one national and one local and the government gazette.	Open, inclusive and effective consultation with local communities is required.	RAPs must be implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.	Informed and meaningful consultation and participation of PAPs is required throughout the resettlement process.
<b>Eligibility</b>	Under Nigerian legislation, all land rights constitute occupancy rights rather than ownership rights and accordingly eligibility for compensation for loss of land is not provided for. Anyone possessing a statutory or customary right of occupancy to affected land is entitled to compensation for unexhausted improvements made to that land. Encroachers are not recognized as an eligible group, and are thus not entitled to any compensation provisions.	AfDB identifies three groups of displaced people that shall be entitled to compensation or resettlement assistance for loss of land or other assets taken for project purposes: <ul style="list-style-type: none"> <li>- Those who have formal legal rights to land or other assets recognized under the laws of the country concerned.</li> <li>- Those who may not have formal legal rights to land or other assets at the time of the census / asset survey but can prove that they have a claim that would be recognized under the customary laws of the country.</li> <li>- Those who have no recognizable legal right or claim to the land they are occupying in the project area of influence, and who do not fall into either of the two categories described above, but are entitled to resettlement assistance in lieu of compensation for land to improve</li> </ul>	All occupants (including squatters) using or living on the land prior to the cut-off date are eligible for compensation.	Any person with formal land title, land use rights, customary or traditional rights to the land as well as those who occupy / use the land but have no formal title for objective reasons are eligible for compensation for land. People who occupy the land but have no formal or informal claim to it, such as squatters, shall be provided resettlement assistance in lieu of compensation for the land they occupy.

		<p>their former living standards (compensation for loss of livelihood activities, common property resources, improvements (structures and crops) etc.), provided that they themselves or witnesses can demonstrate that they occupied the project area of influence for a reasonable time (at least six months) prior to a cut-off date established by the borrower or client and acceptable to the Bank.</p>		
<p><b>Census and Asset Inventory</b></p>	<p>A survey is required to record the position and dimensions of the land parcels to be acquired, the spatial relation to properties in the area, and a list of all the communities on the property. The enumeration process is asset driven and not household driven. There is no particular format which is currently used by the Land Department. The process mostly comprises of generic questions that are administered orally, and on the basis of factual information and observations, the entitlement for the families is suggested.</p>	<p>A census and comprehensive socioeconomic survey is required with gender disaggregated information.</p>	<p>A census and socio-economic survey are required to collect baseline data and identify PAPs.</p>	<p>A census and socio-economic baseline survey are required. The census should include an inventory of losses (assets, access to resources or services, etc.), a detailed measurement survey and valuation of lost assets. It is to cover the total affected population.</p>

<b>Resettlement Site and Host Community</b>	No provisions	The borrower or client carries out a detailed analysis of host communities to avoid adverse impacts.	Engagement with host communities is required. The resettlement site must offer improved living conditions.	Engagement with host communities is required. EIB also lists several criteria for the resettlement site such as it must not displace other people in the process, not be situated on polluted land, not be located in zones identified as potentially subject to disaster risk followed by a natural hazard; not be threatened by (imminent)
				eviction, be available and have the capacity to absorb the influx of resettled persons at acceptable density levels, i.e. resettlement should not lead to new resettlement.
<b>Livelihoods</b>	No provisions	Strategies to improve livelihoods of PAPs are required.	Strategies to improve livelihoods of PAPs are required.	Strategies to improve livelihoods of PAPs are required.



<b>Gender</b>	No provisions	<p>Special consideration has to be paid to the needs and rights of women. In the context of gender vulnerability, the client must give careful consideration to actively facilitating consultation with, and participation by both women and men in ways that are sensitive to the social and political constraints and barriers that women and men may face.</p> <p>The RAP must include a specific protocol specifying safeguards for the quality and quantity of land to be allocated to women, especially widows and divorcees, to ensure their means to generate income and achieve food security.</p> <p>Land titles at the resettlement site are to be in the name of both spouses or of single heads of household, regardless of gender, if this does not conflict with the borrower or client's own laws and legislation. Compensation payments to families are made to both husbands and wives when this is technically feasible and socially acceptable.</p>	<p>The consultation process must ensure that women's perspectives are obtained and that their interests are factored into all aspects of resettlement planning and implementation. Addressing livelihood impacts may require intrahousehold analysis in cases where women's and men's livelihoods are affected differently. Women's and men's preferences in terms of compensation mechanisms, such as compensation in kind rather than in cash, should be explored.</p>	<p>The project proponent must ensure that compensation and income restoration measures are implemented without discrimination. Regarding gender, the promoter must ensure equal treatment of women during compensation and income restoration processes, especially with regard to women's rights and interests in land, property, assets, and compensation and relocation assistance, even where these are not recognised in formal law. Within household units, it is encouraged that titles of replacement land and structures</p>
<b>Cut- off date</b>	Though a cut-off date is not written into Nigerian legislation, discussions with the Ministry of	There is a requirement to establish a cut-off date for eligibility that is acceptable to the Bank. The borrower	The client is required to establish a cut-off date for eligibility. Information	The client is required to establish a cut-off date for eligibility. Information regarding
	Lands suggest that there is a six week notice period given for land to be acquired by a Project. This is not, however, a formal cutoff date.	or client documents the cut-off date(s) and disseminates information about it (them) throughout the project area of influence in a culturally appropriate and accessible manner, before taking any action on clearing land or restricting local community access to land.	regarding the cutoff date is to be well documented and disseminated throughout the project area.	the cutoff date is to be well documented and disseminated throughout the project area. The cut-off date is specified in the RAP and discussed and agreed with the EIB as part of the RAP preparation process.

<b>Timing of Compensation</b>	No provisions	Compensation is to be made before PAPs move; before land and related assets are taken; and, if the project is implemented in phases, before project activities begin for each particular phase.	In general compensation needs to be given to all those affected before taking possession of the land.	All affected persons need to be paid fair compensation in good time for expropriated assets.
<b>Compensation</b>	Cash compensation is generally made based upon market value. Whilst in principle there is allowance for in-kind compensation or replacement of assets, cash compensation is common practice.	PAPs are compensated for all their losses at full replacement cost. PAPs can be offered a range of different compensation packages, resettlement assistance, and livelihood improvement options. Engagement is key to determining the appropriate compensation packages.	PAPs are compensated for all their losses at full replacement cost. PAPs can be offered a range of different compensation packages, resettlement assistance, and livelihood improvement options. Engagement is key to determining the appropriate compensation packages.	PAPs are compensated for all their losses at full replacement cost. PAPs can be offered a range of different compensation packages, resettlement assistance, and livelihood improvement options. Engagement is key to determining the appropriate compensation packages; choices must be offered to PAPs.
<b>Security of Tenure</b>	Security of tenure is not provided to affected people under Nigerian legislation.	Required.	Required.	Required.
<b>Communal Resources</b>	No provisions.	Page 32 of the ISS mentions compensation for the loss of communal resources.	Compensation is required if communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas are impacted.	No provisions.
<b>Resettlement</b>	No provisions	Displaced people are provided with	Displaced people are	Regardless of the circumstances

<p><b>assistance</b></p>		<p>targeted resettlement assistance with the aim of ensuring that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved beyond pre-project levels.</p>	<p>provided with targeted resettlement assistance with the aim of ensuring that their standards of living, income earning capacity, production levels and overall means of livelihood are improved beyond pre-project levels.</p>	<p>and without discrimination, the promoter will ensure that affected persons or groups identified in the census, especially those who are unable to provide for themselves, have, during and after resettlement, safe and secure access to: (a) essential food, potable water and sanitation; (b) basic shelter and housing; (c) appropriate clothing; (d) essential medical services; (e) livelihood and subsistence sources; (f) fodder for livestock and access to common property resources previously depended upon; and (g) education for children and childcare facilities.</p>
<p><b>Vulnerable Groups</b></p>	<p>Many Nigerian policies address the needs of vulnerable people, such as the Gender Policy, Child Act or NEEDS framework. However, there are no specific provisions related to resettlement.</p>	<p>Special attention needs to be paid to vulnerable groups and special provisions required in the RAP process.</p>	<p>Special attention needs to be paid to vulnerable groups and special provisions required in the RAP process.</p>	<p>Special attention needs to be paid to vulnerable groups and special provisions required in the RAP process.</p>

<p><b>Grievances</b></p>	<p>Section 30 of the Land Use Act 1990 6 v: “Where there arises any dispute as to the amount of compensation calculated in accordance with the provisions of section 29, such dispute shall be referred to the appropriate Land Use and Allocation Committee.”</p>	<p>There is a requirement to establish a culturally appropriate and accessible grievance and redress mechanism to resolve, in an impartial and timely manner, any disputes arising from the resettlement process and compensation procedures. PAPs must be informed about the mechanism.</p>	<p>The client is required to establish a grievance mechanism as early as possible in the project development phase. This will allow the client to receive and address specific concerns about compensation and relocation raised by displaced persons or members of host communities in a timely fashion, including a recourse mechanism designed to resolve disputes in an</p>	<p>The promoter is required to set up and maintain a grievance mechanism that is independent, free and in line with the requirements set out in Standard 10. It must allow for prompt addressing of specific concerns about compensation and relocation from PAPs and host communities and other directly involved entities. The mechanism should be easily accessible, culturally appropriate, widely publicized,</p>
			<p>impartial manner.</p>	<p>and well-integrated in the promoter’s project management system. It should enable the promoter to receive and resolve specific grievances related to compensation and relocation by affected persons or members of host communities, and use the grievance log to monitor cases and improve the resettlement process.</p>

<p><b>Monitoring</b></p>	<p>No provisions</p>	<p>An independent third party is required to monitor the implementation of large-scale or complicated RAPs, with regular feedback from PAPs. For largescale resettlement operations quarterly reviews are recommended, and indepth reviews of midterm progress, consistent with the overall project scheduling, are critical.</p>	<p>The client is required to establish procedures to monitor and evaluate the implementation of a Resettlement Action Plan or Livelihood Restoration Plan.</p>	<p>The promoter is required to set up necessary systems to monitor the implementation of a RAP on a regular basis and take corrective action as necessary. Affected persons will be consulted as part of the monitoring activities. The implementation and effectiveness of the resettlement action plan shall be subject to monitoring and review by qualified resettlement specialists and/or other independent third parties as appropriate and commensurate to the scale and risks involved in the resettlement.</p>
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### African Convention on the Conservation of Nature and Natural Resources

The African Convention on the Conservation of Nature and Natural Resources was adopted in Algiers, Algeria, on September 15, 1968, and entered into force on June 16, 1969. The Convention stipulates that the contracting States shall undertake to adopt the measures necessary to ensure the conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interests of the people.

### Convention Concerning the Protection of the World Cultural and Natural Heritage

The Convention was adopted in Paris, France on October 17, 1972. The Convention sets aside areas of cultural and natural heritage for protection. It places obligations to each State Party to recognize that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage situated on its territory, belongs primarily to that State.

### Convention on the Conservation of Migratory Species of Wild Animals

This Convention also known as the Bonn Convention was adopted in 1979 and entered into force in 1983. It stipulates actions for the conservation and management of migratory species including habitat conservation.

### Vienna Convention for the Protection of the Ozone Layer

The Vienna Convention was adopted in 1985 and entered into force on September 22, 1988. It places general obligations on countries to take appropriate measures to protect the environment against adverse effects resulting from human activities which tend to modify the ozone layer.

### The Montreal Protocol on Substances that Deplete the Ozone Layer

The Protocol was adopted on September 16, 1987, as an international treaty to eliminate ozone-depleting chemicals production and consumption.

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### Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal

The Convention was adopted on March 22, 1989, and entered into force on May 1989. It focuses attention on the hazards of the generation and disposal of hazardous wastes. The Convention defines the wastes to be regulated and controlled in order to protect human and environmental health against their adverse effects.

### The United Nations Convention on Biological Diversity

The convention was adopted in 1994. The objectives of the Convention include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

### The United Nations Framework Convention on Climate Change

The Convention on Climate Change was adopted in 1992 during the Rio Earth Summit in Rio De Janeiro, Brazil and entered into force in 1994 to limit Greenhouse Gas (GHG) emissions which cause global warming. Nigeria being a signatory to this framework has made it develop its Nationally Determined Contribution (NDC) which shows its global commitment towards embracing sustainable development measures that limit the rate of global warming and negative impacts of climate change. It shows the country's climate targets and measures to be adopted in actualizing them.

### Solemn Declaration on Gender Equality in Africa 2004

The Solemn Declaration on Gender Equality in Africa was adopted by the AU Assembly in 2004, calling for member states' continual action toward achieving gender equality and reinforcing their commitment to international and regional women's rights instruments. In addition to calling for wider ratification of the Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa, it also addresses state responsibility for tackling violence against women and gender-based discrimination.

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Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa, 2003

The Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa, better known as the Maputo Protocol, is an international human rights instrument established by the African Union was adopted in Maputo in July 2003 and went into effect in 2005. It guarantees comprehensive rights to women including the right to take part in the political process, social and political equality with men, and improved autonomy in their reproductive health decisions.

Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), 1979

Adopted December 18, 1979, and entered into force on September 3, 1981, the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) is an international legal instrument that requires countries to eliminate discrimination against women and girls in all areas and promotes women's and girls' equal rights.

#### **1.9.23.5 AfDB Integrated Safeguards Systems**

The AfDB's Integrated Safeguards System (ISS) is a set of policies, procedures, and guidelines established to identify, assess, and mitigate potential E&S risks and impacts associated with the Bank's funded projects and programs. The ISS were designed to ensure that the Bank's investments promote sustainable development and do not harm people or the environment. The updated ISS (April 2023) are comprised of the following:

- AfDB's Vision for Sustainable Development
- AfDB's E&S Policy
- Ten E&S Operational Safeguards (OS)
- E&S Guidance Notes (ISS Guidance notes)

There is a significant overlap between the AfDB operational safeguards and the IFC PSs; nevertheless, as the AfDB safeguards are also relevant to this Project the assessment of E&S performance is also assessed against these. A summary of the AfDB Safeguards is provided in Table below:



AfDB Safeguard	Description
E&S OS 1 (Assessment and Management of Environmental and Social Risks and Impacts)	<p>The aim of this overarching OS, along with the nine other Oss that complement it, is to mainstream E&amp;S considerations; including those related to climate change vulnerability; into Bank operations and thereby contribute to sustainable development in Africa.</p> <p>An ESIA study carried out under this OS helps to determine the scope and extent to which other OSs are addressed. It sets out the Borrower's (or Project's) responsibilities for assessing, managing, and monitoring E&amp;S risks and impacts associated with each stage of an operation/project supported by AfDB.</p> <p>This OS, together with OS10 (Stakeholder Engagement and Information Disclosure) provide the overall process framework for the E&amp;S assessment and management of AfDB financed operations at project level.</p>
E&S OS 2 (Labour and Working Conditions)	<p>The objectives of OS2 are as follows: protect workers' rights; promote safety and health in the workplace; promote the fair treatment, non-discrimination, and equal opportunity of project workers; protect project workers, including vulnerable workers; prevent the use of all forms of forced labour and child labour; support the principles of freedom of association and collective bargaining of project workers, provide project workers with accessible means to raise workplace concerns; and enquire that the Bank, and national competent authorities as appropriate, be informed promptly of any material adverse impacts and events relating to labour protection and health and safety at the workplace. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 3 (Resources Efficiency and Pollution Prevention and Management)	<p>OS3 sets out the requirements to address resource efficiency and pollution 36 prevention and Management throughout the project life cycle in a manner consistent with Good International Industry Practice (GIIP). Throughout the different phases of the project's lifecycle—planning and design, construction, commissioning, operations, and decommissioning—the project is required to assess and evaluate resource-efficiency and pollution-prevention techniques and implement them, taking into consideration their technical and financial feasibility and cost-effectiveness. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 4 (Community Health, Safety and Security)	<p>This OS addresses potential risks and impacts on communities that may be affected by project activities. Occupational health and safety (OHS) requirements for project workers are set out in OS2, and measures to avoid or minimize impacts on human health and the environment due to existing or potential pollution are set out in OS3. The applicability of this OS is established during the ESIA described in OS1.</p>
E&S OS 5 (Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement)	<p>The objectives of OS5 are to: avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative project designs have been explored; ensure resettlement plans and activities are informed by social assessments (including gender issues); avoid forced evictions; mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use; improve living conditions of poor or vulnerable persons who are physically displaced by the project; establish a mechanism for monitoring the performance and effectiveness of involuntary resettlement activities which result from project activities; conceive and execute resettlement activities as sustainable development programs; and ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected. The applicability of OS5 is established during the ESIA described in OS1</p>
E&S OS 6 (Habitat and Biodiversity Conservation & Sustainable Management of Living Natural Resources)	<p>This OS outlines the requirements for the Project to (i) identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats, and (ii) observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services. The applicability of OS6 is established during the ESIA as described in OS1.</p>

E&S OS 7 (Vulnerable Groups)	OS7 contributes to poverty reduction and sustainable development by ensuring that projects supported by the Bank enhance opportunities for vulnerable groups to participate in, and benefit from, the development process in ways that do not threaten their unique cultural identities and well-being. The applicability of OS7 is established during the ESIA as described in OS1
E&S OS 8 (Cultural Heritage)	This OS sets out general provisions on risks and impacts to cultural heritage from project activities. OS7 sets out additional requirements for cultural heritage in the context of vulnerable groups and highly vulnerable rural minorities including Indigenous Peoples (IPs). The applicability of this OS is established during the ESIA described in OS1.
E&S OS 9 (Financial Intermediaries (FIs))	The objectives of this OS are to: set out how the FI will assess and manage environmental and social risks and impacts associated with the subprojects it finances; promote good environmental and social management practices in the subprojects the FI finances; o promote good environmental and sound human resources management within the FI; support the adoption of best practice standards in corporate governance, business management and corporate responsibility by enterprises supported by the Bank based upon the requirements of OSs 1 through 10, as appropriate; and encourage the consideration of environmental and social governance issues in capital market institutions such as development finance entities and stock exchanges.
E&S OS 10 (Stakeholder Engagement and Disclosure of Information)	This OS therefore recognizes the importance of open and transparent engagement between the project and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation. OS10 applies to all Bank Group’s funded operations. The project will engage with stakeholders as an integral part of the project’s ESIA and project design and implementation, as outlined in OS1

## 1.10 Terms of Reference

The project proponent, FMAFS recognises the importance of a detailed environmental analysis viz-a-viz its responsibilities to the success of this project and is desirous to implement this EIA study in order to understand the environmental sensitivity of the project area and the need to address the impacts, where significant. The main thrusts of the TOR are as follows:

- Conduct baseline studies that are required to characterize the existing environment;

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- Assess the types of project alternatives to be considered;
  - Undertake consultations with relevant stakeholders via Stakeholder consultation;
  - Assess the significance of both positive and negative impacts by weighting them against local conditions and established limits to acceptable change (defined by legislation, by recognized experts, stakeholders etc.) which the proposed development should not exceed, and the trend of change in the area if no development takes place; implemented environmental and social analysis of all the necessary issues to be considered before project implementation, bearing in mind the necessary interactions with other sub-consultants and consideration of alternatives.
  - Assess detailed project descriptions, including general layout & physical descriptions, and project implementation strategies
  - Carry out detailed descriptions of the existing environmental and socio-economic situation that incorporates stakeholder consultations, literature reviews and field study.
  - Undertake health & safety, environmental and socio-economic impact assessments that include qualitative and quantitative risk assessments among other tools and techniques.
  - Propose mitigating and ameliorating measures as applied to the construction and operation of the project.
  - Develop Environmental Management Plan that appropriately incorporate monitoring, mitigation and management systems that are consistent with identified impacts and that provide a contingency for unforeseen impacts.
  - Preparation of a detailed EIA report which will form the basis for the issuance of Environmental Impact Statement (EIS) by Federal Ministry of Environment and other approving authorities where applicable.

## **1.11 Structure of EIA Report**

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The format of this report is essentially in line with the recommended format and guidelines by the Federal Ministry of Environment (FMEnv). Accordingly, the report is organised into the nine main chapters (1-9) as follows:

- **Preliminary Sections:**

These include Table of Contents, List of Tables, Figures, Plates, and Executive Summary

- **Chapter One: Introduction**

This chapter provides background information about the proposed project and highlights objectives, scope of work for the environmental assessment as well as the applicable legal and administrative framework for the project.

- **Chapter Two: Project Justification**

This chapter outlines the project justification, including the need; value / benefits of the project and project development options.

- **Chapter Three: Project and Process Description**

This chapter describes the proposed project location, project activities and processes involved including construction & installation, project operation and maintenance and schedule.

- **Chapter Four: Description of Existing Environment**

This chapter describes the existing (baseline) environmental conditions of the project area including the socio-economic and health status of the inhabitants in the area. Also included are records of consultations held with the stakeholders notably the elders and youths in the host communities.

- **Chapter Five: Potential and Association Impacts**

In this chapter, potential and associated environmental impacts of project activities are identified and evaluated.

- **Chapter Six: Impact Mitigations/Measures**

This chapter proffers mitigation and ameliorative measures that would be adopted to eliminate or reduce to acceptable levels significant adverse impacts identified.

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- **Chapter Seven: Environmental and Social Management Plan (ESMP)**

This chapter presents the Environmental and Social Management Plan (ESMP) that will be adopted throughout the project life cycle. It also includes the Environmental Management System (EMS) plan that will ensure the effectiveness of the mitigation measures and the remediation plan after decommissioning.

- **Chapter Eight: Decommissioning Plan**

This chapter briefly presents the details of decommissioning plan at the end of the project life cycle.

- **Chapter Nine: Stakeholder Engagement and Grievance Redress Mechanism**

- **Chapter Ten: Conclusions**

This chapter presents conclusions.

- **References**

This section contains all the cited references and bibliographies referred to in the report.

- **Appendices**

As much as possible, materials presented in the report are highlights, mostly the most important findings and results for clarity and to make the report easy reading and friendly. Other information sources, including some raw data are presented as appendices.

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## **CHAPTER TWO**

### **PROJECT JUSTIFICATION**

#### **2.1 Introduction**

This chapter describes the project needs, benefits and development options as well as its sustainability.

#### **2.2 Need for the Project**

Nigeria is the most populous country on the African continent with over 223,000,000 million people, and a population growth estimated at 2.41% per year. Like other middle-income countries, Nigeria faces significant and persistent poverty and inequality. Major factors contributing to rural poverty include low agricultural production and productivity, limited opportunities for value-addition, challenges of marketing capacity, poor yields in quality and quantity, and significant deficits in support systems such as infrastructure, access to productivity-enhancing inputs, financial backing, commercial orientation, and effective policies, as well as environmental degradation and the effects of climate change. These challenges limit prospects for rural households. With competing needs on the national budget, this situation threatens national food security. Over 70% of Nigeria's population cannot afford a nutrient-adequate diet. The high sensitivity of the agricultural sector to increasing climate change and climate variability combined with high poverty rates are the main sources of Nigeria's vulnerability to food insecurity and malnutrition. In 2011, the Federal Government of Nigeria (FGN) developed its Agricultural Transformation Agenda, which aims to achieve a hunger-free Nigeria through an agricultural sector that drives income growth, accelerates the achievement of food and nutritional security, generates employment, and transforms Nigeria into a leading player in global food markets to grow wealth for millions of farmers. In the context of its agricultural transformation strategy, the FGN is tackling two main interrelated challenges: (i) Meet domestic food requirements by stepping up local sourcing to reduce its food import bill; as well as (ii) Modernize its farming model to reduce poverty levels

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in rural areas. The FGN's strategy is to turn the country's huge food deficit into a market and employment opportunity for smallholders and small operators.

With the launch of the Special Agro-industrial Processing Zone (SAPZ) programme, Nigeria can, in less than a decade, banish food insecurity, while radically improving export earnings from agriculture, creating millions of lucrative agro-industrial jobs and opportunities for its citizens. The SAPZ is the flagship for Nigeria's agriculture, which entails the development and operation of agro-industrial processing clusters in areas of high food production across the country, to engender competitiveness in agroindustrial production and processing that is critical to further unlock the potentials of Nigeria's agriculture, to improve food and nutrition security, to reduce post-harvest losses, create jobs for women and youth, as well as create wealth for the rural community.

The Federal Government of Nigeria has therefore requested the joint support of AfDB and IFAD in the materialization of its transformation agenda. The FGN seeks to leverage AfDB-IFAD complementary expertise, experience, and comparative advantage in the setting-up of SAPZs to: (i) sustainably meet the domestic food supply gap for key food products; (ii) create exportable surpluses; (iii) provide income and employment opportunities for rural poor households; and (iv) produce a replicable climate resilient and low emission model for further investments. Focus lies on high potential climate resilient pro-poor value chains that can be scaled up and have relevance to the industry and off-takers operating in Agricultural Industrial Hubs (AIHs) and Agricultural Transformation Centres (ATCs), as well as on significantly improving livelihoods and generating decent employment, especially for women and youth. With regards to the demand and uptake of agricultural products, the FGN and AfDB will focus on attracting private-sector agribusinesses to set up processing plants in zones of high food production, to process commodities into food products. In addition, the FGN and AfDB will create an enabling environment for the private sector by putting in place appropriate fiscal policies and incentives, investment, and infrastructure policies for SAPZ.

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## 2.3 Benefits of the Project

There are several significant benefits to gain from the construction of the project. The beneficiaries include the project proponent, the State and Federal Governments, the local community and importantly the local economy. The development is expected to benefit the location by creating an economic hub thereby creating local employment and raising the standards of living. The employment in turn is expected to train manpower towards skilled and un-skilled job requirements. Employment opportunities will be generated by the project. Based on these considerations, the following benefits have been considered:

- ✦ Meeting the development needs and policies of the Federal Government of Nigeria and Bauchi State.
- ✦ Revenue generation for the Government through industrial, residential, commercial and social zones and other service charges and tax payments.
- ✦ Creating both direct and indirect employment opportunities for the local population and fostering sustainable inclusive economic growth;
- ✦ improving value-addition opportunities and creating surplus for export of products;
- ✦ Increased of incomes, reduce wastages, ensure value addition, generate employment opportunities as well as export earnings.
- ✦ Development of tremendous impact on the economy of the Bauchi State through job creation, security, socio-political stability effective economic growth and attainment of sustainable development.

## 2.4 Value of the Project

The African Development Bank (AfDB), with support from other development partners, has launched \$520 million Special Agro-Industrial Processing Zones (SAPZs) in Nigeria with seven States as pioneer beneficiaries. The African Development Bank is providing \$210 million for the development of the SAPZs in Nigeria, in partnership with the Islamic Development Bank (IsDB) which is co-financing with \$150 million, and with the



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International Fund for Agricultural Development (IFAD), which is co-financing with \$160 million.

## **2.5 Envisaged Sustainability**

The proposed project shall be sustained in broad and diverse ways. There shall be harmonization between the proposed project and the social, environmental, economic and technical aspects of the project. The proponent intends to achieve the project sustainability in the following ways:

### **2.5.1 Technological Sustainability**

BASG has set up a highly technical multi-disciplinary project team that includes Architects, town planners, project management specialist, geologist, soil scientist, civil engineers, electrical engineers, structural and mechanical engineers, to prepare the engineering design of the development, which shall give rise to building construction, plumbing, electrical installations, roofing and painting, in an environmentally friendly manner. Equipment and machineries to be put in place for this project are those whose operation shall not have adverse effect on the environment in terms of release of noxious gases, noise and vibration. This project shall be undertaken using the best available technology in construction and building industry (from ground work to the finishing). It shall comply with environmental regulations and urban development laws of Nigeria and Bauchi State. All the structures and every associated infrastructural facility shall be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment and systems that save resources including energy, and water conservation shall be given priority without compromises on cost. The equipment and vehicles shall have the highest levels of combustion efficiency by ensuring a proactive maintenance culture.

Asphalt mixers, crushers and other construction equipment and machinery will be incorporated with pollution control devices like dust arrestors/precipitators, emission control, noise abatement devices and desulfurization devices. The equipment and vehicles

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will have the highest levels of combustion efficiency, capability to use cleaner fuels like biodiesel and will have enhanced safety features.

### **2.5.2 Economic Sustainability**

This project will be sustained economically by way of improving trade relations between Nigeria and the rest of the world; bringing in foreign investments into the country usage, and expanding local markets and trades in Bauchi State which in turn will increase foreign exchange inflow as well as generate revenue for the government. A move towards a solution-based business model will be undertaken, whereby a new perception of value is established, that will enhance material gain, eliminating the concept of waste as part of the production cycle.

It is planned that the proposed project will employ directly almost 6,500 workers. In different sectors, these skilled and unskilled workers will be part of all the socioeconomic activities that will take place at SAPZ proposed project and assist the development of Nigeria. Besides, SAPZ proposed project will create a considerable amount of indirect employments in neighboring States of North Eastern Nigeria. Most importantly, residents will leave in more organized, civilized and well-disciplined commercial and residential District mostly established by foreign investors and their Nigerian counterparts. Direct payments for land spaces, goods and services will bring returns to the investors and governments.

### **2.5.3 Environmental Sustainability**

The project will be environmentally sustained by incorporating into the project design, practical mitigation measures or controls proffered for the identified environmental impacts of the proposed project (see Chapter Six), as well as implementing the environmental monitoring and management programmes as recommended in the EMP (Chapter Seven). Implementing these actions would also ensure that the project meets and/or exceeds the requirements of the Nigerian Federal Ministry of Environment and World Bank/ IFC regarding minimizing the environmental and social impacts. The proposed project shall comply with environmental regulations and standards locally and internationally.

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#### **2.5.4 Social Sustainability**

The project has secured its first social license – the host communities’ acceptance of the proposed project and their eagerness to see it succeed. The project will attract a lot of improvements in the social well-being of communities in the neighborhood of the project area. Some categories of jobs including some sub-contracting services shall be employed from the communities, resulting in financial upliftment and reduction in the number of unemployed indigenes and Nigerians. Bauchi State holds a comparative advantage in terms of availability of labour. In addition, BASG is committed to effective and continuous stakeholders’ engagements and consultations and compliance with applicable national social laws, relevant international conventions and World Bank social safeguard policies.

### **2.6 Project Development Options**

#### **2.6.1 No project option**

The “no-project option” implies that the construction of the proposed SAPZ project will not be achieved. This option is considered if there is economic, technical or human capacity deficiencies or that the proponents are unwilling to commence the project or that the regulatory authorities are unwilling to approve the project; thus, leading to a “no project option”. This option will translate to non-beneficiary by the people and government of Bauchi State in particular and the nation as a whole. This will also mean that the envisaged positive socio-economic impact on the people and government of Bauchi State and the nation will not be achieved. This alternative was rejected because it was not viable. Also associated with this option are; loss of resources already committed to the project, depriving employment opportunities that can be accrued from the project. This is not good for socio-economy, population growth, poverty alleviation, health, expansion, and development of the nation. This option was not considered, therefore, the need for the project.

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### **2.6.2 Delayed Project Option**

This option implies that the execution of this project will be delayed until a much later date. Such option is usually taken when conditions are unfavorable for project implementation, such as in a situation where there is war, or host community is deeply resentful of the project. Also, if the economics of the project are unacceptable or unattractive at the time, then a delay may be feasible. But none of these conditions are applicable. In fact, on the contrary, both the economics and the political environment are most favorably disposed towards the project. Therefore, the implication of delaying the project will include the fact that all Contractors, workers and equipment that have been mobilized for this project, and procurement, will have to be demobilized. Also, because of the inflationary trends in Nigeria, such a delay may result in unanticipated increase in project costs, leading to a decrease in final profit accruable from the project. These, and other related problems make it impossible to adopt the delayed project option.

### **2.6.3 Project Implementation Option**

The third option considered was the execution of the proposed project as planned. This option was accepted because the project will uplift the socio-economic activities of the host communities through its Corporate Social Responsibility (CSR). Further, it will generate employment opportunities for thousands of Nigerians. It will also stimulate the springing up of ancillary industries that will equally, provide more job opportunities to the teeming unemployed youths in the country thereby increasing their standards of living. The SAPZ project is expected to achieve significant milestones, including reducing the country's current food import bill through import substitution, boosting revenue from agricultural exports, creating wealth for rural farming communities, creating new sustainable jobs, especially for women and youths. These prospects will elude Nigerians if the project is not encouraged.

### **2.6.4 Project Location Alternatives**

In accordance with the requirements of Nigeria's EIA procedures together with international best practice, a number of alternatives have been considered during the formulation of the proposed Project design. The present location of the SAPZ project was

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identified as the preferred location taking into consideration the following location alternative factors. The important factors that influence the site selection include:

▪ **Accessibility and Transportation**

- Proximity to major transportation networks such as Abubakar Tafawa Balewa International Airport gives access to key distribution channels; Bauchi – Kano expressway major highway for adequate movement of goods and personnel.
- The AIH is centrally located to all the ATCs
- Accessible from all parts of the State through good road networks

▪ **Utilities and Infrastructure**

- Availability and reliability of essential utilities such as Gubi Dam water supply to the project site; steady power supply and existing ATBU large solar farm for electricity and telecommunication networks.

▪ **Security**

- Close proximity to Nigerian Air Force Base (NAF) Quarters as emergency response capabilities.

▪ **Land availability**

- Sufficient land area (150ha) for current and future expansion.
- Land acquisition belongs to Bauchi State Government.
- Good topography and geological factors.

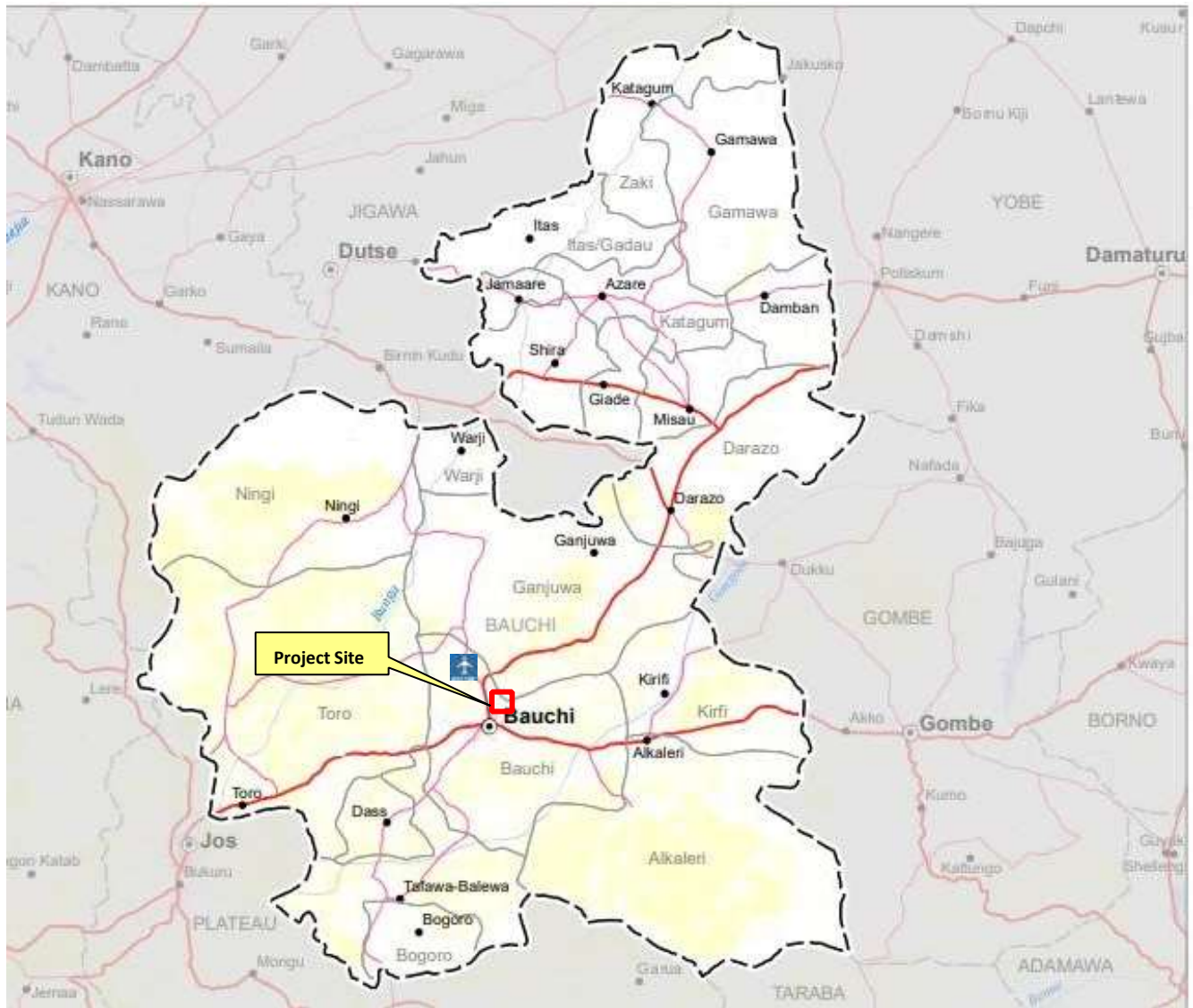


Figure 2.1: Map showing major road networks linked to the project site.

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## **CHAPTER THREE**

### **PROJECT DESCRIPTION**

#### **3.1 Background of the Project**

The proposed Special Agro-Industrial Processing Zones (SAPZ) project is an integrated development initiative designed to concentrate on agro-processing activities within areas of high agricultural potential to boost productivity, integrate production, processing and marketing of selected commodities. The SAPZ Program goal is to increase household incomes, foster job creation in rural agricultural communities, especially for youth and women, and enhance food and nutritional security in Nigeria. The development objective is to support inclusive and sustainable agro-industrial development. The main project activities associated to the development of the SAPZ project include pre-construction works and mobilization of equipment and machineries, site clearance, excavation and earth works, construction of roads, green spaces, specialized infrastructure, zone specific infrastructure, industrial zone for target sectors, specialized agro-infrastructure zone, logistic zone, institutional zone, residential zone, multi-facility complex, amenities and utilities zone, transportation and logistics zone and greenery and walkways.

The SAPZ will be made up of two building blocks which include:

1. Agricultural Transformation Centre (ATC)
2. Agro-Industrial Hub (AIH)

#### **1. Agricultural Transformation Centre (ATC)**

The ATCs are designed to link smallholder farmers to the agro-processing hub and are centres strategically located in high-production areas, to serve as aggregation points to accumulate agricultural produce from the community for primary processing to supply the agro-processing hub for further value addition, or to send them to centres of great demand for distribution and retail to consumers. The ATC is a rural-based development institution to implement integrated initiatives for the rural communities and at selected locations for facilitating agro commodities procurement. ATC is one of the rural



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development initiatives of SAPZ which would not only promote inclusive rural development but would also serve as a backward linkage to the AIH in terms of raw material sourcing and supplying and forward linkage to agro production zone.

## **2. Agro-Industrial Hub (AIH)**

The Agro-Industrial Hub will be supported by a network of compact and efficient Agricultural Transformation Centres (ATCs) that will coordinate farmers, their cooperatives and clusters' production (land preparation, planting and input supply), harvesting, agglomeration (primary on-farm storage, preservation and processing), and marketing, activities. The hub will include the installation of various crop-processing factories for several commodities. The food processing facilities will be equipped with the mechanical capacity to manage the entire production process from input reception to packaging of the final products in order to meet domestic and international demand. Target crops include Sesame, Rice, Sorghum, Millet, Maize, Groundnut, Soy-Beans, Cassava Acha, Sweet Potatoes, Bambara nuts and assorted vegetables. The agro-industrial processing complex will also provide shared facilities to ensure excellent support to stakeholders within the zone. The infrastructure available in the hub will provide an opportunity for stakeholders to develop their individual projects and facilities within the park. As a result, stakeholders will be able to set up their processing plants and benefit from the available power distribution, water supply, wastewater treatment, Information Communication Technology (ICT) connectivity, waste management etc. within the hub.

### **3.2 Description of Project Location (AIH)**

The proposed Agro-Industrial Hub (AIH) Centre is located at Gubi, Bauchi Local Government Area (LGA) of Bauchi State, Nigeria as shown in Figure 3.1. The site is about 20km from Bauchi township. The total land area is 150 hectares along Bauchi-Kano expressway within Latitudes 10°28'23"N - 10°28'11"N and Longitudes 9°47'19"E - 9°45'54"E. The proposed site area is surrounded by adjoining facilities such as the Abubakar Tafawa Balewa University (ATBU) Main Campus directly opposite the site about 3km to the main campus; the Nigerian Airforce (NAF) Quarters to the south west



about 350m; Sir Abubakar Tafawa Balewa International Airport is located towards the North about 4.6km from the site (Figure 3.2). The Gubi Dam is located about 8km to the west. The geographical coordinates of the site boundaries are given in (Table 3.1). At present, the site is largely covered by scattered trees especially Mango trees. There are few existing settlements and villages present in the proposed site. Villages identified near the proposed project location include Kuhu, Malmo and Gubi communities.

**Table3: Proposed AIH Boundary Coordinates**

Coordinate No	Longitude	Latitude
1.	10.4735419	9.7899295
2.	10.471357	9.7872975
3.	10.4698375	9.5106448
4.	10.4672082	9.7822392
5.	10.4651265	9.7796948
6.	10.4630497	9.7771608
7.	10.4609725	9.7746265
8.	10.4678076	9.7721146
9.	10.4608426	9.7705887
10.	10.4623725	9.7693257
11.	10.464503	9.7718101
12.	10.4688725	9.7767249
13.	10.471057	9.7791547
14.	10.4731951	9.7815948
15.	10.4748771	9.783747
16.	10.4774391	9.7846529
17.	10.4800015	9.7855588
18.	10.4820877	9.7863236
19.	10.479234	9.7872868
20.	10.4772816	9.7878464
21.	10.4763218	9.7883282
22.	10.4666876	9.774258

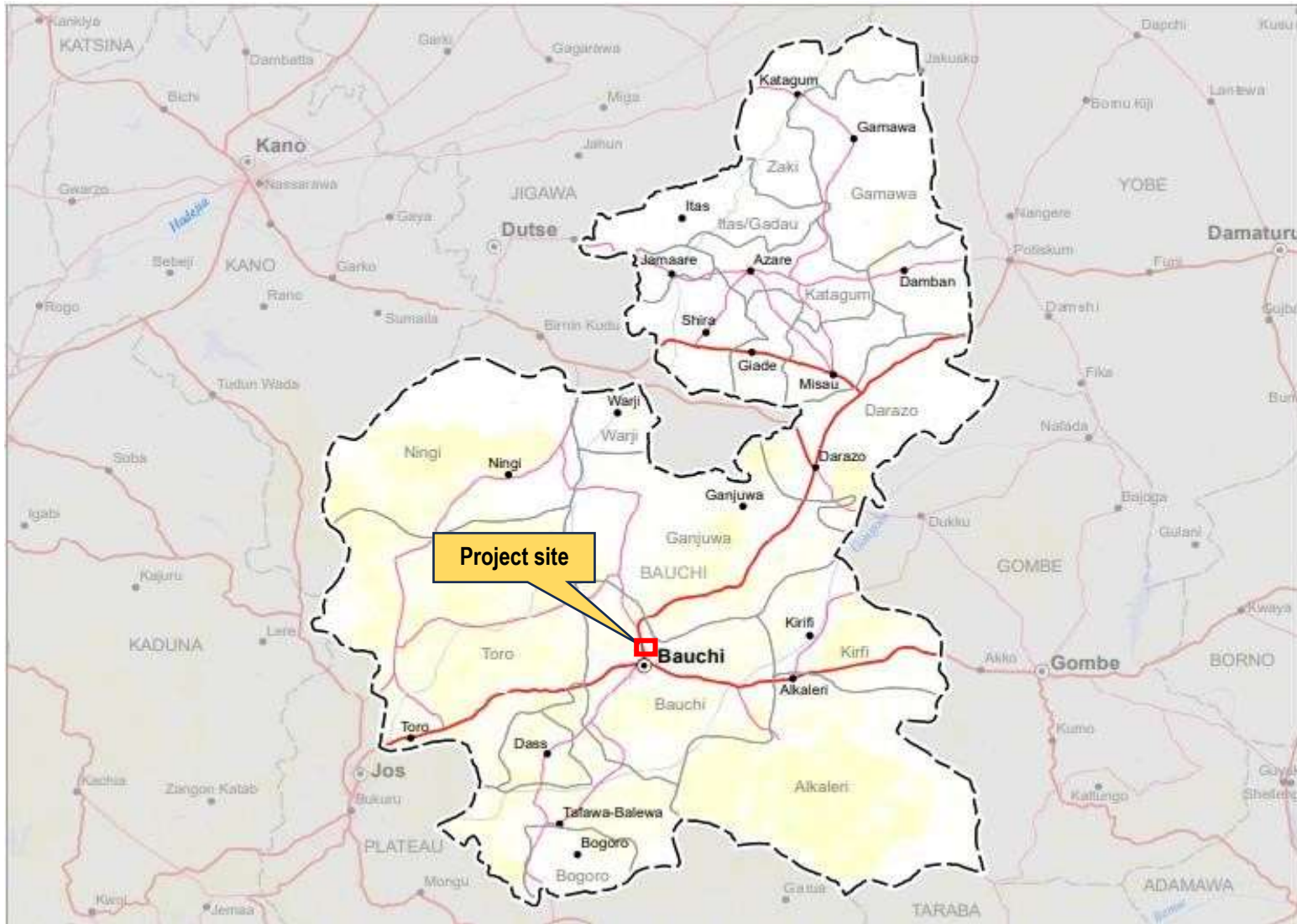


Figure 3.1: Map of Bauchi State showing Bauchi LGA project location



Figure 3.2: Satellite imagery of the proposed Gubi-AIH surrounding features



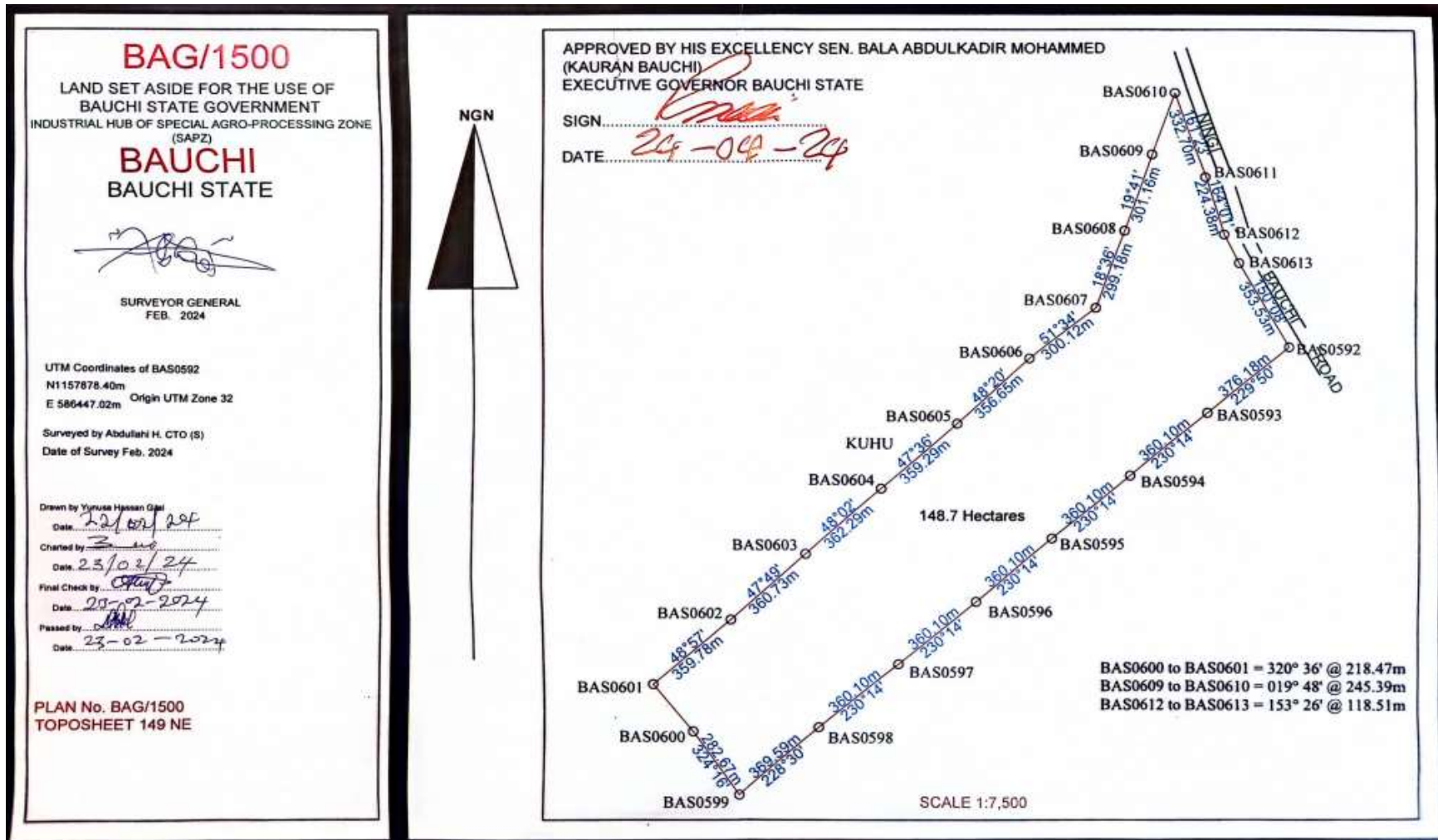


Fig. 3.3: Proposed AIH Land layout

### 3.3 Description of ATCs Location

The proposed model of AIHs and ATCs work on the concept of “hub and spokes” model where an AIH is fed by a series of ATCs spread over a vast procurement zone which in turn are being fed by the Aggregation Centres (ACs) located in the core production area in the State. The sustenance of the proposed AIH is solely dependent on the continuous inflow of raw materials. An aggregation centre that shall serve as an input feeder for every ATC shall be strategically located in four LGAs places within the radius of influence/procurement of that ATC apart from having its collection facilities for the benefits of the farmers in the near vicinity. The proposed ATCs centers are distributed in each of the three (3) senatorial zones of Bauchi State with their value chain commodities as highlighted in Table 3.2. The three (3) Senatorial Zones which are North, South and Central zones represent each of the ATC centres. The Northern Zone is Azare in Katagum LGA; South Zone has two ATCs due to its population, land mass and agricultural economic diversity; they are Alkaleri in Alkaleri LGA and Galam in Dass LGA, and the ATC in the Central Zone is Rampa in Darazo LGA of Bauchi State. The proposed ATC centers are identified and based on the availability and connectivity in the identified locations.

**Table4: Proposed ATCs location and Priority Value Chains**

S/N	Host Community	Zone	LGA	Commodity Value Chains	Priority Value Chains
1.	Azare	North	Katagum LGA	Rice, Sesame, Roselle (Zobo)	Rice and Sesame
2.	Rampa	Central	Darazo LGA	Sesame, Millet, Sorghum, Ground nut Roselle	Sorghum, Millet and Groundnut
3.	Alkaleri	South	Alkaleri LGA	Cassava, Maize, Bambara nuts, Rice, Cowpea	Cassava and Maize
4.	Galam	South	Dass LGA	Rice,Acha (Fonio), Onions and Assorted vegetables	Rice and Acha
				<ul style="list-style-type: none"> <li>• Ganjuwa-Soybeans</li> <li>• Toro-Sweet Potato</li> <li>• Ningi-Sorghum and Groudnuts</li> </ul>	

Source: Field work, 2024

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**Please Note that:**

1. Tafawa Balewa and Bogoro will feed in their produce to the Dass ATC because of their proximity to the ATC and commonality of commodities of comparative economic advantage.
2. Toro, Ganjuwa and Ningi LGAs will feed in their produce to the AIH in Bauchi directly, because of their proximity to the AIH
3. Kirfi LGA, Gombe State Boarder (Lariski) a major grain market will feed in to Alkaleri ATC
4. Jamaare, Shira, Gamawa, Giade, Itas/Gadau and Zaki LGAs will feed in their produce to Azare ATC in Katagum LGA
5. Misau and Dambam LGAs will feed in their produce in Darazo ATC

**Proposed Agricultural produce Value chains**

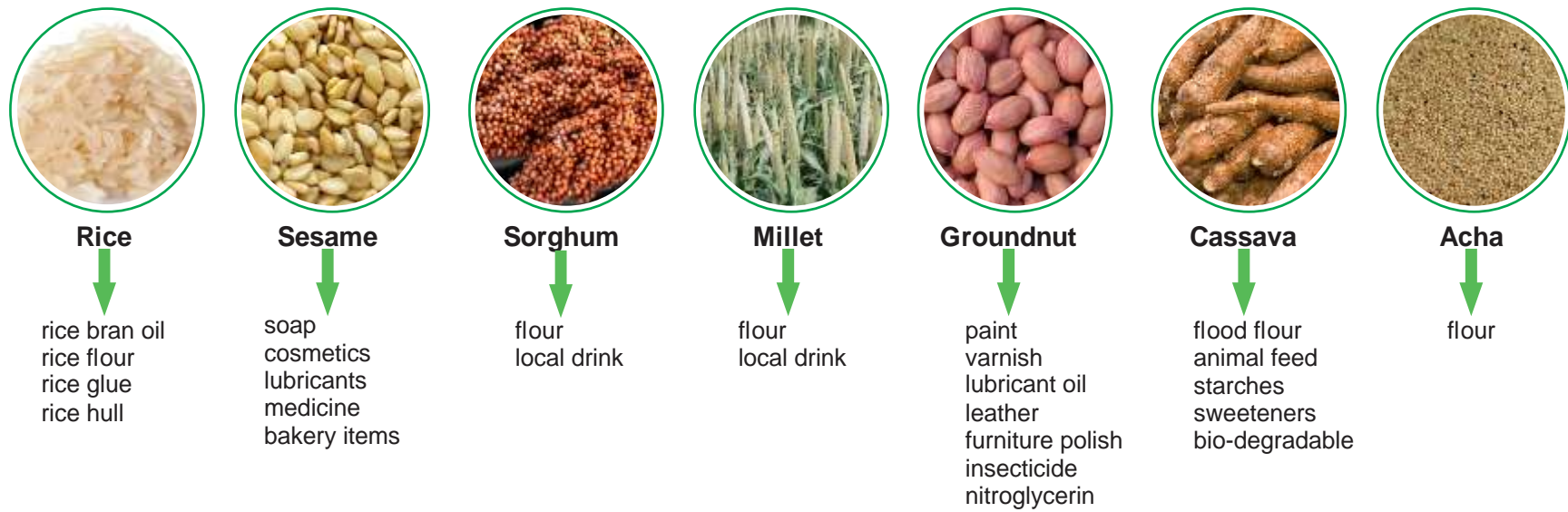


Figure 3.4: Agricultural value chain

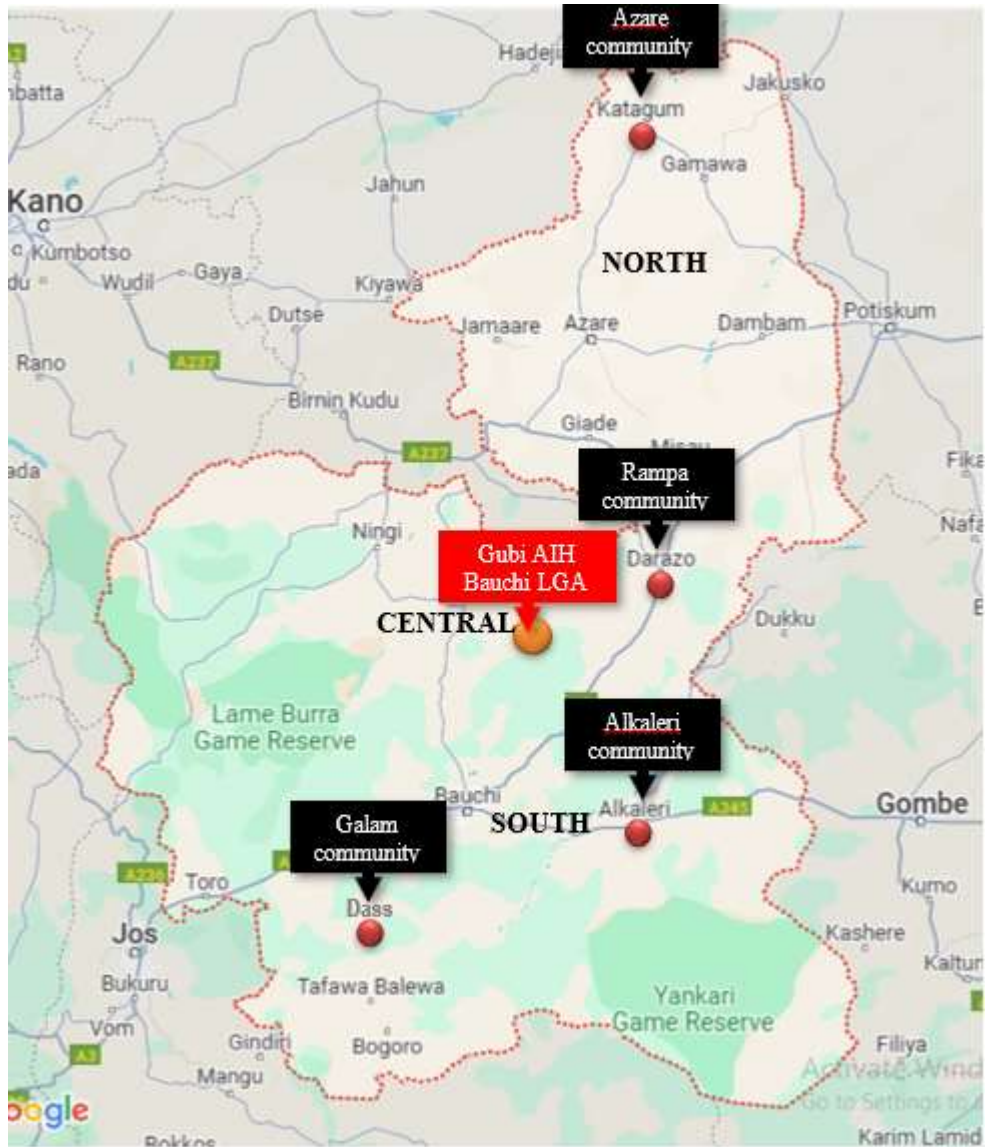


Figure 3.5: Proposed ATC Centres distributed across the three Senatorial Zones



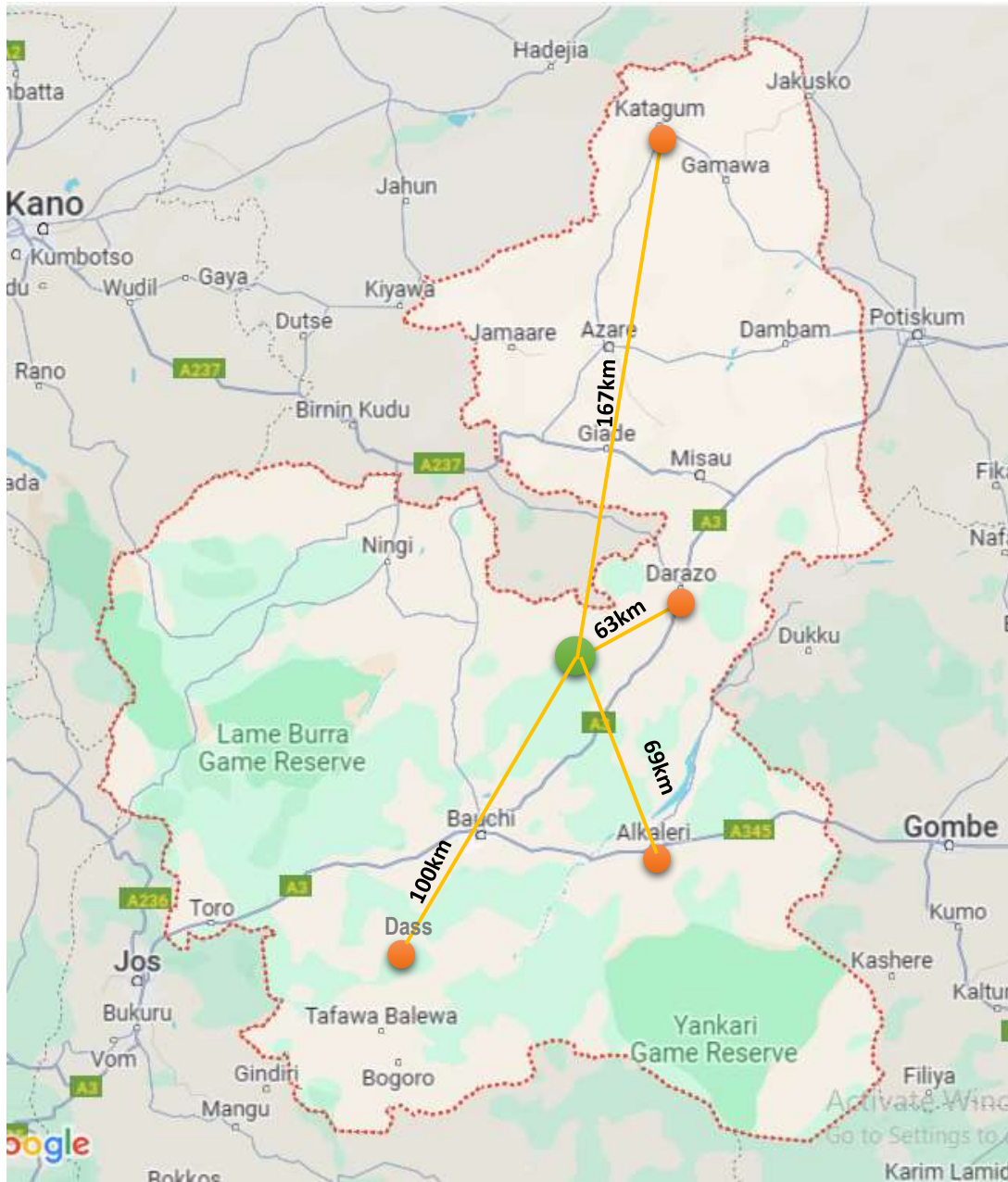


Figure 3.6: Map illustrating the distances of the ATCs from the AIH project site

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## **3.4 Existing Infrastructure and Facilities at the Agro-Industrial Hub**

The project site was assessed to present an understanding of the accessibility to the site from a broad national/regional context, and the existing infrastructure and facilities as presented herein. The state of physical infrastructure plays a major role in the attraction of investments which are in turn vital for employment creation.

### **3.4.1 Accessibility**

#### **Roads**

The Agro-Industrial Hub is accessed primarily by road. The Hub is currently accessible by Trunk A roads which link Bauchi town connects to Gombe-Bauchi-Alkaleri, Potiskum-Bauchi-Ganjuwa (Soro) and Dawaki-Bauchi-Tafawa Balewa. From the North, the Trunk A road that accesses the site from Gamawa and Azare. The trunk roads that provide access to the SAPZ project site are presented in Figure 3.7. Access to the proposed SAPZ project site is easy because it is situated along the Bauchi – Kano road.



Figure 3.7: Road showing connectivity to the proposed AIH site

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### **Railway**

The closest railway system to the AIH location is the Bauchi Railway Station about 20.8km from the proposed AIH site as presented in Figure 3.8. The 5km rail line linking Bauchi to Inkil community along Bauchi-Gombe expressway. The scope of services aimed at expanding the tracks to Alkaleri in Alkaleri Local Government Area of Bauchi State. This will enhance transportation of goods and materials between Alkaleri ATC and the AIH centre including other adjoining communities.

### **Airport**

Air transportation is considered the fastest way to move people and goods from a place to another and its presence in a city or region can foster quicker economic development. There is the Abubakar Tafawa Balewa International Airport close to the AIH which is about 4.6km away from the project site (See Figure 3.8). The airport shall serve as a fast means for the transportation of agricultural produce from the AIH to the local and international markets. The SAPZ transportation plan should therefore aim at providing quick access from the agro-allied industries to the cargo airport.

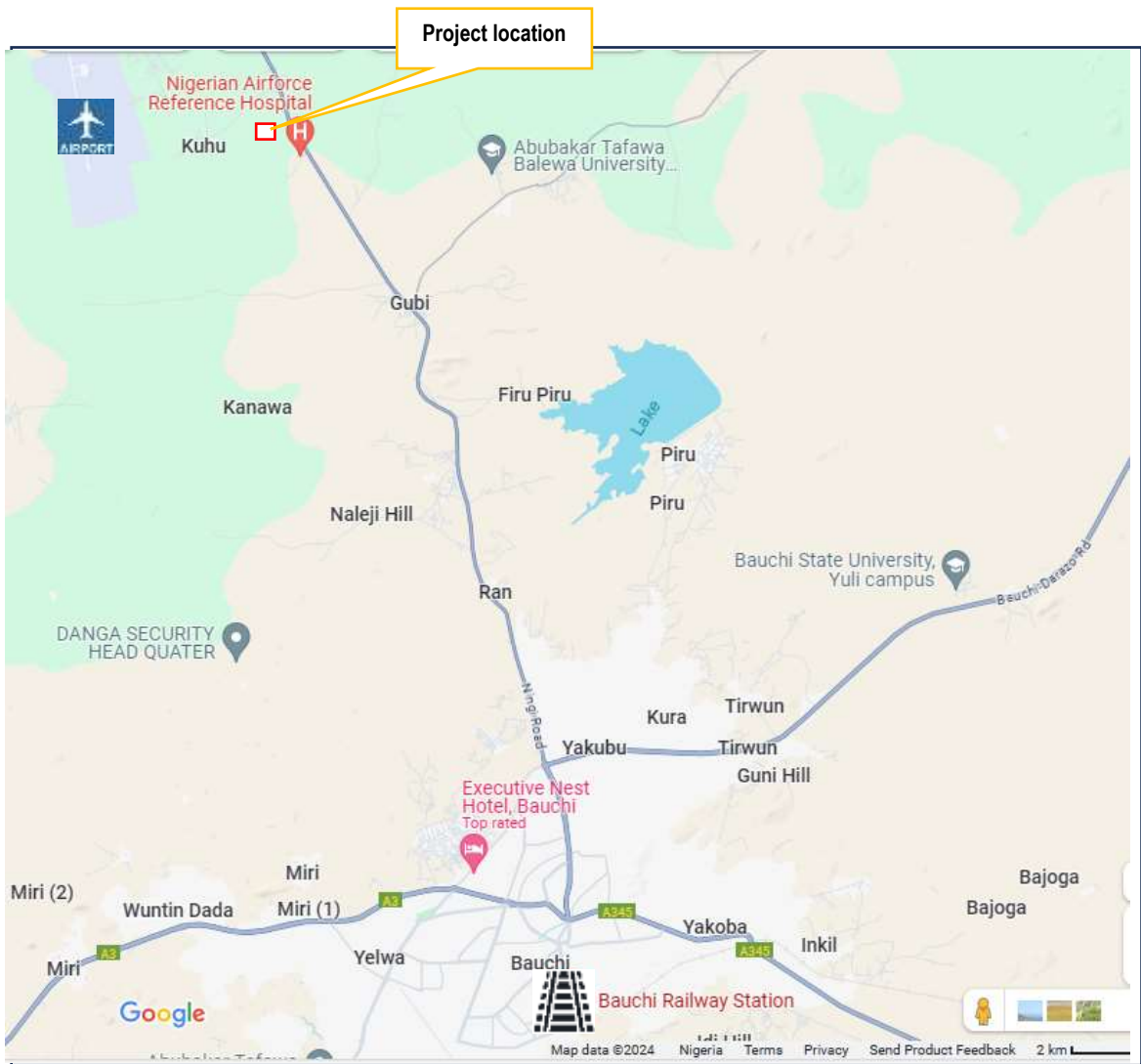


Figure 3.8: Satellite image showing Bauchi railway station and the international airport



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## 3.5 Utility Infrastructure

### Power

Bauchi State generally relies on power supply from the national grid which is transmitted and managed along transmission lines and stations. The most conventional source of power for Bauchi SAPZ project is reliance on the national grid. Alternative sources of power are also recommended. SAPZ project will collaborate with national distribution companies, to purchase and distribute electricity within the project area. To enhance sustainability and reduce reliance on conventional energy, the project shall outline specific investments in renewable energy generation. It shall propose partnerships with private companies, Independent Power Producers (IPPs), to install and operate renewable energy plants, including a wind power plant and a solar hybrid power plant system. Additionally, as part of this investment plan, it will include a biogas electrical generation plant fueled by organic waste from greenhouses.

### Water

Water is one of the most essential resources for agricultural production. The water sources available to the SAPZ include rainwater, surface water, and underground water. The amount of rainfall and precipitation are sufficient for intensive and specialized farming. However, for industrial agricultural activities that require constant supply of water with no dry season shortages; hence alternative sources of water are necessary for irrigation. Irrigation options include the use of underground water through drilling of boreholes, implement rainwater harvesting from the roofs or the collection of surface water from accessible water bodies. The future plans include construction of a new Dam at the AIH project site connecting from the Kuhu stream (see Fig. 3.9). It will serve as its primary source of water and is a potential source of hydroelectric power. This connection aims to reduce reliance on groundwater extraction. By integrating both local groundwater and natural rainwater sources, this comprehensive strategy enhances the project's sustainability and its adaptability to fluctuating water demands.



Plate 1.1: Kuhu stream at the project site

### 3.6 Project Components

The Agro-Industrial Hub is designed to encompass a diverse array of facilities and services. It is planned to include Industrial use (multi-products processing zone, clustered processing zone); Logistics and Warehousing (warehouse, cold storage, open yard, truck parking); Non-Industrial use (residential, commercial, social amenities, offices, support services). Additionally, it will feature a wastewater treatment facility, a solid waste facility area, two areas dedicated to administrative and social facilities, truck parking lots, and technical infrastructure areas. Also, provision of range of services including electricity, heat, utility water for irrigation, wastewater treatment, telecommunications, and solid waste management (*see Figure 3.10*).

#### 3.6.1 Infrastructural Design of the proposed Gubi-AIH

The description of the Gubi-AIH, product mix and facility configuration

- Water Treatment Plant (WTC), Solid Waste Management (SWM), compressor/chiller/boiler networks, gas distribution, sewer network, communication network, street lighting, wastewater network, electrical substation, etc.
- Logistics (loading and unloading yards, packaging halls, transportation hubs, cargo handling centres, raw material collection and storage halls, finished goods storage, packaging and labeling, procurement centre, etc), quality control labs, QA/QC labs; and

- 
- Institutional (fuel station, retail space, custom and security, weigh bridge, canteen, fire station, etc).

### **Residential Zone**

- Multi formatted housing, guest houses, place of workshop, school, crèche, public amenities, playground, polyclinic, retail space, etc.

### **Greenery and Walkways**

- Green belt along the boundary, lawns and parks, tree plantation along the proposed roads, internal walkways, etc.

- Buildings

The following amenity and utility buildings form a part of the processing zone, which must be centralized:

- Administration including Research and Development (R&D) centre, display centre and disaster management centre
- An information kiosk and market intelligence cell
- Certification lab and QA & QC lab
- Extension centre
- Training centre including incubation centre
- Warehouse
- Customs and security
- OHT/UGS/WTP
- Substation
- SWM plant for hazardous waste and non-hazardous waste
- STP
- Truck layby weighbridge and fuel station, and
- Other utilities including a fire station, workshop and equipment shed.



- 
- Non-processing zone in AIH

The following amenity buildings form a part of the non-processing zone.

- School and crèche
- Playground
- Polyclinic
- Retail space
- Place of worship
- Residential blocks (2 & 3 BHK apartments, male & female dormitories) and
- Public amenity



Figure 3.10a: proposed SAPZ Project layout

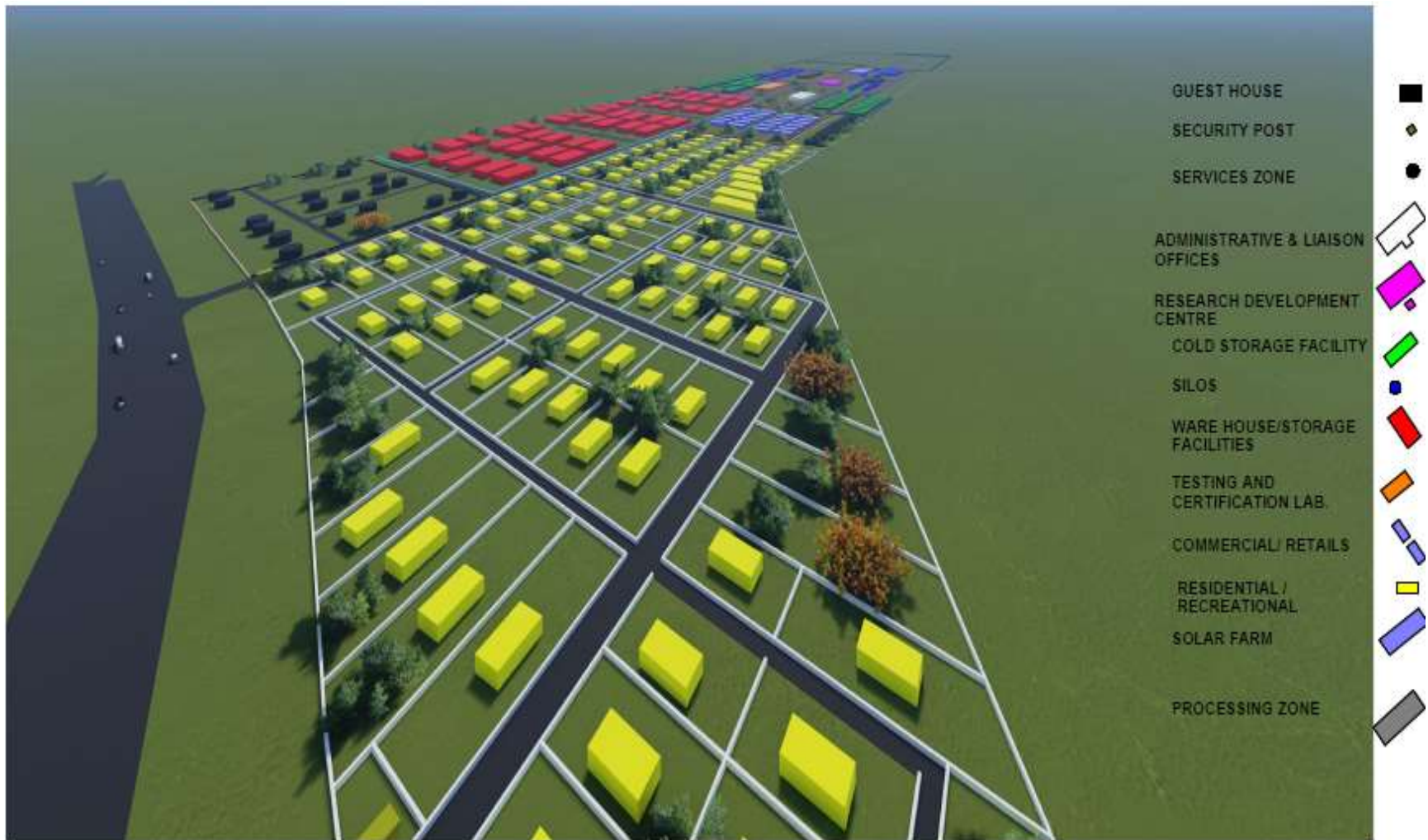


Figure 3.10b: proposed SAPZ Project layout



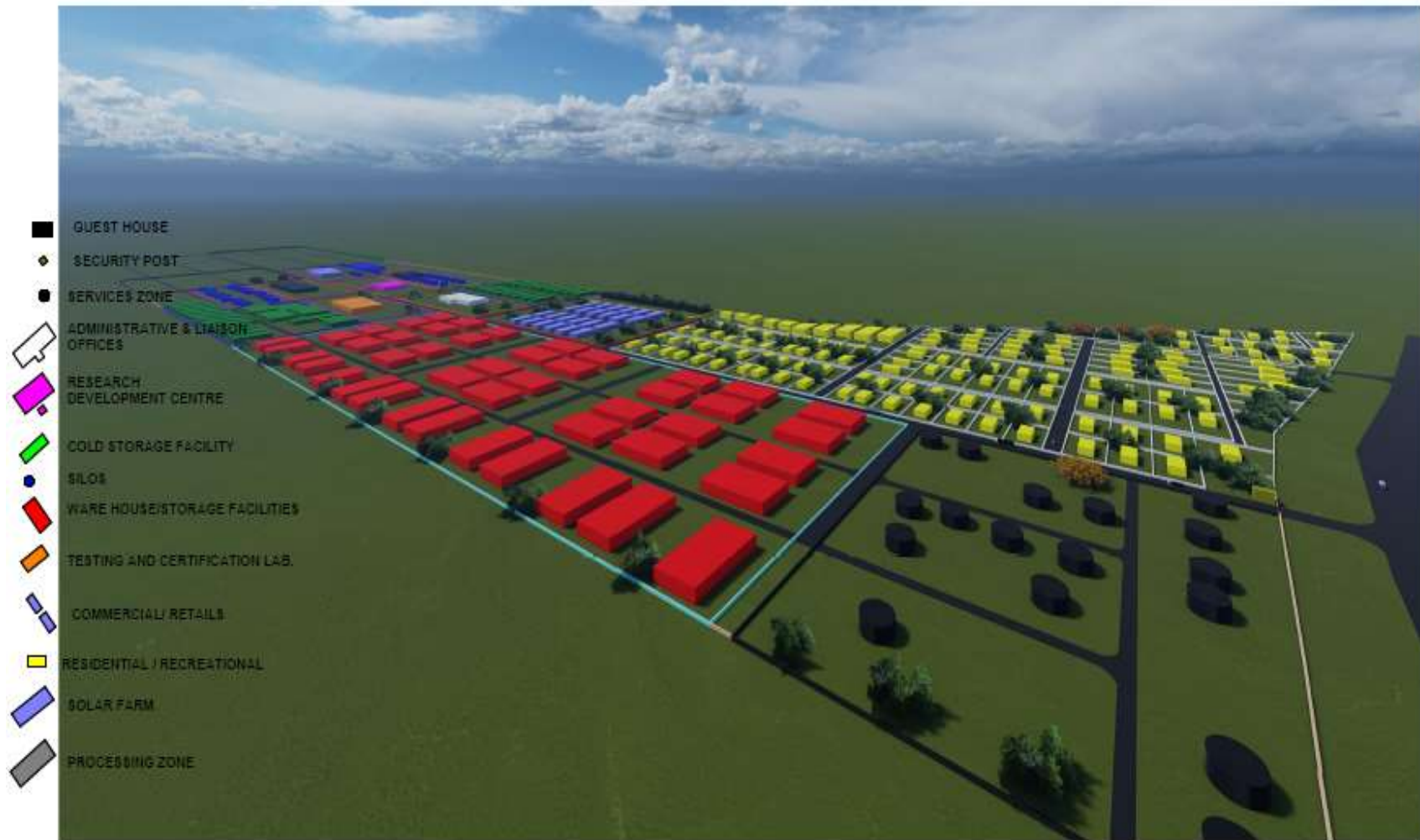


Figure 3.10c: proposed SAPZ Project layout

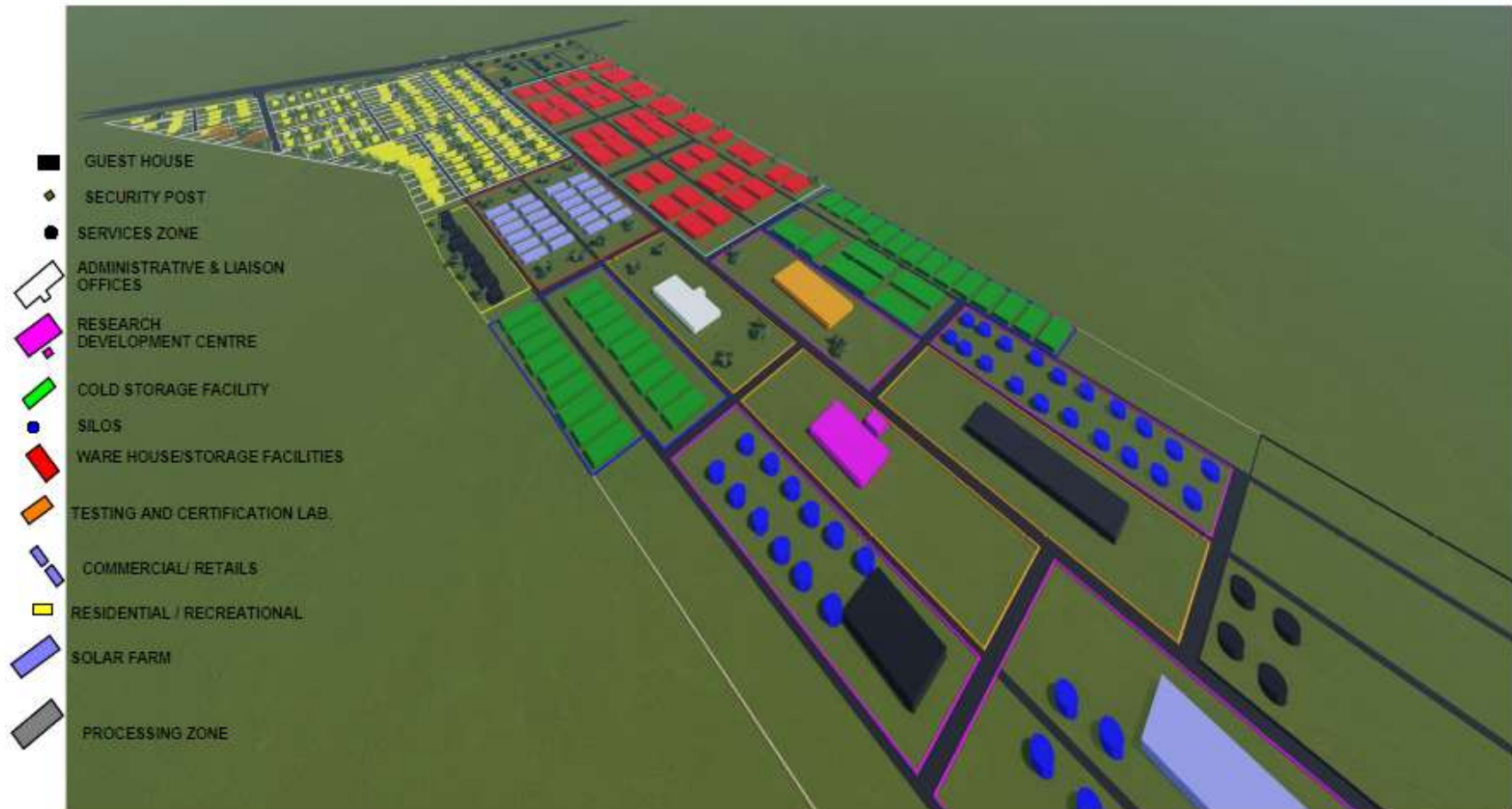
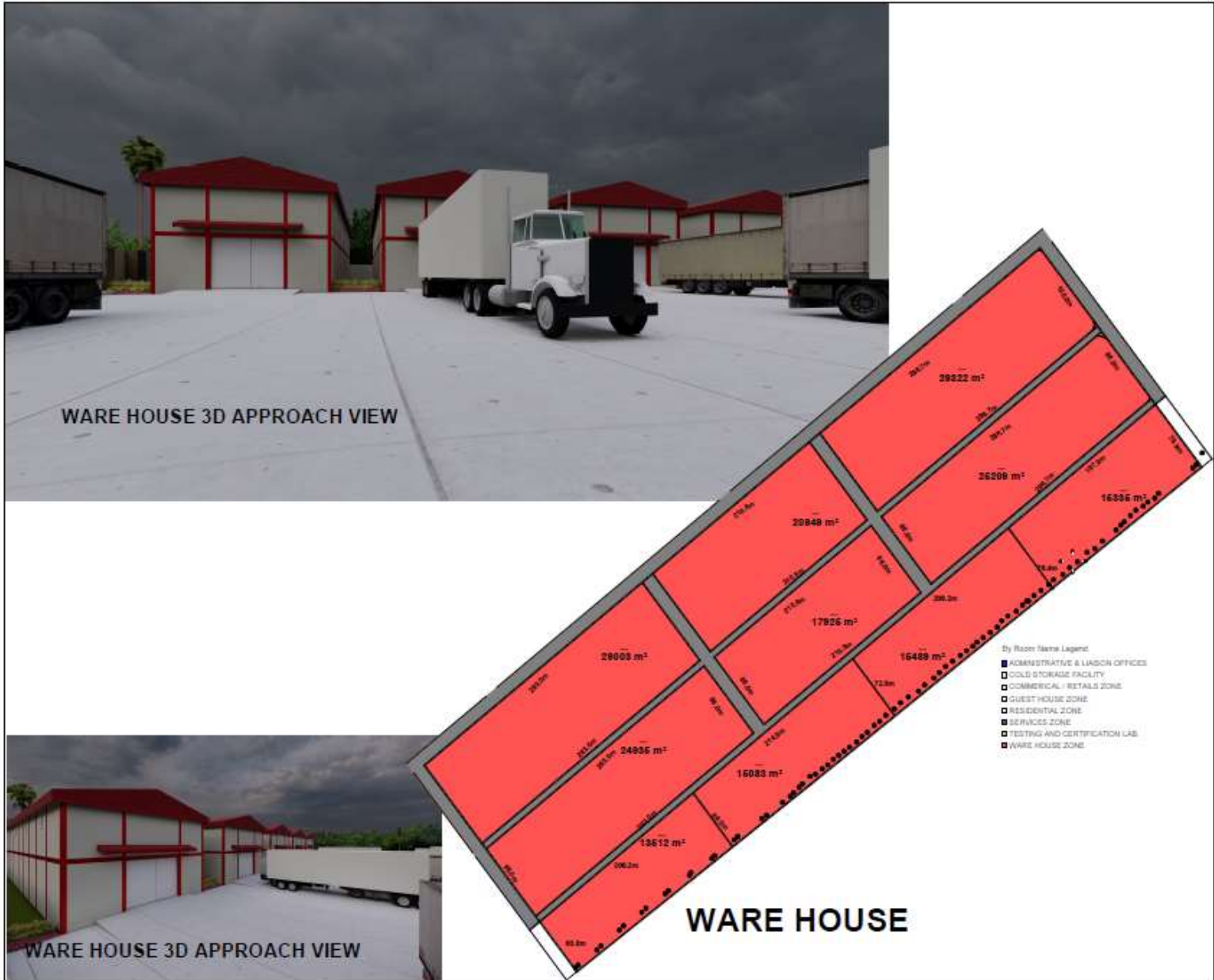


Figure 3.10d: proposed SAPZ Project layout







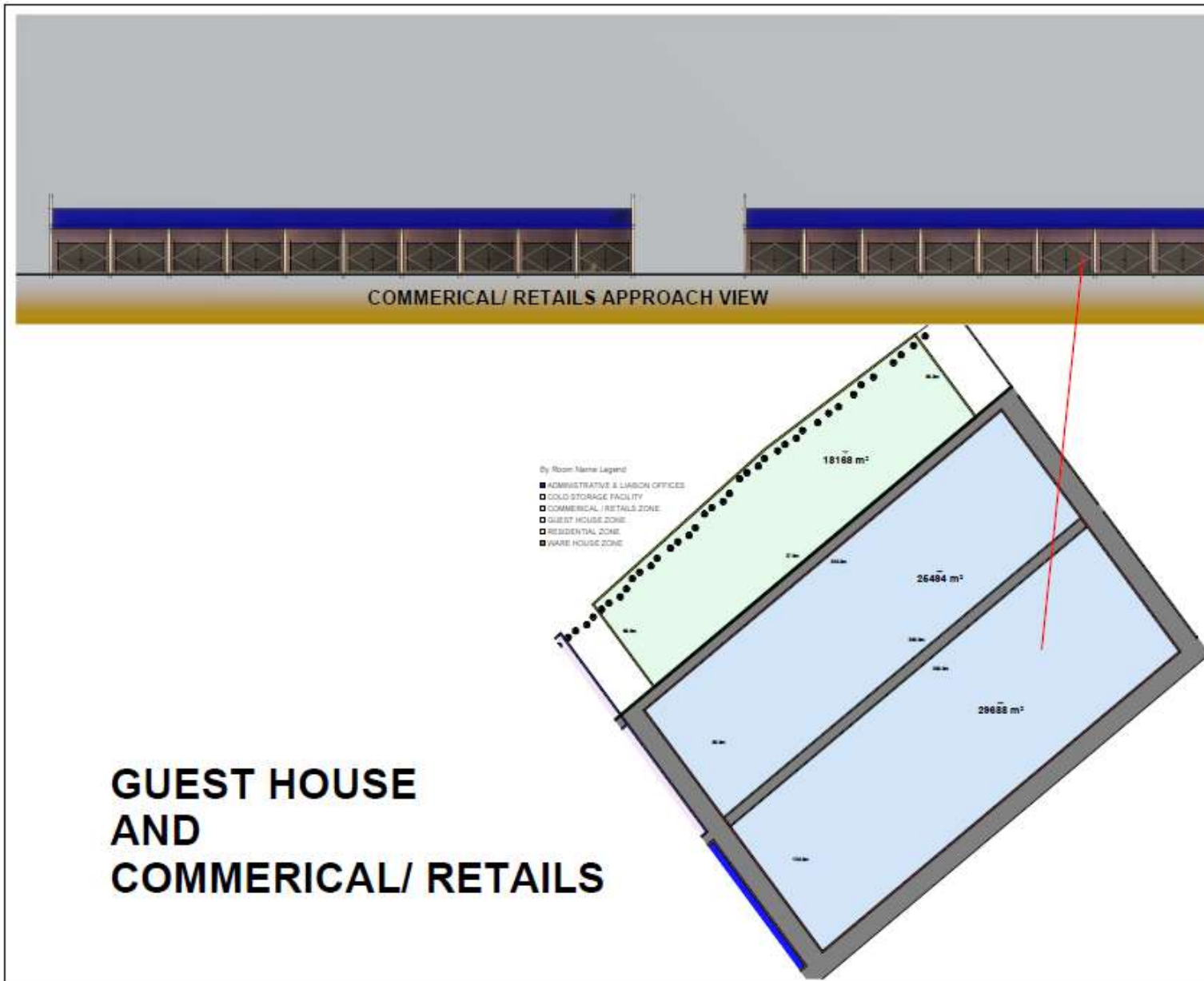


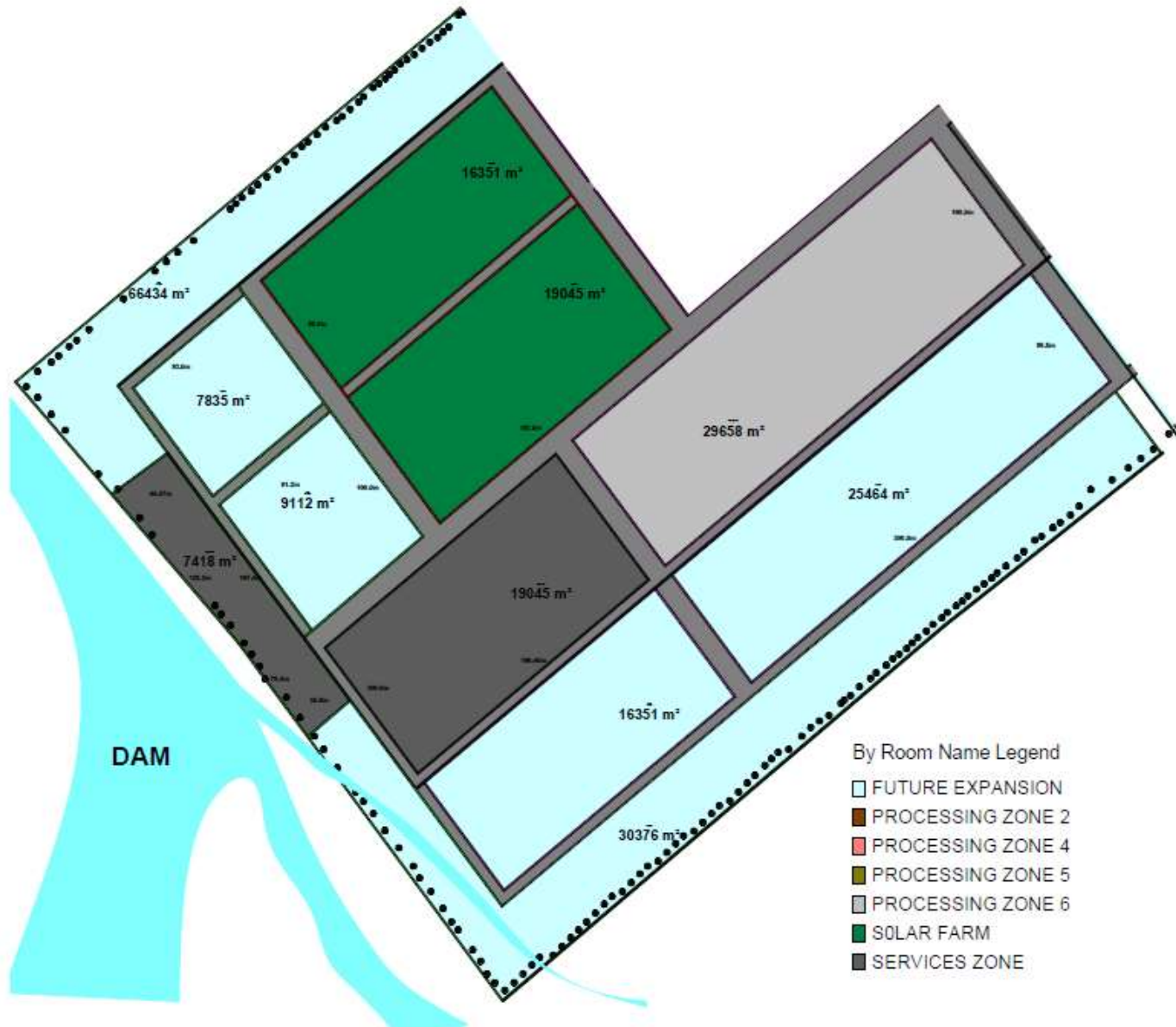
- By Room Name Legend
- ADMINISTRATIVE & LIAISON OFFICES
  - COLD STORAGE FACILITY
  - COMMERCIAL / RETAILS ZONE
  - FUTURE EXPANSION
  - GUEST HOUSE ZONE
  - RESEARCH DEVELOPMENT CENTRE
  - SERVICES ZONE
  - TESTING AND CERTIFICATION LAB
  - WARE HOUSE ZONE

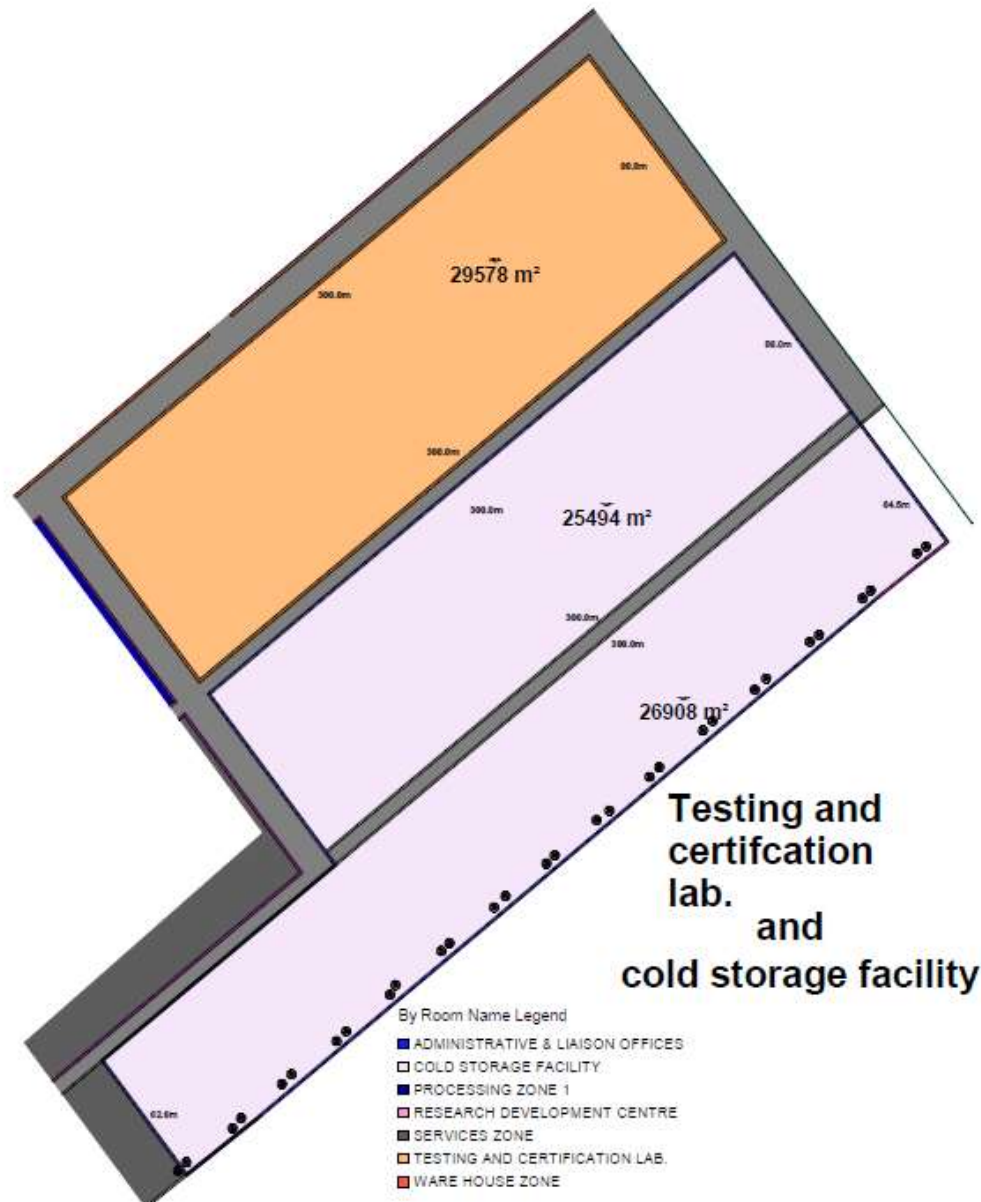
**COLD STORAGE FACILITY AND ADMINISTRATIVE & LIAISON OFFICES**











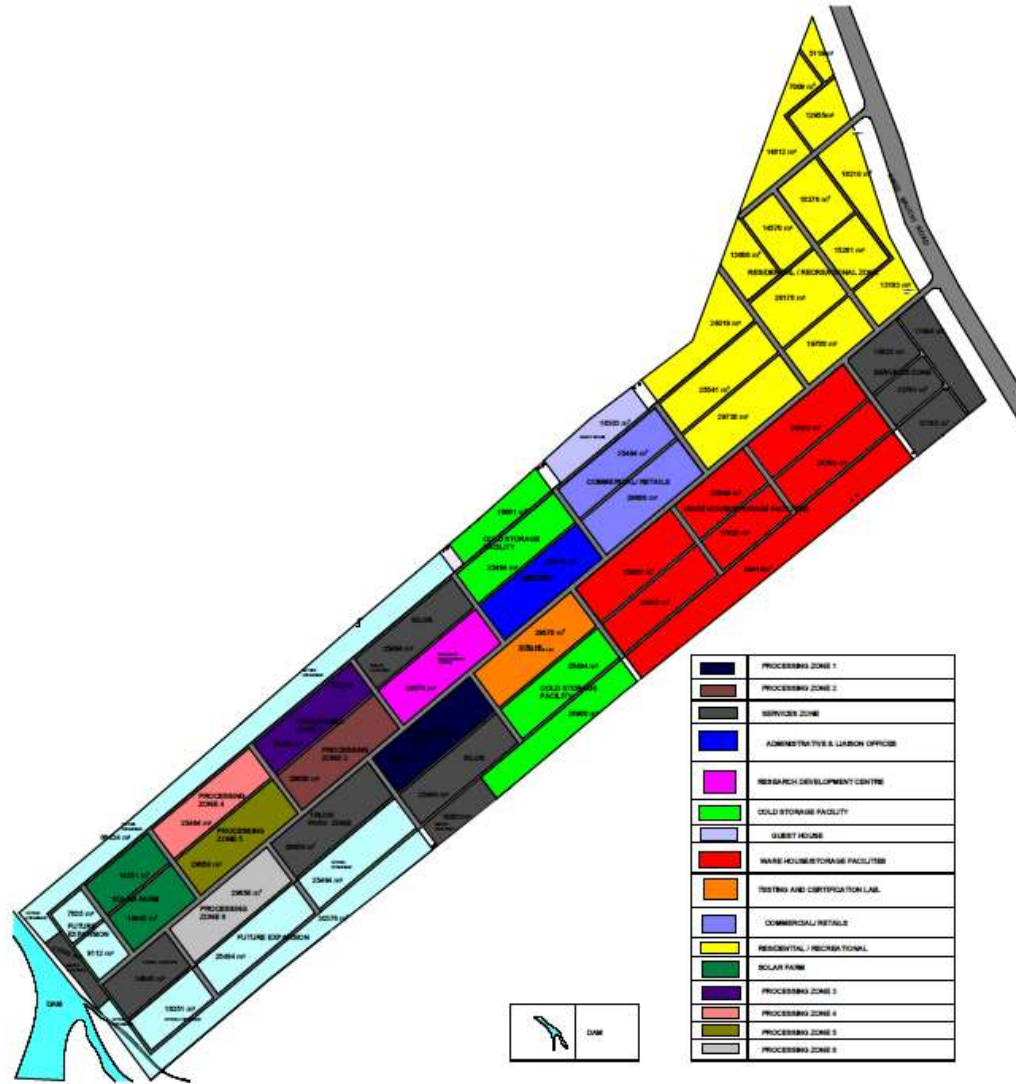


Figure 3.10e: proposed SAPZ Project layout

### 3.6.2 Proposed Infrastructure Plan

The following engineering strategies are discussed in the Infrastructural plan for the SAPZ Processing Hub:

S/N	Activities	Utilities, infrastructure within AIH
1.	Roads (general considerations)	<ul style="list-style-type: none"> <li>A proper hierarchy of roads is proposed to ensure smooth traffic movement inside Hub.</li> <li>Primary, secondary and tertiary roads are planned to give access to the industries within Hub.</li> </ul>
2.	Walkable (pedestrian walkways and bicycle movement)	<ul style="list-style-type: none"> <li>The project shall have walkable paths;</li> <li>Planning and maintenance of the pedestrian walkways;</li> <li>The tree line alongside pedestrian walkways shall provide shade for pedestrians;</li> <li>Buildings and factories shall be easily accessible from the pedestrian walkways;</li> <li>Routes and paths are provided for easy movement of visitors with sufficient care so that no transport system comes in the way of pedestrians;</li> <li>Planning of necessary signage, street name boards, zone guiding maps and visitors' guidance map at necessary locations</li> </ul>
3.	Surface drainage (design and scheme)	<ul style="list-style-type: none"> <li>The drainage system is planned to cater for the entire AIH through gravity flow;</li> <li>Providing drains on both sides of the roads;</li> <li>The proposal includes a rectangular brick masonry drain for the remaining areas for optimization of the area under drainage.</li> <li>The considerations include RCC box/pipe culverts of suitable sizes for road crossings;</li> <li>Enhancing the groundwater table and reduce water demand through effective rainwater management; and</li> <li>Rainwater harvesting is envisaged all along the drain at regular intervals.</li> </ul>
4.	Water demand	<ul style="list-style-type: none"> <li>The project shall have a 24/7 treated water supply adopting national and global standards with sufficient quantity.</li> <li>For processing, bathing and washing clothes, cooking, drinking, the proposal contemplates the use of potable water;</li> <li>The usage of non-potable water includes gardening, cleaning, cooling and toilet flushing;</li> <li>Rainwater harvesting systems are proposed to be installed and utilized;</li> <li>Supply of recycled wastewater for secondary uses</li> </ul>
5.	Water Treatment Plant	<ul style="list-style-type: none"> <li>The system selected shall ensure that the quality of water is within the drinking water standards;</li> <li>For WTP with a source of water as storage tanks, groundwater and pond/riverside/surface runoff.</li> <li>The study shall include the optimization of the system depending on the actual quality of raw water.</li> </ul>
6.	Sewage quality estimation	<ul style="list-style-type: none"> <li>The sewerage system is planned to cater for the anticipated peak discharge requirements and to treat the waste to the required discharge standards;</li> <li>The estimation of the sewage shall vary depending upon the land use distribution;</li> <li>The proposal includes handling of wastewater generated from toilets (considered as sewage) and the wastewater generated from bath/shower, laundry, hand basin, and kitchen (considered as sullage, greywater);</li> </ul>



7.	Sanitation (common and public toilets)	<ul style="list-style-type: none"> <li>• Common and public toilets are provided at strategic locations, apart from toilets to be built by the occupant industries.</li> </ul>
8.	Solid Waste Management (SWM)	<ul style="list-style-type: none"> <li>• SWM is one of the essential services for maintaining the quality of life in the AIH and for ensuring better standards of health and sanitation;</li> <li>• If properly collected at the source, SWM would reduce the number of downstream problems related to transportation and disposal of the same. The solid waste generated in AIH can be broadly categorized as under: <ul style="list-style-type: none"> <li>- Industrial non-hazardous wastes;</li> <li>- Industrial hazardous waste;</li> <li>- Domestic wastes: kitchen and wood waste, plastic, paper, floor sweepings;</li> <li>- Road sweeping and sanitary waste: human waste;</li> <li>- Garden and agriculture waste: leaves, branches, plants</li> <li>- Roads/building construction waste: earth, asphalt, concrete, brick, plastic, wood, glass, stones;</li> <li>- E-Waste: computer systems, peripheral equipment, mobile phone sets, TVs, audio sets and also household appliances;</li> <li>- Hospital and biomedical waste;</li> </ul> </li> <li>• The project shall reduce landfills caused by waste so that it is minimal. Source segregation of solid waste generated is a prerequisite for recycling. The gardening in the project can effectively utilize composted organic waste. Also, considerations include energy creation through waste;</li> <li>• The generation rates of industries, logistics, commercial and residential areas vary to such an extent that exact quantification of solid waste generation is not feasible;</li> <li>• It is mandatory to implement source, and the activity includes adequate considerations for the planning of collection, transportation of waste within the site area. Users will be required to segregate their waste into the following categories and put it in colour-coded bins: <ul style="list-style-type: none"> <li>- Industrial non-hazardous waste</li> <li>- Industrial hazardous waste</li> <li>- Bio-degradable waste</li> <li>- Non-biodegradable waste</li> <li>- E-waste like parts of computer, floppies, monitor, cartridges, ribbons</li> <li>- Construction debris, street sweepings</li> <li>- Hospital and biomedical waste</li> </ul> </li> </ul>
9.	Power supply and distribution	<ul style="list-style-type: none"> <li>• Electricity shall be available 24/7 in all parts of the site with smart metering linked to online platforms for monitoring and transparency;</li> <li>• The system parameters are as follows: <ul style="list-style-type: none"> <li>- Transmission line – 33kV</li> <li>- Number of phases – 3</li> <li>- System frequency – 50Hz</li> <li>- Consumer supply voltage – 11kV/22kV/400 Volt/230 Volt</li> </ul> </li> <li>• The proposal includes distribution substation in a strategic location, and individual facilitation and all power reticulation are to be carried out at 11kV.</li> <li>• A network of overhead lines or underground cables can distribute power;</li> <li>• For the initial phase, the considerations include an overhead distribution system, and however, the underground cable system shall replace the overhead distribution system over a period; <ul style="list-style-type: none"> <li>- Lighting controls - all non-emergency exterior and common area lighting such as landscaping, surface and covered parking, pathways, street lighting shall have daylight sensor/ timer-based control;</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>- Centralized Heating, Ventilation, and Air Conditioning (HVAC) systems;</li> <li>• Onsite renewable energy: <ul style="list-style-type: none"> <li>- Use of on-site renewable technologies, to minimize environmental impacts associated with the use of fossil fuel energy.</li> <li>- Rooftop Solar Photovoltaic (PV) panels are one of the proven methods of renewable energy. It has been envisaged to provide such solar PV panels for generating power leveraging the roof spaces available atop the various building.</li> </ul> </li> </ul>
10.	Street lighting, outdoor light pollution reduction	<ul style="list-style-type: none"> <li>• The proposal envisages two different forms of the street light: <ul style="list-style-type: none"> <li>- Streetlights for the road network</li> <li>- Solar street lighting</li> </ul> </li> <li>• All the roads and streets are provided with street lighting not only to assist pedestrians and traffic but also to increase safety and security in the area</li> <li>• All lighting includes Light Emitting Diode (LED) streetlight fixtures mounted on power poles or streetlight columns.</li> <li>• For major roads, the average illumination should be about 20 lux, and</li> <li>• Exterior lighting shall be in such a manner that no external light fixture emits more than 5% of the total initial designed fixture.</li> </ul>
11.	Information Technology (IT) connectivity, telecommunication, and ICT-enabled occupant industry services.	<ul style="list-style-type: none"> <li>• The project shall have Wi-Fi services with high-speed internet across the AIH area.</li> <li>• The concerned officials of the ministry and other private operators shall provide all telecommunication services.</li> <li>• The infrastructure includes value-added telecom services and internal communications for the users are not covered under the general infrastructure.</li> <li>• Provision of all major services through online and offline platforms.</li> <li>• The occupant industries can access information through data available on the online system, and</li> <li>• Robust data infrastructure system shares information and enhances internal coordination.</li> </ul>
12.	Landscaping, public open spaces and green cover or vegetation.	<ul style="list-style-type: none"> <li>• The activity includes works associated with the landscaping within the AIH covering tree strips along the boundary, roads, public greenery.</li> <li>• Well dispersion of public open spaces throughout the site</li> <li>• The workspace shall have access to open space within 10 minutes walking distance.</li> <li>• Open spaces are of various types – natural, green, plazas, parks, or recreation areas – which serve various sections of people.</li> </ul>
13.	Safety and Security	<ul style="list-style-type: none"> <li>• The site to have very high levels of public safety - all residents to feel safe in all parts of the site during all hours of the day, and</li> <li>• The proposal includes a lighting system, CCTV surveillance system and armed security men.</li> </ul>

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### 3.7 ATC proposed Plan

The master planning exercise for ATC shall be conducted based on the following considerations:

- Commodities handled within each of the ATC and the estimated number of ATCs
- Commodity volume expected considering the production and surplus available in the catchment area of each ATC including seasonality of storage and storage requirements.
- Availability of agribusiness, social and commercial infrastructure.
- Availability of support facilities

The sustenance of the proposed AIH is solely dependent on the continuous inflow of raw materials. In this regard, it is prudent to obtain the raw materials outside the influence zone (200km radius from AIH) boundaries as well. The tentative location of the ATCs was shortlisted based on the following factors:

- The extent of the agricultural land in the procurement area within a 200km radius
- The extent of the mixed vegetation type of land parcels;
- Connectivity and access from the nearest existing road network;
- Distance from the proposed AIH; and
- The radius of the influence of each ATC



### 3.8 Proposed ATCs Site Specific Description

This section deals with the description of each of the proposed ATC sites. The ATCs sites identified are spread across four (4) LGAs as presented in Table 3.3. Map and details of these ATC sites are presented by figure 3.11.

**Table5: Detail of ATC sites and their coordinates**

S/N	Site Address	LGA	Coordinates	
			Latitude ( <sup>0</sup> N)	Longitude ( <sup>0</sup> E)
1.	Azare community along Misau road, Bauchi State	Katagum	11°39'31"N	10°12'30"E
2.	Rampa community along Bauchi- Potiskum-Maiduguri Road, Bauchi State	Darazo	11°01'25"N	10°24'46"E
3.	Alkaleri community along Bauchi- Gombe Road, State	Alkaleri	10°16'22"N	10°20'32"E
4.	Galam community along Bauchi- Tafawa Balewa Road, State	Dass	10°01'22"N	9°32'41"E

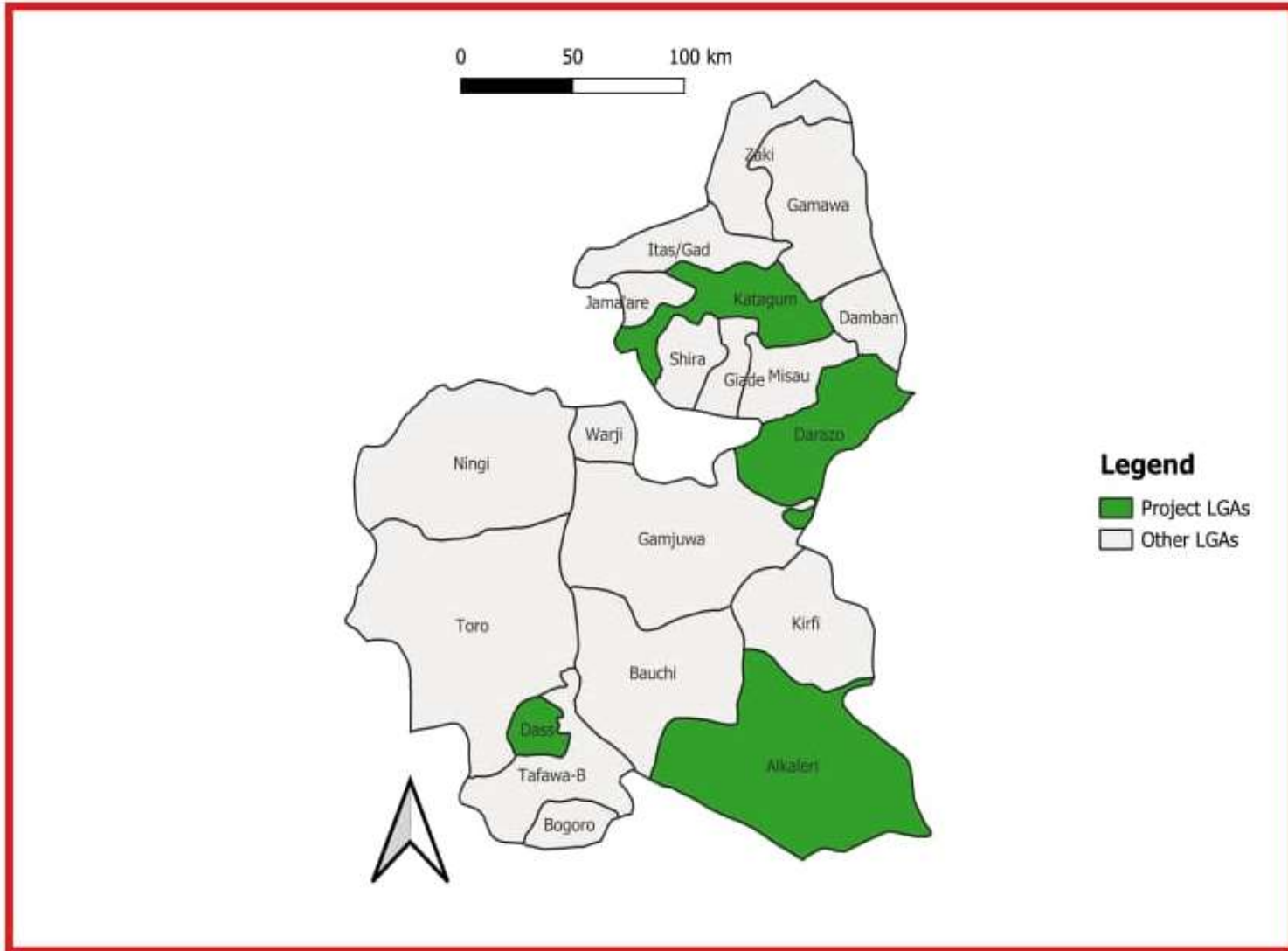


Fig. 3.11: Administrative Map of Bauchi State highlighting the proposed ATC LGAs and locations

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### 3.8.1 Azare ATC Site Description

The ATC project site is located at Azare community along Misau road, Katagum LGA, Bauch State. Katagum is a town, a local government area and a traditional emirate in Bauchi State with population of 295,970 at the 2006 census. The ATC project site is situated within Latitude 11°39'31"N and Longitude 10°12'30"E. The proposed project site is former Bauchi State Agricultural Development Program (BSADP) that spread across an area of 34.24ha with a gentle slope and relatively rectangular in shape and neem trees being used as parameter fence around its boundaries. It is bounded by three communities: from the east is Fatara community at 2.5km, on the south-east Yakiri at 1.5km, south is Katanga community at 2.5km.

#### *Infrastructure inside the ATC project site*

The proposed site has an existing infrastructures belonging to former BSADP such as staff housing quarters, 12 housing apartments for the senior staffs, 17 for intermediates staffs and 12 for junior staffs. There is an administrative building and office including a Guest House and 4000 metric tones silos on the project site. Other structures in the project site include primary school, cottage groundnut oil belonging to the Federal Government occupying about 200sqm; and a private block industry that encroached into the land occupying over 400sqm (Plate: 1.0).

#### *Surrounding Facilities*

The surrounding facilities around the ATC project site are Abubakar Talali Ali Polytechnic, Collage of Administration and Business Studies Annnex directly opposite the site about 70m; Federal Government Collage Azare shares boundary towards south, while 10m from behind down to the left flank of the site are build up residential areas. Azare town is about 3.5km from the project site. There is a transmission center about 20km across the road and an airstrip located at 9km from the project site, known as Azare airstrip. The distance between the proposed Azare ATC site to Gubi-AIH is estimated at 167km, and to the closest ATC located at Darazo community at 63km.

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### ***Social Amenities***

The site is connected to national grid that supplies the facility with electricity, and untarred pathways within the project site. The source of ground water at the project site is hand pump borehole and well water. Out of the 2 handpump borehole only 1 is functional.

### ***Existing Environment***

It witnesses two major seasons each year which are the dry and the rainy seasons, and the average temperature of 32C° while the total annual precipitation level of the area is 1190 mm of rainfall. The town located on the northern bank of the Jama'are River, which is a tributary of the Hadejia. Most of the inhabitants are peoples from the Fulani, Kanuri, Karai-karai and Hausa tribes. The main agricultural products include peanuts (groundnuts), sorghum, millet, rice (especially in the riverine fadamas, or "floodplains"), cowpeas, cotton, indigo, and gum arabic. Livestock include horses, cattle, goats, sheep, donkeys and a lot of poultry.

There is no erosion or gully observed within the project site, even though there is no proper drainage system, but the water flow was properly channeled in such a way that it did not create gully. Vegetation cover at the project area are neem trees.



Primary school at the project site



BSADP Staff quarters at the project site



4000 tons food Silo at the project site



BSADP administrative building



Water tank at the project site



hand pump borehole



Water well



Water tank



Vegetation within the project site



consultation with community members



Consultation with community members







Consultation with members of the community

Plate 1.2: Surrounding infrastructures and features of Azare community





Figure 3.12: Satellite image showing the surrounding features of the ATC site

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### **3.8.2 Proposed ATC Darazo Site Description**

The project site is located at Rampa community along Bauchi-Potiskum-Maiduguri Road, Darazo Local Government Area (LGA), Bauchi State. It is within Latitude 11°01'25''N, Longitude 10°24'46''E. Darazo LGA was created in 1991. It has an area of 3,015 km<sup>2</sup> and a population of 251,597 at the 2006 census. The proposed ATC project site is former Bauchi Farm Training Center that spread across an area of 15.17ha. It is fenced with mango trees and barbwire as parameter fence around its boundaries. It is bordered by three communities, from the east is Lliyasu community at 3.7km, on the west Darazo at 2.97km, south is Lafiyaru community at 3.67km and on the North boundary between Jigawa State 14km.

#### ***Infrastructures inside the ATC Proposed Project site***

There are existing infrastructures in the project site consisting of 2 hostels, 1 administrative building, Meteorological center and over 10 staff quarters. These facilities are occupied by the former staffs of Bauchi Farm Training Centre (Plate: 1.0).

#### ***Surrounding facilities***

There are two settlements close to the project site about 157m opposite the project site across the Bauchi-Potiskum-Maiduguri road and about 700m behind the project site. Darazo community the main town is about 3km where the local government headquarters is located. Some part of the project site land is been used for substantial farming and mango plantation that stretched beyond the project land, also for rearing of animal such as goat and cows.

#### ***Social Amenities***

The source of ground water within the project site is handpump borehole and well water. The hand pump borehole is barely functional, as the people within settlements depends majorly on well water.

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### *Existing Environment*

The project area witnesses two major seasons each year which are the dry and the rainy seasons, and the average temperature of 32C° while the total annual precipitation level of the area is 1190 mm of rainfall. The majority of the inhabitants in Dorazo LGA are members of the Hausa ethnic group, that comprises several towns and villages that make up Darazo LGA, such as; Jimbim, Gabarin, Lago, Yutare, Tauya, Wahu, Gabchiyari, Sade and other. The commonly spoken languages in Darazo LGA include Hausa and the Zumbum languages.

A seasonal river was observed at the project site, which cut across the project area, and it flows towards north down toward Jigawa State. The river is always dry during dry season, but active during rainy season maximum current flow that has created a gully in some part of the project site.



Darazo Farm Training Center, Staff quarters





Farming activities and rearing of goats and cows at the project site



Well water at the project site



non-functional handpump water



Seasonal river across the project area



Engagements with the state representatives, residents inside the project site and some members of the surrounding communities

Plate 1.3: Surrounding infrastructures and features of Rampa community



Figure 3.13: Satellite image showing the surrounding features of the ATC site

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### 3.8.3 Proposed ATC Alkaleri Site Description

The project site is located at Alkaleri community along Bauchi-Gombe road, Alkaleri LGA, Bauchi State. It is within latitude 10°16'22"N, longitude 10°20'32"E. Alkaleri is a Local Government Area of Bauchi State, Nigeria. Its headquarters situated in the town of Alkaleri (or Alkalere) on the A345 highway in the northern part of the Local Government Area. The LGA has an area of 5,918 km<sup>2</sup> and a population of 329,424 according to 2006 population census (NPC, 2006).

The proposed project site is former Bauchi State Agricultural Development Project site that spread across an area of 6ha. The Alkaleri community is within Maimadi community, bordered by other communities towards east is Budawaire community at 2.8km, on the North are Dandalhari and Lado community at 2km, and towards south are Dambori and Gwaram community at 3km each.

There are existing infrastructures at the project sites which belongs to BSADP. These infrastructures are administrative building, staff quarters, a lodge and stop and shop agricultural hub, where people can buy, showcase and consult for anything in regard to agricultural activities. The building was constructed and handed over to the State government, which the Director of Agriculture, Bauchi State promised to hand it over for this ATC project.

#### *Surrounding facilities*

The surrounding of the site location is an active build-up residential and commercial area with some other facilities such as: fuel stations, car wash and other small businesses. The busy Alkaleri market is less than 1km from the project site, same with the Local government headquarters. There other facilities located around the project site like, School of health technology that is located 2km from the project site, primary/secondary school, all with 2km from the site. The estimated distance from the proposed Alkaleri ATC site to the AIH at Gubi is estimated at 70km.

The site is connected to national grid that supplies the facility with electricity, untarred pathways and drainage system within the project site. The source of ground water at the project site is borehole and around the site is hand pump boreholes and water well.



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There is a seasonal river is much active during rainy season and it flows north, crossing the road to connect with other water source, that goes all the way down to din-dima river located at over 6km from project site.

### ***Existing Environment***

The predominant ethnic group in the area are the Fulani with some Kanuri, Dugurawa, Guruntawa and Labur "Jaku" people are present in a lesser population. The Local Government is bounded in the North by Gombe State; East by Kirfi Local Government Area; South Tafawa Balewa and West Bauchi Local Government Areas.

BSADP reported that April is the hottest month of the year with temperature rising to about 40°C. The coldest months are December and January, when the temperature may fall as low as 17°C to 22°C. The mean annual rainfall ranges between 1000-1200mm. The raining season extends from May/June to September/October. The dry season starts September/October, to April/May. The maximum humidity may increase drastically during the middle of raining season to about 96% in August and drop sharply to about 10% during harmattan around December.







Infrastructures within the project site, Primary school, residential house, food silo and administrative building.



House designs around the project site



Water source within and around the project site, hand pumps, water well and borehole







Consultation with the state, occupant and the community

Plate 1.4: Surrounding infrastructures and features of Alkaleri community



Figure 3.14: Satellite image showing the surrounding features of the ATC site

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### 3.8.4 Proposed ATC Dass Site Description

The project site is located at Galam community along Bauchi-Tafawa Balewa road, in Dass LGA of Bauchi state with coordinates; longitude 10°01'22"N , Latitude 9°32'41"E.

The proposed project site is former Nigeria Directorate of Employment (NDE) proposed site that spread across an area of 19.16ha, relatively flat and rectangular shape. It is bounded by four communities, from the south-east is Dabardak community at 1.21km, on the south-west Kuletu at 400m, north-east is Galam community at 300m and on the north-west is Sabonlayi community at 300m opposite the project site, across the road. The total 19.16ha contains minimal infrastructures such as 2 uncompleted presumed to be administrative buildings, at the linter level.

The surrounding of the site location is not much an active build-up residential or commercial area, however among the four community that around the site, two closest with active residential structures is Sabonlayi and Dabardak community, both with an estimated population of 200-300. Primary schools are located at Dabardak community (Darbadak primary school), Kuletu (Kuletu primary school), and Sabonlayi community (Bulaye primary school) the closest to the project site across the road.

The most active community with commercial activities closest to the project site is Dass community less than 3km from the project site. The local government headquarters is located in the same Dass community and with other commercial activities such hospital, primary/secondary school, shops and others.

The project site land is been used for farming purpose and grazing. The source of ground water around the project site is handpump borehole and water well and no water body was observed within the project site, except two burrow pit been used for mud block purpose, one across the road at 50m and another by the side at 250m.

### Existing Environment

The local government has an area cover of 535 km<sup>2</sup> and a population of 89,943 at the 2006 census. The people of Dass local government area engages in farming for a living because of their rich land. It is located in the southern part of Bauchi state and bordered by Tafawa Balewa, Bauchi and Toro local government areas. The most prominent tribe being the Hausa ethnic group. The religion of Islam is widely practiced in Dass LGA

while the Hausa language is commonly spoken in the area. Popular landmarks in Dass LGA include the Mbulla hills. Farming is the major occupation of the people of Dass LGA with crops such as Maize and Rice produced in massive quantities within the area.



Infrastructures within the project site, an uncompleted administrative building



House designs around the project site and the primary school opposite the site.





Water source within and around the project site, hand pumps, water well



Burrow pit around the project site





Consultation with the state, occupant and the community

Plate 1.5: Surrounding infrastructures and features of Galam community



Figure 3.15: Satellite image showing the surrounding features of the ATC site

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## 3.9 Project Activities

The project activities will broadly cover the following areas:

### **Pre-construction activities include**

- Site Preparation,
- Engineering Design
- Materials Delivery, etc.

### **Construction activities include**

- Land clearing
- Civil Works
- Electrical works
- Installations

### **Operational activities include**

- Operation of the Agro-Processing facilities
- Movement of raw materials in and finished products out of the Hub.
- Maintenance of the Agro-Processing facilities and

### **The decommissioning activities include**

- Demolition and removal of Agro-processing hub components for relocation or sale

### **3.9.1 Associated Facilities**

The project will also involve installing associated facilities that are crucial for the operational efficiency and sustainability of the agricultural zone. This includes the construction of administrative/technical/social facilities, energy transmission lines / transformer centers, connection/access roads, a wastewater treatment facility, a fuel station and truck parking lots. Additionally, as part of future plans to further enhance sustainability and self-sufficiency, the project intends to incorporate renewable energy sources like wind, solar, and biogas systems into the SAPZ project. Project's future expansions or modifications will involve additional studies that should be conducted by

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preparing document(s) for these associated facilities and/or updating the ESMP prepared within the scope of the project to reflect the current situation.

### **3.9.2 Project Workforce**

The project aims to support investments that contribute to increasing employment in rural nonarable lands and boosting the national exports of agricultural products. The projected employment impact is substantial, with an estimated 6,500 individuals expected to be employed with about 35% will be women. Moreover, during the construction and drilling activities, it is anticipated that several hundred individuals will be employed.

In the project area, it has been decided not to construct any accommodation facilities for the employees. Instead, round-trip transportation will be arranged for them using shuttle services. This approach is designed to minimize the project's footprint and simplify logistics related to employee housing. However, there is a contingency plan in place should the need arise to establish a camp site for the Project. If a camp site becomes necessary, it will be developed in strict accordance with the standards for worker accommodation as outlined by the International Finance Corporation (IFC).

### **3.9.3 Implementation Schedule**

The project activities will be carried out on a phase-by-phase basis as follows;

- Site Survey
- Site Leveling
- Leveling & Grading
- Marking for Mounting Structures
- Pier Foundations
- Structure Erection
- Structure & Model Alignment

The proposed schedule for the engineering, procurement and construction is provided in table 3.4 below.

**Table6: Proposed Project Timeline**

S/N	Activities	Q1 2024	Q2 2024	Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026
1.	Initial Conception												
2.	Site survey & mapping												
3.	Grid & load flow survey												
4.	Feasibility studies												
5.	ESIA												
6.	Financial Closure												
7.	Engineering & Construction												
8.	Interconnection & commissioning												→
9.	Start operation												→

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## **CHAPTER FOUR**

### **DESCRIPTION OF EXISTING ENVIRONMENT**

#### **4.1 Introduction**

This chapter presents the current ecological conditions around the environment of the proposed Gubi-Agro Industrial Hub (Gubi-AIH) project. The objective of baseline data acquisition is to identify environmental issues associated with the proposed project by predicting them as well as proffering measures to mitigate/minimize and avoid their adverse effects. The environmental components studied are physico-chemical environment (meteorology, geology, sediment/soil type and distribution, surface/groundwater characteristics), biological environment (location and distribution of benthos, plankton, fisheries, flora and fauna characteristics), as well as socio-economic and health conditions describing the demographic structure, culture, heritage sites, social and health status of the people and their environment, including outcomes of consultations held.

The baseline conditions are based on information sourced from literature review, stakeholder consultation and data interpretation, as well as findings from laboratory analysis and field data sampling collected within the proposed project site boundary (1 km radius). The data gathered shall be utilized to inform future decisions about environmental management and to track any changes that may occur to the environmental elements.

#### **4.2 Study Approach**

The baseline status of the project area was obtained through consultations with the relevant stakeholders as well as from field studies covering the following:

- Reconnaissance survey;
- Field studies including air, surface water, sediment, soil and vegetation sampling;
- Geophysical investigation and groundwater sampling;



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- Field analysis and sample preservation;
  - Laboratory analysis of samples;
  - Socio-economic and health studies;
  - Data processing, analysis and interpretation; and
  - Reporting

#### **4.2.1 Area of Influence**

Sampling stations were established within the proposed Gubi-AIH project site with a control station established outside this site for soil, air quality, and noise. This is to guarantee that the impact of the proposed Gubi-AIH facility is measured against the sample taken from the control station to make decisions about environmental monitoring and management in the future. The entire area of influence for the proposed Gubi-AIH project site covers 6.9km<sup>2</sup>. This excludes the nearest communities of Kuhu, Malmo, and Gubi where groundwater samples were collected, and a socioeconomic and health survey was conducted in the course of this study. Surface water and sediment sampling were carried out in the seasonal stream that cuts across the proposed Gubi-AIH project site. This stream flows northeast and recharges the Gubi river located about 8 km north.

All sampling was conducted in compliance with the FMEnv requirement (Appendix 3). Statutorily, the Federal Ministry of Environment from prior engagements and recent technical review sessions has required a 10 km radius zone of influence for Category 1 projects EIA field sampling design. However, based on the expert judgment and understanding of the dynamics of aquatic systems, the EIA consultant only extended to 10km for the socio-economic survey in the Gubi community located 5km south of the proposed Gubi-AIH project site.

Environmental factors considered when selecting sample points were the sensitivity of physical and biological receptors (e.g., location of water bodies, flora, and fauna, settlements) as well as the geographical dynamics of the study area such as wind direction, upstream/downstream system, and topography of the area. Receptors within the study area include trees and shrubs, rock outcrops, dilapidated buildings, seasonal streams, flora, fauna, and soil.



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#### **4.2.2 Baseline Data Acquisition Methods**

Measurements, field data collection, and sample collection of representative populations were utilized in the data acquisition process to determine the environmental parameters of the study area. This exercise involved a multi-disciplinary approach and was executed within the framework of a quality, health, safety and environment (QHSE) management system approach. Using the best available equipment, resources, and personnel, this method guarantees that the necessary data and samples are collected with established (scientific and regulatory) requirements. Elements of this approach include:

- review of existing reports that contain environmental information on the study area;
- designing and development of field sampling strategies to meet work scope and regulatory requirements;
- pre-mobilization activities (assembling of the field team, sampling equipment/materials calibrations/checks, review of the work plan and schedule with the team, and job hazard analysis);
- mobilization to the field; fieldwork implementation - sample collection (including positioning and field observations), handling, documentation and storage protocols and procedures; and
- demobilization from the field; transfer of sample custody to the laboratory for analyses.

The methodology/procedures for collecting field data are described in the succeeding sub-sections. Also, baseline environmental conditions of the proposed Gubi-AIH project's area as recorded during field study are described in succeeding sections below. The detailed documentation of the fieldwork execution including descriptions of the laboratory analytical methods and procedures, the detection limits for the various parameters analyzed as well as an overview of the general QHSE plan adopted for field data gathering and laboratory analysis are presented.

#### **4.2.3 Consultation with Regulators and Stakeholders**

Prior to field sampling, meetings were held with the relevant stakeholders to intimate them of the project and seek their consent to carry out the field data gathering.

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Consultation is an important element of socio-economic assessment and an integral component of the entire EIA process. This is because appropriate and adequate consultations ensure smooth project implementation and guarantee economic and commercial sustainability of the proposed project. It involves information dissemination and interaction/dialogues with the host communities and other stakeholders on the EIA of the proposed project. The key objectives of consultation on the ESIA for the proposed Gubi-AIH project are to:

- Ensure that the communities and all stakeholders are given early and adequate information on the ESIA and the proposed Gubi-AIH project activities;
- Provide a framework for improving the understanding of the potential impacts of the proposed project on the socio-economics and biophysical environment;
- Include stakeholders' views and concerns as part of the ESIA execution especially as it concerns the potential impacts;
- Identify contentious issues in the proposed project execution;
- Establish transparent procedures for carrying out the proposed projects; and
- Create accountability and a sense of local ownership during project implementation, thus minimizing communities' conflicts and project delays that may result thereof.

#### **4.2.4 Reconnaissance Survey and Delineation**

Site visits were carried out from 26<sup>th</sup> to 27<sup>th</sup> April 2024, to collect primary data relevant to the site assessment and for the generation of baseline information used in assessing potential impacts. The areas visited were the proposed Agro Industrial Hub at Gubi and the ATCs in Azare-Katagum LGA, Rampa- Darazo LGA, Alkaleri and Galam- Dass LGA communities in Bauchi State. During the site visit, site assessment was carried out (strengthened by secondary data obtained from desk studies), samples for environmental assessment were collected, socio-economic data was collected through the administration of questionnaires and the conduction of semi-formal interviews, and stakeholder meetings were held. Plans for community consultations were also made and were eventually carried out. Information obtained from all these activities—is presented in this chapter. Photo 4.1 to Photo 4.6 show images of the site visitation team on site.



Plate 1.8.1: Site visitation Team at Gubi-AIH project site



Plate 1.6: Site visitation Team observing the project site at Gubi-AIH



Plate 4.3: Site visit exercise at Rampa (Darazo LGA )ATC site



Plate 4.4: Site visit exercise at Alkaleri ATC site



Plate 4.5: Site visitation team at Galam ATC site



Plate 4.6: Site visit exercise at Azare (Katagum LGA ) ATC

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#### **4.2.4 Desktop Studies**

Desktop studies involved the acquisition of relevant background information on the environment of the study area. Approved reports from earlier environmental studies conducted in the region, as well as books, articles, maps, and other materials about the proposed Gubi-AIH project area and environs similar to it, were among the materials studied. The list of materials consulted is specified in the relevant sections.

#### **4.2.5 Field Sampling/Measurement**

To accurately describe the ecology and meteorology of the study area and ascertain seasonal variations of particular environmentally relevant characteristics, field data gathering exercise was conducted for dry season sampling from April 25 to 27, 2024. The specific objectives of the ecological field sampling were to determine:

- Ambient air quality and noise level of the study area;
- Physico-chemical and microbiological characteristics of the soil within the study area;
- Physico-chemical and biological characterization of water and sediment samples within the study area;
- Hydrobiology and fisheries resources of the study area;
- Wildlife abundance and diversity of the study area and environs;
- Vegetation characteristics of the area; and
- Establishing the socio-economic and health status of the project affected communities.

Ecological samples and data (water, soil, sediment etc.) were collected as appropriate. The exercise involved in situ measurement of unstable parameters where possible or they were preserved for laboratory analysis.

##### **a. Field Study and Sampling Design**

Field data gathering was designed to cover the proposed Gubi-AIH project area. Soil sample stations were established to ensure the major soil types that characterise the proposed Gubi-AIH project site are adequately covered. Also, surface water and sediment sampling as well as hydro-biological studies were carried out at the surface water station



while air quality and noise level measurement stations were distributed to ensure the entire project site is representatively covered. On the whole, the following sample requirements were established:

- Soil samples obtained from fifteen (14 + 1 control) stations, with samples collected from 0-15cm for top soil and from 16-30cm for subsoil;
- Surface water/sediment samples from one station;
- Air quality measured at fifteen (14 + 1 controls) stations;
- Noise level measured at fifteen (14 + 1 controls) stations;
- Groundwater sampling at two (2) stations (hand-dug well and borehole);
- Vegetation and wildlife

The sampling locations were selected as waypoints using the Geographic Positioning System (GPS), and subsequently plotted in a sampling map (Figure 4.1a and 4.1b) that was utilized during field study. Locations for biophysical sampling considered ecological types around the project areas, vulnerable environmental attributes with regards to the potential and associated impacts of the environment and control or buffer zones. Socioeconomic and health impact studies on the other hand, considered human habitations, infrastructures, cultural heritage sites and prevailing health conditions of people within the sphere of influence to the proposed Gubi-AIH project area. Table 4.1 presents an inventory of the biophysical and socio-economics/health details collected during the field studies.

**Table7: Inventory of Biophysical and Socio Samples**

S/N	Environmental Component	Parameter	No of Samples as requested by FMEnv
1	Surface water and Sediments	chemical microbial, Benthos and Plankton	1 sampling unit/water body
2	Groundwater	Physico chemical and microbial	2
3	Soil	Physico chemical and microbial	30 + 1 Control (for both 0-15cm and 16-30cm)
4	Ambient air quality	Criteria pollutants	15 + control
5	Noise	Sound level	15 + control
6	Geology/ Geophysics	Static water level, Stratigraphy, flow direction	-
7	Meteorology	Temperature, relative humidity,	-

8	Vegetation	Transects, key Informant Interviews, Use of Binoculars, Direct Observation and sample collection	-
9	Wildlife	Direct Observation, Key Informant Interviews and indirect count method	
10	Socio-economics / Health	Interviews, questionnaires, focus group discussions, publications	-

Source: Fahamu Fieldwork, 2024

**Table8: Sampling Stations and Geo-position**

S/N	Identification	Lat	Long	S/N	Identification	Lat	Long
<b>Air Quality &amp; Noise Level</b>				<b>Soil Sampling</b>			
1	Aq.N-01	10°28'47.78"N	9°47'11.87"E	1	S.S-01	10°28'51.43"N	9°47'9.37"E
2	Aq.N-02	10°28'34.47"N	9°47'1.04"E	2	S.S-02	10°28'35.30"N	9°46'58.84"E
3	Aq.N-03	10°28'26.33"N	9°46'49.28"E	3	S.S-03	10°28'26.67"N	9°46'47.75"E
4	Aq.N-04	10°28'16.21"N	9°46'38.82"E	4	S.S-04	10°28'17.34"N	9°46'36.34"E
5	Aq.N-05	10°28'8.85"N	9°46'28.36"E	5	S.S-05	10°28'9.15"N	9°46'26.23"E
6	Aq.N-06	10°27'59.96"N	9°46'18.38"E	6	S.S-06	10°28'1.29"N	9°46'16.61"E
7	Aq.N-07	10°27'51.62"N	9°46'7.49"E	7	S.S-07	10°27'52.42"N	9°46'5.84"E
8	Aq.N-08	10°27'39.88"N	9°46'14.62"E	8	S.S-08	10°27'37.03"N	9°46'15.65"E
9	Aq.N-09	10°27'47.21"N	9°46'22.89"E	9	S.S-09	10°27'42.71"N	9°46'23.16"E
10	Aq.N-10	10°27'53.16"N	9°46'31.14"E	10	S.S-10	10°27'50.34"N	9°46'31.83"E
11	Aq.N-11	10°28'3.00"N	9°46'41.40"E	11	S.S-11	10°28'3.55"N	9°46'38.98"E
12	Aq.N-12	10°28'11.60"N	9°46'50.27"E	12	S.S-12	10°28'13.31"N	9°46'48.77"E
13	Aq.N-13	10°28'21.70"N	9°47'2.22"E	13	S.S-13	10°28'22.78"N	9°47'0.82"E
14	Aq.N-14	10°28'31.43"N	9°47'16.31"E	14	S.S-14	10°28'27.76"N	9°47'20.67"E
15	Aq.N-Cntrl	10°28'26.60"N	9°46'29.76"E	15	S.S-Cntrl	10°28'20.18"N	9°46'26.41"E
<b>Surface water and sediment sapling</b>				<b>Groundwater sampling</b>			
1	S.W-01	10°28'18.06"N	9°47'7.83"E	1	G.W-01	10°28'36.57"N	9°46'15.17"E
				2	G.W-02	10°29'4.77"N	9°47'4.91"E

Source: Fahamu Fieldwork, 2024



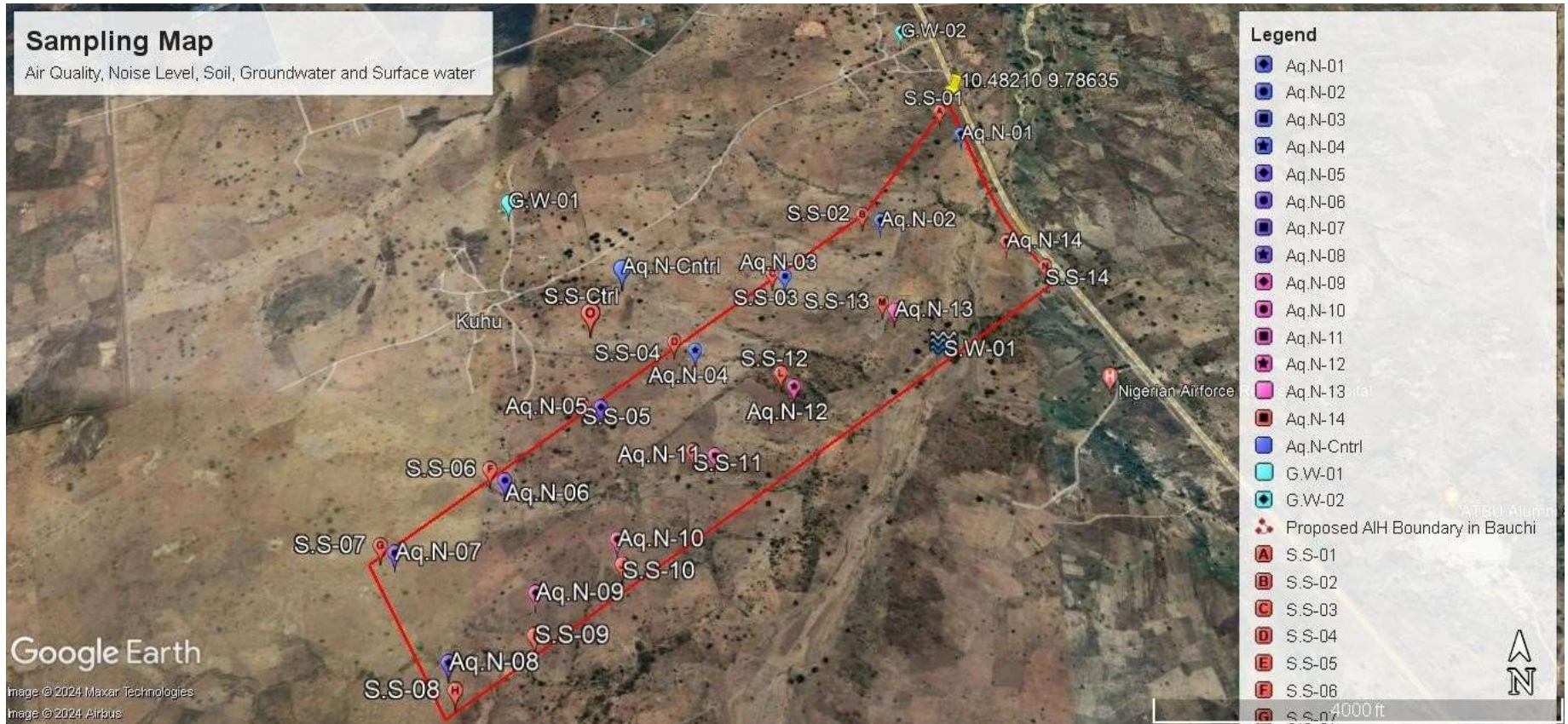
Plate 1.13: Sampling Materials



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**b. Analytical Methods**

Samples collected from the field were analysed in Federal Ministry of Environment accredited laboratory, Abuja Environmental Protection Board (AEPB) Laboratory, Plot 776 Cadastral AO off Z, Maimalari Street, Central Business District, Abuja (Appendix 3). This study employed analysis techniques approved by the Federal Ministry of Environment. Some international analytical procedures were also adopted for this study. Those of APHA, EPA, and ASTM analytical procedures for soil, sediment, and water quality were among analytical procedures adopted and used in the course of this study. To ensure the reliability and integrity of some unstable physico-chemical parameters, insitu measurement of pH, conductivity, Total Dissolved Solids (TDS), and temperature were carried out in the field. All field instruments were regularly cleaned and recalibrated after each use. The Quality Assurance and Quality Control (QA & QC) for laboratory analyses is in accordance with FMEnv recommended method, and include blank analyses to establish analyte level, duplicate analyses to establish analytical precision, spiked and blank sample analyses to determine analytical accuracy.



Source: Fahamu Fieldwork 2024

Figure 4.1a Generalized sampling map for all Environmental components studied at the proposed Gubi-AIH project area

### 4.3 Climate and Meteorology over study area

The study area is located in the semi-arid climatic zone of Nigeria and characterized by two distinct seasons, the hot dry season and the cool rainy season. Generally, Nigeria's climate is characterized by the dry and wet conditions associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator. The Inter-Tropical Convergence Zone (ITCZ) appears as a band of clouds, usually thunderstorms that circle the globe near the equator and Nigeria is located just north of the equator. When the ITCZ is to the south of the equator, the north-east winds prevail producing the dry-season and whenever it moves into the Northern Hemisphere, the south westerly wind prevails, bringing rainfall and the rainy (wet) season.

#### 4.3.1 Climate

Mean daily maximum temperatures range from 29.2°C in July and August to 37.6°C in March and April. The mean daily minimum ranges from about 11.7°C in December and January to about 24.7°C in April and May. The sunshine hours range from about 5.1 hours in July to about 8.9 hours in November. Indeed, October to February usually records the longest sunshine hours in the state. Humidity ranges from about twelve per cent in February to about 68 per cent in August. The rainy season months are May to September, when humidity ranges from about 37 per cent to 68 per cent. Monthly rainfall ranges from 0.0mm in December and January, though only traces of less than 0.1mm in February and November, to about 343mm in July. Onset of the rains is often in March while they end virtually by October. Figure 5.4 shows map of the annual average temperature of the study area.

#### 4.3.2 Rainfall

In Bauchi State, the average yearly rainfall varied from 0.24 mm in February, the lowest month of the year, to 299.88 mm in August, the highest month of the year. The rain was observed to be highest in the months of August, when the peak rainfall is observed and drops to 186.76 mm in the month of September (Figure 4.2).

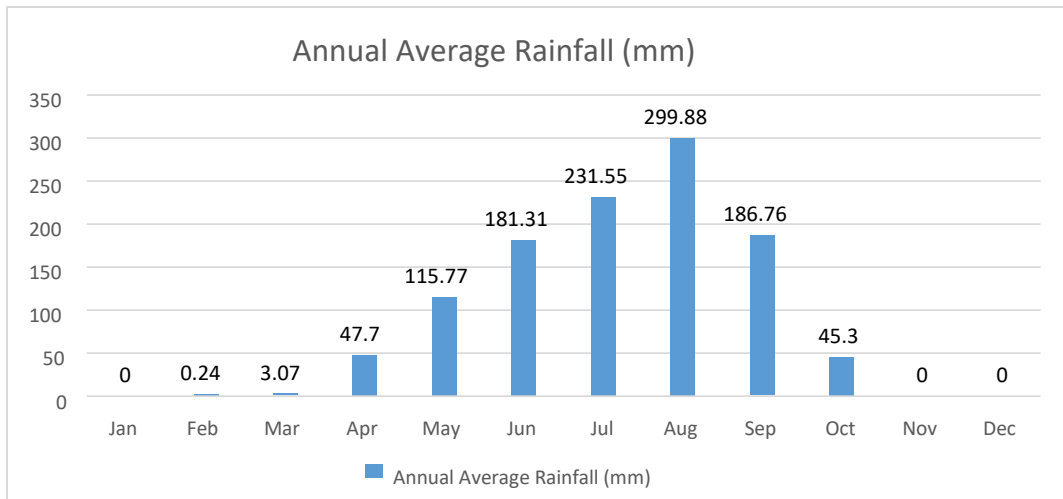


Figure 4.2: Mean Monthly Rainfall in Bauchi State  
 Source: Nigerian Meteorological Agency (NIMET), 2020

### 4.3.3 Temperature

Figure 4.3 below illustrates the mean yearly maximum and minimum temperatures for Bauchi State throughout the same climatic period as reported by NIMET. The maximum monthly average is 37.12°C, recorded in the month of April. During field work, temperature was as high as 42.7°C with the lowest being 34.9°C (Figure 4.4). These results can be associated to climate change effect over the proposed AIH project which brought about variations on atmospheric temperature and other climatic parameters. As shown in the chart temperatures increases with time as the area receives more heat from solar radiation.

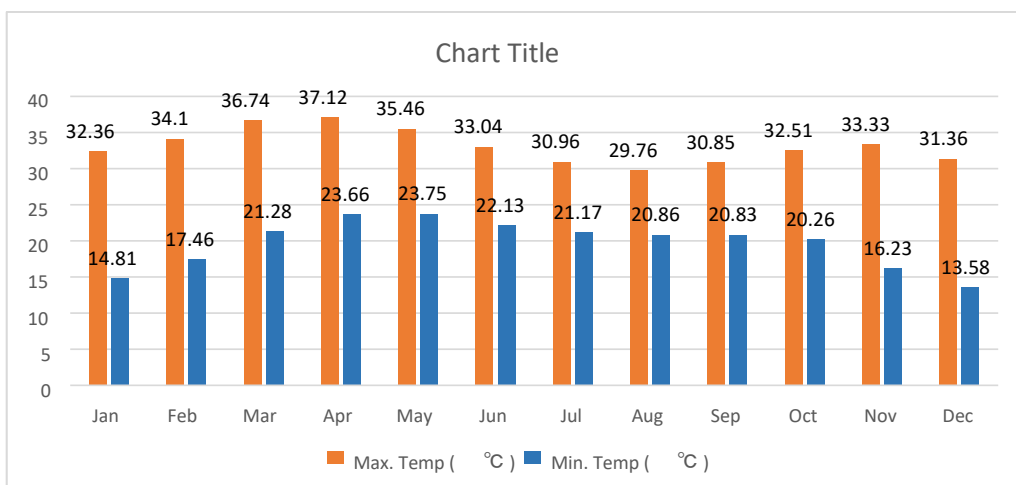


Figure 4.3: Mean Monthly Minimum and Maximum Temperatures for Bauchi State  
 Source: Nigerian Meteorological Agency (NIMET), 2020

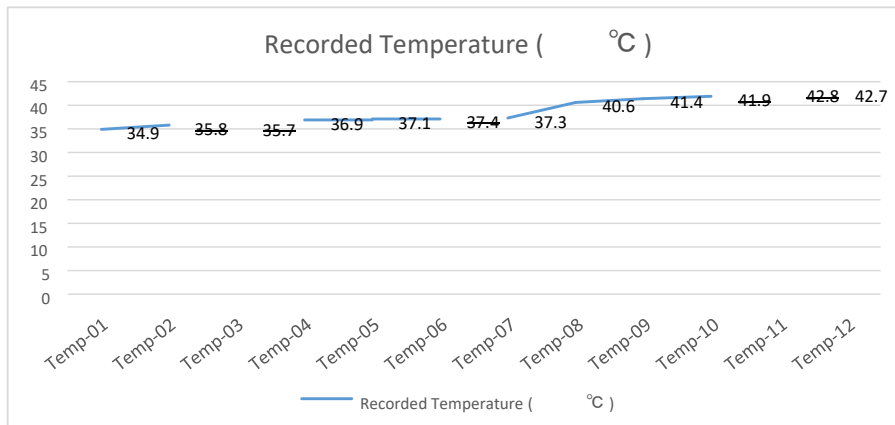


Figure 4.4: Results of Temperature recorded at the site for the proposed AIH project *Source: Fahamu Nig. Ltd. Field work, 2024*

#### 4.3.4 Solar Radiation

Data obtained from NIMET indicate that solar radiation received in the proposed AIH project area is 6,500Wh/m<sup>2</sup> per day (figure 4.5). This high value is likely linked to the clear sky days (few clouds and little dust) often experienced in the area which result in temperature as high as 44°C. The brighter period of the year lasts for 2.7 months, from January 28 to April 19, with an average daily incident shortwave energy per square meter above 6.1 kWh. The brightest month of the year is March, with an average of 6.3 kWh. The darker period however lasts for 2.2 months, from July 1 to September 7, with an average daily incident shortwave energy per square meter below 5.2 kWh. The month of August happens to be the darkest in the period, with an average of 5.0 kWh. This resources possess great potential to be tapped on to supply renewable energy to the proposed AIH during operation, thereby limit its impact on the environment through burning of foil fuel to generate energy.



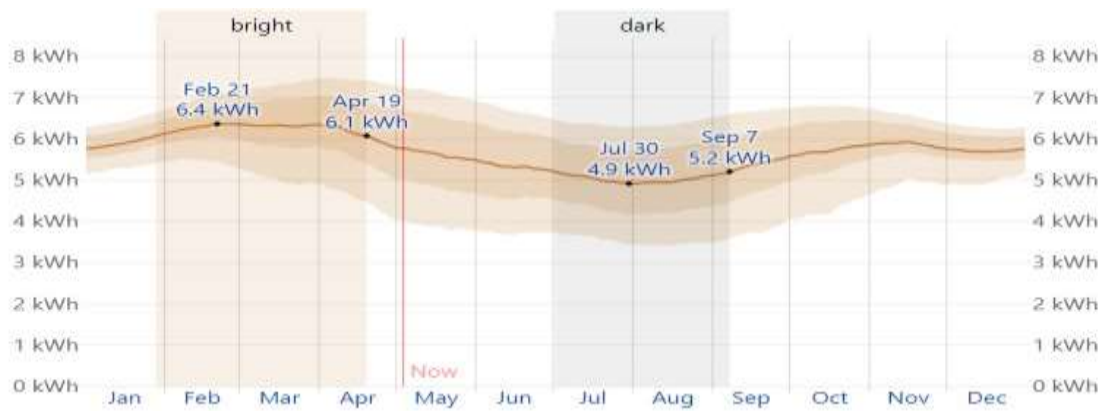


Figure 4.5: Mean Daily Incident Shortwave Solar Energy in the proposed AIH Project Area *Source: Nigerian Meteorological Agency (NIMET), 2020*

### 4.3.5 Wind Speed

The mean monthly wind speed for the proposed AIH project area ranged between 5.0 mph and 9.2mph. The speed was reported to be highest in the months of January and February while lower speed is reported between August and September (Figure 4.6).

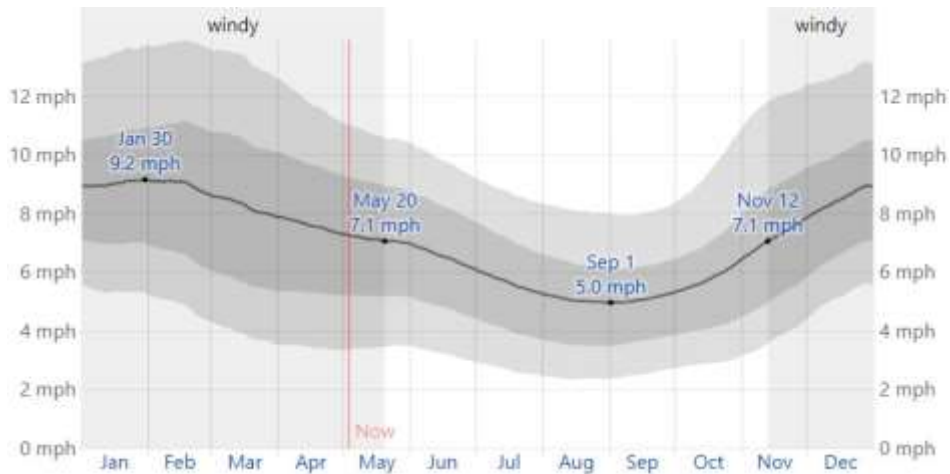


Figure 4.6: Average Monthly Wind speed of the proposed AIH project area *Source: Nigerian Meteorological Agency (NIMET), 2020*

#### 4.3.6 Wind Direction

Data obtained with the aid of Weather-hawk (Windmate<sup>R</sup>) revealed that easterly wind direction is prevalent in the study area (Table 4.3). The wind direction varied from the northeast to southeast and southwest direction. Table 4.3: Monthly wind direction of the project area.

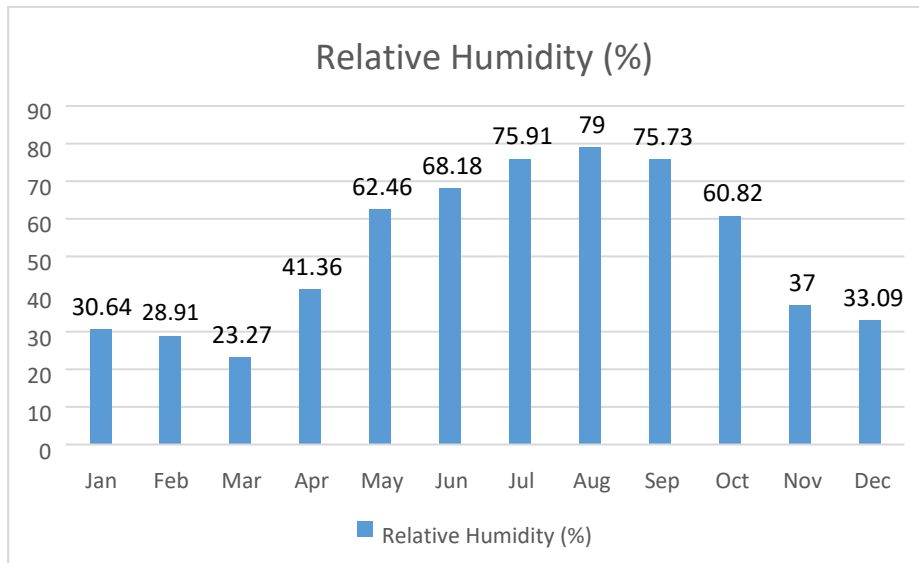
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2010	E	E	E	W	W	W	W	W	NW	NW	SE	SE
2011	E	NE	S	S	SW	SW	SW	S	S	S	NE	NE
2012	NE	NE	NE	SW	S	W	SW	SW	SW	SW	NE	NE
2013	NE	NE	SW	SW	S	S	S	SW	SW	SW	E	E
2014	NE	NE	NE	SW	SW	SW	S	SW	SW	SW	NE	NE
2015	E	E	E	E	W	W	W	W	W	E	E	E
2016	E	E	E	E	W	W	W	W	W	W	E	E
2017	E	E	E	W	W	W	W	W	W	E	E	E
2018	NE	NE	NE	SE	SE	S	S	S	SE	NE	NE	NE
2019	NE	NE	NE	SE	SE	SE	SE	SE	SE	SE	SE	NE
2020	NE	NE	NE	SE	SE	SE	S	S	S	S	NE	NE

Source: Nigerian Meteorological Agency (NIMET), 2020

#### 4.3.7 Relative Humidity

Relative humidity is the ratio of the amount of water vapour in the air at a specific temperature to the maximum amount that the air could hold at that temperature, expressed as a percentage. Relative humidity experienced in the proposed AIH project area was generally high, and above 50%. Values recorded ranged between 58.2% and 73.1%. Higher values were recorded during the morning hours when the heat of sunlight is low; and as the heat of the sunlight increases, the percentage (%) relative humidity drops low. This means that the temperature of the proposed AIH project area has impact on the areas relative humidity. The values recorded at site buttresses the values acquired from the Nigerian Meteorological Agency (Figure 4.7).





**Figure 4.7: Relative humidity of the sampling locations in the project Area**  
 Source: Nigerian Meteorological Agency (NIMET), 2020

#### 4.4 Ambient Air Quality and Noise Level Measurement

On-site ambient air quality measurements were performed using up-to-date calibrated equipment: JLDG Multifunctional Air Quality Tester and 9-in-1 Air Quality Meter. Using these equipment concentrations such as PM<sub>2.5</sub> and PM<sub>10</sub>, SO<sub>2</sub>, H<sub>2</sub>S, CO, CO<sub>2</sub>, CH<sub>4</sub>, and VOCs were determined. Extech Digital Sound Level Meter was deployed for noise level measurements. Noise level was measured in dB(A) weighted bands, to express the relative loudness in air as perceived by the human ear and also at a slow time weighting, which gave the average noise level per sampling location. Calibration of the sound level meter was up-to-date.

Fifteen (15) different locations including control, were considered for measuring of air quality, both within and outside the proposed Gubi-AIH project site. Photographs were taken (Plate 4.8) of the field officers at different points of the proposed project site as part of the measurement procedure. Measurements were conducted on the 27<sup>th</sup> of April 2024, during the dry season. Ambient noise level measurements were also carried out. These measurements were done in situ using Extech Digital Sound Level Meter at fifteen points including control.



Plate 1.12: On-field Measurement of Air Quality Parameters and Noise Levels

### 4.4.1 Results and Analysis of Air Quality

#### Suspended Particulates

Particulates are airborne mixtures of solid, liquid, or solid and liquid particles. These particles appear as haze or smoke. They endanger human health because they affect the cardiovascular and respiratory systems in both acute and long-term ways. Particles may carry any or all of the other pollutants dissolved in or adhering to their surfaces. Particles ranging from the aggregate of a few molecules to pieces of dust, readily visible to the naked eye are commonly found in the atmosphere. Aligning with the assertion of San and El (2012) that particulates cause acute and chronic effects to the respiratory and cardiovascular systems, CCDI (2001) revealed that high concentrations of suspended particulate matter (SPM) are known to irritate the mucous membranes and may initiate a variety of respiratory diseases. Fine particulates may cause cancer and aggravate morbidity and mortality from respiratory dysfunctions.

Particulates in sizes of P.M2.5 and P.M10 were detected in all the locations measured (Table 4.5). the concentrations ranged between 7ppm and 11ppm, and recording a mean value of 9.5ppm for P.M2.5; and between 9ppm and 13ppm and recording a mean value of 11.5ppm. PM2.5 is more likely to travel into and deposit on the surface of the deeper

parts of the lung, while PM<sub>10</sub> is more likely to deposit on the surfaces of the larger airways of the upper region of the lung. Particles deposited on the lung surface can induce tissue damage, and lung inflammation. Measured concentrations of both PM<sub>2.5</sub> and PM<sub>10</sub> were within the FMEnv limit of 250ppm at all the points measured.

### **Sulphur IV Oxide**

Airborne sulfur dioxide is mostly caused by operations related to burning fossil fuels (coal, oil), such as smelting copper in power plants. Breathing causes exposure, which affects the lungs. High exposure levels can cause breathing difficulties, severe airway blockages, burning in the nose and throat, and other symptoms. Sulphur iv oxide is known to be a harsh irritant, and is capable of aggravating asthma, bronchitis and emphysema and promoting impaired functions in the human system (CCDI, 2001).

SO<sub>2</sub> not detected at all the sampling points, which results in the proposed AIH project area free from the pollutant, as its concentration were less than the limit, 0.01ppm FMEnv recommended limit for its atmospheric concentration.

### **Carbon Monoxide**

Carbon monoxide (CO) is a poisonous, colorless, odorless and tasteless gas resulting from the incomplete burning of material containing carbon such as natural gas, gasoline, kerosene, oil, propane, coal, or wood (OSHA, 2012). Adverse health effects have been observed with CO concentrations of 12 - 17ppm for 8 hours (Canter and Hill, 1977) 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 (CCDI, 2001). CO concentrations was not detected at all the sampling points during the measurement time, which were below FMEnv permissible limits.

### **Methane**

Methane, CH<sub>4</sub>, is a colorless, odorless gas with a wide distribution in nature. It is the principal component of natural gas. Anaerobic bacterial decomposition of plant and animal matter, such that occurs underwater produces marsh gas, which is another name for methane. It is non-toxic when inhaled, but it can produce suffocation by reducing the concentration of oxygen inhaled (SCIFUN, 2017). CH<sub>4</sub> was obtained in all measurement

points with concentration levels ranging from 5.2 to 6.59mg/m<sup>3</sup> and a mean value of 5.96mg/m<sup>3</sup>. Neither Nigeria nor the World Bank has recommended a limit for emitting CH<sub>4</sub> gas.

### **Hydrogen Sulphide (H<sub>2</sub>S)**

Hydrogen sulphide is a colourless, flammable gas with a characteristic odour of rotten eggs. It is produced naturally, a few of which are anaerobic bacterial reduction of sulphates and sulphur containing organic compounds, and also as a result of human activity. Nasal olfactory lesions were reported in Sprague-Dawley CD, as rats were H<sub>2</sub>S at 42 or 110 mg/m<sup>3</sup>; the no-observed adverse- effect level (NOAEL) was 14 mg/m<sup>3</sup> (WHO, 2003). H<sub>2</sub>S was not detected at all the points measurement was conducted, leaving the area free of the pollutant and less than FMEnv permissible limit of 0.01ppm.

### **Carbon iv Oxide (CO<sub>2</sub>)**

The concentration of CO<sub>2</sub> in the atmosphere has rose from close to 280 parts per million (ppm) in 1800, at first slowly and then progressively faster to a value of 367 ppm in 1999, echoing the increasing pace of global agricultural and industrial development. Current anthropogenic emissions of CO<sub>2</sub> are primarily the result of the consumption of energy from fossil fuels (IPCC, 2018). CO<sub>2</sub> is a naturally occurring gas, a by-product of burning fossil fuels and biomass and a result of land-use changes and other industrial processes. It is the principal anthropogenic gas that is thought to affect the Earth's radiative balance (Florides and Christodoulides, 2008 citing IPCC, 2007). CO<sub>2</sub> was detected at all the points sampled, with concentration level ranging from 379ppm to 560ppm, with a mean value 503.3ppm.

### **Volatile Organic Compound**

Volatile organic compounds (VOCs) are a large group of organic chemicals that include any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate). VOCs are of interest in part because they participate in atmospheric photochemical reactions that contribute to ozone formation, they play a role in the formation of secondary organic aerosols, which are found in airborne particulate matter, and because many individual VOCs are known to be

harmful to human health. VOCs are emitted from a variety of sources, including motor vehicles, chemical manufacturing facilities, refineries, factories, consumer and commercial products, and natural (biogenic) sources (mainly trees), and health effects vary by pollutant (EPA, 2018). VOCs were detected in all the points sampled, with concentration levels ranging from 0.02–0.22 mg/m<sup>3</sup> and having a mean value of 0.13mg/m<sup>3</sup>. The measured concentrations are well below FMEnv permissible limit of 0.5mg/m<sup>3</sup> and 0.60 mg/m<sup>3</sup> recommended by the National Environmental Air Quality Control Regulation (NEAQCR) 2014.

**Table9: Results of Air Quality and Nose levels at the Proposed AIH Project site**

Sample Point	Latitude	Longitude	Time	P.M. 2.5 (ppm)	P.M. 10 (ppm)	CO (ppm)	CO <sub>2</sub> (ppm)	VOC (mg/m <sup>3</sup> )	CH <sub>4</sub> (mg/m <sup>3</sup> )	SO <sub>2</sub>	H <sub>2</sub> S
Aq.N-01	10°28'47.78"N	9°47'11.87"E	9:50am	8	10	-	385	0.02	5.29	-	-
Aq.N-02	10°28'34.47"N	9°47'1.04"E	10:10am	8	10	-	379	0.05	5.20	-	-
Aq.N-03	10°28'26.33"N	9°46'49.28"E	10:30am	10	12	-	475	0.04	6.05	-	-
Aq.N-04	10°28'16.21"N	9°46'38.82"E	10:50am	7	9	-	479	0.08	5.74	-	-
Aq.N-05	10°28'8.85"N	9°46'28.36"E	11:10am	11	13	-	485	0.1	5.79	-	-
Aq.N-06	10°27'59.96"N	9°46'18.38"E	11:30am	10	12	-	493	0.14	6.03	-	-
Aq.N-07	10°27'51.62"N	9°46'7.49"E	11:50am	9	11	-	490	0.14	6.55	-	-
Aq.N-08	10°27'39.88"N	9°46'14.62"E	12:10pm	11	13	-	525	0.15	6.59	-	-
Aq.N-09	10°27'47.21"N	9°46'22.89"E	12:30pm	9	11	-	550	0.17	5.99	-	-
Aq.N-10	10°27'53.16"N	9°46'31.14"E	12:50pm	8	10	-	549	0.17	5.72	-	-
Aq.N-11	10°28'3.00"N	9°46'41.40"E	1:10pm	11	13	-	538	0.19	6.02	-	-
Aq.N-12	10°28'11.60"N	9°46'50.27"E	1:30pm	10	12	-	551	0.22	6.10	-	-
Aq.N-13	10°28'21.70"N	9°47'2.22"E	1:50pm	10	12	-	547	0.17	6.13	-	-
Aq.N-14	10°28'31.43"N	9°47'16.31"E	2:10pm	9	11	-	546	0.17	6.09	-	-
Aq.N-Cntrl	10°28'26.60"N	9°46'29.76"E	2:30pm	11	13	-	560	0.16	6.10	-	-
Mean				9.5	11.5	-	503.5	0.13	5.96	-	-
Minimum				7	9	-	379	0.02	5.2	-	-
Maximum				11	13	-	560	0.22	6.59	-	-
Equipment Detection Limit											
<b>FMEv Limit</b>				<b>250ppm</b>	<b>250ppm</b>				-	<b>0.01</b>	<b>0.01</b>



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#### 4.4.2 Noise Level

Noise is an airborne pressure variation (wave) that produces excessive or undesired sound and may cause hearing loss or irritation. The physical manifestation of noise is a pressure wave which is caused by vibrating surfaces Patrick and Peter (2006). Apart from causing disturbance to the affairs of man, long-term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995; Oguntoke *et al.*, 2015; Oguntoke *et al.*, 2019). The aggravation and nuisance that high noise levels, whether short- and long-term, generate are the main effects of noise on affected communities (both human and natural). Additionally, animal disturbance is of concern, particularly, during breeding, and noise also scares the wildlife species, thereby causing migration and reducing biodiversity.

WHO (1999) listed hearing impairment caused by noise, speech communication interference, sleep and rest disturbance, psychophysiological, mental-health, and performance effects, effects on residential behavior and annoyance, and interference with intended activities as the negative health effects of noise exposure. The range of sound pressures that can be experienced is quite wide, so in order to keep the values in reasonable ranges, noise levels are expressed in decibels (dB), which have a logarithmic scale. The majority of laws and measurements use the "A" frequency weighting, dB(A), which spans the frequency range that human ears can hear (20 – 20000Hz). Acoustic pressure, sometimes known as sound pressure, is the local pressure difference brought on by a sound wave between the ambient (average, or equilibrium) air pressure. Sound pressure in air can be measured using a microphone, and in water using a hydrophone. The SI unit for sound pressure  $p$  is the Pascal (symbol: Pa). 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 regulatory limit for noise provided by the FMEnv [90dB (A)] is specific to the workplace. However, noise due to construction and installation activities are expected to rise.

The IFC, WHO and FMEnv limits shall be used to benchmark the ambient noise levels measured in the project area. Table 4.5 presents the WHO guidelines for community noise.

**Table10: WHO Guidelines for Community Noise**

Specific Environment	Critical Health Effect(s)	LAeq(dB)	Time base (hours)	Lamax, fast (dB)
Outdoor living area	Serious annoyance, daytime and evening.	55	16	-
	Moderate annoyance, daytime and evening.	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance at daytime and evening.	35	16	
Inside bedrooms	Sleep disturbance at night.	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values).	45	8	60
School classrooms and preschools, indoors	Speech intelligibility, disturbance of information extraction, message communication.	35	During class	-
Pre-schools bedrooms, indoors	Sleep disturbance	30	Sleeping time	45
School, playground outdoors	Annoyance (external source)	55	During play	-
Hospitals, wardrooms, Indoors	Sleep disturbance at night time	30	8	40
	Sleep disturbance at daytime and evenings.	30	16	
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 address, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/earphone	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 L<sub>max, fast</sub>), measured 100mm from the ear;
- #3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background so should be kept low; and
- #4: under headphones, adapted to free-field values.

#### 4.4.3 Result and Analysis of Noise Level

The minimum and maximum noise levels recorded at the points measured are 33.74dBA and 66.2dBA respectively (Table 4.8), while the mean is 45.56dBA (Table 4.6). These values are below 70dBA set limit by the World Health Organization (WHO) for industrial areas and FMEnv limit of 90dBA for 8 hours working period. The noise experienced in the proposed AIH project location are aeolian which is attributed to the movement of wind; psithurism which is generated from the impact of wind on leaves; and chirping sounds produced during bird calls. Sounds generated during vehicular movements are not significant at the time of study. This is attributed to low number of vehicles plying the existing Ningi road and the distance of measurement points from the road.

The sleep disturbance limit was not breached from results obtained from all the measurement points for minimum. However, it was breached for maximum. Adverse impact of the recorded noise values will impact of natural communities which harbour wildlife species. Human communities of Kuhu and Malmo are not affected by ~~this~~ these noise levels as a result to their distances (620m and 550m respectively) from the proposed AIH site boundary. In general, the measured noise levels are representative of agricultural areas.

**Table11: Results of Air Quality and Nose levels at the Proposed AIH Project site**

Sample Point	Latitude	Longitude	Time	Noise (dB[A])		
				Min.	Ave.	Max.
Aq.N-01	10°28'47.78"N	9°47'11.87"E	9:50am	34.0	47.5	64.9
Aq.N-02	10°28'34.47"N	9°47'1.04"E	10:10am	33.7	46.2	64.8
Aq.N-03	10°28'26.33"N	9°46'49.28"E	10:30am	35.2	46.5	63.2
Aq.N-04	10°28'16.21"N	9°46'38.82"E	10:50am	32.6	45.9	65.8
Aq.N-05	10°28'8.85"N	9°46'28.36"E	11:10am	34.1	47.3	65.3
Aq.N-06	10°27'59.96"N	9°46'18.38"E	11:30am	34.1	45.1	65.1
Aq.N-07	10°27'51.62"N	9°46'7.49"E	11:50am	32.7	43.3	66.2
Aq.N-08	10°27'39.88"N	9°46'14.62"E	12:10pm	31.9	42.7	64.5
Aq.N-09	10°27'47.21"N	9°46'22.89"E	12:30pm	33.5	47.2	62.5
Aq.N-10	10°27'53.16"N	9°46'31.14"E	12:50pm	34.2	46.9	65.1
Aq.N-11	10°28'3.00"N	9°46'41.40"E	1:10pm	36.2	45.5	65.3
Aq.N-12	10°28'11.60"N	9°46'50.27"E	1:30pm	33.6	46.1	64.5
Aq.N-13	10°28'21.70"N	9°47'2.22"E	1:50pm	34.9	43.7	63.7
Aq.N-14	10°28'31.43"N	9°47'16.31"E	2:10pm	32.8	44.2	64.4
Aq.N-Cntrl	10°28'26.60"N	9°46'29.76"E	2:30pm	32.6	45.3	63.6
Mean				33.74	45.56	64.6

Minimum				31.9	42.7	62.5
Maximum				36.2	47.5	66.2
Equipment Detection Limit						
FME <sub>Env</sub> Limit						

Source: Fahamu Fieldwork, 2024

## 4.5 Regional Geology and Hydrogeology

### Geology of the Area

The proposed Agro-Industrial Hub shall be developed on a plot of land measuring an estimated 800 hectares, opposite Gubi Campus of the Abubakar Tafawa Balewa University, off Ningi Road, Bauchi LGA, Bauchi State. The terrain within the proposed AIH project site is characterized by relatively flat plains and minor undulating hills resulting from crop cultivation, rock outcrops, gully erosion path, stream and steep slope landform as a result of the stream. The landscape features savanna grassland. Vegetation typical of the proposed AIH project area, which is a Sudan savanna zone is characterized by grasses, shrubs, and scattered trees. However, at the time of study, the vegetation has been altered by agriculture, grazing, and deforestation which are all human activities. The trees, grasses and shrubs creates a habitat for some invertebrates animals. Ant hills were also observed within the proposed AIH project site. Malmo stream runs across the proposed project site and flows Northeast. This stream is a water resources in the area and significant to farming, and also a source of water to Gubi pond located 3.4km Northeast of the proposed AIH proposed site.

The proposed project site in Bauchi is located in northeastern Nigeria. This area has a diverse geological composition due to its location within the Chad Basin and the transition zone to the Basement Complex: the Basin Complex, Basement Complex, Volcanic Activities, Mineral Resources, and Structural Features. Due to its link to the Chad Basin, it is known for its extensive sedimentary deposits which includes sandstone, shale, and limestone. Basement complex dominates the southern part, basically around the Jos Plateau, and comprised of older crystalline rocks such as granite, gneiss, and schist which often form rugged terrain and are associated with mineral deposits like tin, columbite, and tantalite. Various activity has occurred in the state, particularly around the Jos Plateau region which has resulted to ancient

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volcanic rocks and associated geological features like lava flows and volcanic ash deposits. Structural features characterizes the state, resulting from tectonic activities over geological time. They faults, folds, and fractures, which influence the distribution of geological formations and the occurrence of mineral deposits.

Nigerian rocks can be grouped into crystalline and sedimentary rocks. Half of crystalline rocks in Nigeria are buried beneath the Cretaceous and Younger sediments while the other half outcrop largely in the North Central, Southwestern and in three regions from the North to the South along the Cameroon line, that is Mandara highland, Adamawa Plateau and Oban massif. According to Dada et al, 1993, the crystalline rocks can further be divided into three main groups: Basement Complex, Younger Granite, and Tertiary Recent Volcanics.

#### **4.5.1 Hydrogeology of the Area**

Hydrogeologically, the proposed project area is characterized by its geological formations, groundwater resources, and hydrological features. Its presence within the Chad Basin which is rich in sedimentary formation hold significant groundwater reserves. It hydrogeology features several aquifers, including confined and unconfined aquifers. Confined aquifers are typically found in the sedimentary rocks, while unconfined aquifers are prevalent in the weathered and fractured basement complex rocks. Groundwater potential is considerable, particularly in areas where the geology allows for the accumulation and storage of water. The aquifers in the sedimentary formations are often the most productive, providing water for domestic, agricultural, and industrial use.

Hydrological features within the study area include Gubi Lake located approximately 8km southeast of the area and Malmo stream which flows within the proposed AIH project site which contribute to the water resources of the area, serving as a source of water for irrigation and other purposes.



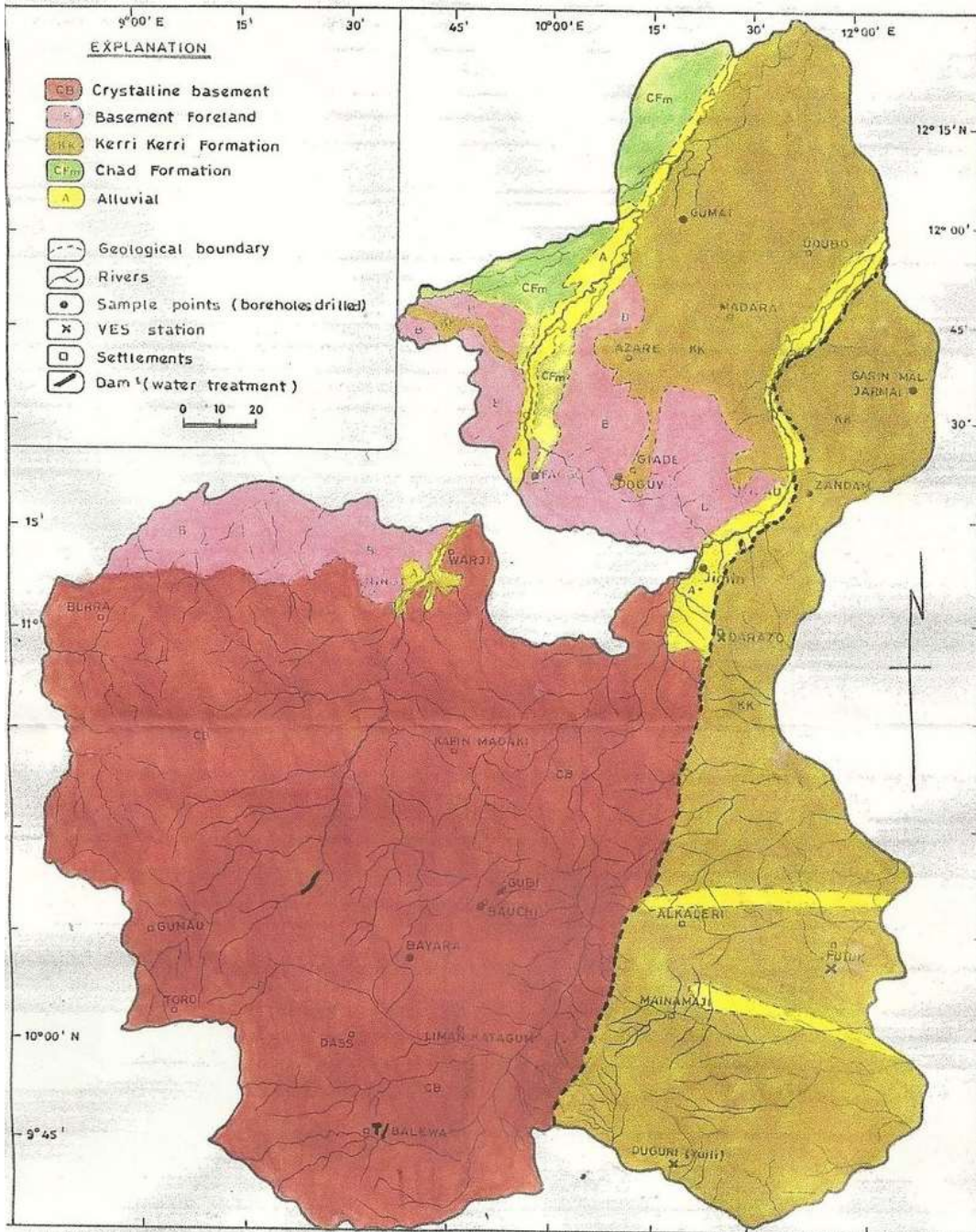


Figure 4.8: Hydrogeological map of Bauchi State

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## 4.6 Soil Quality

The soil within the proposed AIH project site and its surrounding areas varies but is generally fertile, supporting agriculture, which is a significant economic activity being practiced by the locals of Kuhu and Malmo communities. As observed during the on-site field study, the soil types include sandy soils, clayey soils, and loamy soils which are also being mined for construction purposes.

Soil provides water, nutrients and anchorage for plants and trees in natural forests and grasslands, annual and perennial crops and planted grassland. It also provides the habitat for decomposer organisms which have an essential role in the cycling of carbon and mineral nutrients. However, within the proposed project site a gully erosion was observed. This is as a result of soil quality degradation which is as result of human activities which include agriculture, cattle grazing, deforestation and mining. The implementation of the proposed AIH project shall further degrade the soil through improper management of the land resulting from poor management of solid waste, application of construction materials and chemicals, as well as industrial processing activities to be carried out in the facility upon completion. Mitigation measures will be provided for these impacts in Chapter Six.

### 4.6.1 Soil Sampling

A total of thirty (30 Nos) soil samples were collected within the proposed project site and one (1No) control soil sample. At each sampled point, soil samples were collected at two depths (0-15cm for topsoil and 16-30cm for subsoil). This operation was carried out with the aid of a stainless steel Dutch auger (Plate 4.9).

Each sample was collected in aluminium foil, labelled appropriately, and stored in a cooler. The samples were then transported to the Abuja Environmental Protection Board Laboratory (accredited by FMEnv.) in Asokoro District of Abuja.

The physico-chemical characteristics of soil samples obtained from thirty (30) points and one (1) control point within the study area after in-situ/laboratory measurement and analyses are summarized in Table 4.7 below. Details of the results are presented in Appendix 3.





**Plate 1.13: Soil sample collection using soil auger**

**Table12: Proposed SAPZ Physical/Chemical Parameters of Soils Samples**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 1 0-15cm	Bau- SS 1 16-30cm	Bau- SS 2 0-15cm	Bau- SS 2 16-30cm	Bau- SS 3 0-15cm	Bau-SS3 16-30cm
		10° 28' 47.78"N 9° 47' 11.87"E					
	<b>PHYSICAL TEST</b>						
1	TEMPERATURE (°C)	37.4	36.7	37.0	36.7	36.4	36.1
2	PARTICLE SIZES/TEXTURE	SAND/SILT/CLAY 41.03/48.37/10.6	SAND/SILT/CLAY 40.16/46.84/13	SAND/SILT/CLAY 67.18/23.68/9.14	SAND/SILT/CLAY 71.05/20.74/8.21	SAND/SILT/CLAY 58.64/26.02/15.34	SAND/SILT/CLAY 41.23/43.80/14.97
3	pH	7.21	6.99	7.19	6.87	7.24	6.93
4	MOISTURE CONTENT (%)	1.024	1.007	0.930	0.940	0.894	1.022
5	SOIL POROSITY (%)	28.33	23.33	25.00	30.00	33.33	30.00
6	BULK DENSITY (g/cm <sup>3</sup> )	0.790	0.740	0.810	0.790	0.850	0.970
7	WET DENSITY (g/cm <sup>3</sup> )	0.961	0.862	0.960	1.052	1.240	1.441
8	DRY DENSITY (g/cm <sup>3</sup> )	0.615	0.613	0.740	0.617	0.750	0.514
	<b>ORGANICS</b>						
9	TOTAL ORGANIC CARBON	1.72	1.20	2.00	2.00	3.10	2.13
	<b>EXCHANGEABLE IONS</b>						
10	PHOSPHATE (mg/kg)	13.00	16.31	11.20	7.25	12.25	12.000
11	SULPHATE (mg/kg)	57.0	47.60	49.40	37.63	54.13	45.60
12	NITRATE (mg/kg)	19.05	15.00	19.34	17.15	22.67	20.60
13	CALCIUM (mg/kg)	34.60	36.40	30.40	32.40	34.40	31.10
14	MAGNESSIUM (mg/kg)	17.80	18.50	14.60	16.70	17.10	16.00
15	CHLORIDE (mg/kg)	2.30	3.30	1.84	4.10	5.20	1.09
	<b>HEAVY METALS</b>						
16	MANGANESE (mg/kg)	0.120	0.200	0.230	0.165	0.140	0.190
17	COPPER (mg/kg)	0.585	0.490	0.770	0.710	0.665	0.580
18	IRON (mg/kg)	8.960	10.440	6.540	7.500	8.80	10.30
19	ZINC (mg/kg)	5.860	3.740	4.620	4.505	3.800	4.300
20	CADMIUM (mg/kg)	0.021	0.013	0.015	0.020	0.012	0.015
22	LEAD (mg/kg)	0.010	0.009	0.011	0.008	0.011	0.012
22	NICKEL (mg/kg)	0.004	0.004	0.006	0.006	0.008	0.007
	<b>BACTERIAL ISOLATE</b>						
23	Total Heterotrophic Bacteria (cfu/100 ml)	4.3 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>	5.0 X 10 <sup>2</sup>	4.8 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	4.6 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	3.6 X 10 <sup>2</sup>	3.5 X 10 <sup>2</sup>	4.5 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.0 X 10 <sup>2</sup>	3.1 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	3.1 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>
26	Feecal Coliform Count (FCC) (cfu/ 100 ml)	3.3 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	2.9 X 10 <sup>2</sup>	2.6 X 10 <sup>2</sup>	3.0 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>

Source: Fahamu Fieldwork, 2024

**Table13 contd: Proposed SAPZ Physical/Chemical Parameters of Soils Samples**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 4 0-15cm	Bau- SS 4 16-30cm	Bau- SS 5 0-15cm	Bau- SS 5 16-30cm	Bau- SS 6 0-15cm	Bau-SS6 16-30cm
	<b>PHYSICAL TEST</b>						
1	TEMPERATURE (°C)	36.9	36.7	37.2	36.8	36.9	36.5
2	PARTICLE SIZES/TEXTURE	SAND/SILT/CLAY 45.19/25.6/29.21	SAND/SILT/CLAY 44.20/46.37/9.43	SAND/SILT/CLAY 58.02/29.88/12.1	SAND/SILT/CLAY 48.52/40.91/10.57	SAND/SILT/CLAY 45.65/40.91/13.44	SAND/SILT/CLAY 42.73/43.80/13.47
3	pH	7.73	7.43	7.24	6.95	7.32	7.10
4	MOISTURE CONTENT (%)	0.860	1.114	0.920	1.110	0.890	1.020
5	SOIL POROSITY (%)	28.33	23.33	25.00	23.33	23.33	28.67
6	BULK DENSITY (g/cm <sup>3</sup> )	1.340	1.060	1.130	1.090	1.190	0.771
7	WET DENSITY (g/cm <sup>3</sup> )	2.083	1.582	1.630	1.562	1.190	0.665
8	DRY DENSITY (g/cm <sup>3</sup> )	0.593	0.561	0.790	0.624	0.596	0.514
	<b>ORGANICS</b>						
9	TOTAL ORGANIC CARBON	3.60	2.80	2.90	6.00	3.40	5.24
	<b>EXCHANGEABLE IONS</b>						
10	PHOSPHATE (mg/kg)	51.00	39.71	48.10	40.50	48.10	41.00
11	SULPHATE (mg/kg)	63.0	54.20	48.90	41.30	53.00	39.90
12	NITRATE (mg/kg)	16.35	20.19	14.10	18.12	20.13	13.40
13	CALCIUM (mg/kg)	34.10	31.40	36.40	28.40	33.40	32.10
14	MAGNESSIUM (mg/kg)	17.40	16.00	18.10	14.70	17.00	16.70
15	CHLORIDE (mg/kg)	2.138	2.121	1.84	1.350	2.60	1.090
	<b>HEAVY METALS</b>						
16	MANGANESE (mg/kg)	0.160	0.149	0.220	0.118	0.310	0.220
17	COPPER (mg/kg)	0.615	0.490	0.730	0.660	0.465	0.750
18	IRON (mg/kg)	9.130	7.820	10.040	8.560	7.803	11.300
19	ZINC (mg/kg)	6.740	5.140	4.880	6.505	8.400	7.110
20	CADMIUM (mg/kg)	0.026	0.023	0.033	0.027	0.032	0.025
22	LEAD (mg/kg)	0.012	0.010	0.018	0.014	0.018	0.013
22	NICKEL (mg/kg)	0.008	0.007	0.009	0.010	0.010	0.010
	<b>BACTERIAL ISOLATE</b>						
23	Total Heterotrophic Bacteria (cfu/100 ml)	4.6 X 10 <sup>2</sup>	4.6 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	5.0 X 10 <sup>2</sup>	4.5 X 10 <sup>2</sup>	4.7 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	4.1 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	4.4 X 10 <sup>2</sup>	3.8 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.8 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	3.3X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	2.9 X 10 <sup>2</sup>	3.3 X 10 <sup>2</sup>
26	Feacal Coliform Count (FCC) (cfu/100 ml)	3.1 X 10 <sup>2</sup>	2.6 X 10 <sup>2</sup>	2.8 X 10 <sup>2</sup>	2.3 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	2.3 X 10 <sup>2</sup>

Source: Fahamu Fieldwork, 2024

**Table13 contd: Proposed SAPZ Physical/Chemical Parameters of Soils Samples**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 7 0-15cm	Bau- SS 7 16-30cm	Bau- Control 0-15cm	Bau- control 16-30cm
	<b>PHYSICAL TEST</b>				
1	TEMPERATURE (°C)	37.0	36.8	36.9	36.7
2	PARTICLE SIZES/TEXTURE	SAND/SILT/CLAY 47.34/39.1/13.56	SAND/SILT/CLAY 55.96/36.60/7.44	SAND/SILT/CLAY 44.92/38.72/16.36	SAND/SILT/CLAY 53.30/38.98/7.72
3	pH	7.56	7.41	7.39	7.28
4	MOISTURE CONTENT (%)	1.180	0.850	1.280	1.011
5	SOIL POROSITY (%)	28.33	20.00	22.33	26.70
6	BULK DENSITY (g/cm <sup>3</sup> )	1.340	1.020	1.250	0.940
7	WET DENSITY (g/cm <sup>3</sup> )	2.083	0.970	1.936	0.806
8	DRY DENSITY (g/cm <sup>3</sup> )	0.593	0.643	0.555	0.654
	<b>ORGANICS</b>				
9	TOTAL ORGANIC CARBON	3.60	2.12	2.32	1.92
	<b>EXCHANGEABLE IONS</b>				
10	PHOSPHATE (mg/kg)	44.00	37.000	37.0	30.0
11	SULPHATE (mg/kg)	64.3	58.60	66.8	57.0
12	NITRATE (mg/kg)	18.12	20.00	17.24	13.85
13	CALCIUM (mg/kg)	35.20	32.40	30.80	31.40
14	MAGNESSIUM (mg/kg)	18.00	16.70	15.70	16.60
15	CHLORIDE (mg/kg)	2.138	2.500	2.600	2.800
	<b>HEAVY METALS</b>				
16	MANGANESE (mg/kg)	0.410	0.320	0.290	0.330
17	COPPER (mg/kg)	0.660	0.580	0.480	0.610
18	IRON (mg/kg)	9.120	7.850	9.800	7.550
19	ZINC (mg/kg)	6.270	4.115	4.800	5.210
20	CADMIUM (mg/kg)	0.027	0.016	0.021	0.019
22	LEAD (mg/kg)	0.019	0.008	0.013	0.011
22	NICKEL (mg/kg)	0.011	0.006	0.010	0.007
	<b>BACTERIAL ISOLATE</b>				
23	Total Heterotrophic Bacteria (cfu/100 ml)	5.2 X 10 <sup>2</sup>	4.8 X 10 <sup>2</sup>	4.7 X 10 <sup>2</sup>	5.9 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	4.8 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>	4.1 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.6 X 10 <sup>2</sup>	3.8 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>
26	Feecal Coliform Count (FCC) (cfu/ 100 ml)	3.0 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	3.0 X 10 <sup>2</sup>	2.5 X 10 <sup>2</sup>

Source:

Fahamu

Fieldwork,

2024

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### **Analysis of Soil Samples**

Physico-chemical analysis was carried out on the soil samples collected from the proposed AIH project site in Bauchi State (Table 4.7), with the result clearly shows that soil types are based on the proportion of sand, silt, clay and fragment of clay and silt which varied largely between sandy and silt.

**Temperature:** Soil temperature refers to the measurement of the ground's inherent warmth. It controls the chemistry and biology of the ground and the atmospheric-ground gas exchange. The importance of soil temperature in agriculture is due to its impact on the effectiveness of many farming procedures. Soil temperature is not a universal value and depends on several constituents, including its colour, slope, vegetation cover, compaction, moisture, and, naturally, the amount of sunlight available. Average temperature recorded for samples between 0 - 15cm 37°C while those of 16 - 30cm was 36.6°C, and comparing with 36.9°C and 36.7°C recorded for the control point. Results obtained are within the limit of <40°C as recommended by FMEnv for plant survival.

**pH:** Soil pH is a measure of the acidity or alkalinity of the soil. Natural soil pH depends on the rock from which the soil was formed (parent material) and the weathering processes that acted on it—for example climate, vegetation, topography and time. Generally, for a pH decrease of 1, the acidity increases by a factor of 10. Soil pH decreases with an increase in soil depth. At a higher pH, soil builds up toxic level of certain nutrients. For example, molybdenum, typically a plant nutrient, becomes poisonous to plants in large amounts. The average value recorded was 7.35 for level 0 - 15cm, and 7.1 for level 16 - 30cm against control values of 7.39 and 7.28 respectively. Generally, values recorded are within the neutrality region of pH scale, and also fall within FMEnv range of 6 to 9 recommended for plant survival.

**Moisture Content:** soil's moisture content is the total amount of water in the ground's pores or on its surface. The weather, the type of land, and the plants all have an impact on the moisture content of the soil. The amount of poisonous compounds, the salinity of the soil, the structure and thickness of the ground, as well as its temperature and heat-retaining capacity, are all impacted by soil moisture. It displays the state of the field as

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well as how much water is there in a particular zone. The size and aeration of a plant's roots, which initially absorb water, have a direct impact on the health of the plant. The effect of soil moisture on plants and the final yield is very important. The average value reported for moisture content of the soil are 0.957% for soils on level 0 - 15cm and 1.009% for soils of level 16 - 30cm, against control values of 1.280% and 1.011% respectively.

**Soil Porosity:** Soil porosity refers to the amount of air or water that exists in the spaces between mineral particles (and solid organic matter) in soil. The pore space both contains and regulates the majority of the soil's functions. The size distribution of the pores and the continuity between them, rather than just the total amount of pore space, govern the behaviour and function of soil. The average value reported for the sample was 27.38% for soil within level 0 - 15cm and 25.5% for soil within 16 - 30cm. Values recorded for control samples however are 22.33% and 26.70% respectively.

**Exchangeable Anions:**

**Nitrate ( $\text{NO}_3^-$ ):** The exchangeable anions decreases with increasing soil sampling depth. Average values recorded for the exchangeable anions were; nitrate 18.16mg/kg, sulphate - 51.04mg/kg, chloride - 2.4mg/kg respectively. These values were below FMEnv limits of 20mg/kg, 52.4mg/kg and 35mg/kg recommended for plant survival.

Nitrates are highly soluble compounds and as such move readily and available to plant roots at the top soil. Nitrates are also subject to leaching if they move out of the root zone and can eventually cause contamination of ground water if present in excess.

**Phosphate ( $\text{PO}_4^{3-}$ ):** Just like any other soil nutrient, its concentration decreases with increase in soil sampling depth. The average value recorded for was 30.1mg/kg, which is above FMEnv limit of 5mg/kg recommended for plant survival. Phosphorus containing compounds are essential for photosynthesis by plant for energy transformations and for the activity of some hormones in both plants and animals.

**Chlorides (Cl):** Just like any other soil nutrient, its concentration decreases with increase in soil sampling depth. The average value recorded for was 2.4mg/kg. High

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chloride level can seriously harm the majority of plant parts, which will therefore have an impact on production and fruit quality. Chloride can harm things in a variety of ways, including low level of chlorophyll cause the leaves to yellow. low fruit sugar content.

**Sulphate (SO<sub>4</sub><sup>2+</sup>):** sulphur is a component of several secondary metabolites (SMs) that are essential for the growth, development, and physiological processes of plants. The types of species and developmental stages have an impact on the sulphur requirements of plants. For instance, more sulphur is needed during vegetative growth and seed formation. Numerous biological functions, such as photosynthesis, energy production, photo protection, and metabolic processes, call for self-sustaining substances, such as proteins containing Fe-S clusters. For plants, inorganic sulphate (SO<sub>4</sub><sup>2+</sup>) is the main and most important source of sulphur. Just like any other soil nutrient, its concentration decreases with increase in soil sampling depth. The average value recorded for was 51.04mg/kg and below FMEnv limit of 250mg/kg recommended for plant survival.

**Total Organic Carbon (TOC):** Total organic carbon (TOC) is the carbon (C) stored in soil organic matter (SOM). Organic carbon (OC) enters the soil through the decomposition of plant and animal residues, root exudates, living and dead microorganisms, and soil biota. It supports the growth of beneficial soil microorganisms, enhancing nutrient cycling and overall soil ecosystem functioning. Average TOC concentration detected in the soil samples was 2.97mg/kg.

**Heavy Metals:** The heavy metals tested for in this study include Fe, Cu, Zn, Mn, Pb, Cd and Ni. The average concentrations of these heavy metals were 8.9mg/kg, 0.625mg/kg, 5.4mg/kg, 0.2mg/kg, 0.01mg/kg, 0.02mg/kg and 0.01mg/kg respectively. Heavy metals with severe adverse health effect in human metabolism are lead and mercury, which presents obvious concern due to their persistence in the environment as well as documented potentials for serious health implications.

### **Soil Microbiology**

The soil samples were also examined for the presence of heterotrophic bacteria and fungi as well as hydrocarbon utilizing micro-organisms whose population may be affected by



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activities of the facility. The soils of the area generally showed the type of species of micro-organisms. The surface soils showed species of micro-organisms that include: *Bacillus spp*; *Pseudomonas spp*; *Rhizopus stolonifer*; *Corynebacterium spp*; and *Aeromonae spp*. The sub-soils indicated *Aeromonae spp*; *Mucor spp*; *Trichoderma spp*; *Micrococcus spp*; *Aspergillus flavus*; *Bacillus spp*. These microbial groups have been associated with organic transformation and re-cycling in soils.

## 4.7 Surface Water Quality

Surface water considered for this study is the Malmo stream that crosses the proposed AIH project site. It is a seasonal stream which is significant agricultural practices within the area as well as a source for mining activities. However, at the time of this study, large section of the stream is dried and no longer flows, only a section that stored water.

The rationale for surface water studies is to acquire baseline concentrations for the physico-chemical and microbial contents for which future evaluation and monitoring could be based. Several activities of the project may impact on the surface water. Such activities include: wastewater disposal, sewage disposal, thus polluting the water body. Pollution of the water body shall impact negatively on the health and socioeconomic status of project affected persons residing in Kuhu and Malmo communities as well as other persons residing in communities downstream of the proposed AIH project site. However, the mitigation measures of these impacts are presented in chapter six of this report.

### 4.7.1 Sampling Methodology

One (1) sample was collected from the stream (Plate 4.10) for analysis to determine the physico-chemical factors, trace metal contents, microbiological status and productivity of the stream. Concentrations of pH, temperature, conductivity and total dissolved solids (TDS) were determine *in-situ*. Others parameters were analysed in the laboratory. They amongst others includes turbidity, nitrate, sulphate, chloride, BOD<sub>5</sub>, COD, Oil and Grease and various heavy metals etc.



Plate 1.14: Surface water Sampling at Malmo stream

Sample for physico chemical analysis was stored in an ice-packed Dometic cooler and transported to laboratory where they are transferred into the fridge and preserved at 4<sup>0</sup>C before the analysis. Samples for Heavy metal analysis were preserved using 1:1 nitric acid while those for oil and grease were preserved by acidifying to pH 2 using 1:1 sulphuric acid. In situ measurements of Temperature, pH, Conductivity, and Total dissolved solid were carried out at all sample locations. Plate 4.10; shows surface water *in situ* measurement. Samples for microbiology were collected and preserved in a sterilized McCartney bottles and stored in an ice packed Dometic cooler and transported to the laboratory for identification and counting.

Samples for BOD were collected using the BOD bottles. The bottles were filled to the brim and covered with the stopper to ensure that no air bubble was trapped in the bottles. The samples were then kept away from sunlight.

#### 4.7.2 Surface water Physico-Chemical Result

The physico-chemical characteristics of the surface water body (Malmo stream) within the proposed project area are summarized in Table 4.8. (see Appendix 3 for detailed results)

**Table14: Proposed SAPZ Physical / Chemical Parameters of Surface Water Sample**

Source	PARAMETERS	SW1	FMEnv LIMIT
	Fieldwork, 2024		
		10°28'18.06"N; 7°47'7.83"E	
<b>Analytical Discussion of Surface water Results</b>			
<b>A PHYSICAL TEST</b>			
1	Odour	Odorless	Odorless
2	TEMPERATURE ( °C)	31.4	25-35
3	pH	7.1	6-8
4	ELECTRICAL CONDUCTIVITY (µS/cm)	189.0	1000
5	DISSOLVED OXYGEN (mg/l)	3.3	7.0
6	TOTAL DISSOLVED SOLIDS (mg/l)	95.0	1000
7	SALINITY (%)	0.0	0.0
8	ALKALINITY (m/l)	28.5	100
9	TOTAL SUSPENDED SOLID (mg/l)	0.022	<10
<b>B CHEMICAL TEST</b>			
10	TOTAL HARDNESS (mg/l)	154.08	NS
11	MAGNESIUM HARDNESS (mg/l)	34.24	NS
12	CALCIUM HARDNESS (mg/l)	119.84	NS
13	PHOSPHATE (mg/l)	0.514	5
14	NITRATE as NITROGEN (mg/l)	12.90	10
15	TOTAL CHLORIDE (mg/l)	30.0	0.2
16	BOD (mg/l)	25.4	30
17	COD (mg/l)	100.6	100
18	SULPHATE (mg/l)	62.2	250
<b>C HEAVY METAL</b>			
19	MANGANESE (mg/l)	0.233	0.3
20	IRON TOTAL (mg/l)	0.685	0.2
21	COPPER (mg/l)	0.208	0.1
22	CADMIUM (mg/l)	0.007	0.02
23	ZINC (mg/l)	0.513	1
24	LEAD (mg/l)	0.004	0.05
25	NICKEL (mg/l)	0.002	0.05
<b>D BATERIOLOGICAL</b>			
26	Total Coliform count (CFU/100ml)	430	400
27	Escherichia Coli (cfu/100 ml)	2.0 X 10 <sup>2</sup>	0.0
28	Salmonella (cfu/100 ml)	0.7 X 10 <sup>2</sup>	0.0
29	Shigella (cfu/100 ml)	0.6 X 10 <sup>2</sup>	0.0
30	Staphylococcus (cfu/100ml)	2.6 X 10 <sup>2</sup>	0.0

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sample collected from Malmo stream was examined at the Abuja Environmental Protection Board Laboratory in Asokoro, Abuja. The analysis covers for physical, chemical, heavy metal and concentrations. The results are displayed in Table 4.8 above and in the analyses that follow:

**Temperature:** Temperature is the degree of coldness or hotness of a body. It is an important factor that contributes to a chemical reaction. Temperature value of the sampled stream, Malmo stream was 21.4<sup>0</sup>C, falling within 25<sup>0</sup>C - 35<sup>0</sup>C limit of FMEnv. Higher temperature values can cause the water to warm, thereby, resulting in the water holding insufficient dissolved oxygen which is required for the survival of different

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aquatic species. Higher water temperature can also accelerates the degradation of sediment humus by microorganisms, and organic matter is released into the water layer in the form of phosphate.

**pH:** pH of a solution is described as the negative logarithm to base 10 of hydrogen ion concentration. pH defines acidity, neutrality and alkalinity of the water sample analyzed. Surface water pH which can be influenced both by natural and human-made factors is a crucial parameter for assessing water quality due to its impact on the chemical and biological processes that occur in water bodies. It determine the solubility and biological availability of nutrients and heavy metals in water to determine the corrosivity. Value recorded is 7.1 which is within 6-8 range of the FMEnv.

**Alkalinity:** Alkalinity is the most readily available measure of the acid-neutralizing capacity of surface waters, resisting PH change from alkaline to to acidity. Alkaline water maintains PH of 8 or higher. The PH scale is used to measure the alkalinity of water. Alkalinity value of Malmo stream is 28.5mg/l, which is within 100mg/l limit of the FMEnv.

**Conductivity:** Conductivity is described as ionic mobility in solution. In other words, it is a key electrical property of surface water it reveals the amount of dissolved substances, chemicals, and minerals that are present in the water. The value recorded is 189.0 $\mu$ S/cm, indicating lower ionic richness when compared with the permissible limits of 1000 $\mu$ S/cm established by FMEnv.

**Total Hardness:** total hardness is the sum of the calcium and magnesium concentrations (both expressed as calcium carbonate, in milligrams per liter [mg/L]) present in water which makes the water difficult to form lather with soap. Calcium and magnesium are divalent metal ions that come from minerals dissolved in the water. The total hardness value recorded was 154.08mg/l, and it is below 200mg/l permissible limit set by the FMEnv.

**Salinity:** Salinity is the quantity of dissolved salt in a body of water; it have significant effect conductivity, many facets of the chemistry of natural waters, and the biological

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activities that occur there. Salinity, temperature, and pressure all affect the physical characteristics of water, such as density and heat capacity. The salinity level of the sampled Malmo stream is 0.0mg/l. Excessive salinity can be hazardous for drinking, irrigating, and watering livestock.

**Dissolved Oxygen (DO):** Dissolved oxygen is the amount of oxygen present in water, as a measure of how much oxygen from the atmosphere that is dissolved in water. It gets into water by diffusion from the atmosphere, aeration of the water as it tumbles over falls and rapids, and as a waste product of photosynthesis. DO is available to living aquatic organisms, and tells a lot about water quality, because life in an aquatic environment is supported by its presence. The recorded value for sample collected was 3.3mg/l as against the 7.5mg/l limit of FMEnv.

**Total Dissolved Solids (TDS):** Total dissolved solids (TDS) is a measure of the amount of inorganic salts, which include dissolved organic matter and calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates in water. TDS value recorded was 95.0mg/l, which is within the 1000 mg/l FMEnv standard for surface water. Water with a high TDS content has an adverse flavor, sometimes tasting brackish, salty, and bitter. TDS also enhances color and turbidity of water, and it could cause laxative or constipation in humans.

**Total Suspended Solids (TSS):** TSS are the solids in water that can be trapped by a filter. Value recorded was 0.022mg/l and 0.0140mg/l for both hand-dug well and borehole respectively. Both concentrations were below FMEnv recommended limit of <10mg/l for potable water.

**Biochemical Oxygen Demand (BOD):** BOD is the amount of dissolved oxygen (DO) needed by aerobic biological organisms to break down organic material present in water at a certain temperature over a specific period. The higher the rate of BOD present in water, the more rapidly oxygen depletes in the water body. This means less concentration of oxygen available to higher forms of aquatic life; and the consequences become stress,

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suffocation and death of the aquatic organisms. BOD was detected at 25.4mg/l in the water sample, thus, below the 30mg/l limit of FMEnv.

**Chemical Oxygen Demand (COD):** COD is the amount of dissolved oxygen needed in water to decompose organic materials. It is a measure of water and waste water quality, and it increases as the concentration of organic material increases. Water with high COD typically contains decaying plant matter, human waste, or industrial effluents. COD value recorded in the water sample was 100.6mg/l, which is slightly above 100mg/l FMEnv limit.

**Cations:** Cations are positively charged ions. They are formed when a metal loss its electron(s), to possess net positive charge(s). The surface water sample is enriched with cations and anions. Cations occur in increasing order:  $\text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+ > \text{Na}^+$ , meaning the bedrock is rich in Ca, Mg, K and Na nutrients. Their values obtained in the surface water sample were Ca=119.84mg/l and Mg=34.24mg/l.

**Anions:** Anions are negatively charged ions. They are formed when a non-metal gains electron(s). Anions in the surface water sample occur in decreasing order:  $\text{Cl}^- > \text{SO}_4^{2-} > \text{NO}_3^- > \text{PO}_4^{3-}$ . Their values as obtained from the sample were  $\text{SO}_4^{2-} = 62.2\text{mg/l}$ ,  $\text{NO}_3^- = 12.90\text{mg/l}$  and  $\text{PO}_4^{3-} = 0.514\text{mg/l}$ . They were all within the FMEnv limit of 250, 10 and 5mg/l recommended for potable water.

**Heavy Metals:** Heavy metal is metals with relatively high density, atomic mass or atomic numbers (James C. Nwafor, 2006). Several acute and chronic toxic effects of heavy metals affect different body organs: kidney, nervous system disorders, vascular damage, cancer, birth defects, etc. are examples of complications as a result of heavy metals' toxic effects. From laboratory investigation, values of Mn, Fe, Zn and Cu obtained from surface water sample were 0.233mg/l, 0.6851mg/l, 0.513mg/l and 0.208mg/l. Apart Cu and Fe whose values are above the FMEnv limit, Mn and Zn as well below the set limit. Other heavy metals such as Pb, Ni, and Cd were also detected, and are within the FMEnv limit.

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**Coliform:** Coliform bacteria are organisms that are present in the environment and in the faeces of all warm-blooded animals and humans. Coliform bacteria will not likely cause illness, however, their presence in water indicates that disease-causing organisms (pathogens) could be in the water system. Value recorded of coliform in the water sample was 430CFU/ml, which is above 400CFU/ml limit set by FMEnv. Exposure to the water body could result to health issues which includes gastrointestinal upset and general flu-like symptoms such as fever, abdominal cramps, and diarrhea.

**Escherichia Coli:** *E. coli* was present in the water sample, with concentrations up to  $2.0 \times 10^2$ . Escherichia Coli (*E. Coli*) is a sub-group of the fecal coliform group. Most *E. coli* bacteria are harmless and are found in great quantities in the intestines of people and warm-blooded animals. Some strains, however, can cause illness. The presence of *E. coli* in a drinking water sample almost always indicates recent fecal contamination, meaning there is a greater risk that pathogens are present.

**Salmonella:** Salmonella was present in the water sample, with concentrations up to  $0.7 \times 10^2$ . Salmonella infection (salmonellosis) is a common bacterial disease that affects the intestinal tract. Salmonella bacteria typically live in animal and human intestines and are shed through stool (faeces). Humans become infected most frequently through contaminated water or food.

**Shigella:** Surface water is contaminated with shigella when feces from infected people or animals or sewage finds its way into the surface water body. Shigella bacteria can causing large waterborne disease outbreaks such as stomach pain, diarrhea and fever to people who are infected. Shiegella was present in the surface water sample, with value up to  $0.6 \times 10^2$ .



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## **4.8 Ground Water Quality**

Both natural and man-made factors controls the chemistry of groundwater. Chemical composition of geologic formations affects the hydrochemical characteristics of groundwater during their circulation in the subsurface (Elango et al. 2003). This underground passage through the pore spaces and weathered zones may alter the natural composition of the groundwater through the action of various hydrochemical processes (Rajmohan and Elango 2004). In other words, the many processes occurring in groundwater can be revealed by the composition of the water. Numerous human activities have the potential to alter the chemistry of groundwater. These include industrial pollutants and point sources such as waste disposal facilities.

### **4.8.1 Groundwater Vulnerability**

The reason for the vulnerability categorization is the ease with which pollutants can pass through the fracture and weathered formation as a result of rainfall and runoff carrying over from the surface to groundwater. This assessment is based on the generic consideration of soil and rock types and does not indicate that the risks to individual sources are high.

### **4.8.2 Sampling Methodology**

Ground water sample were typically collected from a hand-dug well in Kuhu and from the discharge line of a borehole in Malmo communities which are closest to the proposed AIH project site. These samples were collected using 750ml plastic bottles, labeled appropriately, preserved in ice pack and transported to AEPB Laboratory in Abuja for laboratory analysis.



Plate 1.15: Ground water sample collection and *in situ* measurement

**Table15: Proposed SAPZ Physical / Chemical Parameters of Ground Water Sample**

Sl. No	PARAMETERS	Source: Environmental work, 2024	GW1 Kuhu	GW2 Malmo	FME Env LIMIT
<b>Analytical Discussion of Groundwater Results</b>					
<b>A PHYSICAL TEST</b>					
1	Odour		Odorless	Odorless	Odorless
2	TEMPERATURE ( °C)		30.4	31.1	<40
3	pH		7.5	7.3	6-9
4	ELECTRICAL CONDUCTIVITY (µS/cm)		315.0	341.0	1000
5	DISSOLVED OXYGEN (mg/l)		3.5	3.7	7.5
6	TOTAL DISSOLVED SOLIDS (mg/l)		158.0	171.0	500
7	SALINITY (%)		0.01	0.01	0.0
8	ALKALINITY (mg/l)		26.0	29.0	100
9	TOTAL SUSPENDED SOLID mg/l)		0.0130	0.0140	<10
<b>B CHEMICAL TEST</b>					
10	TOTAL HARDNESS (mg/l)		308.16	291.04	200
11	MAGNESIUM HARDNESS (mg/l)		85.60	85.60	50
12	CALCIUM HARDNESS (mg/l)		222.56	205.44	150
13	PHOSPHATE (mg/l)		0.295	0.488	5
14	NITRATE as NITROGEN (mg/l)		5.40	7.80	10
15	TOTAL CHLORIDE (mg/l)		11.6	7.80	250
16	BOD (mg/l)		-	-	7.5
17	COD (mg/l)		-	-	30
18	SULPHATE (mg/l)		57.9	62.7	250
<b>C HEAVY METAL</b>					
19	MANGANESE (mg/l)		0.214	0.194	0.2
20	IRON TOTAL (mg/l)		0.398	0.628	1.5
21	COPPER (mg/l)		0.003	0.005	0.1
22	CADMIUM (mg/l)		0.008	0.007	0.05
23	ZINC (mg/l)		0.116	0.158	0.1
24	LEAD (mg/l)		0.0011	0.0016	0.05
25	NICKEL (mg/l)		0.006	0.009	0.05
<b>D BACTERIOLOGICAL</b>					
26	Total Coliform count (CFU/100ml)		4.1	2.9	1.8
27	Escherichia Coli (cfu/ml)		2.7 X 10 <sup>1</sup>	1.0 X 10 <sup>1</sup>	Absent
28	Salmonella (cfu/ml)		1.8 X 10 <sup>2</sup>	1.1 X 10 <sup>2</sup>	Absent
29	Shigella (cfu/ml)		0.0	0.0	Absent
30	staphylococcus (cfu/100ml)		0.0	0.0	Absent

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ter samples collected from the hand-dug well and community borehole at both Kuhu community and Malmo community respectively were analysed for physical, chemical heavy metal and bacteriological concentrations at the Abuja Environmental Protection Board Laboratory at Asokoro, Abuja; and result presented (Table 4.9 above) and analyses below as follows:

**Temperature:** Temperature is the degree of coldness or hotness of a body. It is an important factor that contributes to a chemical reaction. Groundwater temperature varies from place to place and so is with weather conditions. The average temperature during field work was 38.7<sup>0</sup>C. Temperature values recorded for both water samples of the hand-dug well and borehole were 30.4<sup>0</sup>C and 31.1<sup>0</sup>C respectively. Both are below the <40<sup>0</sup>C FMEnv permissible limit for potable water.

**pH:** pH of a solution is described as the negative logarithm to base 10 of hydrogen ion concentration. pH defines acidity, neutrality and alkalinity of the groundwater sample analyzed. A slightly alkaline pH value obtained for both water samples are 7.5 and 7.3 for the hand-dug well in Kuhu community and community borehole in Malmo community respectively. RPI, (1985) and Ideriah *et al.*, (2010) opines that water with pH values in this range is safe for consumption; and the pH value falls within the recommended pH range of 6-9 by FMEnv.

**Alkalinity:** Alkalinity is a measure of water's ability to resist pH changes that lead to acidity, or to neutralize acids, and maintain a fairly stable pH. This ability is usually referred to as water's 'buffering capacity'. Alkaline water has a pH of 8 or higher. The pH scale is used to measure the alkalinity of water. Water with a pH of 8 to 10 is considered mildly alkaline, while water with a pH of 10+ is considered very alkaline. A pH of 7 is neutral, while anything lower than 7 is considered acidic. Alkalinity values recorded were 26.0mg/l and 29.0mg/l for the hand-dug well Kuhu community and borehole in Malmo community respectively. Both values are below FMEnv recommended limit of 100mg/l for water portable.

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**Conductivity:** Conductivity is described as ionic mobility in solution. In other words, conductivity is a key electrical property of that solution. With the temperature of the samples being 30.4<sup>0</sup>C and 31.1<sup>0</sup>C, conductivity values of the water were 315.0µS/cm and 341.0µS/cm respectively. The value shows that the conductivity of the water sample was low, indicating lower ionic richness when compared with the permissible limits of 1000µS/cm established by FMEnv.

**Total Hardness:** Hardness refers to the amount of dissolved calcium or magnesium in water which makes the water difficult to form lather with soap. Calcium and magnesium are divalent metal ions that come from minerals dissolved in the water. The total hardness value recorded for both water samples were 308.16mg/l and 291.04mg/l respectively. Both values are above 200mg/l permissible limit set by the FMEnv.

**Salinity:** Salinity is the amount of dissolved salt in a body of water. It makes a significant contribution to conductivity and influences many aspects of the chemistry of natural waters as well as the biological activities that take place there. Temperature, pressure, and salinity all influence the physical properties of water, including its density and heat capacity. Salinity values for both samples were 0.01mg/l. Salinity level that are too high can be harmful to freshwater plants and animals and dangerous for drinking, irrigating, and watering livestock.

**Dissolved Oxygen (DO):** Dissolved oxygen is the amount of oxygen present in water, as measure of how much oxygen from the atmosphere that is dissolved in water. DO is the amount of oxygen available to living aquatic organisms, and tells a lot about water quality, because life in aquatic environment is supported by the presence of DO. Values recorded were 3.5mg/l and 3.7mg/l as against the 7.5mg/l limit of FMEnv.

**Total Dissolved Solids (TDS):** Total dissolved solids indicate concentration of inorganic salts: calcium, magnesium, potassium, sodium, bicarbonates, chlorides, sulphates and some amounts of organic matter that are dissolved in water. TDS values recorded were 158mg/l and 171mg/l, and they falls within FMEnv limit of 500mg/l for potable water. High value of TDS in groundwater affects the taste of water; it can make water taste

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bitter, salty, and brackish. Higher solids in water increase turbidity and colour of water. Water containing high solid may cause laxative or constipation effects (Sasikaran *et al*, 2012)

**Total Suspended Solids (TSS):** TSS are the solids in water that can be trapped by a filter. Value recorded were 0.0130mg/l and 0.0140mg/l for both hand-dug well and borehole respectively. Both concentrations were below FMEnv recommended limit of <10mg/l for potable water.

**Biochemical Oxygen Demand (BOD):** BOD is the amount of dissolved oxygen (DO) needed by aerobic biological organisms to break down organic material present in water sample at a certain temperature over a specific period. BOD was not detected in both water samples, thus, both water are safe for drinking BOD concentrations for observed for both samples falls within FMEnv limit of 7.50mg/l for potable water.

**Chemical Oxygen Demand (COD):** COD is the measure of water and waste water quality. COD increases as the concentration of organic material increases. Water with high COD typically contains decaying plant matter, human waste, or industrial effluents. COD is the amount of dissolved oxygen needed in water to decompose organic materials. COD was not detected in both water samples, thus, both water are safe for drinking COD concentrations for observed for both samples falls within FMEnv limit of 30mg/l for potable water.

**Cations:** Cations are positively charged ions. They are formed when a metal loss its electron(s), to possess net positive charge(s). The Groundwater sample is enriched with cations and anions. Cations occur in increasing order:  $\text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+ > \text{Na}^+$ , meaning the bedrock is rich in Ca, Mg, K and Na nutrients. Their values obtained in the groundwater samples were Ca=222.56mg/l and Mg=85.60mg/l for the hand-dug well, and Ca=205.44mg/l and Mg=85.60 for the borehole respectively. These values were above the FMEnv limits of 150mg/l and 50mg/l and for cations recommended for potable water.

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**Anions:** Anions are negatively charged ions. They are formed when a non-metal gains electron(s). Anions in the groundwater sample occur in decreasing order:  $\text{Cl}^- > \text{SO}_4^{2-} > \text{NO}_3^- > \text{PO}_4^{3-}$ . Their values for the groundwater sample obtained were  $\text{SO}_4^{2-} = 57.9\text{mg/l}$ ,  $\text{NO}_3^- = 5.4\text{mg/l}$  and  $\text{PO}_4^{3-} = 0.2951\text{mg/l}$  for the hand-dug well, and  $\text{SO}_4^{2-} = 62.7\text{mg/l}$ ,  $\text{NO}_3^- = 7.8\text{mg/l}$  and  $\text{PO}_4^{3-} = 0.488\text{mg/l}$  for the borehole respectively. They were all within the FMEnv limit of 250, 10 and 5mg/l recommended for potable water.

**Heavy Metals:** Heavy metal is metals with relatively high density, atomic mass or atomic numbers (James C. Nwafor, 2006). Several acute and chronic toxic effects of heavy metals affect different body organs: kidney, nervous system disorders, vascular damage, cancer, birth defects, etc. are examples of complications as a result of heavy metals' toxic effects. From laboratory investigation, values of Mn, Fe, Zn and Cu obtained from groundwater samples were 0.214mg/l, 0.3981mg/l, 0.116mg/l and 0.003mg/l for the hand-dug well, and 0.194mg/l, 0.628mg/l, 0.158mg/l and 0.005mg/l for the borehole respectively. Apart from the hand-dug well for which concentration of Manganese was 0.214mg/l which is above FMEnv limit for potable water, all other concentrations recorded were below limits of 0.2mg/l, 1.5mg/l, 0.1mg/l, and 0.1mg/l recommended by FMEnv for potable water. Other heavy metals such as Pb, Ni, and Cd were below equipment detection limits of (0.0001mg/l).

**Coliform:** Coliform bacteria are organisms that are present in the environment and in the faeces of all warm-blooded animals and humans. Coliform bacteria will not likely cause illness, however, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in the water system. Values recorded of coliform in both water samples were 4.1CFU/ml and 2.9CFU/ml against 1.8CFU/100ml which is the limit set by FMEnv. This indicates members of both Kuhu and Malmo communities are exposed health effect associated with consumption of the water, which includes gastrointestinal upset and general flu-like symptoms such as fever, abdominal cramps, and diarrhea.

**Escherichia Coli:** *E. coli* was present in the water samples with concentrations ranging up to  $2.7 \times 10^1$  and  $1.0 \times 10^1$ . Escherichia Coli (*E. Coli*) is a sub-group of the fecal

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coliform group. Most *E. coli* bacteria are harmless and are found in great quantities in the intestines of people and warm-blooded animals. Some strains, however, can cause illness. The presence of *E. coli* in a drinking water sample almost always indicates recent fecal contamination, meaning there is a greater risk that pathogens are present.

**Salmonella:** Salmonella was present in the water samples with concentrations ranging up to  $1.8 \times 10^2$  and  $1.1 \times 10^1$ . Salmonella infection (salmonellosis) is a common bacterial disease that affects the intestinal tract. Salmonella bacteria typically live in animal and human intestines and are shed through stool (feces). Humans become infected most frequently through contaminated water or food.

**Shigella:** Shigella was absent in the groundwater sample. Shigella are bacteria that cause an infection called shigellosis. Shigella causes diarrhea, fever and stomach cramps.

## 4.9 Biodiversity Studies

Biological diversity or biodiversity simply means the resources upon which individuals, families, communities, nations and future generations depend. It is the link between all organisms on earth, binding each into an interdependent ecosystem in which all species have their role. It is the web of life.

### 4.9.1 Terrestrial Biodiversity

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.” Ecosystem services are the benefits that ecosystems provide to humans and the environment, and biodiversity is the source of these benefits. These services includes:



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- (i) provisioning services, which are the products people obtain from ecosystems;
  - (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes;
  - (iii) cultural services, which are the non-material benefits people obtain from ecosystems;  
and
  - (iv) support services, which are the natural processes that maintain the other services.

Biodiversity frequently serves as the foundation for ecosystem services that people value. Therefore, effects on biodiversity can frequently have a negative impact on the provision of ecological services. The management and mitigation of the proposed AIH project's impacts on biodiversity and ecosystem services by clients over the course of the project are covered by this Performance Standard.

The objectives of this biodiversity study are to:

- Identify biodiversity resources in the study area,
- Identify the benefits from biodiversity,
- Determine the ecosystem services of the biodiversity and ensure sustainable management of the resources through appropriate conservation measures.

Most of the detailed biodiversity inventories in Nigeria are held as propriety rights of multinational oil companies who often conduct such exercises as a pre-requisite for their operations. However, private recording is a new and a fascinating trend. This is owed largely to greater awareness, economy liberalization, threat of changing climatic regimes and enforcement of the ESIA act and its various instruments. The availability of biodiversity data in most regions is poor. The few that exist are mainly ESIA reports of telecommunication firms and quarrying operation. And these include *Bridelia ferruginea*, *Cadaba grandulosa*, *Cola cordyla*, *Cordia stuhlmannii*, *Detarium microcarpum*, *Diospyros mespilliformis* and *Erythrophleum africanum* plant species, and *Osteolaemus tetraspis*, *Agama agama*, *Alligator sinensis*, *Civettictis civetta*, *Rattus rattus*, *Helioscius rufobrachium* and *Potamochoerus porcus* fauna species were constantly mentioned in the reports of the reviewed ESIA's.

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#### 4.9.2 Flora Studies

Bauchi State is one of the states in the northern part of Nigeria that span two distinctive vegetation zones, namely, the Sudan savannah and the Sahel savannah. The northern part of the state which hosts the proposed AIH is located in the Sahel savannah region. The Sahel has a tropical semi-arid climate according to Köppen climate classification which is typically hot, sunny, dry, windy all year long and receives a low to very low amount of precipitation annually.

The Sahel typically, is mostly covered in grassland and savanna, with areas of woodland and shrubland. Grass cover is fairly continuous across the region, dominated by annual grass species such as *Cenchrus biflorus*, *Schoenefeldia gracilis* and *Aristida stipoides*. Species of acacia are the dominant trees, with *Acacia tortilis* the most common, along with *Acacia senegal* and *Acacia laeta*. Other tree species include *Commiphora africana*, *Balanites aegyptiaca*, *Faidherbia albida*, and *Boscia senegalensis*. Areas of desert shrub, including *Panicum turgidum* and *Aristida sieberana*, alternate with areas of grassland and savanna. During the long dry season, many trees lose their leaves and the predominantly annual grasses die.

##### ***Sampling Parameters and Methods***

Floristic data were collected randomly using a 50cm quadrant. 10 sampling points considered for the purposed of this study. Observations and photographic methods were also employed. Trees, grasses and shrubs were identified, photographs taken and checks carried out in plant album.

Result revealed that trees dominates the proposed AIH project site. Others are shrubs and grasses. Most of the species for this report were identified in the field. Unknown species were collected, pressed and preserved for identification at The National Park Service, off Umaru Musa Yar'Adua Expressway in Abuja. Furthermore, botanical exploration was carried out for collection and listing of plant species not encountered within the sampled plots. Literature and herbaria were consulted for species already listed for the area. Table 4.10 and Plate 4.4 presents photographs and list of plant species observed in the course of this study.







Plate 1.16: Photographs showing plant species observed in the study area

**Table15: List of Plant Species observed in the project area**

S/N	Scientific Name	Common Name	Family	Conservation Status
1	<i>Erythrophleum lasisnthum</i>	Ordeal tree	Fabaceae	Least Concern
2	<i>Chukrasia tabularis</i>	Chittagong wood	Meliaceae	Least Concern
3.	<i>Cordia dichotoma</i>	Clammy Cherry	Boraginaceae	Least Concern
4.	<i>Eucalyptus camaldulensis</i>	River bed gum	Myrtaceae	
5.	<i>Salsola tragus</i>	Windwitch	Amaranthaceae	
6.	<i>Shorea robusta</i>	Sal tree	Dipterocarpaceae	Least Concern
7.	<i>Guaiacum colteri</i>	Guayacan	Zygophyllaceae	
8.	<i>Ziziphus lotus</i>	Lotus tree	Rhamnaceae	
9.	<i>Acacia seyel</i>	Shittimwood	Leguminosae	
10.	<i>Balanite aegyptiaca</i>	Desert date	Zygophyllaceae	
11.	<i>Azadirata ctaindica</i>	Neem	Meliaceae	Least Concern
12.	<i>Adansonia digitata</i>	Baobab	Malvaceae	Least Concern
13.	<i>Faidherbia albida</i>	Apple-ring acacia	Fabaceae	
14.	<i>Tamarindus indica</i>	Tamarind tree	Fabaceae	
15.	<i>Hyphaene thebaica</i>	Doum	Arecaceae	Least Concern
16.	<i>Anogeissus leiocarpus</i>	n birch; Bambara	Combretaceae	

Source: Field study, 2024

### IUCN Status of the Flora

IUCN Red List is set as precise criteria to evaluate and classify species in terms of high risk of global extinction. The general aim is to provide an explicit and objective framework for conservation of the species to the public and policy makers, as well as help the international community reduce activities leading to species extinction. This is because the Red lists are among the most widely used conservation tools globally. The IUCN status of the plant resources for the studied area was evaluated using IUCN version 2017 .3 criterion. The results showed that some of the plant species encountered do not fall to the categorization of IUCN Red lists while some are carrying Least Concerned (LC) recognition.

### 4.9.3 Life form of the Plants in the Area

The results revealed that trees formed the dominant life form in the study area which accounted for 57.45% followed by Shrub (36.15%). Grass accounted for 3.85% (Table 4.11). Some of the tree species encountered include *Sterculia oblongata*, *Anthocleista vogelli*, *Albizia zygia*, *Musanga Cecropioides*, *Terminali ivorensis*, *Tabernaemontana pachysiphon*, *Raphia sudanica*, *Cleistopholis patens*, *Albizia ferruginea*, *Albizia zygia*.

**Table16: Life form of the Plants in the Location**

Form	No	Percentage
grass	4	4.12
shrub	36	37.11
tree	57	58.76
	97	<b>100.00</b>

Source: Fahamu Field study, 2024

## 4.11 Socio-Economic Assessment

### 4.10.1 Introduction

The socio-economic baseline describes the existing social conditions essential to identifying and assessing the potential impacts of a proposed project. The baseline data was collected through various methods, including a review of secondary data, primary data collection from key informant interviews, village-level surveys, Focus Group Discussions (FGD), and household surveys. The data was used to assess potential impacts and generate mitigation measures for the ESIA study. The primary objective of this study was to survey the baseline social and economic features of the host communities (Kuhu, Malmo and Gubi) where the proposed SAPZ project is located. The aim of the study was to ascertain the potential effects of the proposed SAPZ project on the social and economic lives of the people of the communities including potentially positive effects. Specifically, this study was undertaken to achieve the following objectives:

- Establish baseline Socio-economic and health status of the host communities.

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- Identification or definition of ameliorative/mitigation/enhancement measures such as to protect and promote socio-economic and public safety.
  - Advise on management or implementation plan so as to control levels of impacts.
  - Define a monitoring mechanism that would ensure performance. ○ Incorporate socio-economic and health factors in decision making.

#### **4.10.2 Socio-economic Study Methodology**

This socio-economic study was undertaken based on recommended guidelines by the appropriate regulatory agencies such as the Federal Ministry of Environment (FMEnv) as contained in the EIA Act CAP E12 LFN 2004. The methods adopted in the collection and analysis of information are discussed below.

##### **Research Design**

A descriptive research design has been selected to provide in-depth explanation and analysis using quantitative and qualitative approaches. The overall study design entailed determining the target populations i.e. the population of the host/impact community of the project. It also involved making decisions to:

- Whether to obtain information at one point several points in time
- The methods of data collection; and
- Whether questionnaires, if used should be self - administered face-to-face, using trained interviewers.

It was decided that:

- Questionnaires were used and administered face to face to house hold respondents at one point in time by trained assistants;
- Discussions were held with focus groups;
- Key informants (Knowledgeable persons within the community) were interviewed;
- Observation and measurements of key community features were undertaken by trained assistants; and that photography was liberally employed to clarify the community and project features



- In terms of research design, the study belongs to the class described as ‘passive Observation’ (Cook and Campbell, 1979), in the sense that subjects were studied in-situ, without any form of experimental manipulation.

### **Instrumentation and Data collection**

This Study employed both primary and secondary data sources. The latter comprised government records and internet, while the former included pre-coded questionnaires, interviews (of Key Informants), Focus Group Discussion (FGDs), direct observation, direct measurement, standardize formats for recording observations, photography, and participatory research.

#### ***Primary Data Collection***

The various data collection tools are described below:

##### **a) Questionnaires**

A detailed and structured questionnaire was used alongside other methods to acquire relevant information. Questionnaires had questions on basic demography, livelihood of inhabitants, availability of social infrastructure etc. This was distributed and completed for the project area. A total of 347 questionnaires were administered among the residents of the project areas and the same number of copies were retrieved for analysis of the socio-economic baseline for the project area.

Table 4.12 presents the distribution of administered questionnaires per community. The questionnaires were administered based on the size of the community. Considering the homogeneity of the population, this sample size is considered adequate. In administering the questionnaire, a purposive sampling procedure was utilized to select individuals/groups that were sampled for the survey.

**Table17: Questionnaire administered and retrieved per community**

S/N	Community	No of questionnaire administered	No of questionnaire retrieved
1.	Kuhu	50	50
2.	Malmo	50	50
3.	Gubi	247	247
	<b>TOTAL</b>	<b>347</b>	<b>347</b>

Source: Field study, 2024

## b) The Stakeholder Engagement Process (SEP)

Stakeholder engagement is an all-inclusive, interactive, systematic and continuous process, spanning the entire life cycle of a project, in which stakeholders are engaged as active partners in establishing the priorities and focus of a project or programme; and not treated merely as the passive recipients of the project when completed. Stakeholders' engagement is all about redressing the problem of nonparticipation of stakeholders by providing strategies, processes and infrastructure to enable the proponent to:

- i. Discover what really matters to key stakeholders involve them in providing feedback on corporate strategies and performance and in identifying what and how things can be changed.
- ii. Monitor and manage stakeholder's contributions and satisfaction levels.

Information disclosure and consultation will be carried out throughout the preparation period, construction period and operation period of the project, by laying primary focus on the requirements (inclusiveness) of directly affected and vulnerable groups, such as the elderly, women, physically challenged, etc. Table 4.13 is a list of categories of stakeholders consulted.

**Table18: List of categories of stakeholders consulted**

S/N	Categories of Stakeholders	Institutions consulted
1.	Government Ministries, Departments	<ol style="list-style-type: none"> <li>1. Federal Ministry of Environment</li> <li>2. Bauchi State Ministry of Environment</li> <li>3. Federal Controller, Bauchi State Ministry of Environment.</li> <li>4. Ministry of Agriculture, Bauchi State</li> <li>5. Ministry of Agriculture Extension Services</li> <li>6. Bauchi State Agricultural Development Programme</li> <li>7. Bauchi LGA</li> <li>8. Katagum LGA</li> <li>9. Darazo LGA</li> <li>10. Ganjuwa LGA</li> <li>11. Alkaleri LGA</li> <li>12. Tafawa Balewa</li> </ol>
2.	Traditional Institution	Mai Angwa, Sariki, Imam, Hakimi
3.	Youths, Women Leader and Community Based Organisations	Youths, Women Leader, Community Based Organisations, Mai Angwa in the communities

Source: Fahamu Field Work, 2024

Other sources of primary data utilized for this socio-economic study include: interviews, Focus Group Discussion (FGDs) and participant observation. While interviews and participant observation were used to source information on socio-economic indices, public consultation provided the basis for understanding the attitude, perception and approach of the people to the issues surrounding the project area. Questionnaires with both open and closed-ended questions providing data on socio-economic and health indices were utilized.



**Plate 1.17:** Pictorial evidence of consultation at Gubi



**Plate 4.18:** Pictorial evidence of consultation at Malmo and Kuhu

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## **Concerns and Expectations of the respondent from the Project**

Various interactions with the communities' residents revealed that the people are happy to see development projects in their area since it will lead to community development. There concerns arising from their previous experience of Gubi dairy farm that later collapsed and also, people from the Kuhu community that are farming and rearing animals inside the project site. They are concerned that the project will lead to retaken over their farm and ranching space.

Notwithstanding their concerns, they expressed eagerness to welcome the project with the desire that employment will be created for their youths, good road constructed to ease the current transportation problem, provision of electricity, potable water, hospital/clinic and schools for their children.

They are given the assurance of continuous consultation to fine tune a system of addressing all their concerns and that some percentage or workers shall be employed from their communities while affected farmers are compensated.

### ***Secondary Data Collection***

The Secondary sources of data collection were utilized particularly in areas where the primary data sources suffer limitations or constraints. Thus, information was sourced in alignment with the objective of this survey from relevant stakeholders such as the National Population Commission, the National Bureau of Statistics and the National Institute of Social and Economic Research. Other secondary data sources include:

#### **a) Maps and Literature Search**

The exercise commenced with the identification of leadership in the affected communities and government organs within the project area. Existing administrative, topographic and street maps were adopted. Extensive literature searches relevant to the area and the proposed ZAPS project were conducted with a view to acquiring initial information on the characterization of the area. The activity culminated in the generation of a checklist of environmental attributes that may be affected.

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## **Data Analysis**

Data collected were analysed using appropriate statistical software packages. Most quantitative data were subjected to inferential statistics such as percentages, ratios, mean etc.

### **4.10.3 Socio-economic Baseline Information**

Baseline information on socio-economic was obtained through the following activities:

- Reconnaissance survey, selection and training of survey assistant;
- Pre-stating of questionnaires;
- Household listing;
- Field Identification and Interview of Key Informants;
- Questionnaire administration and interview of Key assistance.
- Focus Group Discussion (FGD) and
- Photography and geo-location of key features.

The socio-economic baseline information obtained for this study include:

- Demographic Profile of the study area;
- Administrative and socio-cultural institutions;
- Livelihood Assets and Activities;
- Infrastructure and Services;
- Housing Structures/settlement patterns;
- Land Acquisition;
- Project Affected Persons (PAPs);
- Waste management;
- Health Profile;
- Gender Assessment; and
- Community Concerns and Perceptions.

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#### 4.10.4 Affected Communities and People

The Proposed Gubi-AIH Project is situated in Gubi, Bauchi Local Government Area of Bauchi State. Other neighboring communities are Malmo and Kuhu communities.

##### *Bauchi State*

Bauchi State was created in 1976 and covers an area of 66,510 square kilometres. The State with 20 LGAs, shares border with Yobe State to the North-East, Jigawa State, to the North-West, Kano and Kaduna States to the West, Plateau and Taraba State to the South and Gombe State to the East. It lies within the tropical climatic zone with marked wet and dry season with Average Annual rainfall depth varying from 700mm to 1300mm. Bauchi is basically composed of crystalline rocks in Nigeria basement complex.

According to the National Bureau of Statistics, the state`s population is about 5,421,273 spread across 55 different ethnic groups with a population growth at an average of 3.4% per annum and represents 3.34% of Nigeria`s population. Predominant ethnic groups in Bauchi state are Hausa, Fulani, Gerawa, Sayawa, Jarawa, Bolewa, Karekare, Kanuri, Fa`awa, Butawa, Warjawa, Zulawa, and Badawa.

##### *Gubi community*

Gubi Community is located in Bauchi Local Government Area of Bauchi State, Nigeria. Its geographical coordinates are 10° 26' 23" North, 9° 48' 47" East. The distance from Bauchi to Gubi is about 24 kilometers away from Bauchi metropolis. Gubi has a tropical wet and dry savannah climate.

##### *Malmo Community*

This is a rural community with disperse housing settlements. Malmo community is an agrarian community where people involved in Crop farming (cultivation and growing of crops) Rearing of livestock. preservation of farm produce, as well as producing and maintaining of crops and farmland. The people engage in farming activities for a livelihood because of their vast fertile land. Different varieties of crops are produced in the area including rice, millet, sorghum, cowpea, groundnut, and soybeans. Furthermore, livestock such as cattle, sheep, and goats are produced in the area. The dominant

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language in the community is Hausa and Fulani Tribes. Meanwhile the Hausas are more in number. While Islam is the dominant religion of the people.

### ***Kuhu Community***

Kuhu village is a small settlement found in a rural inhabitant setting with unique economic and social activities due to their dynamics and peaceful ways of life. Kuhu villages is one of the community settlements that is sharing borderline with the project study area. Kuhu Community villagers is largely dependent on agriculture for livelihoods. The popular Sir Abubakar Tafawa Balewa Bauchi State International Airport is situated 2½ km west of Kuhu in the capital of Bauchi State. Also, the Abubakar Tafawa Balewa University is about 1 kilometer away from Kuhu village. The Proposed Special Agricultural Processing Zone situated Gubi Dairy Farm which was previously known as Gidan Madara is also situated very close to Kuhu/Malmo community area.

### ***Cultural Heritage***

There are no archaeological and sacred sites, such as traditional burial grounds and shrines in the communities. Furthermore, there are no taboos, although it is forbidden to entice married women into illicit relationship and stealing of any form is forbidden and attracts punishment. In conclusion, there are no taboos that will negatively impact contractor activity on the project. The major festivals celebrated within the study area are Muslim festivals such as "Salah" celebrations of IdeI fitri and IdeI Kabir.

### ***Religion***

The majority of the local population are Muslim with only a small number identified as Christians and adherents of traditional religion. The Christian households were found in the Gubi community accounted for about 3%.

## **4.10.5 Traditional Administrative Structure**

Running along with the state administrative structure are the traditional authorities. Although there is no traditional head of state, each state has a traditional leader and in the case of Bauchi state, there is an Emir. The Emir of Bauchi has authority over the whole state and is supported by an Emirate Council. The Emirate Council acts as an advisory

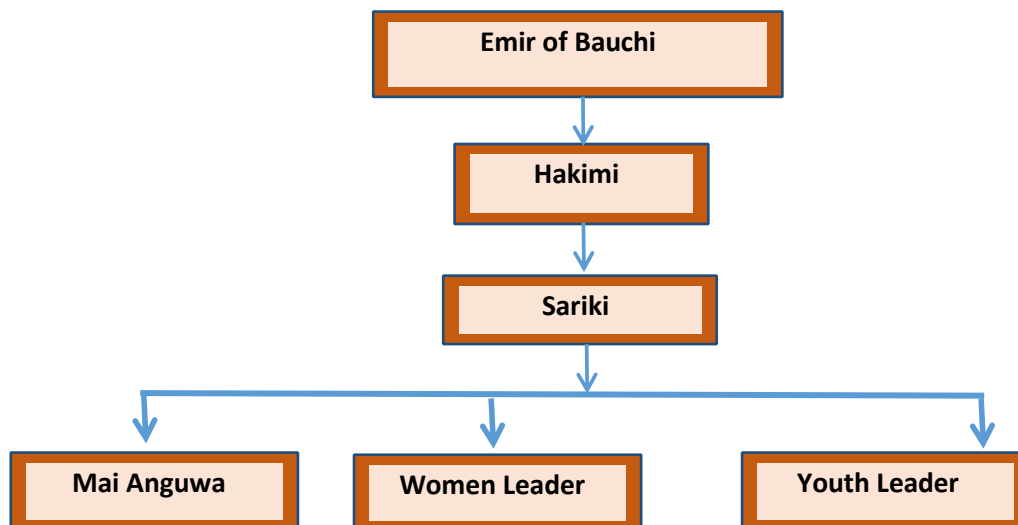


board to the Emir; council members are not elected, but selected based on their knowledge, skills and influence.

At LGA level there is no traditional authority equivalent, however, at the district level the Hakimi is the traditional leader. Each Hakimi is supported by a number of Seriki's, who are the traditional leaders at the settlement level. Seriki's are often supported by a Yerima, who is a trusted individual and often a family member, who shares responsibilities for managing the settlement. The final level in the traditional authority structure is a Mai Angwa, who is the leader of a sub-settlement and answers directly to the Seriki.

All traditional leaders are selected by the Emirate Council and the positions are hereditary with candidates chosen from members of a royal family. Once selected, the Hakimi, Seriki and Mai Angwa all need to be approved by the Emir before taking up the leadership position. The traditional authority continues to be an important administrative structure in the day to day lives of the local population. Cultural ties continue to be strong and although traditional leaders must subscribe to national laws, they have executive and judicial powers, and are key to conflict resolution.

Finally, within northern Nigeria, Imams also play a significant role in the lives of local people. Not all settlements have a mosque, but local people travel every Friday to their nearest mosque to pray. Imams continue to influence the behaviour and opinions of local people.



**Figure 4.9:** Showing Traditional Administrative Structure of Host Community

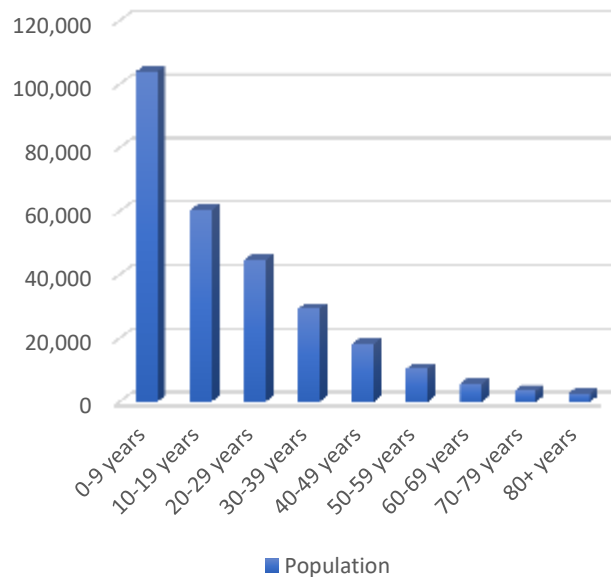
#### 4.10.6 Demographic Profile of the Study Area

##### (a) Population Size

According to the 2006 National Population Commission and National Bureau of Statistics of Nigeria (web), the population of Bauchi LGA is 493,730. This population has increased steadily over the years, 2022 projection placed the number at 881,600, with a population density of 273.9/km<sup>2</sup>. Therefore, the annual population change between 2006 and 2022 is 3.7%, with area of 3,219km<sup>2</sup> area. Furthermore, the structure of the population (2006 census) showed the children aged 0-9 had the highest proportion of the population, followed by ages 10 – 19 years and ages 20 – 29 years respectively, and the least were people 60 years and above. Males and females equal 50% in the area. The family size is large with an average of about 10-15 persons per house. The population characteristics of Bauchi LGA is presented by figure 4.10, 4.11 and table 4.11. The population of the affected communities were not documented. However, by estimation, the three communities of Gubi, Malmo and Kuhu have an estimated population of approximately 50,000 residents (Gubi – 20,000; Malmo – 16,000 and Kuhu – 14,000)



#### Population



**Figure 4.10:** Gender distribution of Bauchi LGA  
Source: 2006 Census

**Figure 4.11:** Age distribution of Bauchi LGA

**Table 4.14: Gender and Age Distribution of Bauchi LGA**

Age Distribution	Population
0-9 years	169,986
10-19 years	113,667
20-29 years	86,546
30-39 years	52,700
40-49 years	33,517
50-59 years	18,301
60-69 years	9,380
70-79 years	5,310
80+ years	4,323
Gender	
Males	252,420
Females	241,310

Source: 2006 Census

### (b) Ethnic Composition of Respondents

Generally, the project communities are a mix of two or more ethnic groups, with Gerewa representing the largest group and accounting for about 78% of respondents. Figure 4.12 below presents the ethnicity of respondents.

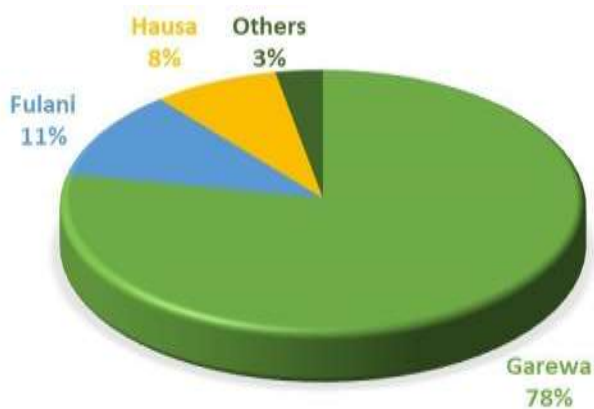


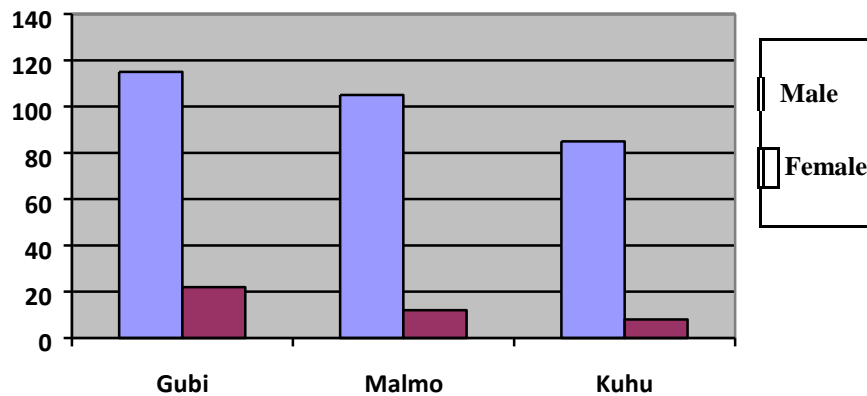
Figure 4.12: Ethnic groups of respondents in the project area

### (c) Gender Distribution of Respondents

A total of 347 questionnaires were administered across the three communities around the project area which include: Kuhu, Malmo and Gubi communities. The field survey revealed that the respondents is made up of 88% male and 12% female. The gender distribution of respondents across the communities is presented by table 4.67 and figure 4.13. The high proportion of males encountered in the project area can be attributed to the fact that many of the men are farmers, while their wives engage in trading activities nearby, additionally, cultural and religion belief does not permit married women to interact freely with male counterpart especially visitors.

**Table20:** Sex composition of the respondents

Community	Female	Male	Total
Gubi	22	115	137
Malmo	12	105	117
Kuhu	8	85	93
<b>Total</b>	<b>42</b>	<b>305</b>	<b>347</b>



**Figure 4.13:** Sex composition of respondents

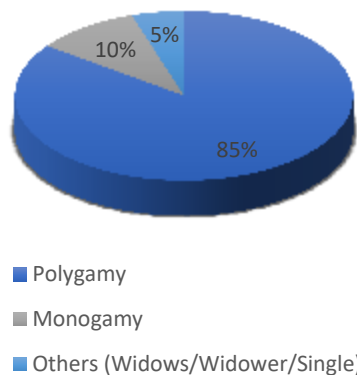
### (d) Marital status of Respondents

All the respondents across the three communities were married across the age-groups. However, 85% of the males practiced polygamy, while about 10% married only one wife and most of them with one wife are young people that just got married, but still have ambition of marrying another wife in near future. About 20% of the respondents are widows and widowers. This third category were largely elderly women who by reason of age have lost

their partners. Polygamy is more dominant in Northern Nigeria, due to cultural and religion belief. However, members of the communities marry at an early age of about 17 years old. The older men claimed that the several wives and children enabled them to maintain their farms and to support their farming and fishing occupations to feed and maintain the family.

**Table20: Nature of Marriage of Respondents**

Description	Number	Percentage
Monogamy	6	10
Polygamy	51	85
Others (widows, etc)	3	5
<b>Total</b>	<b>60</b>	<b>100</b>



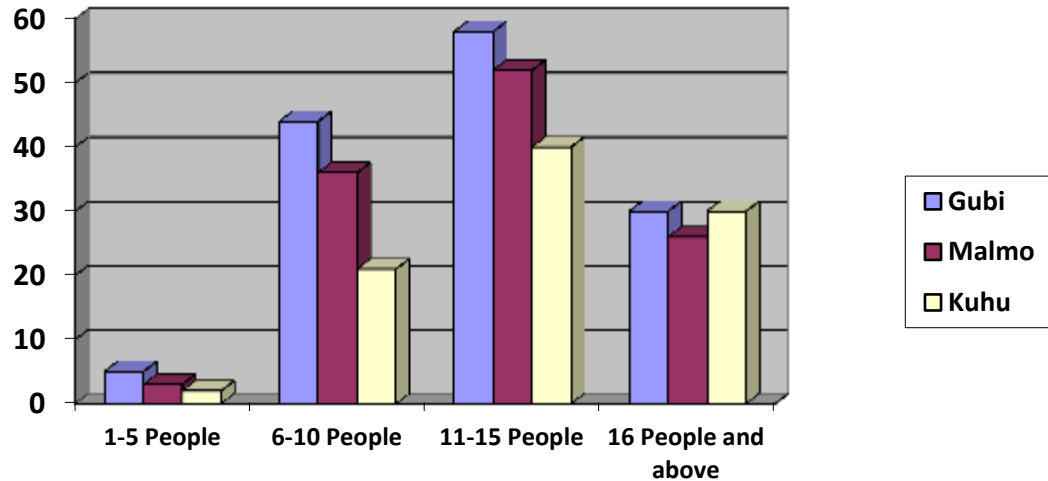
#### (e) Household Size of Respondents

Information on household size of the communities in the project area is presented in figure below. As could be seen, the dominant household sizes in the project area are those made up of 11-15 persons, accounting for 43% of the households, closely followed by those made up of 6-10 persons (29%), 16 above 25% and 1-5 made up only 3%. The predominance of large family size is as result of polygamy widely practiced in the region of the project site and peculiarity of rural dwellers maintaining large family sizes to secure additional hands during agricultural activities, which are their main occupations. Furthermore, table below also corroborated the rural dwellers theory, as Malmo and Kuhu community that is more remote compared to the Gubi community have more numbers of large household.

**Table22:** Household Size of Respondents

Community	1-5 people in Household	6-10 people Household	11-15 people Household	16 people and above	Total
Gubi	5	44	58	30	137
Malmo	3	36	52	26	117
Kuhu	2	21	40	30	93
<b>Total</b>	<b>10</b>	<b>101</b>	<b>150</b>	<b>86</b>	<b>347</b>

Source: EISA Field work 2024



**Figure 4.14:** Household Size of Respondents

**(f) Literacy Level**

Educational attainment in the Project location is generally low, with a large number of survey respondents having no education and unable to read or write. The highest levels of education were found in Gubi, with 5% of respondents obtaining some form of tertiary education and a further 30% completing SSCE. Gubi also had fewer residents with no education (18%) and no residents that have only attended kindergarten.

The lowest levels of education attainment were found in Kuhu and Malmo, where two thirds of respondents (61%) have no education and an additional 19% stopped schooling at primary school level. No one has a tertiary education and just 1% have some sort of vocational training.

Religious education is important in most settlements around the Project location with an average of 16% of respondents attending a Qur’anic school. The settlement of Kuhu

reported the highest level of attendance for religious schooling, with 45% of respondents attended a Qur’anic school located inside the community.

Low levels of educational attainment by residents within the Project site are matched by low levels of literacy. Almost 70% of residents reported that they cannot read or write. Literacy levels between settlements follows the same patterns as educational attainment with the lowest levels of literacy found in Kuhu and Malmo(13%) and the highest found in Gubi 30%.

The Educational status showed that about 61.67% of respondents have had at least primary education and can speak using Hausa Language. As shown in table below, respondents that have had secondary and tertiary education were very few (10.8%) as there is no presence of secondary school in the communities. About 30% of the residents had no formal education, though many of them attended Qur’anic schools, where they learn Arabic language and some also can communicate in Pidgin English, perhaps due to their interaction with city residents, the predominance of people without formal education are found at Kuhu and Malmo communities. Generally, the people were relatively informed on socio-economic and health issues relating to the overall development of the community.

**Table23: Educational attainment of the sampled community members**

Village name	mal education	Primary	Secondary	OND	HND	Degree
Gubi	28	89	17	12	5	4
Malmo	39	72	10	8	4	2
Kuhu	37	51	8	4	3	1
<b>Total</b>	<b>104</b>	<b>212</b>	<b>35</b>	<b>24</b>	<b>12</b>	<b>7</b>

#### 4.10.7 Economic Activities within the Project Area

##### (a) Land Use

The rural nature of the project area, the land is primarily used for crop farming and livestock rearing. Cropping is mostly mixed, and typically cultivated crops include maize, rice, millet, and guinea corn. Slash and burn is used for site clearing, with areas of regeneration used to feed livestock.



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There is usually some coordination between livestock farmers and crop farmers to maximize the effectiveness of land use. Farmers often have limited access to fertilizers and so at the end of each season the livestock farmers are encouraged to graze their animals on their land. This provides food for the livestock and manure for the farmers, also to avoid conflict of interest.

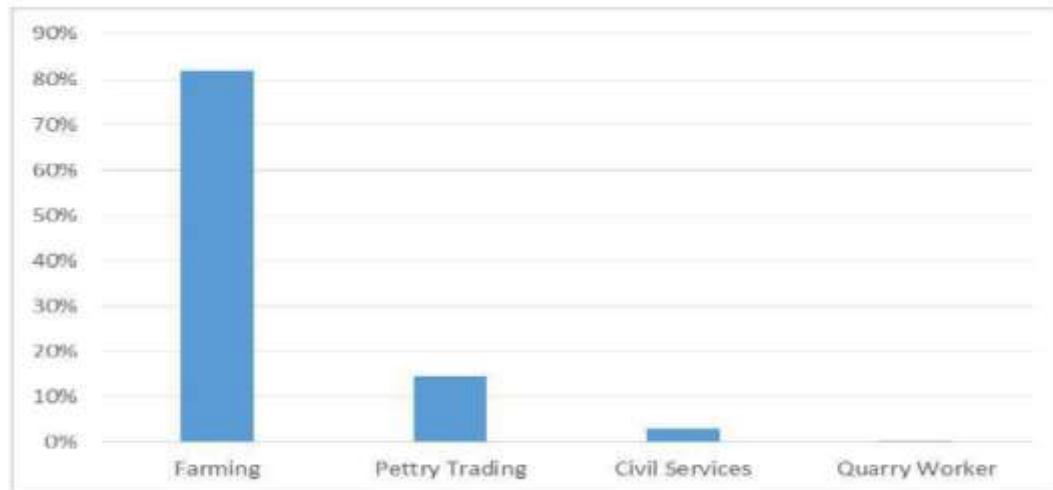


**Plate 1.18:** Land use in the study area (mixed land use)

### **(b) Occupation**

Being an agrarian community, farming is the predominant occupation within the proposed project area. Farming activities cut across all age groups and genders; majority of the inhabitants who are in government employment are also involved in farming during farming seasons as a means of supplementing their earnings from their various paid employment. Some of the crops grown include; guinea corn, maize, and tomatoes, sweet pepper, cucumber among others. However, the project would not negatively impact any of the farms or crops in this area much, as the project site is an area already mapped out for ranching, even though the surrounding community do farm inside it. Domestic animals reared include; sheep, goats, and cows. Petty trading activities were observed to be practiced by both male and female genders who were selling household items such as soft drinks, masa, kunu, snacks, cigarette, charcoal, food items, artisan worker and others. Fishing was observed only in Gubi community because of the water sources that converge at Gubi dam.

As shown in Figure 4.15, farming is the predominant occupation of people in the study communities (82% of the respondents). Other livelihood activities include trading/business (14.4%), civil service (3.1%) and industry worker (0.4%).



**Figure 4.15:** Occupation of Respondents

The farmers reported growing various types of crops as indicated in Table 4.17. The most popular crop was said to be maize which is grown by 62.4% of farmers. Other crops include beans (24.8%); millet (23.2%), ground nut 19.2%; rice 18.8%; guinea corn (8%), sorghum/cowpea (4.8%) and soya beans 0.8%.

**Table24:** Crops grown by farmers

Crops	No. of Farmers	%
Maize	156	62.4
Millet	58	23.2
Rice	47	18.8
Beans	62	24.8
Ground nut	48	19.2
Guinea corn	20	8.0
Sorghum/cowpea	12	4.8
Soya beans	2	0.8

### (c) Monthly Income of Respondents

Income distribution is highly dependent on the occupation and how much money an individual earns. The income distribution of the study area reveals that majority of the people are poor; where earnings from various economic activities were below one (1) Dollar per day. The table below shows that people in Gubi community, which is the most active commercially make more monthly income compared to the other two communities with less social activities.

**Table25: Monthly Income of Respondents**

Village name	> ₦5,000	₦5,000 - ₦20,000	₦20,000 - ₦50,000	₦50,000 - ₦100,000	100,000 and Above	Total
Gubi	4	21	52	36	24	137
Malmo	3	24	62	22	6	117
Kuhu	3	14	48	18	10	93
<b>Total</b>	<b>10</b>	<b>59</b>	<b>162</b>	<b>76</b>	<b>40</b>	<b>347</b>

### (d) Housing and Living Conditions

In the host communities of study most of the houses (90%) were personally owed by the residents. There are traditional mud houses with thatcher roofing material or zinc, while some are built with block cements and aluminium zinc as roof in the communities.

Traditional houses provide good ventilation for the residents, but it also exposes them to mosquito bite, which will make them susceptible to malaria disease. Malaria as well known is an endemic tropical disease which is currently being prevented with insecticide treated net. The building arrangement as witnessed in the three communities are constructed in clusters pattern.



**Plate 1.19:** House type in the study area

#### **4.10.8 Public Infrastructure and Social Facilities**

##### **(a) Educational facility**

Responsibility for the Nigerian education system is shared between the federal, state and local governments. At a federal level, the Ministry of Education regulates education through policy formation, ensures quality control and manages tertiary level institutions. It is the state's responsibility to manage secondary education, with primary education managed at the LGA level.

The education system in Nigeria is provided by both public and private institutions, and is divided into three levels: basic education (nine years), post- basic/senior secondary (three years), and tertiary (four to seven years, depending on the course).

The Universal Basic Education Program (UBE) is free and compulsory between the ages of 6 and 15 and covers 6 years of primary school (6 years old to 12 years old), followed by 3 years of Junior Secondary School (12 years old to 15 years old).

Educational facilities within the Project site is poor, with local pupils of Kuhu and Malmo community only have one primary school, with only one single block building and two classroom. While Gubi has their own primary school that is much better with two block buildings. Kuhu and Gubi also has a Qur'anic school. However, secondary can only be accessed in Bauchi metropolis which is about 18km.



**Plate 1.21:** Primary School located between Kuhu and Malmo

### **(b) Water Supply**

There are three main ways to access water for domestic use in the communities around the project site: hand pump borehole, hand dug wells and River/stream. In Kuhu community, their only source of water is hand dug well located in different points within the community. Malmo community is supplied by water from hand dug well and one hand pump borehole, they use the well water for domestic purposes, while the hand pump borehole is for consumption such as drinking and cooking. Gubi community's sources of water supply are hand dug wells and two hand pump boreholes, which serves the same purpose for washing and direct consumption.



**Plate 1.22:** Sources of water in the study area

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### **(b) Electricity Supply**

The main source of electricity across the three communities is the National grid, as the infrastructures to support electricity are there, electric poles were observed up to 5 meters away from Kano-Bauchi road. Since the area is compatible and validated to be with industrial park qualities, the electricity power supply transformer (50KV) were observed at Malmo community, which serves both Malmo and Kuhu community, and Gubi community with 50kva transformer. Nevertheless, the surrounding communities mostly electrifies their place with it, as their consumptions are majorly light point and charging of their electronics appliances such as phones, touch lights, radio and others.



**Plate 1.23:** Transformer that supplies the communities with electricity, located at Kuhu

### **(c) Transportation facility**

The site is connected to major highway that linked Bauchi to Jigawa and Kano state, also connect to Gombe state and other states such as Kaduna and Plateau state. The road is a single lane highway. The railway station is located at Bauchi metropolis over 15km away from the communities, while the airport is 4km away. Trucks and bus parks are also found at Bauchi metropolis.

Transport and road infrastructure around the Project site is generally poor and most settlements do not have asphalt roads, except Malmo where 300meter of their main access road is graded with one sided drainage, but not yet tarred. Car ownership is very low and motorcycle remain widely used for transportation, followed by bicycles. Communities around the Project site walk few kilometres before they can get a vehicle or motorcycle to access social services. Distances walked differ from one community to the



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other, for instance, households around Kuhu and Malmo, the average travel distance to the closest village market called Durum village market is 4.59km. Meanwhile people in Gubi covers longer distance. The distance to the only primary schools in Kuhu and Malmo community is close, as the schools was sited at the boundary of both communities.

#### **(d) Security facility**

There were no police post or station across the length and breadth of the communities. The nearest security presence around the project site is the navy base, very close to Kuhu and Malmo. As expected, the communities rely largely on local community policing (vigilante groups) or solely rely on tradition medium in tackling crime. The practice of good neighborliness as held in rural areas is generally relied upon for security of lives and properties (everyone watching over the others things).

#### **(e) Drainage**

There is no drainage system around the community, except the uncompleted road project that passed through Malmo and Kuhu community, with one side concrete gutter that is yet to be completed.



**Plate 1.24:** Untared road with drainage, connecting Malmo and Kuhu community.



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#### 4.10.9 Security and Social Issues

There are no records of communal/tribe clashes/conflict in the communities; residents of the various communities have lived together in peace and harmony for several decades and engages in inter-tribal marriages; hence they treat one another with respect and see themselves as families/in-laws. The presence of NAF quarters around the project site will tackle insecurity around the project area.

##### ***Vulnerable or Marginalised Groups***

Vulnerability is the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard (IFC, 2012). In the context of this report, vulnerable groups are groups who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be more adversely affected by a Project than others. They may include people who are limited in their ability to take advantage of a Project's development benefits.

Vulnerable groups within the villages were observed to be men and women, children and youths. This classification is by virtue of their economic vulnerability and susceptibility based on dependency. The women depend on their husbands, who are farmers and not economically buoyant, while the men are often farmers who rely on their farm produce to survive. Other vulnerable groups are the farmers, who are not the owners of their farmland and could lose their livelihood if their right to use the land for farming is revoked.

***Women and the female-headed households:*** The majority of the households in all the villages are male-dominated. Also, women's participation in community-level decisionmaking is low. None of the villages has women in their leadership council. Men are generally seen as the head of the household even if they do not reside in the house.

***Youths:*** All the villages have youthful populations. Some youths are involved in the livelihood activities of their parents, such as farming. When implementing Corporate Social Responsibility (CSR), the Project will need to consider and provide special attention to the needs of the youths as they were observed to be involved primarily in farming.

***Children:*** These vulnerable groups depend on their parents for nurture and sustenance, and many cannot make decisions. Without adequate representation by an adult, the

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children may be vulnerable to exploitation. However, the Project needs to consider how the children will be represented and help determine how they will be affected.

#### **4.10.10 Waste Management**

The predominant method of waste disposal includes burning and indiscriminate disposal. Majority of their domestic waste comprises of biodegradable food waste, consist of nonbiodegradable waste such as polyethene bags (nylon), plastic bottles of water and other drinks and other agricultural waste from farms.

The survey results show that 41.6% of the respondents dispose their waste in open dumpsites, 33.6% burn or bury their domestic waste, 26.4% use temporal public dumpsites, 15.2% dump their waste into drainage channels and stream while an insignificant 1.6% recycle their waste. The results show the need to prohibit open dumping of waste in the area in order to reduce environmental nuisance and poor sanitation.

#### **4.10.11 Health Assessment**

##### **Health care facility**

The Inhabitants of the study areas do not enjoy access to standard health care service delivery when compared with their contemporaries living in Bauchi Township. Dearth of standard medical facility had been the bane of inhabitants of the study areas as they must travel several kilometers to access standard health care services in Bauchi Specialist hospital. Communities like Kuhu and Malmo lack healthcare facilities, while Gubi has a Primary health clinic that is poorly equipped.

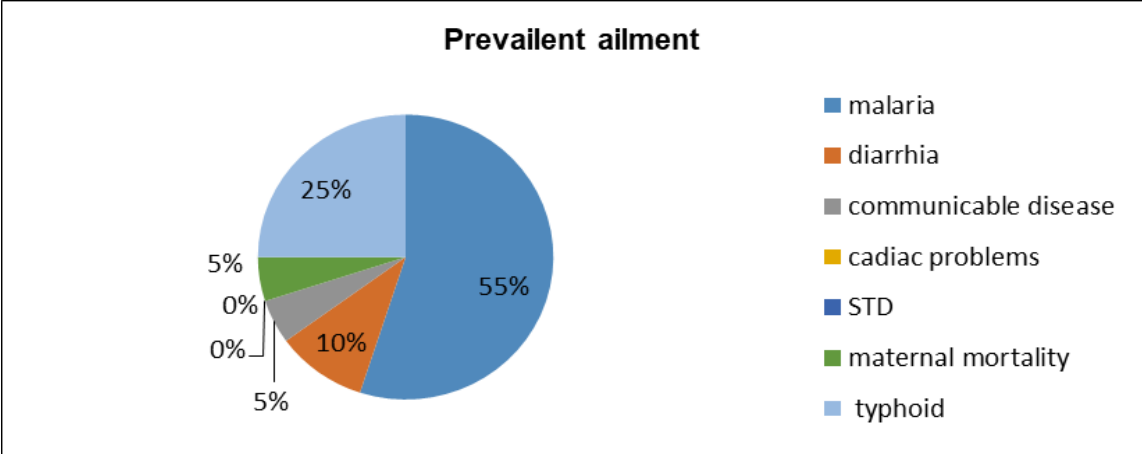
Medical Referrals are usually made to Kirfi General Hospital, Navy specialist Hospital and Bauchi Teaching Hospital/Specialist, which are more equipped to handle medical emergencies of all sorts. The medical services obtainable from Gubi healthcare facilities include: routine immunization, Pregnancy test, Antenatal, RDT for malaria and typhoid treatment. Due to lack of equipped hospital, some respondents reported relying on traditional medicine to cure minor ailments.

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### **Health Indicators in the Project Affected Area**

The Bauchi State faces many challenges in improving the health status of residents and data shows that the state has very low health indicators, especially for child mortality, maternal health, HIV/AIDS, malaria and other diseases that were targeted for reduction under the Millennium Development Goals (MDG). According to a World Health Organisation (WHO) data published in 2013, life expectancy in Nigeria is: Male 54, Female 55 and total life expectancy is 55. For Bauchi state, there is no precise data on life expectancy but the estimated data is very similar to the national data (male 53, female 56) (Nigeria Bureau of Statistics NBS, 2014). The population structure of Bauchi state also indicates low life expectancy, high birth rate, and high death rate. Despite the challenges facing local people in accessing primary health care services, over half of survey respondents stated that a midwife attended their child's birth and in three settlements over 80% of all births were attended by a midwife.

Survey respondents reported that the most common illnesses found in the Project area are malaria, cough, yellow fever, dysentery/diarrhoea, and skin diseases/rashes. Malaria is the most serious illness in the Project area, and Bauchi state in general, affecting children the most. According to the Bauchi State Strategic Health Development Plan (BASSHDP) 2010 - 2015, the target was to reduce the incidence of malaria in Bauchi state from 11,534/100,000 to 7500/100,000 by 2020. No precise data is available on the incidence of malaria in each community, but the general consensus amongst stakeholders, is that malaria is the most serious illness in the Project area. The main reasons for the high incidence of malaria and other diseases are lack of awareness on health matters, inadequate health facilities and inadequate social infrastructure, such as electricity and sanitation facilities.



**Figure 4.16:** Prevalent ailments in the Communities  
 Source: Field survey 2024

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## 4.11 Defining Stakeholder Engagement

Stakeholder engagement is an ongoing process of sharing project information, understanding stakeholder concerns, and building relationships based on collaboration. Stakeholder consultation is a key element of engagement and essential for effective project delivery. Disclosure of information is equally as vital. If there are risks or adverse impacts from a project, consultation must be inclusive and culturally appropriate and provide stakeholders with opportunities to express their views. In line with current guidance from the International Finance Corporation (IFC), consultation should ensure “*free, prior and informed consultation of the affected communities.*” In other words, effective consultation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities. The Project’s consultation program was intended to ensure that stakeholder concerns are considered, addressed and incorporated in the development process, especially during the ESIA.

### 4.11.1 Objectives

The stakeholder engagement process was designed to conform to the Nigerian EIA Act and International standards. For this project, the key objectives for stakeholder engagement are:

- i. inform and educate stakeholders about the proposed Project;
- ii. gather local knowledge to improve the understanding of the environmental and social context;
- iii. better understand the locally-important issues; iv. provide a means for stakeholders to have input into the project planning process;
- iv. take into account the views of stakeholders in the development of effective mitigation measures and management plans; and
- v. lay the foundation for future stakeholder engagement

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#### 4.11.2 Stakeholder Engagement Activities

This section describes the stakeholder engagement activities that have been carried out so far. The activities that are planned for later stages are also described.

##### Scoping Activities

At the scoping stage, project stakeholders were identified to understand the individuals, groups, and organizations that may be affected by or may influence project development positively or negatively. Initially, a broad list of potentially affected and interested parties (AIPs) was considered, such as:

- National, regional and local government;
- Local businesses/cooperatives and associations;
- Local communities and individuals; and

The initial EIA scoping consultations were carried out with the following stakeholders:

- Federal Ministry of Environment
- Bauchi State Ministry of Environment
- Ministry of Agriculture Bauchi State
- Abubakar Tafawa Balewa University Bauchi
- Nigerian Air Force Tactical Air Command Base
- Ministry of Agriculture Extension Services
- Bauchi State Agricultural Development Programme
- Bauchi State Local Government Area
- Katagum Local Government Area
- Darazo Local Government Area
- Ganjuwa Local Government Area
- Alkaleri Local Government Area
- Dass Local Government Area
- Traditional rulers, youth groups, women, elder groups, etc

The consultations served to provide stakeholders with information about the Project and to gather information important to the ESIA. The objective was to identify any key

concerns or high-level issues that the stakeholders had at this early stage. Additional consultation shall be undertaken as the study progresses.

Plates 4.21 to 4.31 show the sample photographs of the stakeholder Scoping Workshop conducted on the 27<sup>th</sup> of April 2024 while attendance lists and other stakeholder engagement tools are provided in Appendix 1.



Plate 1.25: Opening remarks by a Permanent Secretary (Perm. Sec.)





Plate 1.26: Presentation by the ESIA Consultant during the Scoping Workshop



Plate 1.27: Cross-section of stakeholders during the scoping workshop (front view)



Plate 1.28: Stakeholders from ATBU addressing participants during the Scoping Workshop



Plate 1.29: Scoping workshop banner

### Consultation Meetings at the ATCs



Consultation meeting with the people of Alkareli LGA



Plate 1.30: Group photograph with the Caretake-Chairman of Alkareli LGA during Community Consultation



Plate 1.31: Consultation meeting with Ganjuwa LGA



Plate 1.32: Group picture with Ganjuwa LGA



Plate 1.33: Meeting with Director Agric. & Natural Resources at Toro LGA





Plate 1.34: Stakeholder meeting and site site exercise at Galam community, Dass LGA



Plate 1.35: Group photograph at Rampa community, Darazo LGA

## Summary of Consultations

Items	Description
Date of Public consultation	27 <sup>th</sup> April 2024
Name of Stakeholders (community)	Gubi, Malmo/Kuhu Community
Language of communication	Hausa and English
Introduction	Meeting commenced with opening prayer said by a member of the community. The Master of the Ceremony (MC) introduced the Permanent Secretary, representative of the Honourable Commissioner of Agriculture, the representative Hon. Commissioner, Federal Ministry of Environment, the Director, BSAPA and the Consultants.
Opening Remarks	Meeting was chaired by the Permanent Secretary. The Perm. Sec. sensitized the audience on the objectives of the SAPZ project. He pointed out that SAPZ project is designed to help farmers to be more efficient across all value chains and segments. In his remarks, he introduced the ESIA Consultant and Team and called on the Hon. Representative (Ministry of Environment) team leader to address the audience. The Hon. Minister's Rep. gave an overview of their assignment and the purpose of the community consultation. Which he explained was to sensitize the people on the proposed project as well as the impact (positive and negative) associated with the project. He further emphasized that the aim of the assignment was to enhance the positive impact and minimize or eliminate the negative impact. He mentioned some of the impacts both positive and negative associated with the project. He also informed them that he would like to know the impacts of rice production, processing and marketing on the environment and social life of their community. He urged them to cooperate and participate effectively during group discussions and urged them to fill the questionnaire without bias.
Response of stakeholders about the project	Stakeholders were enthused by the proposed Special Agricultural Processing Zone (SAPZ) project and gave the assurance of their unflinching support to project.
Feedback of the Stakeholders	Members of the neighbouring communities raised the following concerns: <ul style="list-style-type: none"> <li>The inhabitants of the host village/settlements are perturbed due to total absence of standardized health care facility in Kuhu and Malmo community environs where only a dispensary exist and this portend danger, loss of lives as medical attention is always sorting several kilometres away from the village/settlements in Kuhu/Malmo communities.</li> <li>The communities Youth are desirous that SAPZ project will assist them in providing health facilities and improving the standard of the school infrastructure in the communities also support them by providing grounding machines, sowing machines among others; as they have some skills but needed empowerment to reduce their burden of overdependence on their parent.</li> </ul>
Remarks/Recommendations	Community members appreciates the project proponent. Also, the community people want a regular schedule meeting or a kind forum where they can always air their concern should there is any in the future time.

Response of stakeholders about the project	akeholders were delighted about the project and optimistic that the project would help the farmers to improving their storage and processing capacity as well as increasing the community’s status. However, representatives of the neighbouring communities pleaded that the project should be designed to accommodate them in the area of employment opportunity for their people. Meanwhile they promise
	to They promise to work harmoniously with the PIU and the contractors when work commences.

### 4.11.3 Field Mission on SAPZ Programme

The Special Agro-Industrial Processing Zones (SAPZ) field mission took place from 3<sup>rd</sup> – 4<sup>th</sup> May, 2024 in Bauchi State. The team comprises of the Africa Development Bank (AfDB) staff, SAPZ National Coordination Office (NCO), Federal Ministry of Agriculture and Food Security (FMAFS) and Federal Ministry of Finance (FMF). The primary objective of this field mission is to conduct a Scoping Assessment to ascertain the State readiness status for eligibility. This mission was highly aimed at understanding the ground realities of the indicative ATCs and Hub locations identified by the State as part of the study and the required selection of appropriate site. It also aimed at collecting primary data regarding the allied activities within the identified location scheduled for its development which can have a potential impact on the development.

The team had a respective courtesy visit to the Governor, Sen. (Dr.) Bala Abdulkadir Mohammed on the 3<sup>rd</sup> of May 2024. There were interactions with different stakeholders, government officials, local authorities to comprehend the SAPZ development project on a holistic aspect. On the 4<sup>th</sup> May, 2024 the team visited the Agro-Industrial Hub (AIH) and a Rice Milling factory along with the Honourable Commissioner Agriculture, Permanent. Secretary, BSADP, representatives from different ministries, and stakeholders.

The proposed AIH site was visited located at Gubi, Bauchi LGA, Bauchi State. The field mission team members visited the Agro-Industrial Hub (AIH) to have first-hand information and knowledge about the site and its features along side the Honourable Commissioner, Perm. Sec. Director, BSADP, representatives from Abubakar Tafawa Balewa University, Bauchi (ATBU), Stakeholders and the ESIA Consultant (Plates 4.31).

The team interactions and discussions on site are given below:

1. Prioritization of commodities
2. Proposed meeting with other potential stakeholders including the

The second visit was to Tiamin Rice milling factory located along Bauchi-Darazo road, Bauchi State. The team discussed intensively the proposed SAPZ project with the facility owners and how to partner with the proposed project.

**Field Mission: Site visit at Gubi Agro-Industrial Hub Site, Bauchi LGA**



Plate 1.36: Site verification exercise at the proposed Agro-Industrial Hub site





Plate 1.36 contd: Site verification exercise at the proposed Agro-Industrial Hub site

**Field Mission: Site visit to Tiamin Rice milling factory located along Bauchi-Darazo road**



Plate 1.37: Walk tour and site viewing at Tiamin Rice factory





Walk tour and site viewing at Tiamin Rice factory



Presentation at Tiamin conference hall



Group Photograph

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## CHAPTER FIVE

### POTENTIAL AND ASSOCIATED IMPACT ASSESSMENT

#### 5.1 Introduction

The objectives of Environmental and Social Impact Assessment (ESIA) are to identify and describe the potential environmental and social impacts associated with the proposed project activities, predict the likelihood and magnitudes of such impacts, evaluate the significance of changes likely to result from them, and thereafter proffer measures that will be taken to mitigate the predicted impacts. This chapter, therefore, presents the associated and potential Health, Safety, and Environmental (HSE) impacts of the proposed implementation of the Special Agro-Industrial Processing Zone (SAPZ), Bauchi, Nigeria.

#### 5.2 Impact Assessment Methodology

The use of appropriate impact identification and prediction methods is crucial for good ESIA. Several methods have been developed over the years for impact assessment, while new approaches continue to emerge. Every method has merits and demerits; however, all good methods have certain elements in common, which are widely accepted as essential for good ESIA. The Scientific Committee on the Problems of the Environment (SCOPE, 1979) suggested that the following qualities should be considered while choosing Impact assessment methods:

***Comprehensiveness:*** This implies that the method should be able to detect the full range of important elements and combinations of elements, directing attention to novel or unsuspected effects or impacts, as well as to the expected ones.

***Selectivity:*** This has to do with the ability of the method to focus attention on major factors. It is often desirable to eliminate as early as possible (i.e., during identification) impacts that would dissipate effort if included in the final analysis.

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**Mutually exclusive:** This quality ensures that double counting of impacts or effects are avoided. However, experience has shown that this is difficult because of the many interrelationships existing in the environment.

**Yield to Confidence limits:** Subjective approaches to uncertainty are common in many existing methods and can sometimes lead to quite useful predictions. However, explicit procedures are generally more acceptable, as their internal assumptions are open to critical examination, analysis, and, if desirable, alteration.

**Objectivity:** The objectivity of impact assessments has been well emphasized by many regulators including the FMEnv. Objectivity minimizes the possibility that the predictions automatically support the preconceived notions of the promoter and/or assessor. Such prejudgments are usually caused by a lack of knowledge of local conditions or insensitivity to public opinion. A second merit of objectivity is to ensure comparability of EIA predictions amongst similar types of actions. An ideal prediction method contains no bias.

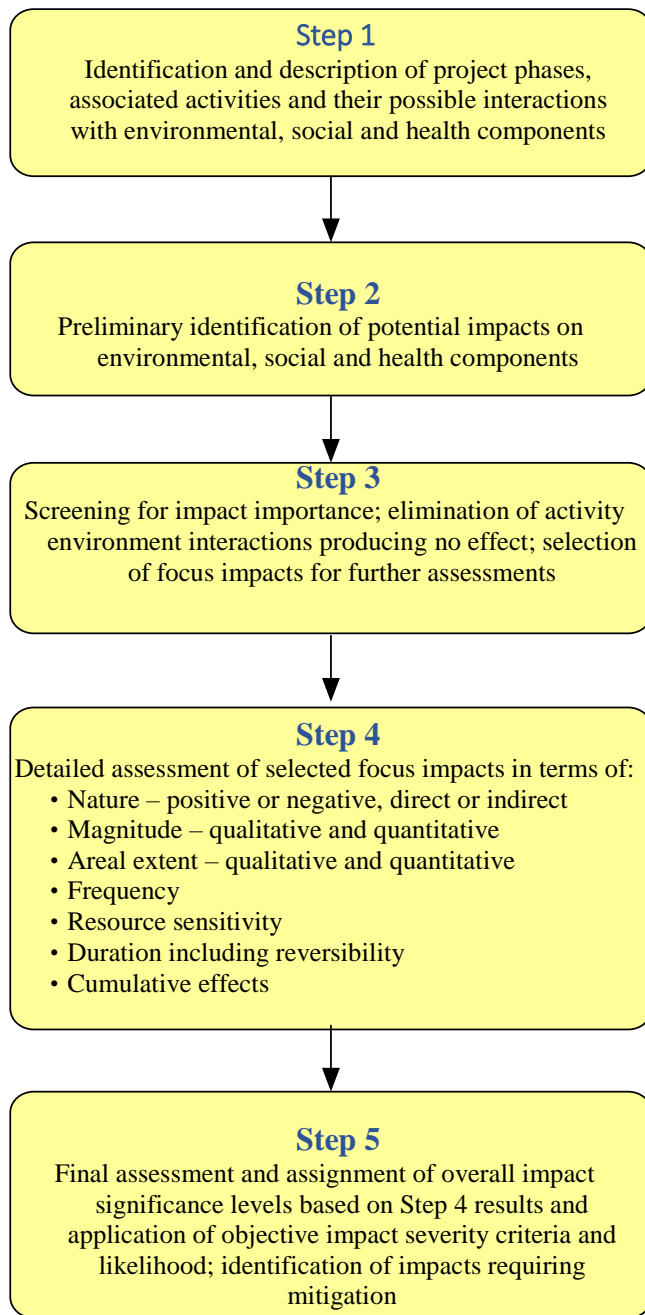
**Prediction of Interactions:** Environmental, social, and economic processes often contain feedback mechanisms. A change in the magnitude of an environmental effect or impact indicator could produce unsuspected amplifications or dampening in other parts of the system.

Generally, impact assessment methods fall under seven types of approaches:

1. The Leopold matrix approach
2. The Battelle environmental evaluation system
3. Checklists
4. Matrices
5. Flowcharts and Networks
6. Mathematical/Statistical and computer models
7. Overlays using maps and GIS

In selecting an overall impact assessment methodology for this project, several widely used methods were reviewed and qualities considered appropriate were incorporated in the assessment. The major steps in the impact assessment methodology for this project are presented in Figure 5.1.





**Figure 5.1:** Schematic of the Impact Assessment Methodology

### 5.3 Identification and Description of Project Phases and their Possible Interaction with the Environment

The analysis of impacts covers the following project phases and associated activities' interaction with the environment.

1. **Pre-construction:** This will include mobilization of materials and personnel, recruitment of workers and community engagement, permit to work, site preparation activities, creation of access road and camping, etc.
2. **Construction/Installation:** Soil excavation, foundations and building constructions, and other associated earthen works, metal works, waste management, etc.
3. **Operation and maintenance:** Operations such as processing of agricultural products for exportation, transportation of raw materials from ATCs to the Hub and subsequent maintenance activities
4. **Decommissioning:** Disusing/abandoning of project.

Table 5.1 shows the environmental components as they interact with the various project phases

**Table26: Environmental Components and their Impact Indicators**

Aspect	Environmental Component	Project Phase	Impact Indicators
<b>Biophysical</b>	Climate	All project phases	Humidity, Temperature, Rainfall, Wind Speed and Direction
	Air quality	All project phases	Gaseous emissions (like: NO <sub>x</sub> , SO <sub>x</sub> PM, CO, VOC ) that contaminate ambient air.
	Noise levels	All project phases	Day and night disturbance, hearing loss communication impairment.
	Water Quality (Surface water and Groundwater)	Construction, Operation and Maintenance phases	Changes in the baseline physico-chemical and biological properties of surface water; Changes in the Physico-chemical properties of sediment; Changes in community composition and abundance of aquatic biota including; microbes, plankton, macrobenthos, fishes, mammals, reptiles, amphibians, bird species, etc.
	Geology	Pre-construction phase	Changes in geology structure
	Soil	Pre-construction, operation and maintenance phases	Changes in physicochemical and biological properties of soil

	Topography	Pre-construction phase	Changes in land terrain and topography
	Vegetation	Pre-construction phase	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species
	Wildlife	Pre-construction phase	Changes in wildlife distribution and abundance
<b>Human, Socioeconomic and Cultural</b>	Land-use pattern	Pre-construction and Construction phases	Changes in land-use patterns such as agriculture, fishing, logging, hunting, etc,
	Local Population level	All project phases	Immigration and in-migration of workers and other people
	Socio-economic system	All project phases	Changes in employment opportunities, income differentials, inflation, difference in per capita income, inequality of benefits to local population, etc.
	Socio-cultural system	Operation and Maintenance	Changes in social structure, organisation and cultural heritage, practices and beliefs, natural resources, rights of access, changes in value system influenced by foreigners, etc.
	Basic Amenities and Infrastructure	All project phases	Access to goods and services such as housing, education, healthcare, water, fuel, electricity, sewage and waste disposal, consumer goods brought into the region, etc.
	Transportation System	All project phases	Changes in transport systems and associated effects such as noise, accident risk, changes in existing facilities, etc.
	Aesthetics	Construction phase	Presence of unsightly structures.

## 5.4 Preliminary Identification of Potential Impacts on the Environment

The existing baseline description of the environment and the various project phases/ activities were used to develop a checklist of the potential and associated impact of the proposed Special Agro-industrial Processing Zones (SAPZ) on the biophysical and socioeconomic environment. The World Bank Environmental Assessment Sourcebook on Industrial setup and FMEnv EIA Sectoral Guidelines for Infrastructures were used as references in developing the checklist (Table 5.2).

**Table27: Checklist of Associated and Potential Impacts**

Project Phase/Activity	Associated and Potential Impacts
<b>Pre-Construction</b> <ul style="list-style-type: none"> <li>• Permitting</li> <li>• Land Acquisition</li> <li>• Mobilisation of materials and personnel</li> <li>• Recruitment</li> <li>• Site Preparation</li> </ul>	Economic loss arising from the clearing of farmlands
	Uncertainty and misunderstanding due to a lack of information and communication.
	Acquisition/Displacement of people
	Employment opportunities arising from the recruitment of skilled and unskilled workers
	Business opportunities for local contractors through sub-contracting activities
	Local support services from roadside supply markets and shops etc.
	Skill acquisition and enhancements to local indigenes and workforce.
	The influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure
	Increase of communicable diseases due to the influx of people
	Increase in social vices (like theft, prostitution, etc.) resulting from the increased number of people
	Community agitation over unidentified stakeholders, leadership tussles etc.
	Increased traffic during mobilization on the road with risk of accidents leading to injury/death and loss of asset
	Conflicts/community agitations over employment issues (quota and methods)
	Nuisance (noise and vibrations) due to movement from heavy-duty equipment and vehicles affecting site workers and wildlife
	Increase in dust particles and vehicular emissions
	Disturbance of the vegetative cover due to site clearing and preparation
	<b>Construction Phase</b> Civil work, Mechanical and Electrical work which include: <ul style="list-style-type: none"> <li>• Drainage</li> <li>• Foundation (trenching, Piling etc).</li> <li>• Building erection</li> <li>• Cabling and Conductor wire stringing</li> <li>• Painting and coating</li> <li>• Transportation and logistics etc.</li> <li>• Commissioning /Testing</li> <li>• Waste management</li> </ul>
<ul style="list-style-type: none"> <li>• Paper, domestic waste</li> <li>• Waste from the laydown area and campsite (material and wood)</li> <li>• Scrap metal, wood, sand, concrete, iron rods, paper</li> <li>• Used oil and replace/obsolete equipment parts that may contaminate soil/groundwater</li> </ul>	
Contamination of surface water as a result of siltation caused by increased erosion during site preparation	
Visual intrusion and aesthetic quality resulting from the construction of the road	
Workplace accidents/ incidents (falling from height, injury from falling objects, etc.)	
Littering of the site with packaging materials and unused construction material.	
Respiratory disorder from inhalation of cement dust.	
Respiratory / health hazards to onsite personnel due to the release of fumes from construction equipment (bulldozers, excavators)	
Injuries to on-site workers from falls or dislodgement of earth, rocks, or other materials.	
Localised increase (above baseline values) in ambient concentrations of air pollutants (NO <sub>x</sub> , SO <sub>x</sub> , CO <sub>x</sub> , C <sub>x</sub> H <sub>y</sub> , H <sub>2</sub> S, & SPM) from fuel combustion engines (e.g. cement mixing machine) used for construction and cement dust	
The influx of predominantly male population and job seekers into host communities and neighbouring communities could lead to increased sexual activity, and the introduction of commercial sex workers.	

	Increase in the ambient noise level of the area above baseline values due to noise generated from construction activities
	Increased pressure on social amenities (housing, water supply, roads) due to the influx of workers and job seekers into the community
	Decrease in groundwater aquifer as a result of groundwater abstraction for construction activities e.g. concrete mixing, equipment washing, etc.
	Increased erosion potential as a result of construction activities such as excavation and reduction in structural stability and percolative ability of soil resulting from compaction during civil works and installation activities.
	Damage to ecological resources and environmental degradation by minor spillages during fuelling of construction trucks and equipment
	Risk of electrocution and burns (to onsite workers) during electrical installation processes
	Job creation/ Business opportunity/Economic enhancement
	Accidents due to the collapse of the structure under construction
	Kidnapping of personnel
<b>Demobilisation</b> Demobilization after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, and objects at height lead to injury or fatalities.
	Soil/groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, lubricants, hydraulic oil etc.)
	Traffic congestion during transportation of demobilized equipment and personnel
	Generation of dust and automobile/heavy-duty equipment emissions
	Waste disposal (scrap metal, wood, sand, concrete, paper)
	Reclamation and restriction of access roads to prevent unauthorized uses
	Loss of employment and business opportunities due to completion of the construction phase
	Illegal access to the building site leads to accidents, sabotage, asset damage and loss
	Surface runoff and erosion resulting in sedimentation problems
<b>Operations and maintenance</b> <ul style="list-style-type: none"> <li>• Building inspection and checks</li> <li>• Power generation/servicing</li> <li>• Transportation of raw materials and finished product</li> <li>• Agro-products processing for export</li> <li>• Plant maintenance</li> <li>• industrial waste discharges</li> <li>• Emergence of small-scale enterprises</li> <li>• Green buffer development around each industrial plot.</li> <li>• Recruitment of workers</li> </ul>	Risk of injury from fall from height/trip or being hit by object
	Air pollution by gaseous emission (CO, SO <sub>2</sub> , NO <sub>2</sub> ) and particulates from power generator and other processing plants
	Soil contamination resulting from accidental leakages and spills of hazardous substances from generators and plant servicing (diesel, spent oil etc.)
	Generation of dust and gaseous pollutants from automobile emissions
	Increase in noise level nuisance from vehicles plying the access roads
	Traffic congestion as a result of transportation of raw materials and processed agro-products
	Metallic materials generation from plant parts, retrofitting/upgrade of parts during plant servicing
	Potential for land contamination from industrial waste disposal
	Pollution of surface water bodies by wastewater generated from industrial waste discharges
	Change in Land Use of nearby areas
	Recreational facility
	Acquisition of skills by individuals to be employed

	Increase in income for workers.
<b>Decommissioning/ Abandonment</b> <ul style="list-style-type: none"> <li>Removal of electrical cables and wires</li> <li>Demolition of buildings for facilities retrieval</li> <li>Waste generation</li> <li>Transportation of Plant components for sale/ another site</li> </ul>	Risk of accident and injury to workers during demolition of structures
	Increased dust and vehicular emissions during haulage of plant components from the site by heavy-duty vehicles
	Increased sedimentation process close to river banks and floodplains along the building sites
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages
	Traffic obstruction from transportation of decommissioned structures and equipment
	Availability of land for alternative uses such as community hall
	Improved Ecology, Air Quality and Aesthetics

## 5.5 Screening of Impact Importance

This involves the elimination of project activity-environmental interaction producing no effect and selection of focus impact for further assessment. The basis for the screening was derived from the following:

- Knowledge of the Project activities as summarized in Table 5.1.
- Detailed information on the environmental and socio-economic setting of the Project's area of influence as documented in Chapter 4. The potential environmental and social receptors/resources that could be affected by the proposed Project are summarized in Table 5.1.
- Consultation with relevant stakeholders including potentially affected community
- Review of other ESIA reports on similar projects/environments.
- Series of experts group discussions, meetings and experience on similar projects.

A modified Leopold matrix (Leopold, 1971) was used for the screening. The matrix arrays project activities against environmental (biophysical and socio-economic) components, and supports a methodical comprehensive and objective identification of impacts each activity could have on the environmental components. The matrix consists of a horizontal list of biophysical and socio-economic environmental components that could be affected by the proposed activities versus a vertical list of project activities, which represent environmental aspects, or sources of impacts associated with each project phase.



Entries in the matrix cells represent the nature and preliminary ranking of the impacts. The ranking of the severity is based on the colour code shown in Table 5.3 below.

**Table27: Impact Ranking Matrix**

+	Positive Impact
0	Negligible/No Impact
1	Minor Impact
2	Moderate Impact
3	Major Impact

The impact ranking categories are defined as follows:

**Positive Impact** - this is an impact that adds a measurable benefit to the environment. It is considered sufficient for the impact assessment to indicate that the Project is expected to result in a positive impact, thus no magnitude designation is assigned.

Ranking of negative impacts are discussed below:

**Negligible Impact:** this impact may occur but based on experience, available scientific information and expert knowledge will have very insignificant, immeasurable, undetectable effect on the environment or within the range of normal natural variation.

**Minor Impact:** this impact could either affect a large (as defined below) or moderate (less than 40%) amount of an affected resource and has mid to long-term effect, but is most likely reversible.

**Moderate Impact:** This affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations when compared with national or international limits and standards specific to the receptors) and may bring about a change in species abundance, but does not threaten the integrity of that population or any population dependent on it. **Major Impact:** this impact would affect a large (higher than 40%) amount of a resource and/or has a relatively long-term effect.

In this preliminary screening, all potential impacts, whether likely or unlikely, are considered. The likelihood of an impact is further assessed in the detailed impact evaluation. The result of the preliminary impact identification and screening is presented in Table 5.4.

**Table29: Activity-Receptor Interaction for Impact Screening**

Summary of Project Activities at various Phases	Receptors														
	Physical					Biological		Socio-economic					Others (Health and Safety)		
	Air Quality	Ambient Noise	Soil	Groundwater and Aquifers	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities	Infrastructure	Employment/ Income	Construction workers	Workplace health and safety	General Public
<b>Pre-construction Phase</b>															
Site selection	0	0	0	0	0	0	0	2	1	1	0	1	0	0	1
Site clearing and preparation	2	1	1	0	0	3	3	3	1	1	1	+	2	2	1
Mobilization of construction equipment and materials to site	2	2	1	0	0	1	1	2	2	2	1	+	2	2	1
Construction of access road, drainages and erosion control	2	2	3	2	2	2	2	2	1	1	1	+	2	3	2
<b>Construction Phase</b>															
Civil work activities including excavation, trenching, cable laying, foundation, construction of buildings	3	2	2	2	3	1	1	3	2	2	2	+	3	3	2
Installation of agro-processing plant and other facilities	1	2	0	1	0	0	0	0	1	1	1	+	2	3	1
Waste generation and disposal	2	0	3	0	2	0	0	2	0	0	0	+	0	2	2
<b>Commissioning</b>															
Testing of agro-processing plant and associated infrastructure.	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0
Commissioning of the Agro-Industrial Hub (AIH).	0	2	0	0	0	0	0	0	2	2	1	0	0	0	2
<b>Operation and Maintenance</b>															
Power generation	3	3	0	0	0	0	0	0	0	0	2	+	2	3	2
Plant operation and maintenance	3	3	2	2	0	1	1	0	2	2	2	+	3	3	2
Movement of Agro-products from ATCs to AIH for storage and exportation	2	1	1	0	0	1	1	0	0	0	2	+	2	3	2
Routine maintenance; waste generation and disposal	2	1	2	0	2	1	1	2	0	0	0	0	2	2	2
Decommissioning	2	2	2	0	2	+	+	+	2	1	1	2	2	2	2

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## 5.6 Detailed Assessment of Selected Focus Impact

The preliminary identification and screening of environmental and social impacts resulted in a group of focus impacts (impacts ranked 1, 2 and 3), which were further assessed in terms of severity and significance. Impact severity and significance criteria used at this next stage (as shown in table 5.5 and table 5.6) relied on a number of resources and tools including the following:

- ISO 14001 guidelines
- Federal Ministry of Environment (FMEnv) EIA Guidelines.
- Overlaying project components on maps of existing conditions to identify potential impact areas and issues.
- Environmental Baseline Studies conducted specifically for this project.
- Consultation with Nigerian experts and residents.
- Experience from similar projects in Nigeria and worldwide.
- Discussion with design contractors and project engineers.
- Published and unpublished documents (such as The World Bank Environmental Assessment Sourcebook, relevant IFC Performance Standards, and other authoritative texts on performing environmental and social impact assessments) providing guidance on performing impact analysis for industrial development activities.
- UNEP EIA Training Resources Manual (1996) and
- European Commission Guidance on EIA/EIS Review (European Commission, 2001).

**Table30: Impact Characterization**

<b>Impact Characterization</b>	<b>Definition</b>
Beneficial Impacts	Impacts that would produce an overall positive effect on the wellbeing of the people as well as the environment.
Adverse Impacts	Impacts that may result in: <ul style="list-style-type: none"> <li>• irreversible and undesirable change(s) in the biophysical environment;</li> <li>• decrease in the quality of the biophysical environment;</li> <li>• limitation, restriction or denial of access to or use of any component of the environment to others, including future generations; and</li> <li>• sacrifice of long term environmental viability or integrity for short term economic goals</li> </ul>
Direct Impacts	Impacts resulting directly (direct cause-effect consequence) from a project activity
Indirect Impacts	Impacts that are at least one step removed from a project activity. They do not follow directly from a project activity.
Normal Impacts	Impacts that will normally be expected to follow a particular project activity
Abnormal Impacts	An impact is considered to be abnormal when it follows a project activity as against sound predictions based on experience
Short-term Impacts	Impacts that will last only within the period of a specific project activity.
Long-term Impacts	Impacts whose effects remain even after a specific project activity.
Reversible Impacts	Impacts whose effects can be addressed on application of adequate mitigation measures
Irreversible Impacts	Impacts whose effects are such that the subject (impacted component) cannot be returned to its original state even after adequate mitigation measures are applied
Cumulative Impacts	Impacts resulting from interaction between ongoing project activities with other activities, taking place simultaneously
Incremental Impacts	Impacts that progress with time or as the project activity proceeds.
Residual Impacts	Impacts that would still remain after mitigation measures have been applied

**Table31: Characterization of potential and associated impacts of the proposed project**

Project Phase/Activity	Associated and Potential Impacts	Impact Characterization								
		Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
<b>Pre-Construction</b> -Permitting -Mobilization -Recruitment -Site Preparation	Economic loss arising from loss of farm lands.	√		√		√			√	
	Employment opportunities arising from recruitment of skilled and unskilled personnel.	√			√	√				√
	Business opportunities for local contractors through subcontracting activities.	√			√	√				√
	Local support services from road side supply markets and shops, etc		√		√					√
	Skill acquisition and enhancements to local indigenes and workforce.	√			√		√		√	
	The influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure.		√	√		√				√
	Increase of communicable diseases due to influx of people		√	√		√				√
	Increase in social vices (like theft, prostitution etc.) resulting from increased number of people		√	√		√				√
	Community agitation over unidentified stakeholder, leadership tussles etc.		√	√		√				√
	Conflicts/community agitations over employment issues (quota and methods)	√		√		√				√
	Noise and vibrations due to movement from heavy duty equipment and vehicles affecting site workers, residents and wildlife	√		√		√				√
	Increase of dust particles and vehicular emissions such as SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , etc	√		√		√				√
	Increased traffic during mobilization on road with risk of accidents leading to injury/death and loss of asset		√	√			√			√
	Disturbance of the vegetative cover due to site clearing and preparation	√		√			√		√	
	Littering of the environment due to waste from wood, sand paper; domestic waste from laydown area and camp site (material and wood)	√		√		√			√	
Contamination of surface water as a result of siltation caused by increased erosion during site preparation	√		√		√				√	

Project Phase/Activity	Associated and Potential Impacts	Impact Characterization								
		Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
<b>Construction / Installation</b> Civil work, Mechanical and Electrical work which include; <ul style="list-style-type: none"> <li>• Drainage</li> <li>• Foundation (trenching, Piling etc).</li> <li>• Building erection</li> <li>• Cabling and Conductor wire stringing</li> <li>• Painting and coating</li> <li>• Transportation and logistics etc.</li> <li>• Commissioning /Testing</li> <li>• Waste management</li> </ul>	Workplace accidents from burns, bruises, trips and falls, object at height leading to injury/ fatalities.	√		√			√			√
	Employment of local labour and skills acquisition for workers taking advantage on new opportunities	√			√		√			√
	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	√			√		√			√
	Increase in revenue opportunities for local population due to presence of nonresident workers and travelers		√		√		√		√	
	Generation of dust and automobile / heavy duty equipment emissions from construction earthworks.	√		√		√		√		√
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along access roads and building sites.	√		√			√	√	√	
	Fauna disturbance and displacement as a result of migration away from construction area (e.g. birds, rodents and reptiles)	√		√			√		√	
	Soil/groundwater contamination resulting from accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)		√	√		√		√		√
	Risks injury/death and loss of assets resulting from accidents associated with road transportation to and from construction sites		√	√			√	√		√
	Risk of electrocution and burns (to onsite workers) during electrical installation processes	√		√			√			√
	Traffic congestion during haulage of plant components to site for installation		√	√		√				√
	Risk of injury from fall from height and building collapse due to unstable geotechnical conditions	√		√			√			√
Reduction in wildlife population as a result of poaching due to easier access created by access roads		√	√			√	√	√		



Project Phase/Activity	Associated and Potential Impacts	Impact Characterization								
		Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding for building components	√		√			√			√
	Noise nuisance from construction activities e.g. Piling resulting to irritation in humans and temporal migration of sensitive mammals	√		√		√				√
	Visual intrusion as a result of alterations from accidental ignition of onsite diesel storage tanks	√		√		√				√
	Waste Disposal <ul style="list-style-type: none"> <li>Scrap metal, wood, sand, concrete, paper</li> <li>Spent oil and replaced /obsolete equipment parts that may contaminate soil/groundwater</li> <li>Waste from the laydown area and building sites causing unsightliness</li> </ul>	√		√		√		√		√
<b>Demobilization -</b> Demobilization after the construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, and objects at height leading to injury or fatalities.	√		√			√			√
	Soil/groundwater contamination resulting from improper waste disposal and accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)		√	√			√			√
	Traffic congestion during transportation of demobilized equipment and personnel		√	√		√				√
	Generation of dust and automobile/heavy-duty equipment emissions		√	√		√		√		√
	Waste disposal (scrap metal, wood, sand, concrete, paper)	√		√		√				√
	Reclamation and restriction of access roads to prevent unauthorized uses		√		√			√	√	
	Loss of employment and business opportunities due to completion of the construction phase	√		√		√			√	
	Illegal access to building site leads to accident, asset damage and loss		√	√		√				√

Project Phase/Activity	Associated and Potential Impacts	Impact Characterization								
		Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
<b>Operation and Maintenance</b> <ul style="list-style-type: none"> <li>• Building inspection and checks</li> <li>• Power generation /servicing</li> <li>• Transportation of raw materials and finished product</li> <li>• Agro-products processing for export.</li> <li>• Plant maintenance</li> <li>• Industrial waste discharges</li> <li>• Emergence of small-scale enterprises</li> <li>• Green Buffer development around each industrial plot.</li> <li>• Recruitment of workers</li> </ul>	Risk of injury from fall from height/trip or being hit by an object	√		√			√			√
	Security threats such as kidnapping and banditry attack		√	√			√		√	
	Air pollution by gaseous emission (CO, SO <sub>2</sub> , NO <sub>2</sub> ) and particulates from power generator		√	√			√	√	√	
	Soil contamination resulting from accidental leakages and spills of hazardous substances from generator servicing (diesel, spent oil etc.)		√	√			√			√
	Generation of dust and gaseous pollutants from heavy-duty equipment, agro-processing machinery, automobile emissions	√		√			√		√	
	Increase in noise level nuisance from operation machines and vehicles plying the access roads		√	√			√	√	√	
	Traffic congestion along agro-products transportation route		√	√		√		√	√	
	Reduction of water tables and source of water for production processes	√		√		√			√	
	Metallic materials generation from plant parts, retrofitting/upgrade of parts during plant servicing	√		√			√			√
	Potential for land contamination from industrial waste disposal	√		√		√			√	
	Pollution of surface water bodies by wastewater generated from industrial waste discharges	√		√			√		√	
	Change in Land Use of nearby areas	√		√		√		√	√	
	Recreational facility from lawns/parks/green areas		√		√		√	√	√	
	Acquisition of skills by individuals to be employed as operators	√			√		√	√	√	

Project Phase/Activity	Associated and Potential Impacts	Impact Characterization								
		Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
<b>Decommissioning/ abandonment</b> <ul style="list-style-type: none"> <li>Removal of electrical cables and wires, water and sewage treatment plant pipelines.</li> <li>Demolition of buildings for facilities retrieval</li> </ul>	Risk of accident and injury to workers during demolition of structures	√		√			√			√
	Increased dust and vehicular emissions during haulage of plant components from the site by heavy-duty vehicles	√		√			√			√
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages		√	√		√		√		√
	Traffic obstruction from transportation of decommissioned structures and equipment		√	√		√		√		√
<ul style="list-style-type: none"> <li>Waste generation</li> <li>Transportation of Plant components for sale/another site</li> <li>Re-vegetation of site</li> </ul>	Abandoned structures possibly taken over by miscreants/criminals		√	√		√				√
	Availability of land for alternative uses such as community hall, farmland, etc	√			√		√		√	
	Improved Ecology, Air Quality and Aesthetics	√			√	√			√	

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## 5.7 Final Assessment and Assignment of Overall Impact Significance Levels

At this stage, the potential and associated impacts identified and characterized in the previous stages of the assessment process were evaluated. The evaluation which was based on clearly defined criteria was used to determine the significance or otherwise of the impacts. The criteria and weighing scale adopted for the evaluation are described below.

### Legal/Regulatory Requirements (L)

Here, the proposed project activities that resulted in impacts were weighed against existing legal/regulatory provisions to determine the requirement or otherwise for permits before the execution of such activities. Such legal/regulatory requirements were identified from the laws/guidelines, which have been reviewed in chapter one of this report. The weighting scale used was as follows:

**Table32: Legal/Regulatory Requirements Criterion**

Condition	Rating
No legal/regulatory requirement for carrying out project activity	Low =1
Legal / regulatory requirement exist for carrying out activity	Medium =3
A permit is required prior to carrying out project activity which may result in impact on the environment	High =5

### Risk Posed by Impact (R)

The health, safety and environmental risks associated with each impact were assessed and ranked as “low”, “medium” or “high”, using the Risk Assessment Matrix (RAM). Reference was also made to the source references listed in the previous sections. Three criteria (consequence, probability of occurrence and severity) were used as basis for ranking the risks of the impacts. These were determined using the RAM as shown in Table 5.8.

**Table33: Risk Assessment Matrix (RAM)**

Consequences	Probability				
	A	B	C	D	E
I					
II					
III					
IV					

Probability Category	Definition
<b>A</b>	Possibility of Repeated Incidents
<b>B</b>	Possibility of Isolated Incidents
<b>C</b>	Possibility of Occurring Sometime
<b>D</b>	Not Likely to Occur
<b>E</b>	Practically Impossible

Consequence Category	Considerations			
	Safety / Health	Public Disruption	Environmental Aspects	Financial Aspects
I II III IV	Fatalities / Serious Impact on Public	Large Community	Major/Extended Duration/Full-Scale Response	<b>High =5</b>
	Serious Injury to Personnel / Limited Impact on Public	Small Community	Serious / Significant Resource Commitment	<b>Medium =3</b>
	Medical Treatment for Personnel / No Impact on Public	Minor	Moderate / Limited Response of Short Duration	<b>Low =1</b>
	Minor Impact on Personnel	Minimal to None	Minor / Little or No Response Needed	<b>None</b>

The risks (measure of the likelihood and magnitude of an adverse effect) associated with such project operations were evaluated in terms of:

- Risk to human health;
- Risk to asset (commercial and economic risk);
- Risk to the biophysical environment; and
- Risk to the SAPZ’s reputation.

Based on the matrix above, the weighting used was as follows:

**Table34: Risk Criterion**

Risk	Attribute – Environmental, Human Health, Safety and Reputation
<b>1= Low</b>	<ul style="list-style-type: none"> <li>This means that no further mitigation may be required</li> </ul>
<b>3= Medium</b>	<ul style="list-style-type: none"> <li>This means that the impact can be mitigated with additional controls and modifications</li> </ul>
<b>5=High</b>	<ul style="list-style-type: none"> <li>This means that the impact requires avoidance or major control/mitigation</li> </ul>

**Frequency of Impacts Occurrence (F)**

Evaluation of the frequency of occurrence of each impact was also carried out. Frequency of occurrence was rated as “high”, “medium” or “low” based on the historical records of accidents/incidents, consultation with experts and professional judgment. The frequency criterion is summarized below.

**Table35: Frequency Criterion**

Frequency	Attribute – Environmental, Human Health and Safety
<b>High = 5</b>	<ul style="list-style-type: none"> <li>Major degradation in quality in terms of scale (&gt;1% of the study area or habitat within the study area), appearance, duration (beyond duration of project)</li> <li>Irreversible or only slowly recoverable (change lasting more than 1 year) degradation of environmental ecosystem level (population, abundance, diversity, productivity)</li> <li>High frequency of impact (occur continuously and almost throughout the project execution period (&lt; 4months))</li> <li>Geographic extent of impact (e.g. encompassing areas beyond study area)</li> </ul>
<b>Medium =3</b>	<ul style="list-style-type: none"> <li>Degradation in quality in terms of scale (&gt;0.1% of the study area, habitat), appearance, duration (a few months)</li> <li>Effect beyond naturally occurring impacts variability</li> <li>Slow reversibility (change lasting a few months before recovery), lasting residual impact</li> <li>Potential for cumulative impact</li> <li>Intermittent frequency of impact (occurs on only a few occasions during the project execution period)</li> <li>Limited geographic extent of impact (large area within study Area)</li> </ul>



<b>Low = 1</b>	<ul style="list-style-type: none"> <li>• Minor degradation in quality in terms of scale (&lt;0.1% of study area, habitat, very localized), appearance, duration (a few days to a month)</li> <li>• Effect within range of naturally occurring impacts, changes, dynamics</li> <li>• Rapid reversibility (change lasting only a few weeks before recovery), no lasting residual impact of significance</li> <li>• No potential for significant cumulative impact</li> <li>• Low frequency of impact (occur in just about one occasion during the project execution period)</li> <li>• Only very localized geographic extent of impact (e.g. not more than a few meters from impact source point)</li> </ul>
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### Importance of Impact (I)

The importance of the target environmental component with respect to the identified potential impact was also determined and rated as “high”, “medium” or “low”. The ratings were based on consensus of opinions among consulted experts including project engineers and other stakeholders in the proposed project. The importance criterion is summarized below.

**Table36: Importance Criterion**

Importance	Attribute – Environmental, Human Health and Safety
<b>High = 5</b>	<ul style="list-style-type: none"> <li>• Highly undesirable outcome (e.g., impairment of endangered, protected habitat, species)</li> <li>• Detrimental, extended flora and fauna behavioural change (breeding, spawning, moulting)</li> <li>• Major reduction or disruption in value, function or service of impacted resource</li> <li>• Impact during an environmentally sensitive period</li> <li>• Continuous non-compliance with international best practices</li> </ul>
<b>Medium = 3</b>	<ul style="list-style-type: none"> <li>• Negative outcome</li> <li>• Measurable reduction or disruption in value, function or service of impacted resource</li> <li>• Potential for non-compliance with international best practices</li> </ul>
<b>Low =1</b>	<ul style="list-style-type: none"> <li>• Imperceptible outcome</li> <li>• Insignificant alteration in value, function or service of impacted resource</li> <li>• Within compliance, no controls required</li> </ul>

## Public Interest/Perception (P)

Here, the interest/perception of the public on the proposed project and the identified potential/ associated impacts were determined through consultation with the proposed project stakeholders. The ratings of high, medium or low were assigned based on consensus of opinions among consulted stakeholders. The public perception/interest criterion is summarized below:

**Table37: Public perception /interest criterion**

Public Perception	Attribute – Environmental and Human Health
High (5)	<ul style="list-style-type: none"><li>• Elevated incremental risk to human health, acute and/or chronic</li><li>• Possibility of life endangerment for community inhabitants and site personnel</li><li>• Major reduction in social, cultural, and economic value</li><li>• Continuous non-compliance with international best practices</li><li>• Any major public concern among the population in the project region</li></ul>
Medium (3)	<ul style="list-style-type: none"><li>• Limited incremental risk to human health, acute and/or chronic</li><li>• Unlikely life endangerment for community inhabitants and site personnel</li><li>• Some reduction in social, cultural, and economic value</li><li>• Possibility of adverse perception among the population</li><li>• Potential for non-compliance</li></ul>
Low (1)	<ul style="list-style-type: none"><li>• No known risk to human health, acute and/or chronic</li><li>• No known risk of life endangered for community inhabitants and site personnel</li><li>• Minor reduction in social, cultural, and economic value</li><li>• Unlikely adverse perception among the population</li></ul>

## Result of Impact Assessment

For each of the three main project phases (pre-construction/construction, operation, maintenance, demobilization and decommissioning), the levels of significance for potential impacts of the proposed project were assigned (table 5.13) as those impacts to which the following conditions apply.

$$\text{High} = (L+R+F+I+P) \geq 15 \text{ or } (F+I) \geq 6 \text{ or } P = 5$$

$$\text{Medium} = (L+R+F+I+P) \geq 9 \text{ but } < 15$$

$$\text{Low} = (L+R+F+I+P) < 9$$

**Table38: Potential and Associated Impact Assessment of the Proposed Project**

Project Phase/Activity	Associated and Potential Impacts	Assessment Criteria							Significance rating
		L	R	F	I	P	Sum	F+I	
<b>Pre-Construction</b> -Permitting -Mobilization -Recruitment -Site Preparation	Economic loss arising from loss of farmlands.	3	5	1	5	5	21	6	High
	Employment opportunities arising from the recruitment of skilled and unskilled personnel	-	-	-	-	-	-	-	Beneficial
	Business opportunities for local contractors through subcontracting activities	-	-	-	-	-	-	-	Beneficial
	Local support services from roadside supply markets and shops etc	-	-	-	-	-	-	-	Beneficial
	Skill acquisition and enhancements to local indigenes and workforce.	-	-	-	-	-	-	-	Beneficial
	The influx of people (migrant workers, subcontractors and suppliers) and increased pressure on existing social infrastructure	1	3	3	3	3	13	6	High
	Increase of communicable diseases due to the influx of people	1	5	1	3	3	13	4	Medium
	Increase in social vices (like theft, prostitution etc.) resulting from increased number of people	1	5	1	3	3	13	4	Medium
	Community agitation over unidentified stakeholders, leadership tussles etc.	1	5	1	5	5	17	6	High
	Conflicts/community agitations over employment issues (quota and methods)	1	5	1	3	5	15	6	High
	Noise and vibrations due to movement from heavy-duty equipment and vehicles affecting site workers, residents and wildlife	3	3	1	3	1	11	4	Medium
	Increase of dust particles and vehicular emissions such as SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , etc	3	3	1	3	1	11	4	Medium
	Increased traffic during mobilization on the road with risk of accidents leading to injury/death and loss of asset	1	3	1	5	3	13	6	High
	Disturbance of the vegetative cover due to site clearing and preparation	3	3	1	3	3	13	4	Medium
	Littering of the environment due to waste from wood, sand, and paper; domestic waste from laydown area and camp site (material and wood)	3	3	3	3	1	13	6	High

Project Phase/Activity	Associated and Potential Impacts	Assessment Criteria							Significance rating	
		L	R	F	I	P	Sum	F+I		
	Contamination of surface water as a result of siltation caused by increased erosion during site preparation	3	3	1	3	1	11	4	Medium	
<b>Construction / Installation</b> Civil work, Mechanical and Electrical work which include; <ul style="list-style-type: none"> <li>• Drainage</li> <li>• Foundation (trenching, Piling etc).</li> <li>• Building erection</li> <li>• Cabling and Conductor wire stringing</li> <li>• Painting and coating</li> <li>• Transportation and logistics etc.</li> <li>• Commissioning / Testing</li> <li>• Waste management</li> </ul>	Workplace accidents from burns, bruises, trips and falls, object at height leading to injury/ fatalities.	3	3	1	3	3	13	4	Medium	
	Employment of local labour and skills acquisition for workers taking advantage on new opportunities	-	-	-	-	-	-	-	-	Beneficial
	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	-	-	-	-	-	-	-	-	Beneficial
	Increase in revenue opportunities for the local population due to the presence of nonresident workers and travelers	-	-	-	-	-	-	-	-	Beneficial
	Generation of dust and automobile/heavy-duty equipment emissions from construction earthworks.	3	3	3	3	1	13	6	High	
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along access roads and building sites.	3	3	1	3	1	11	4	Medium	
	Fauna disturbance and displacement as a result of migration away from construction area (e.g. birds, rodents and reptiles)	3	3	1	3	1	11	4	Medium	
	Soil/groundwater contamination resulting from improper waste disposal and accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)	3	3	1	3	1	11	4	Medium	
	Risks of injury/death and loss of assets resulting from accidents associated with road transportation to and from construction sites	3	3	1	5	3	15	6	High	

Project Phase/Activity	Associated and Potential Impacts	Assessment Criteria							Significance rating
		L	R	F	I	P	Sum	F+I	
	Traffic congestion during haulage of plant components to the site for installation	3	3	1	3	3	13	4	Medium
	Risk of injury from fall from height and building collapse due to unstable geotechnical conditions	1	3	1	3	3	11	4	Medium
	Risk of electrocution and burns (to onsite workers) during electrical installation processes	1	3	1	3	3	11	4	Medium
	Reduction in wildlife population as a result of poaching due to easier access created by access roads	5	1	3	3	1	13	6	High
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding for building components	1	3	3	3	1	11	6	High
	Noise nuisance from construction activities e.g. Piling resulting in irritation in humans and temporal migration of sensitive mammals	3	3	3	3	1	13	6	High
	Visual intrusion as a result of alterations from accidental ignition of onsite diesel storage tanks	1	3	1	3	3	11	4	Medium
	Waste Disposal <ul style="list-style-type: none"> <li>Scrap metal, wood, sand, concrete, paper</li> <li>Spent oil and replaced /obsolete equipment parts that may contaminate soil/groundwater</li> <li>Waste from laydown areas and building sites causing unsightliness</li> </ul>	3	3	3	3	3	15	6	High
<b>Demobilization -</b> Demobilization after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, and objects at height leading to injury or fatalities.	1	3	1	3	1	9	4	Medium
	Soil/groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, lubricants, hydraulic oil etc.)	3	3	1	3	3	13	4	Medium
	Traffic congestion during transportation of demobilized equipment and personnel	3	3	3	5	3	17	8	High
	Generation of dust and automobile / heavy-duty equipment emissions	3	3	1	3	1	11	4	Medium

Project Phase/Activity	Associated and Potential Impacts	Assessment Criteria							Significance rating
		L	R	F	I	P	Sum	F+I	
	Waste disposal (scrap metal, wood, sand, concrete, paper)	3	3	1	3	3	13	4	Medium
	Reclamation and restriction of access roads to prevent unauthorized uses	-	-	-	-	-	-	-	Beneficial
	Loss of employment and business opportunities due to completion of the construction phase	3	3	1	3	3	13	4	Medium
	Illegal access to building site leads to accident, asset damage and loss	1	3	1	3	3	11	4	Medium
<b>Operation and Maintenance</b> <ul style="list-style-type: none"> <li>• Building inspection and checks</li> <li>• Power generation / servicing</li> <li>• Transportation of raw materials and finished product</li> <li>• Agro-products processing for export.</li> <li>• Plant maintenance</li> <li>• Industrial waste discharges</li> <li>• Emergence of small-scale enterprises</li> <li>• Green Buffer development around each industrial plot</li> <li>• Recruitment of workers</li> </ul>	Risk of injury from fall from height/trip or being hit by an object	3	3	1	3	1	11	4	Medium
	Security threats such as kidnapping and banditry attack	3	5	1	5	3	17	6	High
	Air pollution by gaseous emission (CO, SO <sub>2</sub> , NO <sub>2</sub> ) and particulates from power generator	3	3	3	3	1	13	6	High
	Soil contamination resulting from accidental leakages and spills of hazardous substances from generator servicing (diesel, spent oil etc.)	3	3	1	3	1	11	4	Medium
	Generation of dust and gaseous pollutants from automobile emissions	3	3	3	3	1	13	6	High
	Odour disturbances from the processing of Rice, Tomato, Edible oil etc	1	3	5	1	3	11	6	High
	Increase in noise level nuisance from operation machines and from vehicles plying the access roads	3	1	3	3	1	11	6	High
	Traffic congestion along agro-products transportation route	3	3	1	3	3	13	4	Medium
	Threat to community culture, safety and security due to the presence of workers and business opportunists	1	3	1	3	3	11	4	Medium
	Reduction of water tables and sources of water for production processes	3	1	3	3	3	13	6	High
Metallic materials generation from plant parts, retrofitting/upgrade of parts during plant servicing	1	3	1	3	1	9	4	Medium	

Project Phase/ Activity	Associated and Potential Impacts	Assessment Criteria							Significance rating	
		L	R	F	I	P	Sum	F+I		
	Potential for land contamination from industrial waste disposal	3	3	1	3	3	13	4	Medium	
	Pollution of surface water bodies by wastewater generated from industrial waste discharges	3	3	3	3	3	15	6	High	
	Change in Land Use of nearby areas	1	3	1	3	3	11	4	Medium	
	Recreational facility from lawns/parks / green areas	-	-	-	-	-	-	-	Beneficial	
	Acquisition of skills by individuals to be employed as operators	-	-	-	-	-	-	-	Beneficial	
<b>Decommissioning /Abandonment</b> <ul style="list-style-type: none"> <li>• Removal of electrical cables and wires, water and sewage treatment plant pipelines.</li> <li>• Demolition of buildings for facilities retrieval</li> <li>• Waste generation</li> <li>• Transportation of Plant components for sale/another site</li> <li>• Re-vegetation of site</li> </ul>	Risk of accident and injury to workers during demolition of structures	3	3	1	3	1	11	4	Medium	
	Increased dust and vehicular emissions during haulage of plant components from site by heavy-duty vehicles	3	3	1	3	3	13	4	Medium	
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages	3	3	1	3	1	11	4	Medium	
	Traffic obstruction from transportation of decommissioned structures and equipment	3	3	1	3	3	13	4	Medium	
	Abandoned structures possibly taken by miscreants/criminals	1	3	3	3	3	13	6	High	
	Availability of land for alternative uses such as community hall, farmland e.t.c	-	-	-	-	-	-	-	-	Beneficial
	Improved Ecology, Air Quality and Aesthetics	-	-	-	-	-	-	-	-	Beneficial



## 5.8 Analysis of Impacts for the proposed ATC Projects

An in-depth analysis of the identified impacts indicate that some impacts may generate from the local social and economic setting, which may in many ways have significant costs on the social, economic and environmental settings related to the proposed ATC projects. Other impacts are phase specific, but each has different levels of significance indicating that those most sever demand attention for the sustainability of the project. The significance of these impacts is summarized in Table 39.

**Table 39: Impact assessment**

Impact	Description	Impact assessment
Potential employment opportunities	<ul style="list-style-type: none"> <li>- It is envisaged that employment opportunities will increase for local communities during both construction and operational phases. This will be mostly in manual, skilled and unskilled work (excavation, security guards, cleaners).</li> <li>- Technical works (plant/machine operators) will require training, capacity building.</li> </ul>	Significant impact, particularly on individual and local economies
Enhanced farming and livestock keeping skills	<ul style="list-style-type: none"> <li>- The proposed strategy for extending extension services to local producers will enhance their skills and eventually their competitiveness in terms of supplying quality products in the long run.</li> </ul>	Significant
Enhanced women's empowerment	<ul style="list-style-type: none"> <li>- Women's trades such as in food vending and food processing will have a larger market/clientele during both project construction and operational phases. This opportunity will increase their incomes and ability to enhance their livelihood status.</li> </ul>	Significant
Advanced trade linkages	<ul style="list-style-type: none"> <li>- There is the potential of increased involvement of local traders in the value chain associated with ATCs</li> </ul>	Significant
Enhanced District economy and incomes	<ul style="list-style-type: none"> <li>- Once project management structures are clearly shared, District/Municipal authorities will receive revenues from the ATC operations</li> </ul>	Significant
Limitations in access to employment	<ul style="list-style-type: none"> <li>- Possibility of favouritism or discrimination in recruitment which may affect local people's opportunity for employment within the ATCs' catchment. This may be because of recruitment policies, or, targeting of individuals with special skills.</li> </ul>	Significant impact, could affect social acceptability of project, threaten security
Conflict/competition in basic resources	<ul style="list-style-type: none"> <li>- Project development may threaten availability or water access/supply for project and surrounding communities</li> </ul>	Significant, during both construction and operational phases
Decline in business by some traders	<ul style="list-style-type: none"> <li>- Possibility of more attractive terms of trade offered by the ATC facility can minimize the ability of locally established private entrepreneurs to get adequate supply of products for their business</li> </ul>	Not significant, will depend on the conduciveness of business run by the ATC
Loss of competitive edge by local producers	<ul style="list-style-type: none"> <li>- The degree of quality demanded by the ATC may shelve out certain products and hence the incomes of local producers who cannot maintain certain standards.</li> </ul>	Medium impact, can be mitigated by concerted extension services to producers
Dust pollution during construction	<ul style="list-style-type: none"> <li>- Frequent movement of construction vehicles and piling of construction materials, sand, gravel will definitely cause dust</li> </ul>	Significant, but short term

phase	emission beyond normal levels.	
Bio-diversity loss (degradation of vegetation and disturbance of insects)	- Vegetation clearance during construction phase is inevitable given the proposed designs of the facilities. This will definitely disturb the natural environment and fauna dependent on it.	Significant, low scale depending on area to be covered by the facility.
Increased road traffic	- Increased volume of vehicles going in and out of the facility to bring products or transport products to the ATC is expected particularly on the access road to the project area. Depending on volume of traffic this may impact on the safety of traders and residents.	Low significance
Increase in waste generation (solid, liquid)	- A large volume of solid and liquid waste is likely to be generated during the operational phase, and is likely to increase as the volume of products also increases over time. This includes waste water for processing.	Significant
Potential of aflatoxins in crops	- Poor quality of storage facilities at initial collection points (household and ATCs) may expose harvested produce to aflatoxin contamination	Significant, small-scale
Contamination of water sources	- Accidental spillage of liquid waste, solid matter or facility debris into water sources	Likely to occur during both construction and operational phases
Spread of infectious diseases – HIV, STIs	- Population increase, increase in money transactions due to increase in trade and other opportunities may encourage multiplication of transactional relationships and sex. - Possibility of lowly-resourced females to succumb to unsafe sex is likely.	May occur during both construction and operational phases
Gender-based violence (GBV)	- The abuse of women and young girls is likely to happen in the manner of sexual abuse or sexual exploitation.	Medium intensity because it may be mitigated by sensitization and punitive action
Child abuse	- There is a high likelihood of individuals taking advantage of children seeking employment in an environment of lucrative business interaction such as that expected of the ATCs. This is because they are easier to exploit.	Medium intensity because it may be mitigated by sensitization and punitive action
Occupational and Workers health	- Project (facility) workers may be exposed to a number of health and safety hazards during both the construction and operation phase due to work-related hazards, including pollution, or accidents. - There is also the possibility that other individuals may be affected by pollution owing to the increase in number of products transacted within the facility's catchment.	Significant, depending on the quality of safety measures put in place.

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## **5.8 Discussion of Impacts**

### **5.8.1 Positive Environmental and Social Impacts of the Proposed Project**

#### ***Employment Opportunities***

Several employment opportunities (skilled and unskilled) shall be created throughout the project phases.

#### ***Provision of Market for Supply of Construction Materials***

The proposed project shall require supply of a large quantity of materials, most of which will be sourced locally and in surrounding areas. This provides a market for material suppliers such as quarry companies, sand, wood, cement, paints and roofing material dealers as well as other dealers of building materials and local food vendors. The impact is rated significant and positive.

#### ***Improved Drainage***

The project area is seriously affected by gully erosion due to the lack of a well-planned drainage pattern; therefore, upon completion of the project, the drainage system of the area will be enhanced to meet the designed standard of the project. This will have a positive impact.

#### ***Gains in the Local and National Economy***

There will be gains in the local and national economy as a result of the construction of this project, through the consumption of locally available materials including timber, metals and cement. The consumption of these materials in addition to fuel oil for the machines to be used at the site and others will attract taxes including Value Added Tax (VAT) and Income Tax which will be payable to the government. The cost of the materials will be payable directly to the suppliers.

#### ***Informal Sectors Benefits***

During the construction phase of this project, the informal sectors are temporarily likely to benefit more from this phase. This will involve kiosk operators who will be selling food to the workers on site thereby promoting entrepreneurs in the host communities for the period that the construction will be taking place.

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### ***Skills Transfer and Training***

Through labour recruitment locally, the workers will have an opportunity to learn an array of skills that relate to building construction and ancillary works. Improved transport will improve interaction with other communities that will also provide an opportunity for further learning and cultural exchange.

### ***Gender and youth Aspects***

The SAPZ Project will systematically ensure that the project contributes to active gender equality and will not lead to unintended negative gender impacts, such as exclusion. Gender perspectives have been integrated into project formulation in line with the National Gender Strategy and policies while taking due cognizance of the Bank's Gender Policy. The PIU will also ensure development of a Gender Action Plan (GAP) that will drive the real engagement of either of the gender and also the youth to fully engage during the implementation of the project. In terms of project implementation, Component 1, 2 and 3 will aim to ensure that at least 35% of all beneficiaries are female, and/or female headed households to ensure the project addresses the challenges of the most vulnerable households. In terms of Component 4, which focuses on training, a target of 50% has been set to ensure balance in the institutional capacity building efforts.

### ***Climate Change and Green Growth***

This project was screened using the Climate Safeguards System (CSS) of the African Development Bank and found to be a Category 2 Project. In terms of climate change and green growth, the project will contribute to climate change resilience through improved agricultural production, better land use programme and good water and land management practices through catchment management. The project will also enhance climate change resilience through improved storage and warehousing facilities and improved marketing systems. However, efforts should and will be made to seek additional resources that may be used to enhance the effectiveness of this project by implementing climate change adaptation measures such as catchment management programmes and rainwater harvesting initiatives. Such activities will include: (i) sustainable land use practices; (ii) terracing to minimise topsoil losses through erosion; (iii) agroforestry initiatives that will

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improve soil fertility while providing animal feeds; (iv) development of water harvesting micro-dams; (v) provision of drought tolerant crop seeds; and, (vi) capacity building.

### ***Climate mitigation and adaptation***

The project is unlikely to directly cause material greenhouse gas (GHG) emissions. Emissions will arise from transport and construction of infrastructure and facilities such as micro-dams, irrigation systems, agro-processing facilities, dam access roads, agricultural produce storage facilities, or similar activities. In such regard, there will be limited scope for project-based mitigation. However, by improving land, water management and agricultural production systems, the project will directly increase the overall GHG emission efficiency of the agricultural sector and hence reduce the net GHG emission intensity of food production in the country. The project will, therefore, directly assist BAUCHI State to adapt to changing climates by improving the efficiency agricultural production while minimizing wastages through improved storage and marketing systems and market facilitation

## **5.8.2 Anticipated Negative Impacts of the Proposed Project**

### ***Dust Emissions Impact***

During construction work, substantial quantity of dust shall be generated through excavation, construction, leveling works, and to a small extent, transport vehicles delivering materials. Emission of large quantities of dust may lead to significant impacts on construction workers and the local residents. This impact is rated high. However it is expected that after mitigation measures are applied, the residual impact will be low.

### ***Noise and Vibration Impact***

The construction works, delivery of materials by heavy trucks and the use of machinery/equipment including bulldozers, generators, graders and compactors shall contribute high levels of noise and vibration within the construction site and the surrounding area. Elevated noise levels within the site shall affect project workers, the residents, passers-by, domestic animals, wildlife and other persons within the vicinity of the project area.

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### ***Increased Soil Erosion Impact***

The project area will be exposed to erosion and structures need to be developed to reduce soil erosion during construction activities. Soil erosion leads to sediments loading and silting water sources, reduction in stream flows upon abstraction or siltation, expose of aquatic life to risks, depleted oxygen levels and destruction of the river basin.

### ***Impact on Vegetation clearance***

Vegetation clearance/removal of trees shall be required which will lead to disruption/displacement of animal ecosystems and death of animals, among others.

### ***Extraction and Use of Materials Impacts***

Construction materials such as hardcore, rough stone, sharp sand gravel, laterite and water shall be required for the construction activities and will be obtained from quarries, boreholes and land. Sharp sand shall be extracted from rivers. Since substantial quantities of these materials will be required for construction of the proposed development project, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted shall be significantly affected in several ways including landscape changes, displacement of wildlife, intrusion into animal's breeding ground, and destruction of vegetation, poor visual quality and opening of depressions on the surface leading to pond creation thereby serving as a breeding ground for vector organisms, as well as other human and animal health impacts.

### ***Exhaust Emissions Impact***

Trucks and other vehicles that will be used to transport various materials from their sources to the project area will contribute to the increase in emissions of oxides of carbon, oxides of nitrogen, and oxides of sulphur amongst other harmful gases and fine particulates along the way as a result of fossil fuel combustion. Such emissions can lead to several environmental and health impacts including global warming. The impacts of such emissions shall be greater in areas where the materials are sourced and at the construction site as a result of frequent combustion by vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

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### ***Risks of Accidents and Injuries to Workers***

As a result of intensive engineering and construction activities, including grinding and cutting, masonry work, traffic, among others, construction workers will be exposed to risks of accidents and injuries. Such injuries will result from accidental falls from high elevations, injuries from hand tools and construction equipment, cuts from sharp edges of metal sheets, failure and collapse of machines. Injuries and/or fatal death can also occur due to attacks by wildlife. Open ditches, unfinished works and improper storage of materials can lead to accidents to both the public and workers.

### ***Impacts on Soil***

The impacts on the soil of the study area will be: disturbance of the natural soil structure, mixing of layers and compaction thus reducing the ecological function of soil in the respective areas. Generally, the valuable top soil containing organic material, nutrients as well as seeds and the soil fauna will be excavated separately for landscaping.

### ***Waste Generation Impact***

Large quantities of solid waste will be generated at the site during the construction of the proposed development project. Such waste will consist of excavated materials, vegetation, metal drums, rejected materials, surplus materials, surplus spoils, paper bags, empty cartons, waste oil, and waste bitumen, amongst others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be emphasized by the fact that some of the waste materials contain hazardous substances such as waste oil, and solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

### ***Energy Consumption Impact***

During the construction of the proposed project, fossil fuels will be used to run transport vehicles, generators and construction machinery. This fuel is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability.



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### ***Contamination of Environment***

Contamination of soil, water and air will take place during the construction process. Soil contamination will occur through aerial deposition and spills of related pollutants; asphalt residual, and erosion by stormwater. Air quality will be reduced due to generation of dust, hydrocarbon emissions, oxides of nitrogen, oxides of sulphur, oxides of carbon amongst other gases and particulate matter from machineries. Noise generation from machinery, equipment and increased traffic will also lead to disturbance of residential members, and scare domestic and wild animals. Water shall be contaminated due to siltation of water pans, stream; deposit of construction residual materials (asphalt, cement, oil, hydrocarbons, spoils etc). The hydrological patterns will also be affected by increased flows from collection drains and surface run off from the site. The water quality shall change in terms of turbidity, hydrocarbon levels, silt, suspended solids, organic matter etc. Hydrocarbon levels at water sources will increase due to spillage deposit of oil residue, and transfer of hazardous material into aquatic and human systems leading to health risks.

### ***Impact on Sanitary Facilities***

Construction workers will require sanitary facilities while working in the field and other areas leading to pollution of the environment.

### ***Water supply impact***

The proposed project will create or require large quantities of water. Excessive water use may negatively impact on the water source and its sustainability.

### ***Impact on Storm Water Flow and Demand for Sanitation***

The roof and pavements will increase volume and velocity of storm water or run-off flowing across the project area.

### ***Impact on Interference of Traffic Flow***

If access road and its maintenance activities are not well planned or organized, it will interfere with traffic flow leading to delay, accidents and other negative impacts related to traffic flow.

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### ***Social Infrastructural Impact***

From the existing baseline data collected, the project area has a very good and organized social infrastructures such as housing, potable water, schools, health centres, markets etc. This means that there will be increased pressure on these infrastructures as the population will increase with the development of this project.

### ***Impact on Health / Aesthetics***

The impact of the proposed project on the health of the community may arise as a result of sharp increase in the population, induced by employment. This will increase the health demand for the existing health facilities in the community. This may lead to secondary effects like pollution, an increase in solid waste generation in the environment of the project. On the positive side, the presence of clinics will go a long way in stabilizing the health situation in the area.

## CHAPTER SIX

### MITIGATION MEASURES

#### 6.1 Introduction

This chapter presents the mitigation (preventive, reduction and control) measures considered to ensure that the associated and potential impacts of the project on the ecological and socio-economic environment are eliminated or reduced to as low as reasonably practicable, thus preserving the ecological integrity of the existing environment. Also, stated here are details of the control technology and compliance with health and safety hazards requirements including a table showing potential impacts of proposed project with their proffered mitigation measures (Table 6.1).

#### 6.2 Impact Mitigation Methodology

The framework for determining the form of mitigation measures to be applied for the significant impacts identified for the project is shown in Figure 6.1 below. The frequency, severity, sensitivity, scale, magnitude and nature of the impacts were taken into consideration in the assessment.

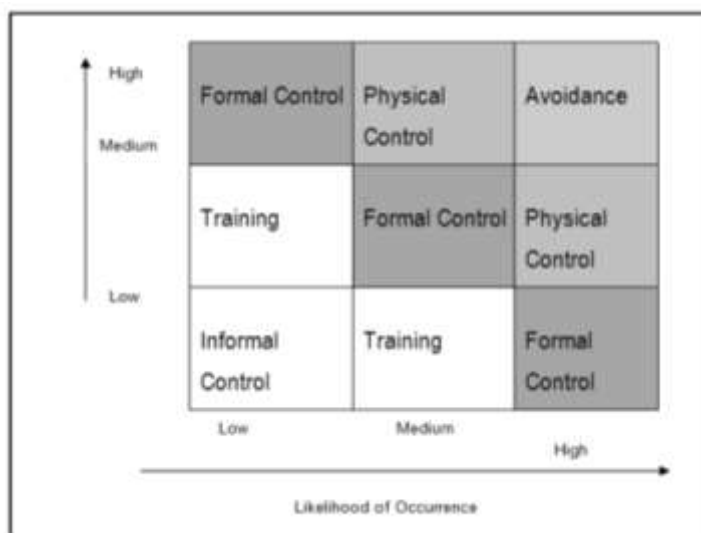


Figure 6.1: Matrix for Determination of Mitigation measures

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The approaches to the mitigation measures include enhancement (for the positive impacts), prevention, reduction, avoidance and compensation (for the significant negative impacts). The mitigation measures for each (significant and adverse) impact of the proposed project activities were generally identified based on the associated effect to the environment and human health/safety.

The definitions of the various approaches to impact mitigation considered are presented below.

**Enhancement:** These are measures proffered to ensure that significant beneficial impacts of the existing facilities and proposed project are encouraged.

**Prevention:** These are measures proffered to ensure that significant and adverse potential impacts and risks do not occur.

**Reduction:** These are measures proffered to ensure that the effects or consequences of those significant associated and potential impacts that cannot be prevented are reduced to a level as low as reasonably practicable.

**Formal control:** This involves the application of documented policy, process or procedure in mitigating the impacts of the project activities.

**Informal Control:** This involves the application of sound judgment and best practice in mitigating the impacts of project activities.

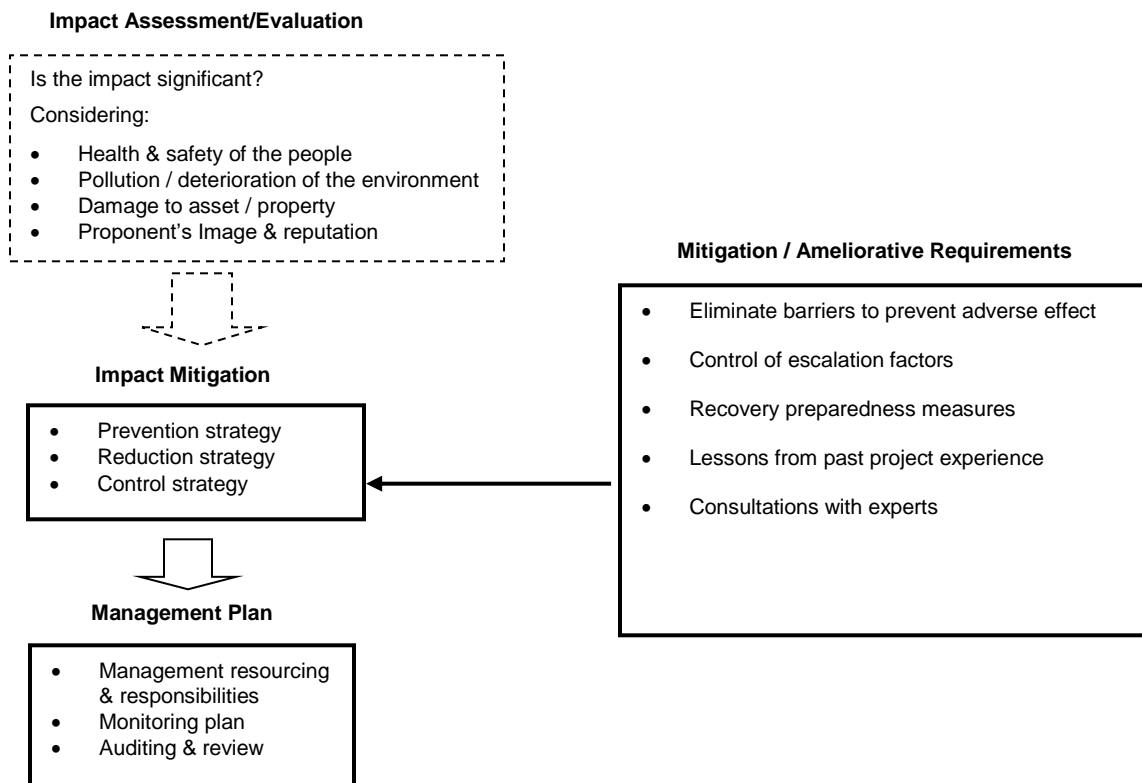
**Physical control:** This involves the application of physical processes or instruments (pegs, flags, sign post etc), not necessarily requiring any special technology, in order to mitigate the impacts of a project or impacts.

**Avoidance:** This involves the modification of plans, designs or schedules in order to prevent the occurrence of an impact or impacts.

**Training:** This involves personnel awareness in specific / specialized areas.

### 6.3 Management Procedure for Mitigation Measures

The management procedures employed for the establishment of mitigation measures for the identified impacts is presented in figure 6.2. Mitigation measures were subsequently proffered for adverse significant potential impacts. These measures (prevention, reduction, control strategies) were developed for the adverse impacts through review of industry experience (past project experience), consultations and expert discussions with multi-disciplinary team of engineers and scientists.



**Figure 6.2:** Management Procedure for Mitigation Measures

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## 6.4 Proffered Mitigation Measures

Accordingly, this section presents the mitigation measures proffered for the significant (medium and high) adverse impacts of the project. These cost effective measures have been proffered with reference to best industry practice and HSE considerations.

Based on the impact assessment matrix in the previous section, the overall ratings of impact significance **High** or **Medium** or **Low** was established for each identified impact. The proffered mitigation measures and the expected final residual impact rating for the identified potential significant impacts are presented in the **Table 6.1**. A residual impact is the impact that is predicted to remain after mitigation measures have been designed into the intended activity. Impact prediction takes into account any mitigation, control and operational management measures that are part of the project design and project plan. The residual impacts are described in terms of their significance in accordance with the categories identified in chapter 5.

**Table39: Impacts and Mitigation Measures of the Proposed Project**

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
<b>Pre-Construction</b> -Permitting -Mobilization -Recruitment -Site Preparation	Economic loss arising from loss of farm lands	High	BASG shall ensure: <ul style="list-style-type: none"> <li>• That due diligence is carried out prior to land acquisition.</li> <li>• To carry out census of affected farmers for compensation.</li> <li>• That all relevant stakeholders and issues are identified, discussed, and resolved properly prior to mobilization.</li> <li>• To implement regular consultations with the local community and other stakeholders (government, community, NGOs, CBOs, etc.) for effective communication and social license; support traditional conflict resolution structures in the project communities.</li> <li>• The activation of Grievance Redress Mechanism.</li> <li>• To compensate and resettle displaced farmers prior to mobilization.</li> </ul>	Medium
	Employment opportunities arising from recruitment of skilled and unskilled personnel	Beneficial	BASG shall ensure: <ul style="list-style-type: none"> <li>• Local contractors are engaged, and prompt payment for engaged labour is made regularly.</li> <li>• Only specialised professional workers will be recruited from outside the communities</li> <li>• To encouraging contractors to maintain a list of short-term employees for future call-ups when required</li> <li>• Adopt procurement practices that favour local merchants and service providers where practicable consultation with the locals shall be carried out in terms of provision of jobs.</li> <li>• Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.</li> </ul>	Positive
	Business opportunities for local contractors through subcontracting activities	Beneficial		
	Local support services from road side supply markets and shops etc	Beneficial		
	Skill acquisition and enhancements to local indigenes and workforce.	Beneficial		
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>• To embark on community development programmes in line with the desires and needs of the people.</li> <li>• The provision of accommodation for workers.</li> <li>• Employment of indigenes.</li> </ul>	Low



Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
	Increase of communicable diseases due to influx of people	Medium	<ul style="list-style-type: none"> <li>To coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents.</li> <li>To install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited.</li> <li>Areal fumigation and use of Insecticide Treated Net should be promoted in the Workers camp</li> <li>Sex education in protected sex, risk of casual sex and counselling services should be provided.</li> <li>Provision should be made for workers to live off-site with their families.</li> </ul>	
	Increase in social vices (like theft, prostitution etc.) resulting from increased number of people a	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Make security plan and emergency response and contacts with security forces.</li> <li>Engage professional security outfit in protecting lives and properties within the project area and the community. This must be registered with the Nigerian Police/NSCDC etc.</li> <li>Prepare a Local Content Plan to facilitate involvement of locals in the security network.</li> <li>Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour.</li> <li>Ensure that the workers are properly cautioned to respect the culture and place of worship of the people.</li> </ul>	Low
	Community agitation over unidentified stakeholder, leadership tussles etc.	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting</li> <li>Set-up and effectively monitor project grievance redress mechanism</li> <li>Engage communities in the monitoring activities to enhance transparency and involvement.</li> <li>Enhance ongoing consultations with local communities (with good representation) to create continuous dialogue, trust and planning of community development activities.</li> </ul>	Low
	Conflicts/community agitations over employment issues (quota and methods)	High		

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<ul style="list-style-type: none"> <li>• Proper consultation with the host communities and youth organizations on the recruitment of labour and work at height.</li> <li>• To liaise with local community head and relevant local organizations to work out formula for recruitment from the host communities</li> <li>• To be transparent in working out the formula for recruitment</li> </ul>	
	Noise and vibrations due to movement from heavy duty equipment and vehicles affecting site workers, residents and wildlife	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>• Vehicles are fitted with effective silencers;</li> <li>• regular maintenance of heavy duty vehicles are performed;</li> <li>• Vehicles are switched off when not in use;</li> <li>• Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>• Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>• Select-low noise‘ equipment or methods of work</li> <li>• Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> <li>• Avoid dropping materials from height, where practicable</li> <li>• Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>• Ensure periods of respite are provided in the case of unavoidable maximum noise level events</li> <li>• Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> </ul>	Low
	Increase of dust particles and vehicular emissions such as SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , etc	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>• Engine to comply with international standards for exhaust gases;</li> <li>• Maintenance of engines and exhaust gas check;</li> <li>• Adoption of engine off policy at the site</li> <li>• Use of the cleanest fuel economically available shall be adopted</li> <li>• Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<ul style="list-style-type: none"> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	
	Increased traffic during mobilization on road with risk of accidents leading to injury/death and loss of asset	High	BASG shall ensure: <ul style="list-style-type: none"> <li>The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>Compliance with journey management policy</li> <li>To minimize movement at the peak hours of the day</li> <li>That all traffic rules are obeyed by the drivers</li> <li>To engage security personnel in traffic control and management</li> </ul>	Medium
	Disturbance of the vegetative cover due to site clearing and preparation	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>That vegetation clearing will be limited to the surveyed area</li> <li>That plants of economic value are transplanted</li> <li>To limit vegetation clearing to approved widths and, as practicable, to minimum required ; and</li> <li>for disturbed areas that are no longer required for project operations, monitor regrowth and, if necessary, initiate actions to enhance regrowth or re-vegetation with appropriate species consistent with operation requirement</li> </ul>	Low
	Littering of the environment due to waste from wood, sand paper; domestic waste from laydown area and camp site (material and wood)	High	BASG shall ensure: <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	Low
	Contamination of surface water as a result of siltation caused by increased erosion during site preparation	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas.</li> <li>Install oil/water separators and silt traps before effluent, leaves</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<p>the site.</p> <ul style="list-style-type: none"> <li>Minimise bare ground and stockpiles to avoid silt runoff.</li> <li>Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>That processed wastewater is treated before discharging to nearby water bodies.</li> <li>That treated wastewater is reused to minimize its discharge volume.</li> <li>An inventory of waste is developed and maintained</li> <li>Remove all water accumulation within bunds using manually controlled positive lift pumps, not gravity drains.</li> <li>Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages.</li> <li>Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers.</li> <li>Protect excavated soil materials from erosion.</li> <li>That the land is physically restored (including revegetation where possible) during the rainy season after the construction activities.</li> <li>Use of existing track for transport of man and material to the extent possible.</li> <li>Construction of foundations to be undertaken in the dry season.</li> </ul>	
<p><b>Construction/ Installation</b>            Work, Mechanical and Electrical work which include;</p> <ul style="list-style-type: none"> <li>Drainage</li> <li>Foundation (trenching, Piling etc).</li> <li>Building erection</li> <li>Cabling and Conductor wire</li> </ul>	<p>Workplace accidents from burns, bruises, trips, and falls, objects at height leading to injury/fatalities.</p>	<p>Medium</p>	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Provision of adequate safety gears and equipments eg PPE especially gloves, and helmets to workers.</li> <li>All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>Unregistered labourers and touts shall not be employed.</li> <li>Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses and developing measures to prevent recurrence</li> <li>workers shall be sensitized and monitored on the need to be</li> </ul>	<p>Low</p>

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
stringing • Painting and coating • Transportation and logistics etc. • Commissioning /Testing • Waste management			safety conscious. • Daily toolbox talks before the commencement of work activities shall be carried out. • Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	
	Employment of local labour and skills acquisition for workers taking advantage on new opportunities	Beneficial	BASG shall ensure: • Local contractors are engaged, and prompt payment for engaged labour is made regularly. • Only specialised professional workers will be recruited from outside the communities • To encouraging contractors to maintain a list of short-term employees for future call-ups when required • Adopt procurement practices that favour local merchants and service providers where practicable consultation with the locals shall be carried out in terms of provision of jobs. • Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.	Positive
	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	Beneficial		
	Increase in revenue opportunities for local population due to presence of non-resident workers and travelers	Beneficial		
	Generation of dust and automobile/heavy duty equipment emissions from construction earthworks.	High	BASG shall ensure: • Engine to comply with international standards for exhaust gases; • Maintenance of engines and exhaust gas check; • Adoption of engine off policy at the site • Use of the cleanest fuel economically available shall be adopted • Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations • Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.	Medium
Flora/habitat loss and disturbance through vegetation clearing and earthworks along access roads and building sites.	Medium	BASG shall ensure: • Ensure that vegetation clearing will be limited to the surveyed area • Ensure that plants of economic value are transplanted • for disturbed areas that are no longer required for project operations, monitor regrowth and, if necessary, initiate actions	Low	

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			to enhance regrowth or revegetation with appropriate species consistent with operation requirement	
	Fauna disturbance and displacement as a result of migration away from construction area (e.g. birds, rodents and reptiles)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Workers are warned not to kill fauna species but allow them to move back to the forest</li> <li>Work force are provided with and use appropriate PPE (cover all, safety boots, hard hats, hand gloves and safety goggles) before venturing into the bush;</li> <li>Work force are provided assistants/experienced guides from the local communities to look out for signs of wild animals (including bees and wasps) in the bush; and trips into the work in inclement weather e.g., periods of low visibility, are avoided</li> </ul>	Low
	Soil/groundwater contamination resulting from improper waste disposal and accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>An inventory of waste is developed and maintained</li> <li>Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>Waste bins shall be provided at designated locations on site for temporary storage of different waste streams.</li> <li>General waste that cannot be reused or recycled shall be disposed of at an approved dumpsite.</li> <li>Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>Portable spill containment and clean-up kits shall be available onsite.</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
	Risks injury/death and loss of assets resulting from accidents associated with road transportation to and from construction sites	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>• use standard warning notice (e.g. signal lights and horn) to other road users;</li> <li>• ensure a practicable journey management programme is developed and adhered to;</li> <li>• maintain speed limits for road vehicles</li> <li>• ensure that mobilization is carried out after due consultation with relevant road authorities and other stakeholders to minimize interference along the road ways</li> </ul>	Low
	Traffic congestion during haulage of plant components to site for installation	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• the creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>• compliance with journey management policy</li> <li>• to minimize movement at the peak hours of the day</li> <li>• that all traffic rules are obeyed by the drivers</li> </ul>	Low
	Risk of injury from fall from height and building collapse due to unstable geotechnical conditions	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Provision of adequate PPE especially gloves and helmet to workers.</li> <li>• All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>• Unregistered labourers and touts shall not be employed.</li> <li>• Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence</li> <li>• workers shall be sensitized and monitored on the need to be safety conscious.</li> <li>• Daily toolbox talks prior to commencement of work activities shall be carried out.</li> <li>• Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.</li> <li>• Test structures for integrity prior to undertaking work.</li> <li>• Implement a fall protection program that includes training in</li> </ul>	Low



Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<p>climbing techniques and the use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.</p> <ul style="list-style-type: none"> <li>Provide an adequate work-positioning device system for workers.</li> </ul>	
	Risk of electrocution and burns (to onsite workers) during electrical installation processes	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Appropriate PPE shall be provided for workers.</li> <li>Workers shall imbibe the workplace safety rules via proper sensitization procedures.</li> <li>Strict compliance to the SOPs shall be ensured.</li> <li>A conduit type of wiring shall be adopted instead of a surface to prevent shock.</li> <li>Only allowing trained and certified workers to install, maintain, or repair electrical equipment;</li> <li>Deactivating and properly grounding live power distribution lines before work is performed on, or close to, the lines;</li> <li>ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards.</li> <li>Prior to excavation works, all existing underground cable installations should be identified and marked. Drawings and plans should indicate such installations.</li> </ul>	Low
	Reduction in wildlife population as a result of poaching due to easier access created by access roads	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Workers are warned not to kill fauna species but allow them to move back to the forest.</li> <li>Poachers are not allowed access to the site</li> <li>Work force are provided with and use appropriate PPE (cover all, safety boots, hard hats, hand gloves and safety goggles) before venturing into the bush;</li> <li>Work force are provided assistants/experienced guides from the local communities to look out for signs of wild animals (including bees and wasps) in the bush; and trips into the work in inclement weather e.g., periods of low visibility, are avoided</li> </ul>	Low
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding for building components	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Cover properly loose materials and keep top layers moist</li> <li>Use binder material for erosion and dust control for long term</li> </ul>	Medium

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<p>exposed surfaces.</p> <ul style="list-style-type: none"> <li>Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt. Spray surfaces prior to excavation</li> <li>Use covered trucks for the transportation of materials that release dust emissions.</li> <li>Speed limits on-site of 15 k/h should be recommended and enforced</li> </ul>	
	Noise nuisance from construction activities e.g. Piling resulting to irritation in humans and temporal migration of sensitive mammals	High	<p>BASG shall ensure that:</p> <ul style="list-style-type: none"> <li>Vehicles are fitted with effective silencers;</li> <li>regular maintenance of heavy duty vehicles are performed;</li> <li>Vehicles are switched off when not in use;</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>Select-low noise' equipment or methods of work</li> <li>Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> <li>Avoid dropping materials from height, where practicable</li> <li>Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>Ensure periods of respite are provided in the case of unavoidable maximum noise level events</li> <li>Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> </ul>	Low
	Visual intrusion as a result of alterations from accidental ignition of onsite diesel storage tanks	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Maintain construction site in orderly condition and do not distribute material over many sites before usage.</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
	<p>Waste Disposal</p> <ul style="list-style-type: none"> <li>Scrap metal, wood, sand, concrete, paper</li> <li>Spent-oil and replaced /obsolete equipment parts that may contaminate soil/ground water</li> <li>Waste from laydown area and building sites causing unsightliness</li> </ul>	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	Low
<p><b>BILISA</b></p> <p>obilization after construction phase</p>	<p>Workplace accidents from burns, cuts, bruises, trips and falls, object at height leading to injury of fatalities.</p>	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Provision of adequate PPE especially gloves and helmet to workers.</li> <li>All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>Unregistered labourers and touts shall not be employed.</li> <li>Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence</li> <li>workers shall be sensitized and monitored on the need to be safety conscious.</li> <li>Daily toolbox talks prior to commencement of work activities shall be carried out.</li> <li>Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.</li> <li>Test structures for integrity prior to undertaking work.</li> <li>Implement a fall protection program that includes training in climbing techniques and the use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.</li> <li>Provide an adequate work-positioning device system for workers.</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
	Soil/groundwater contamination resulting from accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>• Portable spill containment and clean-up kits shall be available onsite.</li> </ul>	Low
	Traffic congestion during transportation of demobilized equipment and personnel	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>• Compliance with journey management policy</li> <li>• To minimize movement at the peak hours of the day</li> <li>• That all traffic rules are obeyed by the drivers</li> <li>• To engage security personnel in traffic control and management</li> </ul>	Low
	Generation of dust and automobile/heavy duty equipment emissions	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Engine to comply with international standards for exhaust gases;</li> <li>• Maintenance of engines and exhaust gas check;</li> <li>• Adoption of engine off policy at the site</li> <li>• Use of the cleanest fuel economically available shall be adopted</li> <li>• Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	Low
	Waste disposal (scrap metal, wood, sand, concrete, paper)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<ul style="list-style-type: none"> <li>• Generation of all wastes are minimize as much as practically possible</li> <li>• Reuse waste materials wherever possible and use designated disposal site;</li> <li>• There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	
	Loss of employment and business opportunities due to completion of construction phase	Medium	BASG shall: <ul style="list-style-type: none"> <li>• Counsel worker and occupant who losses job.</li> <li>• Give enough notice</li> <li>• Pay Workers all entitlement due to them prior to job loss</li> </ul>	Low
	Illegal access to building site leading to accident, asset damage and loss	Medium	BASG shall: <ul style="list-style-type: none"> <li>• Make security plan and emergency response and contacts with security forces.</li> <li>• Professional security outfit be engaged in preventing illegal access to the building sites</li> <li>• Prepare a Local Content Plan to facilitate involvement of locals in the security network.</li> </ul>	Low
<b>ATION AND MAINTENANCE</b> <ul style="list-style-type: none"> <li>• Building inspection and checks</li> <li>• Power generation/ servicing</li> <li>• Transportation of raw materials and finished product</li> <li>• Agro-products processing for export.</li> </ul>	Risk of injury from fall from height/trip or being hit by an object	Medium	BASG shall ensure that: <ul style="list-style-type: none"> <li>• A comprehensive HSE Policy must be displace openly, and enforced through monitoring within the site;</li> <li>• All staff must be trained and retrained on regular basis for HSE compliance;</li> <li>• Develop a training program including a code of conduct for all workers;</li> <li>• Well-equipped Clinic should be put up for emergence attention, while referral system should be arranged with a Secondary Hospital</li> </ul>	Low
	Security threat such as kidnapping and banditry attack	Medium	BASG shall: <ul style="list-style-type: none"> <li>• Engage trained security personnel</li> <li>• Avoid lone working</li> <li>• Avoid working at nights</li> <li>• Avoid night journeys</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
<ul style="list-style-type: none"> <li>Plant maintenance</li> <li>Industrial waste discharges</li> <li>Emergence of small-scale enterprises</li> <li>Green Buffer development around each industrial plot.</li> <li>Recruitment of workers</li> </ul>	Air pollution by gaseous emission (CO, SO <sub>2</sub> , NO <sub>2</sub> ) and particulates from power generator	High	BASG shall ensure: <ul style="list-style-type: none"> <li>Generator to comply with international standards for exhaust gases;</li> <li>Maintenance of generator and exhaust gas check;</li> <li>Use of the cleanest fuel economically available shall be adopted</li> </ul>	Low
	Soil contamination resulting from accidental leakages and spill of hazardous substances from generator servicing (diesel, spent oil etc.)	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>Bunding of areas where hazardous substances are stored (e.g. fuel, waste areas).</li> <li>Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>Portable spill containment and clean-up kits shall be available onsite.</li> <li>Conduct bioremediation of polluted soil immediately to inhibit further spread</li> </ul>	Low
	Generation of dust and gaseous pollutants from automobile emissions	High	BASG shall ensure: <ul style="list-style-type: none"> <li>Engine to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>Preference for usage of clean fuel like LPG, low sulphur diesel should be explored;</li> <li>Energy conservation should be adopted by opting the alternate energy options like solar power;</li> <li>Power Generators and equipment should be provided with</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<p>stacks of adequate height (higher than nearest building) to allow enough dispersion of emission;</p> <ul style="list-style-type: none"> <li>• Enclosure of dust producing equipment,</li> <li>• Use of local exhaust ventilation;</li> <li>• Use of dust extraction and recycling systems to remove dust from work areas;</li> <li>• Regular checking and maintenance of all plant and equipment to minimize the risk gas leakage</li> </ul>	
	Odour disturbances from the processing of Rice, Tomato, Edible oil etc	High	<p>BASG shall</p> <ul style="list-style-type: none"> <li>• Ensure all processing equipment are installed in an enclosed plant and processing activities are taking place within an enclosed system.</li> <li>• Ensure provision of appropriate PPE (respiratory protection) for workers and enforce usage.</li> <li>• Ensure that project staff are not exposed to more than nine hours at a go on any equipment generating noise level of more than 90 dBA</li> </ul>	Medium
	Increase in noise level nuisance from operation machines and from vehicles plying the access roads	High	<p>BASG shall ensure that:</p> <ul style="list-style-type: none"> <li>• Vehicles are fitted with effective silencers;</li> <li>• regular maintenance of heavy duty vehicles are performed;</li> <li>• Vehicles are switched off when not in use;</li> <li>• Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>• Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>• Select-low noise' equipment or methods of work</li> <li>• Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> <li>• Avoid dropping materials from height, where practicable</li> <li>• Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>• Ensure periods of respite are provided in the case of unavoidable</li> </ul>	Low



Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<p>maximum noise level events</p> <ul style="list-style-type: none"> <li>• Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> <li>• Machineries to be used should comply with the noise standards prescribed by FMEV.</li> <li>• Workers shall be given PPE (ear plugs) and enforce compliance;</li> </ul>	
	congestion along agro-products transportation route	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>• Compliance with journey management policy</li> <li>• To minimize movement at the peak hours of the day</li> <li>• That all traffic rules are obeyed by the drivers</li> <li>• To engage security personnel in traffic control and management</li> </ul>	Low
	to community culture, safety security due to the presence of and business opportunists	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>• Develop an induction program including a code of conduct for all workers. Code of conduct to address the following: <ul style="list-style-type: none"> <li>○ Respect for local residents;</li> <li>○ unauthorized taking of products;</li> <li>○ Zero tolerance of illegal activities such as child sexual exploitation and underage sex, prostitution, harassment of women, Gender Based Violence (GBV,) purchase or use of illegal drugs,</li> <li>○ Disciplinary measures and sanctions (e.g. dismissal) for infringement of the code of conduct and/or company rules;</li> <li>○ Commitment / policy to cooperate with law enforcement agencies investigating perpetrators of GBV.</li> </ul> </li> <li>• Limit the number of migrant workers by engaging local workers.</li> </ul>	Low
	on of water tables and sources of water for production processes	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Water conservation measures should be practiced</li> <li>• Waste water should be recycled for reuse.</li> <li>• Rain water harvesting.</li> <li>• Adoption of continuous horizontal washers and vertical spray washers or vertical, double-laced washers.</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<ul style="list-style-type: none"> <li>Adoption of counter current washing (e.g. reuse the least contaminated water from the final wash for the next-to last wash).</li> <li>Use of water flow-control devices to ensure that water only flows to a process when needed.</li> </ul>	
	materials generation from plant parts, retrofitting/upgrade of parts during plant servicing	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Recyclable materials should be sorted and sold to scrap metal converters</li> <li>Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages.</li> </ul>	Low
	al for land contamination from industrial waste disposal	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	Low
	n of surface water bodies by wastewater generated from industrial waste discharges	High		
	n of job and acquisition of skills by individuals to be employed as operators	Beneficial	BASG shall ensure: <ul style="list-style-type: none"> <li>Local contractors are engaged, and prompt payment for engaged labour is made regularly.</li> <li>Only specialised professional workers will be recruited from outside the communities</li> <li>To encouraging contractors to maintain a list of short-term employees for future call-ups when required</li> <li>Adopt procurement practices that favour local merchants and service providers where practicable consultation with the locals shall be carried out in terms of provision of jobs.</li> <li>Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.</li> </ul>	Positive
<b>Commissioning/ Abandonment</b>	accident and injury to workers during demolition of structures	Medium	BASG shall ensure that: <ul style="list-style-type: none"> <li>A comprehensive HSE Policy must be displace openly, and enforced through monitoring within the site;</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
electrical cables and wires, water and sewage treatment plant pipelines. • Demolition of buildings for facilities retrieval • Waste generation • Transportation of Plant components for sale/another site • Re-vegetation of site			<ul style="list-style-type: none"> <li>All staff must be trained and retrained on regular basis for HSE compliance;</li> <li>Develop a training program including a code of conduct for all workers;</li> <li>Well-equipped Clinic should be put up for emergence attention, while referral system should be arranged with a Secondary Hospital</li> </ul>	
	ed dust and vehicular emissions during haulage of plant components from site by duty vehicles	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Engine to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	Low
	soil and adjoining surface water contamination from accidental oil and hazardous substance leakages	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>Portable spill containment and clean-up kits shall be available onsite.</li> </ul>	Low
	obstruction from transportation of decommissioned structures and equipment	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>Compliance with journey management policy</li> </ul>	Low

Project Phase/Activity	Associated and Potential Impacts		Mitigation Measures	Residual Impact Rating
			<ul style="list-style-type: none"> <li>To minimize movement at the peak hours of the day</li> <li>That all traffic rules are obeyed by the drivers</li> <li>To engage security personnel in traffic control and management</li> </ul>	
	Abandoned structures possibly taken-over by miscreants/criminals	High	BASG shall: <ul style="list-style-type: none"> <li>Make security plan and emergency response and contacts with security forces.</li> <li>Re-vegetate the site with local plant species</li> </ul>	Medium
	Availability of land for alternative uses such as community hall, farmland e.t.c	Beneficial	BASG shall ensure: Use local plant species to re-vegetate the abandoned site	Positive
	Improved Ecology, Air Quality and Aesthetics	Beneficial		

## **6.5 Impact Mitigating Measures for Pre-Construction and Construction Phase**

### **6.5.1 Vegetation Clearance and Disturbance**

Clearance of vegetation at the project site to pave way for construction shall take place within the perimeter of the acquired land. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spillover effects on the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area allocated with access routes and other works; deviation works shall be confined close to the road to avoid spread of vegetation destruction; avoid encroachment into drainage. Since sustainable development equally recognizes that vegetation must inevitably give way to developmental projects, adequate care will be taken in order that some native plants within the project radius (2km) will be conserved. Specifically, only trees at the project right of way shall be cut. In addition, the proponent shall re-vegetate some of the disturbed areas through implementation of a well-designed landscaping programme. It is recommended that part of the topsoil excavated from the construction site be re-spread in areas to be landscaped to enhance plant health.

### **6.5.2 Run-off and Soil Erosion**

The contractors shall put in place measures aimed at minimizing run-off and spillover effects on neighbouring land as well as sources of water during rainy season or when wet activities are being conducted on the site. These measures will include clearing the project site of excavated materials or protect excavated sections from storm water, back filling and creating proper channels for waste water and solid waste disposal, develop emergency measures and procedures for protection of soils and streams downstream from effect of siltation, design adequate culverts to accommodate peak flows; stabilize cut-surfaces with gabions, concrete walls, vegetation etc.; direct all surface runoff into existing natural drains and stabilize the drains downstream.

### **6.5.3 Dust Generation and Emission**

Dust emission during construction shall be minimized through strict enforcement of speed controls in the host community as well as limiting unnecessary traffic within the project

site from vehicle delivering materials. Some dust generating activities shall be carried out under wet condition within the project site by damping with water regularly to reduce amount of dust generated by the construction trucks and other heavy equipment. The workers will also be provided with nose masks to protect them against dust effects.

#### **6.5.4 Noise and Vibration**

Noise and vibration shall be minimized in the project site and surrounding areas through sensitization of construction truck drivers to switch off vehicle engines, avoid gunning of vehicle engines or hooting during movement and while offloading materials. Construction machinery including generators and heavy duty equipment shall be insulated or placed in enclosures to minimize ambient noise levels, construction activities to be conducted during the day in order to avoid noise nuisance to the resident around the areas, excavation to be undertaken with ordinary earth movers, ensure good maintenance of vehicles and equipment. Engine mufflers shall be incorporated into all project equipment to reduce noise pollution.

#### **6.5.5 Mitigation Measures for Energy Consumption Impact**

There shall be proper planning of material transportation; this will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the contractor will monitor energy use during construction and set targets for reduction of energy use. Renewable energy sources at the project site office as a sustainable alternative are recommended.

#### **6.5.6 Exhaust Emissions**

This shall be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased within axle weight limits in order to reduce the number of trips or the number of vehicles on the road. Truck drivers shall be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines off at these points. Machineries for construction and other combustion sources shall be provided with equipment to enhance high-efficiency burners that will minimize the emission of noxious gases.

### **6.5.7 Construction Waste Impact**

Construction wastes shall be reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the contractor shall be committed to ensuring that construction materials left over at the end of construction is used in the same or other projects rather than being disposed of. In addition, damaged or waste construction materials including gravel, cement, off-cut of rods, wood and roofing sheets, damaged blocks and waste oil among others shall be recovered for use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents (secondary users). An integrated solid waste management system shall be employed by the contractors. Solid wastes arising from construction works shall be contained and disposed in approved disposal site by the service of Bauchi State Environmental Protection Agency's registered waste contractors. Priority shall be given to reducing waste at source. Other measures to be employed in minimizing solid waste during construction of the project shall include:-

- Use of durable, long-lasting materials and equipment's that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time.
- Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements of weather.
- Use of construction materials that have minimal packaging to avoid the generation of excessive packaging waste.
- Use of construction materials containing recycled content when possible and in accordance with accepted standards.

### **6.5.8 Water Use and pollution of water sources**

The contractor shall ensure that water shall be used efficiently at the site by sensitizing construction staff to avoid irresponsible water usage. No solid waste, fuels/oil shall be discharged into drains. Washing of construction equipment and trucks shall be carried out in a designated area. Waste water from project site and from the site office shall be



channeled into the appropriate channel to avoid contamination of water bodies (both surface and ground) and soils.

### **6.5.9 Mitigation Measures for Landscape related impacts**

The proposed project and Associated Services will affect the surrounding landscape, which encompasses natural relief, vegetation, water courses and other object of aesthetic value. As a result, the project activities will follow the natural relief as far as practicable and cutting of native trees will be minimized.

### **6.5.10 Mitigation Measures for Human Health and Safety Impact**

Since the proposed project will be instrumental in the contamination of water body, air and noise pollution, road accidents, poor signage and traffic control systems worsen the situation if not properly managed. The ESIA report recommends that the project team through the PRO in conjunction with the host and neighbouring Community Leaders and FRSC to carry out comprehensive awareness to prevent outbreaks of communicable diseases including STIs, Screen and treat the affected persons, control dust by spraying water and assign high priority to accident preventive measures, enforce mandatory use of seatbelts, compulsory driver training and testing, prohibition and punishment of driving while those impaired with drugs or alcohol, traffic safety education, testing and inspection of all vehicles to comply with national safety standards, Improve road safety features for non-motorized vehicles, provide proper safety feature for vulnerable road users like pedestrians and cyclists, and reducing congestion.

## **6.6 Mitigation for Operation and Maintenance Phase Impacts**

### **6.6.1 Efficient Solid Waste Management**

Bauchi State Environmental Protection Agency's accredited waste contractor shall be responsible for efficient management of solid waste that shall be generated by the project during its operation and maintenance phase. In this regard, waste handling facilities such as waste receptacles for temporarily holding of domestic waste generated shall be provided. In addition, they will ensure that the waste is disposed off regularly and appropriately.

### **6.6.2 Social Impact**

Immigration of workers will be controlled through employment of locals. Locals' capacity building will be conducted to prepare them for challenging assignment. The contractor will discourage labour yard by allowing workers to live at their homes; this is to reduce vices that will be induced by immigrating labourers as this normally increases incidence of illicit behavior.

### **6.6.3 Energy Consumption**

The contractor shall use energy-efficient lighting systems to light the entire area. This will contribute immensely to energy saving during the operational phase of the project. This will ensure adequate management of the power supply

### **6.6.4 Mitigation Measures for Environmental Pollution and Contamination impact**

All measures will be put in place to avoid environmental pollution and contamination. Oil spillage management measures will be put in place (through storage, and disposal) including use of bio-diesel; materials will be covered to avoid pollution caused by elements of weather such as wind, rain etc; enclose plants and usage and materials transfer facilities, smoking equipment's during site clearing and trucks will be installed with pollution control devices including; control leakages during maintenance and cleaning of vehicles and construction equipment; noisy equipment's shall be installed with sound proof; proper drainage and erosion structures shall be developed to reduce effects of erosions; contaminated soils shall be stabilized before disposal, avoid disposal of oil residuals, asphalt, and engine parts; hold top soils from material sites for rehabilitation and stabilize cut sections. Professional handling of pollution point sources during the project development and decommission of the potential point sources of pollution will be necessary. Quality control of the streams shall be conducted downstream; culverts shall be kept clear at all times and channeled into natural drains, control soil loss from the neighbouring land through storm water flows, introduce appropriate vegetation in the project area and compel occupant to take responsibility of their own pollutants by depositing them in the appropriate bins for evacuation.

### **6.6.5 Occupational Health and Safety Impact**

Contractors of the project shall ensure adherence to the occupational health and safety rules and regulations. They shall be committed to provision of security, insurance of both personnel

and equipment, train and develop capacity especially for inexperienced labourers/workers, compensate for losses and injuries, provide appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the ESMP. Other critical practices that shall be ensured to enhance safety are: evaluation of risks, inform host community on schedule and activities, workers shall be trained on health and safety procedures, reflective signage shall be installed for safety of workers/users, keep public away from material site. In addition, the construction workers shall be exposed to 'Daily Safety Briefing' on health, safety and environment (HSE) to reduce or completely eliminate this impact. Use of PPE shall be enforced. Project workers that shall be engaged with electrical works shall be provided with electrical protective devices such as line hose, gloves, covers and sleeves made of rubber.

## **6.7 Mitigation for Decommissioning Phase Impacts**

### **6.7.1 Mitigation Measures for Dust Emission Impact**

Dust emission during decommissioning shall be minimized through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the area. Some dust generating activities shall be carried out in wet condition; and unpaved traffic routes within and around the area shall be damped with water regularly to reduce amount of dust generated by trucks. The workers will also be provided with nose masks to protect them against dust effects.

### **6.7.2 Mitigation Measures for Exhaust Emissions Impact**

This shall be achieved through proper planning of transportation of materials outside the area and the dismantling activities to ensure that vehicle fills are increased within axle weight limits in order to reduce the number of trips or the number of vehicles on the road. Truck drivers shall be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines off at these points. Machineries for dismantling and other combustion sources will have high-efficiency burners that will minimize the emission of noxious gases.

### **6.7.3 Efficient Solid Waste Management Impact**

Decommissioning waste shall be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the contractor shall be committed to ensuring that materials left over shall be used in the same or other project rather than being disposed of. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, refilling of gullies. An integrated solid waste management system shall be employed. Solid wastes arising from decommissioning shall be contained and disposed off in approved disposal site.

### **6.7.4 Mitigation Measures for Noise and Vibration Impact**

Noise and vibration shall be minimized in the project site and surrounding areas through sensitization of truck drivers to switch off vehicle engines, avoid gunning of vehicle engines or hooting during movement and while offloading materials. Machinery including generators and heavy duty equipment shall be placed in enclosures to minimize ambient noise levels, decommissioning activities to be conducted during the day, excavation to be undertaken with ordinary earth movers, ensure good maintenance of vehicles and equipment. The contractor will provide hearing protective devices, specifically ear muff, for all project workers. The use of the ear-muffs at all times on the site shall be strictly enforced.

## **CHAPTER SEVEN**

### **ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN(ESMP)**

#### **7.1 Introduction**

This chapter presents the Environmental and Social Management Plan (ESMP) developed for the proposed construction of the Special Agro-industrial Processing Zone (SAPZ), Bauchi, Nigeria. An environmental and social management plan (ESMP) is essentially a management tool and standalone component of an ESIA that provides the assurance that the mitigation measures developed for the significant impacts of a proposed project are implemented and maintained throughout the project lifecycle. It outlines management strategies for safety, health, and environmental stewardship in the proposed project implementation. It states in specific terms how the project proponent's commitments will be implemented to ensure sound environmental practice.

Bauchi State Government has designed the ESMP of the proposed project in line with its Health, Safety and Environment (HSE) policy and in accordance with ISO 14001 Environmental Management System specifications. The ESMP for the proposed project shall be a "life document" which shall be reviewed periodically with the incorporation of various mitigation measures for potential impacts and shall form the basis for the actual project implementation.

Compliance with the legal standards on safety and environment is regarded as the minimum requirement and must be satisfied during all phases of the Project development to reduce the risk of an adverse effect on the environment to the lowest level that is reasonably practicable, an objective of the engineering design will be to apply the ALARP principle. Figure 7.1 illustrates this principle graphically.

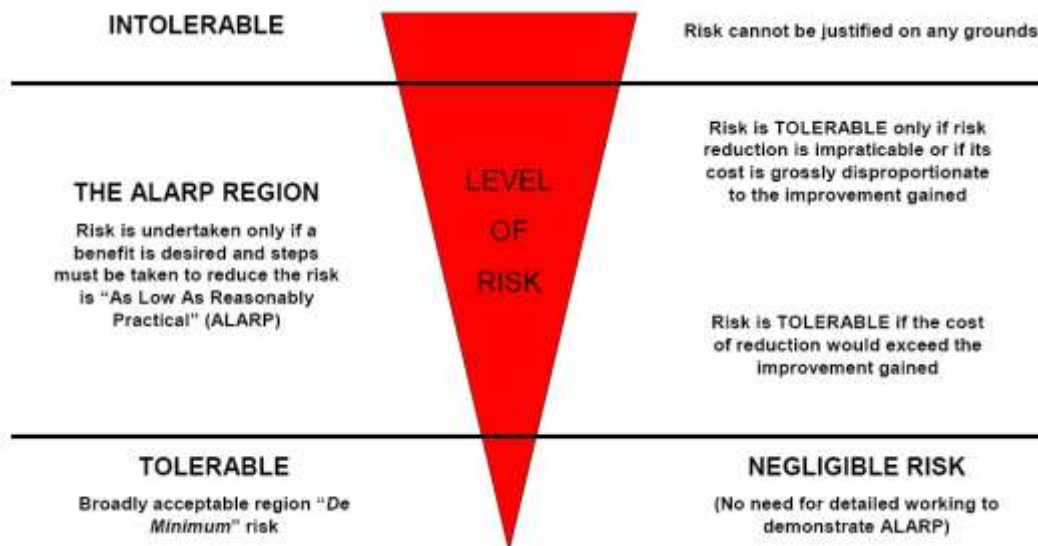


Figure 7.1: Level of Risk and ALARP

## 7.2 ESMP Objectives

The ESMP is essential for successfully implementing the project's environmental performance throughout the life of the Project. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision-making and day-to-day operations. It establishes a framework for tracking, evaluating and communicating environmental performance and helps ensure that environmental risks and liabilities are identified, minimized and managed. The ESMP will be a living document and will continue to develop during the design and construction phase to enable continuous improvement of the project environmental performance.

Specifically, the ESMP is designed to:

- ensure that all mitigation measures prescribed in the ESIA document for eliminating, minimizing, and enhancing the project's adverse and beneficial impacts are fully implemented; and
- ✦ provide part of the basis and standards needed for overall planning, monitoring, auditing, and review of environmental and socio-economic performance throughout the project activities.

This has been developed to manage negative impacts/effects, enhance benefits and ensure good standards of practice are used throughout the project. These objectives shall be achieved by:

- ✦ ensuring compliance with all stipulated legislation on the protection of the biophysical and socio-economic environment and Bauchi State Ministry of Agriculture HSE policy;
- ✦ integrating environmental and socio-economic issues fully into the project development and operational philosophies;
- ✦ promoting awareness of the management of the biophysical and socio-economic environment among workers;
- ✦ rationalizing and streamlining existing environmental activities to add value to efficiency and effectiveness;
- ✦ ensuring that only environmentally and socially sound procedures are employed during the project implementation; and
- ✦ continuous consultations with the relevant regulatory bodies, community leaders (local heads/chiefs, clan heads, landlords, etc.), youth leaders, Community-Based Organizations (CBOs), and other stakeholders throughout the project lifecycle.

### **7.3 Core Elements of the EMP**

In line with the objectives summarized in section 7.2 above, the main elements of this ESMP are:

- Overall project organizational chart (including HSE) organogram;
- Preliminary ESMP guidelines;
- Guidelines for waste management;
- Guideline for Consultation;
- Noise Minimization Guideline;
- Overall safety philosophy/guidelines;
- Emergency/Contingency plan;
- Communication plan;
- Security plan;



- Plan for Training and Awareness;
- Environmental monitoring plan;
- Guidelines for audit and review;
- Guidelines on maintenance and facility management; and
- Guidelines for decommissioning and abandonment.

## 7.4 Structure and Responsibility

The roles and responsibilities (HSE) for the proposed project include:

### **Resident Engineer**

- ✦ HSE management on the project
- ✦ Provide visible leadership, systems and resources for environmental management
- ✦ Initiate action to maintain compliance with requirements
- ✦ Specify and participate in project audits/reviews as required

### **Assistant Project Manager(s)**

- ✦ Review procedures for environmental aspects
- ✦ Follow up actions from project risk assessments and environmental reviews
- ✦ Be the focal point for environmental matters with sub-contractors as required
- ✦ Participate in project audits/review as required

### **HSE Advisor**

- ✦ Be proactive in promoting HSE
- ✦ Follow-up /monitor requirements with responsible parties
- ✦ Provide specialist HSE advice
- ✦ Facilitate project risk assessment as required
- ✦ Lead/participate in audits, as required
- ✦ Maintain the HSE Activities matrix and monitor the close out of Project Environmental Review
- ✦ Development of Project HSE documentation

### **Environmental Lead**

- ✦ Provide specialist environmental advice
- ✦ Jointly monitor project Environmental aspects with Project Team
- ✦ Review relevant project documentation on circulation by Project Team

- ✦ Facilitate project environmental review
- ✦ Lead / participate in audits and inspections as required
- ✦ Review project environmental documentation

### 7.4.1 Institutional Responsibility

The responsibilities of all incorporated institutions in the implementation of this ESMP are presented in Table 7.1 below:

**Table40: Roles and Responsibilities of Relevant Institution**

S/N	Category	Roles & Responsibilities
1.	Federal Ministry of Environment	Provision of advice on screening, scoping, review of draft ESIA report (in liaison with State Ministry of Environment), receiving comments from stakeholders, public hearing of the project proposals, and convening a technical decision-making panel, environmental and social liability investigations, monitoring and evaluation process and criteria.
2	Bauchi State Government	<ul style="list-style-type: none"> <li>• Oversee all environmental compliance at the State level</li> <li>• Review of draft ESIA report (in liaison with Federal Ministry of Environment)</li> <li>• Site assessment and monitoring of ESMP implementation.</li> </ul>
3.	State Government MDAs (Ministry of Physical Planning, Urban Development, Bureau of Lands, etc.	<ul style="list-style-type: none"> <li>• Compliance overseer at State Level, on matters of land acquisition and compensation and other resettlement issues,</li> <li>• Other MDAs come in as and when relevant areas or resources under their jurisdiction or management are likely to be affected by or implicated projects.</li> <li>• They participate in the EA processes and in project decision-making that helps prevent or minimize impacts and to mitigate them.</li> <li>• Issuance of consent or approval for an aspect of a project; allow an area to be included in a project; or allow impact to a certain extent or impose restrictions or conditions, monitoring responsibility or supervisory oversight.</li> </ul>
	BASEPA	<ul style="list-style-type: none"> <li>• Inspection of project premises to ensure strict compliance with sanitation and waste management standards in the state.</li> <li>• Collaboration with other MDAs at the State and Federal level, NGOs and Donor Agencies in environmental protection and management especially in areas of waste recycling etc.</li> </ul>
	Local Government	<ul style="list-style-type: none"> <li>• Provision of oversight function across subprojects in LGAs for ESMP compliance.</li> <li>• Monitoring of activities related to public health, sanitation, and waste management amongst others.</li> </ul>
	Affected Community	<ul style="list-style-type: none"> <li>• Promote environmental awareness.</li> <li>• Review environmental and social performance report made available by BASG</li> <li>• Provide comments, advice, and/or complaints on issues of nonconformity.</li> <li>• Attend public meetings organized by BASG to disseminate information and receive feedback.</li> </ul>
	CDA	<ul style="list-style-type: none"> <li>• Ensure community participation by mobilizing and sensitizing community members.</li> </ul>

	NGOs/CSOs	<ul style="list-style-type: none"> <li>Assisting in their respective ways to ensure effective response actions, conducting scientific researches alongside government groups to devise sustainable environmental strategies and techniques.</li> </ul>
	Others/General Public	<ul style="list-style-type: none"> <li>Identify issues that could disrupt the project and support project impacts and mitigation measures and awareness campaigns.</li> </ul>

## 7.5 Framework for Implementing the EMP

The framework for the implementation of this ESMP is strongly based on a repeated process of continuous improvement which comprises of eleven (11) elements, each with underlying principle and set expectations.

Overview of each of the eleven primary elements is presented as follows.

- Management Leadership, Commitment, and Accountability: Ensures that the workers understand the goals and management commitment to excellence in safety, health, environment, and operational integrity.
- Risk Assessment and Management: Ensures that risks involved in operations are recognized so that they can be appropriately addressed through facility design and/or operating practices.
- Facilities Design and Construction: Ensures elements for the protection of people and the environment are incorporated into the design of facilities and the plans for installations and operations.
- Process and Facilities Information/Documentation: Ensures that the systems designed to protect people and the environments are appropriately documented.
- Personnel and Training: Ensures that personnel understand the systems that are in place and are appropriately trained to perform required roles with respect to their functions.
- Operations and Maintenance: Ensures that facilities are maintained and operated in ways that ensure the protection of people and the environment.
- Management of Change: Ensures that new personnel are informed of existing systems that all affected personnel are informed of changes in the systems, and that safety and environmental aspects are considered when making changes.

- Third Party Services: Through contract, oversight and other mechanisms, third party contractors are held to the same standards as Bauchi State Ministry of Agriculture.
- Incident Investigation and Analysis: Seeks to understand the causes of any incidents so that effective controls or systems can be implemented to prevent recurrence.
- Community Awareness and Emergency Preparedness: Though not highly applicable in offshore project far removed from Community, ensures appropriate outreach and awareness programs are implemented to establish effective emergency procedures and to allay concerns.
- Operations Integrity Assessment and Improvement: Ensures that the safety and environmental performance is monitored against targets to ensure Bauchi State Ministry of Agriculture meeting its goals to protect people and the environment and seeks the means to improve the systems and processes, particularly when goals are not being met.

## 7.6 Bauchi State Government

### Roles and Responsibilities

Bauchi State Government is committed to providing resources essential to the implementation and control of the ESMP in the construction phase of the proposed SAPZ project. The major roles and responsibilities of BASG are provided in Table 7.2 below. Resources include the appropriate human resources and specialized skills. BASG will have dedicated personnel competent based on appropriate education, training, and experience that will manage and oversee the HSE aspects of Project construction and operation.

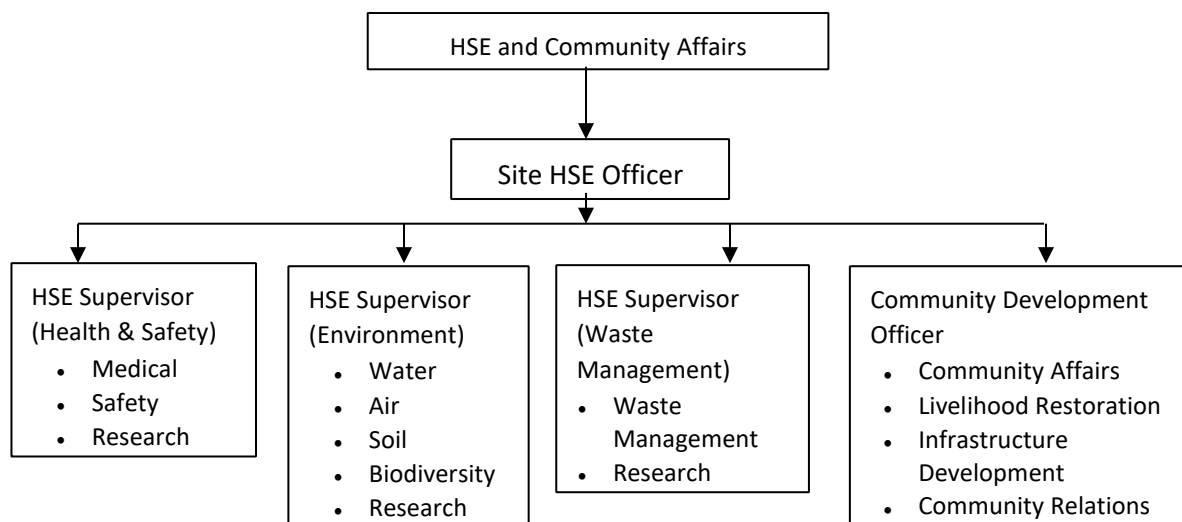
**Table42: Roles and Responsibilities**

Project Manager	Oversee and coordinate all activities of the project and responsible for safety during the construction phase.
General Manager	Manage all technical operations on the project and be responsible for safety during the operations phase.
HSE Manager	Ensure that SAPZ operates under its HSE plans and assists line management in performing their line duties.
Facilities/Site Engineer	Monitor, report, and ensure the efficient working conditions of all facilities on site

Community/Regulatory Liaison Officer	Liaise with the host communities and regulators on BASG 's behalf
Federal Ministry of Environment	Ensure that environmental recommendations in the ESIA to mitigate against construction impacts are implemented
Bauchi State Ministry of Environment	Ensure that environmental recommendations in the ESIA to mitigate against construction impacts are implemented

The management and regulatory responsibilities on a project of this magnitude mandate stakeholders' commitments to environmental and socio-economic issues attached to project sustainability. BASG has a mandatory responsibility under the Nigerian law to perform its operations in the best environmentally and socio-economically sustainable way. So, also, the regulatory agencies (Bauchi State Ministry of Environment) are empowered by law to take responsibility for the monitoring of the operations of all organizations operating within the boundaries of the country/state to ensure environmental and socio-economic sustainability of the recipient communities. The host communities also have an important stake in the environmental and socio-economic sustainability of the project by giving the required support to both the operators and the regulators.

An encompassing all organizational structure for the implementation of the HSE, ESMP and Community Affairs has been designed and approved for the SAPZ project (Figure 72). BASG shall faithfully adopt and implement this organogram for a result oriented HSE systems.



**Figure 7-2: BASG Proposed Organogram for Health, Safety and Environment (HSE)**

## **7.7 ESMP Guidelines**

Preliminary ESMP guidelines have been developed to cover the entire project activities. These include: waste management, consultation, noise minimization, overall safety philosophy, emergency/Contingency plan, communication plan, security plan, training and awareness, environmental monitoring etc.

### **7.7.1 Environmental and Social Management Plan**

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase of the proposed project are outlined in Table 43 below.

**Table43: Environmental and Social Management Plan**

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party	Estimated cost (₦)
<b>Pre-Construction</b> -Permitting -Mobilization -Recruitment -Site Preparation	Economic loss arising from loss of farm lands	High	BASG shall ensure: <ul style="list-style-type: none"> <li>That due diligence is carried out prior to land acquisition.</li> <li>To carry out a census of affected farmers for compensation.</li> <li>That all relevant stakeholders and issues are identified, discussed, and resolved properly prior to mobilization.</li> <li>To implement regular consultations with the local community and other stakeholders (government, community, NGOs, CBOs, etc.) for effective communication and social license; support traditional conflict resolution structures in the project communities.</li> <li>The activation of the Grievance Redress Mechanism.</li> <li>To compensate and resettle displaced farmers and miners before mobilization. where applicable.</li> </ul>	Medium	Stakeholder engagement report	Quarterly	BASG, Project Contractor	25,000,000.00
	Employment opportunities arising from the recruitment of skilled and unskilled personnel	Beneficial	BASG shall ensure: <ul style="list-style-type: none"> <li>Local contractors are engaged, and prompt payment for engaged labour is made regularly.</li> <li>Only specialised professional workers will be recruited from outside the communities</li> <li>To encourage contractors to maintain a list of short-term employees for future call-ups when required</li> <li>Adopt procurement practices that favour local merchants and service providers where</li> </ul>	Positive	Stakeholder engagement report, Evidences of workers Payment	Monthly	BASG, Project Contractor	N/A
	Business opportunities for local contractors through subcontracting activities	Beneficial						N/A
	Local support services from roadside supply markets and shops etc	Beneficial						N/A



Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party	Estimated cost (₦)
	Skill acquisition and enhancements to local indigenes and workforce.	Beneficial	<p>practicable consultation with the locals shall be carried out in terms of provision of jobs.</p> <ul style="list-style-type: none"> <li>Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.</li> </ul>					N/A
	Influx of people (migrant workers, subcontractors and suppliers) and increased pressure on existing social infrastructure	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>To embark on community development programmes in line with the desires and needs of the people.</li> <li>The provision of accommodation for workers.</li> <li>Employment of indigenes.</li> <li>To coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents.</li> <li>To install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited.</li> <li>Areal fumigation and use of Insecticide Treated Net should be promoted in the Workers camp</li> <li>Sex education in protected sex, risk of casual sex and counselling services should be provided.</li> <li>Provision should be made for workers to live off-site with their families.</li> </ul>	Low	Employment Record, HSE Record	Once during mobilization	BASG, Project Contractor	N/A
	Increase of communicable diseases due to influx of people	Medium						N/A
	Increase in social vices (like theft, prostitution etc.) resulting from increased number of people a	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Make security plan and emergency response and contacts with security forces.</li> <li>Engage professional security outfit in protecting lives and properties within the project area and the community. This must be registered with the Nigerian Police/NSCDC etc.</li> </ul>	Low	Security Report	Monthly	BASG HSE Supervisor	N/A

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party	Estimated cost (₺)
			<ul style="list-style-type: none"> <li>Prepare a Local Content Plan to facilitate involvement of locals in the security network.</li> <li>Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour.</li> <li>Ensure that the workers are properly cautioned to respect the culture and place of worship of the people.</li> </ul>					N/A
	Community agitation over unidentified stakeholder, leadership tussles etc.	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting</li> </ul>					To be addressed by GRM
	Conflicts/community agitations over employment issues (quota and methods)	High	<ul style="list-style-type: none"> <li>Set-up and effectively monitor project grievance redress mechanism</li> <li>Engage communities in the monitoring activities to enhance transparency and involvement.</li> <li>Enhance ongoing consultations with local communities (with good representation) to create continuous dialogue, trust and planning of community development activities.</li> <li>Proper consultation with the host communities and youth organizations on the recruitment of labour and work at height.</li> <li>To liaise with local community head and relevant local organizations to work out formula for recruitment from the host communities</li> <li>To be transparent in working out the formula for recruitment</li> </ul>	Low	Stakeholder Engagement Report	Monthly	BASG, Project Contractor	N/A

Noise and vibrations due to movement from heavy duty equipment	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>Vehicles are fitted with effective silencers;</li> </ul>	Low	Noise Level	Daily	BASG, Project Contractor	N/A
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party	Estimated cost (₦)
	and vehicles affecting site workers, residents and wildlife		<ul style="list-style-type: none"> <li>regular maintenance of heavy duty vehicles are performed;</li> <li>Vehicles are switched off when not in use;</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>Select-low noise' equipment or methods of work <ul style="list-style-type: none"> <li>Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> </ul> </li> <li>Avoid dropping materials from height, where practicable</li> <li>Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>Ensure periods of respite are provided in the case of unavoidable maximum noise level events</li> <li>Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> </ul>					

Increase of dust particles and vehicular emissions such as SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , etc	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Engines to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> </ul>	Low	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Weekly during mobilization	BASG, Project Contractor, BSMEnv
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party
			<ul style="list-style-type: none"> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>				
	Increased traffic during mobilization on road with risk of accidents leading to injury/death and loss of asset	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>Compliance with journey management policy</li> <li>To minimize movement at the peak hours of the day</li> <li>That all traffic rules are obeyed by the drivers</li> <li>To engage security personnel in traffic control and management</li> </ul>	Medium	Traffic Record	Daily	BASG, Project Contractor, FRSC

Disturbance of the vegetative cover due to site clearing and preparation	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>That vegetation clearing will be limited to the surveyed area</li> <li>That plants of economic value are transplanted</li> <li>To limit vegetation clearing to approved widths and, as practicable, to minimum required ; and</li> <li>for disturbed areas that are no longer required for project operations, monitor regrowth and, if necessary, initiate actions to enhance regrowth or revegetation with appropriate species consistent with operation requirement</li> </ul>	Low	Flora species record	Once before Mobilization	BASG, Project contractor
Littering of the environment due to waste from wood, sand, paper; domestic waste from laydown area and camp site (material and wood)	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> </ul>	Low	Waste Management Record	Weekly	BASEPA, Project Contractor

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>				

<p>Contamination of surface water as a result of siltation caused by increased erosion during site preparation</p>	<p>Medium</p>	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cutoff drains to divert surface runoff from exposed soils or construction areas.</li> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Minimize bare ground and stockpiles to avoid silt runoff.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas etc.</li> <li>• That processed wastewater is treated before discharging to nearby water bodies.</li> <li>• That treated waste water is reused to minimize its discharge volume.</li> <li>• An inventory of waste is developed and maintained</li> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>• Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers.</li> </ul>	<p>Low</p>	<p>Water Quality</p>	<p>Monthly</p>	<p>BSME, Project Contractor</p>
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>Protect excavated soil materials from erosion.</li> <li>That the land is physically restored (include revegetation where possible) during the rainy season subsequent to the construction activities.</li> <li>Use of existing track for transport of man and material to the extent possible.</li> <li>Construction of foundations to be undertaken in the dry season.</li> </ul>				
<b>Construction/ Installation</b> Civil work, Mechanical and Electrical work which include; <ul style="list-style-type: none"> <li>Drainage</li> <li>Foundation (trenching, Piling etc).</li> <li>Building erection</li> <li>Cabling and Conductor wire stringing</li> <li>Painting and coating</li> <li>Transportation and logistics etc.</li> <li>Commissioning /Testing</li> </ul>	Workplace accidents from burns, bruises, trips and falls, object at height leading to injury/ fatalities.	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Provision of adequate PPE especially gloves and helmet to workers.</li> <li>All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>Unregistered labourers and touts shall not be employed.</li> <li>Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence</li> <li>workers shall be sensitized and monitored on the need to be safety conscious.</li> <li>Daily toolbox talks prior to commencement of work activities shall be carried out.</li> <li>Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.</li> </ul>	Low	Incident/accident rate record	Daily	Project Contractor



• Waste management	Employment of local labour and skills acquisition for workers taking advantage on new opportunities	Beneficial	BASG shall ensure: <ul style="list-style-type: none"> <li>Local contractors are engaged, and prompt payment for engaged labour is made regularly.</li> </ul>	Positive	Stakeholder Engagement Report,	Monthly	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	Beneficial	<ul style="list-style-type: none"> <li>Only specialised professional workers will be recruited from outside the communities</li> <li>To encouraging contractors to maintain a list of short-term employees for future call-ups when required</li> <li>Adopt procurement practices that favour local merchants and service providers where practicable consultation with the locals shall be carried out in terms of provision of jobs.</li> <li>Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.</li> </ul>		Evidences of workers payment		
	Increase in revenue opportunities for local population due to presence of nonresident workers and travelers	Beneficial					
	Generation of dust and automobile/heavy duty equipment emissions from construction earthworks.	High	BASG shall ensure: <ul style="list-style-type: none"> <li>Engine to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	Medium	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> SPM	Weekly	Project Contractor

	Flora/habitat loss and disturbance through vegetation clearing and earthworks along access roads and building sites.	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Ensure that vegetation clearing will be limited to the surveyed area</li> <li>• Ensure that plants of economic value are transplanted</li> <li>• for disturbed areas that are no longer required for project operations, monitor regrowth and, if necessary, initiate actions to enhance regrowth or revegetation with appropriate species consistent with operation requirement</li> </ul>	Low	Biodiversity Record	Once	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Fauna disturbance and displacement as a result of migration away from construction area (e.g. birds, rodents and reptiles)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Workers are warned not to kill fauna species but allow them to move back to the forest</li> <li>• Work force are provided with and use appropriate PPE (cover all, safety boots, hard hats, hand gloves and safety goggles) before venturing into the bush;</li> <li>• Work force are provided assistants/experienced guides from the local communities to look out for signs of wild animals (including bees and wasps) in the bush; and trips into the work in inclement weather e.g., periods of low visibility, are avoided</li> </ul>	Low	Fauna Species Record	Once before Construction	Project Contractor

Soil/groundwater contamination resulting from improper waste disposal and accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>• An inventory of waste is developed and maintained</li> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Waste bins shall be provided at designated locations on site for temporary storage of different waste streams.</li> <li>• General waste that cannot be reused or recycled shall be disposed of at an approved dumpsite.</li> <li>• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> </ul>	Low	Soil & Water Quality and Waste evacuation/disposal rate	Monthly	Project Contractor, BSMEnv, BASEPA
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>Portable spill containment and clean-up kits shall be available onsite.</li> </ul>				
	Risks injury/death and loss of assets resulting from accidents associated with road transportation to and from construction sites	High	BASG shall: <ul style="list-style-type: none"> <li>use standard warning notice (e.g. signal lights and horn) to other road users;</li> <li>ensure a practicable journey management programme is developed and adhered to;</li> <li>maintain speed limits for road vehicles</li> <li>ensure that mobilization is carried out after due consultation with relevant road authorities and other stakeholders to minimize interference along the road ways</li> </ul>	Low	Incident/accident rate record	Daily	Project Contractor
	Traffic congestion during haulage of plant components to site for installation	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>the creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>compliance with journey management policy</li> <li>to minimize movement at the peak hours of the day</li> <li>that all traffic rules are obeyed by the drivers</li> </ul>	Low	Traffic Record	Daily	BASG, Project Contractor, FRSC

Risk of injury from fall from height and building collapse due to unstable geotechnical conditions	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Provision of adequate PPE especially gloves and helmet to workers.</li> <li>• All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>• Unregistered labourers and touts shall not be employed.</li> <li>• Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence</li> </ul>	Low	Result of geotechnical survey	At Foundation	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significan ce rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>• workers shall be sensitized and monitored on the need to be safety conscious.</li> <li>• Daily toolbox talks prior to commencement of work activities shall be carried out.</li> <li>• Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.</li> <li>• Test structures for integrity prior to undertaking work.</li> <li>• Implement a fall protection program that includes training in climbing techniques and the use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.</li> <li>• Provide an adequate work-positioning device system for workers.</li> </ul>				

<p>Risk of electrocution and burns (to onsite workers) during electrical installation processes</p>	<p>Medium</p>	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Appropriate PPE shall be provided for workers.</li> <li>• Workers shall imbibe the workplace safety rules via proper sensitization procedures.</li> <li>• Strict compliance to the SOPs shall be ensured.</li> <li>• A conduit type of wiring shall be adopted instead of a surface to prevent shock.</li> <li>• Only allowing trained and certified workers to install, maintain, or repair electrical equipment;</li> <li>• Deactivating and properly grounding live power distribution lines before work is performed on, or close to, the lines;</li> <li>• ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards.</li> <li>• Prior to excavation works, all existing underground cable installations should be</li> </ul>	<p>Low</p>	<p>HSE record</p>	<p>Throughout construction phase</p>	<p>Project Contractor</p>
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			identified and marked. Drawings and plans should indicate such installations.				
	Reduction in wildlife population as a result of poaching due to easier access created by access roads	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Workers are warned not to kill fauna species but allow them to move back to the forest.</li> <li>Poachers are not allowed access to the site</li> <li>Work force are provided with and use appropriate PPE (cover all, safety boots, hard hats, hand gloves and safety goggles) before venturing into the bush;</li> <li>Work force are provided assistants/experienced guides from the local communities to look out for signs of wild animals (including bees and wasps) in the bush; and trips into the work in inclement weather e.g., periods of low visibility, are avoided</li> </ul>	Low	Biodiversity record	Once before construction	Project Contractor
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding for building components	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Cover properly loose materials and keep top layers moist</li> <li>Use binder material for erosion and dust control for long term exposed surfaces.</li> <li>Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt. Spray surfaces prior to excavation</li> <li>Use covered trucks for the transportation of materials that release dust emissions.</li> <li>Speed limits on-site of 15 k/h should be recommended and enforced</li> </ul>	Medium	Air Quality, HSE Record	Throughout Construction Phase	Project Contractor



Noise nuisance from construction activities e.g. Piling resulting to irritation in humans and temporal migration of sensitive mammals	High	BASG shall ensure that: <ul style="list-style-type: none"> <li>• Vehicles are fitted with effective silencers;</li> <li>• regular maintenance of heavy duty vehicles are performed;</li> <li>• Vehicles are switched off when not in use;</li> </ul>	Low	Noise Level	Daily	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>• Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> <li>• Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>• Select-low noise' equipment or methods of work • Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> <li>• Avoid dropping materials from height, where practicable</li> <li>• Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>• Ensure periods of respite are provided in the case of unavoidable maximum noise level events</li> <li>• Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> </ul>				

Visual intrusion as a result of alterations from accidental ignition of onsite diesel storage tanks	Medium	BASG shall: <ul style="list-style-type: none"> <li>Maintain construction site in orderly condition and do not distribute material over many sites before usage.</li> </ul>	Low	Visual Inspection, Incident/Accident record	Monthly	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Waste Disposal <ul style="list-style-type: none"> <li>Scrap metal, wood, sand, concrete, paper</li> <li>Spent-oil and replaced /obsolete equipment parts that may contaminate soil/ground water</li> <li>Waste from laydown area and building sites causing unsightliness</li> </ul>	High	BASG shall ensure: <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	Low	Waste Generation and Evacuation rate	Daily	Project Contractor, BASEPA

<b>DEMOBILISATION</b> -Demobilization after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, object at height leading to injury of fatalities.	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>• Provision of adequate PPE especially gloves and helmet to workers.</li> <li>• All employees will be required to wear the appropriate PPE whilst performing their duties.</li> <li>• Unregistered labourers and touts shall not be employed.</li> <li>• Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence</li> <li>• workers shall be sensitized and monitored on the need to be safety conscious.</li> <li>• Daily toolbox talks prior to commencement of work activities shall be carried out.</li> <li>• Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.</li> <li>• Test structures for integrity prior to undertaking work.</li> </ul>	Low	Accident/Incident Record, HSE record	Daily	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>• Implement a fall protection program that includes training in climbing techniques and the use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.</li> <li>• Provide an adequate work-positioning device system for workers.</li> </ul>				

Soil/groundwater contamination resulting from accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>• Portable spill containment and clean-up kits shall be available onsite.</li> </ul>	Low	Soil & Water Quality, Waste Management Record	Daily	Project Contractor, BSMEnv, BASEPA
Traffic congestion during transportation of demobilized equipment and personnel	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>• Compliance with journey management policy</li> <li>• To minimize movement at the peak hours of the day</li> <li>• That all traffic rules are obeyed by the drivers</li> </ul>	Low	Traffic Record	Daily	BASG, Project Contractor, FRSC

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>To engage security personnel in traffic control and management</li> </ul>				
	Generation of dust and automobile/heavy duty equipment emissions	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Engine to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	Low	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Daily during demobilization	BASG, Project Contractor, BSMEnv
	Waste disposal (scrap metal, wood, sand, concrete, paper)	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</li> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>	Low	Waste Management Record	Daily	Project Contractor, BASEPA

Loss of employment and business opportunities due to completion of construction phase	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Counsel worker and occupant who losses job.</li> <li>Give enough notice</li> <li>Pay Workers all entitlement due to them prior to job loss</li> </ul>	Low	Staff welfare record	Once	Project Contractor
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Illegal access to building site leading to accident, asset damage and loss	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Make security plan and emergency response and contacts with security forces.</li> <li>Professional security outfit be engaged in preventing illegal access to the building sites</li> <li>Prepare a Local Content Plan to facilitate the involvement of locals in the security network.</li> </ul>	Low	HSE Record	Daily	Project Contractor
<b>Operation and Maintenance</b> <ul style="list-style-type: none"> <li>Building inspection and checks</li> <li>Power generation/ servicing</li> <li>Transportation of raw materials and finished product</li> <li>Agro-products processing for export.</li> <li>Plant</li> </ul>	Risk of injury from fall from height/trip or being hit by an object	Medium	<p>BASG shall ensure that:</p> <ul style="list-style-type: none"> <li>A comprehensive HSE Policy must be displayed openly, and enforced through monitoring within the site;</li> <li>All staff must be trained and retrained regularly for HSE compliance;</li> <li>Develop a training program including a code of conduct for all workers;</li> <li>Well-equipped Clinic should be put up for emergency attention, while a referral system should be arranged with a Secondary Hospital</li> </ul>	Low	Incident/Accident Record	Daily	BASG
	Security threats such as kidnapping and banditry attack	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Engage trained security personnel</li> <li>Avoid lone working</li> <li>Avoid working at nights</li> <li>Avoid night journeys</li> </ul>	Medium	HSE Record	Weekly	BASG

maintenance • Industrial waste discharges • Emergence of small-scale enterprises • Green Buffer development around each industrial plot. • Recruitment of workers	Air pollution by gaseous emission (CO, SO <sub>2</sub> , NO <sub>2</sub> ) and particulates from power generator	High	BASG shall ensure: <ul style="list-style-type: none"> <li>• Generator to comply with international standards for exhaust gases;</li> <li>• Maintenance of generator and exhaust gas check;</li> <li>• Use of the cleanest fuel economically available shall be adopted</li> </ul>	Low	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Monthly	BASG, BSMEEnv
	Soil contamination resulting from accidental leakages and spills of hazardous substances from	Medium	BASG shall ensure: <ul style="list-style-type: none"> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> </ul>	Low	Soil Quality, Waste Management Record	Daily	BASG, BSMEEnv, BASEPA

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	generator servicing (diesel, spent oil, etc.)		<ul style="list-style-type: none"> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps, not gravity drains.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>• Portable spill containment and clean-up kits shall be available onsite.</li> <li>• Conduct bioremediation of polluted soil immediately to inhibit further spread</li> </ul>				



Generation of dust and gaseous pollutants from automobile emissions	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Engine to comply with international standards for exhaust gases;</li> <li>• Maintenance of engines and exhaust gas check;</li> <li>• Adoption of engine off policy at the site</li> <li>• Use of the cleanest fuel economically available shall be adopted</li> <li>• Maintain and operate all vehicles and equipment engines under manufacturers' recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles, and machineries throughout the project phases.</li> <li>• Preference for usage of clean fuel like LPG, and low sulphur diesel should be explored;</li> <li>• Energy conservation should be adopted by opting the alternate energy options like solar power;</li> <li>• Power Generators and equipment should be provided with stacks of adequate height (higher</li> </ul>	Low	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Weekly	BASG, BSMEnv
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significant ce rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<p>than nearest building) to allow enough dispersion of emission;</p> <ul style="list-style-type: none"> <li>• Enclosure of dust-producing equipment,</li> <li>• Use of local exhaust ventilation;</li> <li>• Use of dust extraction and recycling systems to remove dust from work areas;</li> <li>• Regular checking and maintenance of all plant and equipment to minimize the risk of gas leakage</li> </ul>				

Odour disturbances from the processing of Rice, edible oil etc	High	<p>BASG shall</p> <ul style="list-style-type: none"> <li>• Ensure all processing equipment are installed in an enclosed plant and processing activities are taking place within an enclosed system.</li> <li>• Ensure provision of appropriate PPE (respiratory protection) for workers and enforce usage.</li> <li>• Ensure that project staff are not exposed to more than nine hours at a go on any equipment generating noise level of more than 90 dBA</li> </ul>	Medium	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Daily	BASG, BSMEnv
Increase in noise level nuisance from operation machines and from vehicles plying the access roads	High	<p>BASG shall ensure that:</p> <ul style="list-style-type: none"> <li>• Vehicles are fitted with effective silencers;</li> <li>• regular maintenance of heavy duty vehicles are performed;</li> <li>• Vehicles are switched off when not in use;</li> <li>• Maintain and operate all vehicles and equipment engines under manufacturers recommendations</li> <li>• Use experienced drivers and fuel-efficient equipment, vehicles and pieces of machinery throughout the project phases.</li> <li>• Develop a detailed plan that relates to noise control for relevant work practices and discuss this with workers during health &amp; safety briefings</li> <li>• Select-low noise equipment or methods of work</li> </ul>	Low	Noise level	Daily	BASG, BSMEnv

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources).</li> <li>Avoid dropping materials from height, where practicable</li> <li>Avoid mobile plant clustering near residences and other sensitive land uses.</li> <li>Ensure periods of respite are provided in the case of unavoidable maximum noise level events</li> <li>Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> <li>Machineries to be used should comply with the noise standards prescribed by FMEnv.</li> <li>Workers shall be given PPE (ear plugs) and enforce compliance;</li> </ul>				
	Traffic congestion along agro-products transportation route	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>Compliance with journey management policy</li> <li>To minimize movement at the peak hours of the day</li> <li>That all traffic rules are obeyed by the drivers</li> <li>To engage security personnel in traffic control and management</li> </ul>	Low	Traffic Record	Weekly	BASG, FRSC

Threat to community culture, safety and security due to presence of workers and business opportunists	Medium	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>Develop an induction program including a code of conduct for all workers. Code of conduct to address the following: <ul style="list-style-type: none"> <li>Respect for local residents;</li> <li>Unauthorized taking of products;</li> </ul> </li> </ul>	Low	HSE training report	Monthly	BASG
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Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
			<ul style="list-style-type: none"> <li>Zero tolerance of illegal activities such as child sexual exploitation and underage sex, prostitution, harassment of women, Gender Based Violence (GBV,) purchase or use of illegal drugs,</li> <li>Disciplinary measures and sanctions (e.g. dismissal) for infringement of the code of conduct and/or company rules;</li> <li>Commitment / policy to cooperate with law enforcement agencies investigating perpetrators of GBV.</li> </ul> <ul style="list-style-type: none"> <li>Limit the number of migrant workers by engaging local workers.</li> </ul>				
	Reduction of water tables and source of water for production processes	High	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Water conservation measures should be practiced</li> <li>Waste water should be recycled for reuse.</li> <li>Rain water harvesting.</li> <li>Adoption of continuous horizontal washers and vertical spray washers or vertical, double-laced washers.</li> <li>Adoption of counter current washing (e.g. reuse the least contaminated water from the final wash for the next-to last wash).</li> <li>Use of water flow-control devices to ensure</li> </ul>	Low	Water Quality	Monthly	BASG, BSMEnv

			that water only flows to a process when needed.				
	Metallic materials generation from plant parts, retrofitting / upgrade of parts during plant servicing	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Recyclable materials should be sorted and sold to scrap metal converters</li> <li>Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages.</li> </ul>	Low	Waste Management Record	Daily	BASG, BASEPA
	Potential for land contamination from industrial waste disposal	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>All other wastes generated including environmentally deleterious materials generated</li> </ul>	Low	Soil & Water Quality,	Daily	BASG, BSMEnv, BASEPA

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Pollution of surface water bodies by wastewater generated from industrial waste discharges	High	<p>by the project activities shall be disposed offsite in an appropriate, legal, and safe manner.</p> <ul style="list-style-type: none"> <li>Generation of all wastes are minimize as much as practically possible</li> <li>Reuse waste materials wherever possible and use designated disposal site;</li> <li>There is collaboration with relevant waste management agencies to enforce appropriate sanitation and other bye laws.</li> </ul>		Waste Management Record		

	Creation of job and acquisition of skills by individuals to be employed as operators	Beneficial	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Local contractors are engaged, and prompt payment for engaged labour is made regularly.</li> <li>Only specialised professional workers will be recruited from outside the communities</li> <li>To encouraging contractors to maintain a list of short-term employees for future call-ups when required</li> <li>Adopt procurement practices that favour local merchants and service providers where practicable consultation with the locals shall be carried out in terms of provision of jobs.</li> <li>Prepare a Local Content Plan and strictly adhered to it in order to facilitate involvement of local labour.</li> </ul>	Positive	Stakeholder Engagement Record	Monthly	BASG
<b>Decommissioning /Abandonment</b>	Risk of accident and injury to workers during demolition of structures	Medium	<p>BASG shall ensure that:</p> <ul style="list-style-type: none"> <li>A comprehensive HSE Policy must be displaced openly, and enforced through monitoring within the site;</li> <li>All staff must be trained and retrained on regular basis for HSE compliance;</li> <li>Develop a training program including a code of conduct for all workers;</li> </ul>	Low	Incident/Accident Record	Daily	Project Contractor

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
<ul style="list-style-type: none"> <li>Demolition of buildings for facilities retrieval</li> <li>Waste generation</li> <li>Transportation of Plant components for sale/another site</li> <li>Re-vegetation of site</li> </ul>			<ul style="list-style-type: none"> <li>Well-equipped Clinic should be put up for emergence attention, while referral system should be arranged with a Secondary Hospital</li> </ul>				
	Increased dust and vehicular emissions during haulage of plant components from site by heavy-duty vehicles	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>Engine to comply with international standards for exhaust gases;</li> <li>Maintenance of engines and exhaust gas check;</li> <li>Adoption of engine off policy at the site</li> <li>Use of the cleanest fuel economically available shall be adopted</li> <li>Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>Use experienced drivers and fuel-efficient equipment, vehicles and machineries throughout the project phases.</li> </ul>	Low	SO <sub>x</sub> , NO <sub>x</sub> , CO <sub>x</sub> , VOC, SPM	Daily	BASG, Project Contractor, BSMEnv



	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• Install oil/water separators and silt traps before effluent, leaves the site.</li> <li>• Bunding of areas where hazardous substances are stored (e.g fuel, waste areas).</li> <li>• Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains.</li> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.</li> <li>• Portable spill containment and clean-up kits shall be available onsite.</li> </ul>	Low	Soil & Water Quality, Waste Management Record	Daily	Project Contractor, BSMEnv, BASEPA
Project Activity/ Environmental Aspect	Associated and Potential Impacts	Significance rating	Mitigation Measures	Residual Impact Rating	Parameter for Monitoring	Frequency of Monitoring	Responsible Party(ies)
	Traffic obstruction from transportation of decommissioned structures and equipment	Medium	<p>BASG shall ensure:</p> <ul style="list-style-type: none"> <li>• The creation of awareness amongst commercial communities by signages on the potential of increase in traffic, and the need for extra precautions through public enlightenment.</li> <li>• Compliance with journey management policy</li> <li>• To minimize movement at the peak hours of the day</li> <li>• That all traffic rules are obeyed by the drivers</li> <li>• To engage security personnel in traffic control and management</li> </ul>	Low	Traffic Record	Daily	BASG, Project Contractor, FRSC
	Abandoned structures possibly taken-over by miscreants/criminals	High	<p>BASG shall:</p> <ul style="list-style-type: none"> <li>• Make security plan and emergency response and contacts with security forces.</li> <li>• Re-vegetate the site with local plant species</li> </ul>	Medium	Stakeholder Engagement Record	Once at decommissioning	Project Contractor

	Availability of land for alternative uses such as community hall, farmland e.t.c	Beneficial	BASG shall ensure: Use local plant species to re-vegetate the abandoned site	Positive	Stakeholder Engagement Record, Biodiversity Record	Once at decommissioning	Project Contractor
	Improved Ecology, Air Quality and Aesthetics	Beneficial					
<b>TOTAL ESTIMATED COST</b>					<b>150,000,000.00</b>		

## Environmental and Social Management Plan for the proposed ATC Project

Anticipated impact	Proposed Mitigation measures	Monitoring indicators	Responsibility/ Institution	Cost estimate (USD)
<b>CONSTRUCTION PHASE</b>				
Limited access to employment:	<ul style="list-style-type: none"> <li>▪ Design recruitment strategy with respective District and Ward/ Village council to ensure local people are given priority</li> <li>▪ Technical positions to be recruited on professional merit, with special consideration of local experts</li> <li>▪ Recruitment strategy to stipulate 50% of all non-professional occupations to be given to females.</li> </ul>	Transparent recruitment strategy in place which stipulated gender considerations, locality and skills	Project Supervisor/ Local Village/ Bauchi governments	10m
Conflict/competition in basic resources threatening sustainable water access/supply for project and surrounding communities	<ul style="list-style-type: none"> <li>▪ Establish secure and separate water supply connection with Municipal Water supply source.</li> <li>▪ Construction of new Dam/existing Dam</li> <li>▪ Project should have its own water source</li> </ul>	Water supply sources for community and facilities identified. Community-facility platforms for GRM in place and meeting.	Bauchi State Water Board	15m
Dust pollution during construction phase	<ul style="list-style-type: none"> <li>▪ Minimize dust generation by using sprinklers</li> <li>▪ Put speed limits to control construction vehicle speed</li> <li>▪ Workers should use respirators</li> </ul>	Workers and truck drivers be sensitized on speed.	Site environmental officer/ BASEPA	Nil
Bio-diversity loss (degradation of vegetation and disturbance of fauna)	<ul style="list-style-type: none"> <li>▪ Enhance natural environment by planting indigenous trees, shrubs, and grass around project site.</li> <li>▪ Ensure re-vegetation around project site, by planting indigenous trees and shrubs to stimulate natural regeneration</li> </ul>	Facility environmental management policy	Site Environmental Officer/Bauchi State Forestry Division	10m
Increase in waste generation (solid, liquid)	<ul style="list-style-type: none"> <li>▪ Ensure that effective solid waste collection and disposal systems are in place during operations</li> <li>▪ Ensure that all waste water is treated before disposal</li> <li>▪ Ensure debris generated during construction is disposed-off appropriately to minimize pollution</li> </ul>	Facility Waste management policy  Sensitization of workers on environmentally sound waste disposal	Facility supervisor/ Bauchi State Waste Management	5m
Contamination of water sources	<ul style="list-style-type: none"> <li>▪ Construct facilities for storage of contaminated water. Maintain facilities to prevent overflow</li> <li>▪ Ensure waste and other debris is not disposed near water sources.</li> <li>▪ Protect nearby water sources, rivers and streams from degradation due to project activities.</li> </ul>	Protocols for water source protection in place and disseminated	Project supervisor/ BASEPA	5m
Spread of infectious diseases – HIV, STIs	<ul style="list-style-type: none"> <li>▪ Sensitize workers and community members on protective sex</li> </ul>	Frequency of sensitization campaigns on infectious diseases and material distributed	Site Health worker/ Health Officers	Nil
Gender-based violence (GBV)	<ul style="list-style-type: none"> <li>▪ Introduce anti-GBV protocols in workers' employment</li> </ul>	Frequency of Sensitization seminars	Project supervisor	Nil

	<p>contracts</p> <ul style="list-style-type: none"> <li>▪ Promote GBV support services with local Community Development (CD) and Social Welfare (SW) authorities</li> <li>▪ Support community sensitization on GBV and Violence against Women and Children</li> </ul>	to workers and Community	with relevant authorities	
Child abuse	<ul style="list-style-type: none"> <li>▪ Introduce child abuse protocols in workers' employment contracts</li> <li>▪ Promote GBV support services with local Community Development and Social Welfare authorities</li> <li>▪ Support community sensitization on GBV and Violence against Women and Children</li> </ul>	Child protection policy	Project supervisor with relevant authorities	Nil
Occupational and Workers health	<ul style="list-style-type: none"> <li>▪ Establish workplace health and safety procedures and train workers and management to avoid, minimize exposure to infections and accidents.</li> <li>▪ Provide quality respiratory protection to capture dust and micro-organisms</li> <li>▪ Ensure proper storage of chemicals within production or processing sites</li> <li>▪ Ensure that first aid facilities are in place in designated locations and easily accessible.</li> <li>▪ Design training and sensitization sessions to the general public on the possible health hazards generated by project operations and how they can mitigate or avoid them.</li> </ul>	<p>Frequency of training sessions on workplace health and safety standards</p> <p>Workplace occupational health and safety policy in place</p> <p>First Aid Kit in accessible locations within facility</p>	Project supervisor/ OSHA officer	Nil
<b>OPERATIONAL PHASE</b>				
Limited access to employment	<ul style="list-style-type: none"> <li>▪ Design recruitment strategy with respective District and Ward/ Village council to ensure local people are given priority</li> <li>▪ Technical positions to be recruited on professional merit, with special consideration of local experts</li> <li>▪ Recruitment strategy to stipulate 50% of all non-professional occupations to be given to females</li> </ul>	Transparent recruitment strategy in place which stipulated gender considerations, locality and skills	Project Supervisor Local Village/ Bauchi State government	N/A
Conflict/competition in basic resources threatening sustainable water access/supply for project and surrounding communities	<ul style="list-style-type: none"> <li>▪ Establish secure and separate water supply connection with Municipal Water supply source.</li> <li>▪ Project should have its own water source.</li> </ul>	Water supply sources for community and facilities identified	Bauchi State Water Board	3.5m
Decline in business by some traders	<ul style="list-style-type: none"> <li>▪ Establish trading and marketing linkages along the value chain of each product</li> <li>▪ Deliberate promotion of local private investors to</li> </ul>	Equal rights policy in trade and procurement Mobilization for networking and farmers'	District Heads/ Trader Unions/ Associations	Nil

	collaborate in the marketing linkages of targeted products to ATCs	organizations		
Competitive edge by local producers	<ul style="list-style-type: none"> <li>▪ Establish local centers for developing skills such as value addition for crops local producers, and women.</li> <li>▪ Link collection with farm-based extension to improve quality of produce.</li> </ul>	Capacity building and training to local producers	District Heads/ Bauchi State Ministry of Agriculture	Nil
Dust pollution during construction phase	<ul style="list-style-type: none"> <li>▪ Minimize dust generation by using sprinklers</li> <li>▪ Put speed limits to control construction vehicle speed</li> <li>▪ Workers should use respirators</li> <li>▪ Ensure debris generated during construction is disposed off appropriately to minimize pollution.</li> </ul>	Workers and truck drivers sensitized on speed	Site environmental officer/ BASEPA	Nil
Bio-diversity loss (degradation of vegetation and disturbance of fauna)	<ul style="list-style-type: none"> <li>▪ Enhance natural environment by planting indigenous trees, shrubs, and grass around project site.</li> <li>▪ Ensure re-vegetation around project site, by planting indigenous trees and shrubs to stimulate natural regeneration</li> </ul>	Facility environmental management policy	Site Environmental Officer/ Forestry Department	Nil
Increase in waste generation (solid, liquid)	<ul style="list-style-type: none"> <li>▪ Ensure that effective solid waste collection and disposal systems are in place during operations</li> <li>▪ Ensure that all waste water is treated before disposal</li> <li>▪ Ensure debris generated during construction is disposed off appropriately to minimize pollution</li> </ul>	Facility Waste management policy  Sensitization of workers on environmentally sound waste disposal	Facility supervisor	5m
Potential of aflatoxins in crops	<ul style="list-style-type: none"> <li>▪ Educate farmers and monitor the process and quality of all harvesting, handling and drying equipment and storage bins prior to harvest, and during post-harvest to control contamination of aflatoxins.</li> </ul>	Household level training on proper crop storage	Bauchi State Ministry of Agriculture Officer/ BASEPA	Nil
Contamination of water sources at Rampa project site area and Alkeraleri	<ul style="list-style-type: none"> <li>▪ Construct facilities for storage of contaminated water. Maintain facilities to prevent overflow</li> <li>▪ Ensure waste and other debris is not disposed near water sources.</li> <li>▪ Protect nearby water sources, rivers and streams from degradation due to project activities.</li> </ul>	Protocols for water source protection in place and disseminated	Project supervisor/ BASEPA	Nil
Spread of infectious diseases – HIV, STIs	<ul style="list-style-type: none"> <li>▪ Sensitize workers and community members on protective sex.</li> </ul>	Frequency of sensitization campaigns on infectious diseases and material distributed	Local Health facilities/ Community Development Officer (CDO)	Nil
Gender-based violence (GBV)	<ul style="list-style-type: none"> <li>▪ Introduce anti-GBV protocols in workers' employment contracts</li> <li>▪ Promote GBV support services with local Community</li> </ul>	Frequency of Sensitization seminars to workers and Community on GBV	Project authorities	Nil

	Development (CD) and Social Welfare (SW) authorities ▪ Support community sensitization on GBV and Violence against Women and Children	Facility anti-GBV policy		
Child abuse	▪ Introduce child abuse protocols in workers' employment contracts ▪ Promote GBV support services with local Community Development and Social Welfare authorities ▪ Support community sensitization on GBV and Violence against Women and Children	Facility child protection policy	Project authorities	Nil
Occupational and Workers health	▪ Establish workplace health and safety procedures and train workers and management to avoid, minimize exposure to infections and accidents. ▪ Provide quality respiratory protection to capture dust and micro-organisms ▪ Ensure proper storage of chemicals within production or processing sites ▪ Ensure that first aid facilities are in place in designated locations and easily accessible. ▪ Design training and sensitization sessions to the general public on the possible health hazards generated by project operations and how they can mitigate or avoid them.	Frequency of training sessions on workplace health and safety standards  Workplace occupational health and safety policy in place First Aid Kit in accessible locations within facility	Project Supervisor / OSHA officer	Nil
<b>DECOMMISSIONING PHASE</b>				
Loss of employment due to cessation of contracts	▪ Ensure facility workers are prepared for decommissioning	Trainings on alternative income generation to workers	Facility supervisor	10m
Inadequate waste management (debris from facilities)	▪ Ensure that effective solid waste collection and disposal systems are in place during operations ▪ Ensure that all waste water is treated before disposal	Facility waste management protocol to include decommissioning phase	Facility supervisor	Nil
<b>Total Costs (projected)</b>				<b>66.5m</b>

## 7.7.2 Training and Awareness – Site Induction

Training is essential for ensuring that the ESMP provisions are implemented efficiently and effectively. The contractors shall be required to undertake general HSE awareness for their project workforce and specific training for those whose work may significantly have impact on the environment. This is to ensure that they are fully aware of the relevant aspects of the ESMP and are able to fulfil their roles and functions. The contractors shall ensure among others to provide the following training to their personnel as shown in table 44.

**Table44: Proposed Training Program for the Implementation of ESMP**

Capacity Building Activity	Proposed Topics	Objectives	Target Audience	Duration
<b>Module 1:</b> Training on Environmental and Social Management Plan Implementation	<ul style="list-style-type: none"> <li>• Overview of Environmental and Social Impact Assessment</li> <li>• Overview of Potential Impacts of Project</li> <li>• Environmental Pollution &amp; Control</li> <li>• Environmental and Social Management Plan</li> <li>• Basic Environmental and Social Management</li> <li>• Environmental Performance Monitoring – Monitoring Mitigation Measures in ESMP</li> <li>• Environmental Reporting</li> </ul>	To enhance competence in environmental sustainability and regulatory practice	BASG Rep., relevant staff of FMEnv (EA Dept), BSMEnv, BASEPA, other relevant MDAs, LGA departments, Project Contractors, NGOs.	5 days
<b>Module 2:</b> Training on Construction HSE	<ul style="list-style-type: none"> <li>• Introduction to Construction HSE</li> <li>• Overview of Health and Safety Hazards in Construction</li> <li>• Incidents: Causation, Investigation &amp; Reporting</li> <li>• Excavation Safety</li> <li>• Construction Site Inspection</li> <li>• Personal Protective Equipment</li> </ul>	To promote safe & healthy working conditions as well as the health of workers and regulators who may be involved in monitoring during project implementation	BASG Rep., relevant staff of FMEnv (EA Dept), BSMEnv, BASEPA and other relevant MDAs, LGA departments, Project Contractors, NGOs.	4 days



<b>Module 3:</b> Training on Social and Community Engagement	<ul style="list-style-type: none"> <li>• Listening to &amp; understanding the opinions and perspectives of a diversity of stakeholders;</li> <li>• Negotiation and partnership contracting;</li> <li>• Interpersonal communication;</li> <li>• Relationship-building;</li> <li>• Facilitation;</li> <li>• Principles of cross-cultural awareness and cross-cultural communication;</li> <li>• Equity and diversity principles; and</li> <li>• Public sector values and codes of conduct.</li> </ul>	To ensure effective engagement with communities around the project area, public officials and public relation team. To facilitate relationships with communities for continuous stakeholder engagement and peaceful co- existence with the project host communities.	BASG Rep., BSMEnv, BASEPA and other relevant MDAs, Project Contractors	
	<b>TOTAL ESTIMAT</b>		<b>53,000,000.00</b>	

All personnel who have attended the Environmental Induction will sign a Register which will be kept on the Project Files. Toolbox talks, based on the specific activities being carried out, will be given to personnel by the nominated project representative. These will be based on the specific activities being carried out. These talks will take place on-site and will include environmental issues particular to the proposed project, namely:

- Oil/Diesel spill prevention offshore including safe refueling practice.
- Emergency response procedures used to deal with an oil/diesel spill.
- Minimizing disturbance to wildlife such as cetaceans.

### 7.7.3 Communications

Environmental issues will be communicated to the workforce on a regular basis. Daily project meetings, which follow a set agenda incorporating Health, Safety and Environmental issues will be held on-site and a daily report will be generated and distributed.

All staff and sub-contractors involved in all phases of the project will be encouraged to report environmental issues.

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**Environmental Reporting:** The contractor will report the status of project environmental activities to Bauchi State Ministry of Agriculture on a regular basis. These reports will summarize the key environmental issues in the period and identify any non-conformances and the status of corrective actions.

**Communication of Initiatives and Project Information:** Communication of initiatives and project information will be developed as the project progresses. Typically, these will include campaigns to raise environmental awareness, circulars to inform staff of key environmental issues such as lessons learnt from incidents or accidents and the impact of any new legislation.

**Subcontractor Environmental Reporting:** All external communications with local interest groups, external agencies and also the response to any complaints will be conducted by Bauchi State Ministry of Agriculture. Contractors shall notify the onsite Bauchi State Ministry of Agriculture representative if any communications are received from external stakeholders.

#### **7.7.4 Environmental Audit and Review**

Bauchi State Ministry of Agriculture shall conduct periodic HSE audits (monthly/quarterly/annually, etc) of the project activities in the project area in order to ascertain extent of compliance with policy and regulatory requirements. The audits shall be carried out by certified auditors and in accordance with ISO 14001 guidelines. The scope of the audits must include the following, as a minimum: • compliance with all necessary codes, standards and procedures;

- examine line management systems, plant operations, monitoring practices etc.;
- identify current and potential environmental problems especially during the operational phase of the project;
- check the predictions in ESIA and assure implementations and application of recommended practices and procedures; and
- make recommendation for the improvement of the management system of the operation.

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After every audit exercise, the environmental auditor shall produce an Environmental Audit Report (EAR) which shall be submitted to Bauchi State Ministry of Agriculture for review.

#### **7.7.5 Environmental Monitoring Programme**

The Federal Ministry of Environment (FMEnv) guidelines require an environmental monitoring plan as part of an EIA. The aim of the monitoring programme is to ensure that the negative environmental and social impacts already identified in this ESIA are effectively mitigated in the design, construction, operation and decommissioning stages of the project. It also instils confidence in the host Community, the proponent of the project (Bauchi State Ministry of Agriculture) and regulatory bodies that the identified impacts are adequately mitigated.

Environmental monitoring of this project is therefore advocated in order to ensure that the mitigation processes put in place have adequately taken care of the predicted impacts.

This shall necessitate stable programmes to address the following:

- Alteration to the biological, chemical and physical characteristics of the recipient environment;
- Social and health issues;
- Alterations in the interactions between project activities and environmental sensitivities and interactions between the sensitivities;
- Determination of long term and residual effects; and
- Identification of project specific cumulative environmental effects.

Bauchi State Ministry of Agriculture and Regulators shall monitor the project from mobilization through operation stages to keep track of the entire project development life cycle. The monitoring plans for the project including the environmental components, parameters and frequency of monitoring as well as responsibilities are presented in Table

7.5.

**Table45: Monitoring Plan for the Project**

<b>Environmental Components</b>	<b>Indicator Parameters</b>	<b>Frequency</b>	<b>Location</b>	<b>Responsibility</b>
Air Quality	<ul style="list-style-type: none"> <li>• NO<sub>x</sub>, SO<sub>x</sub>, CO<sub>2</sub>, CH<sub>4</sub>, SPM</li> <li>• Noise level</li> </ul>	Monthly during construction and operation	Project site	FMEnv, SMEnv, LGA
Surface Water Quality	<ul style="list-style-type: none"> <li>• Turbidity</li> <li>• TSS</li> <li>• pH</li> <li>• Biological Oxygen Demand (BOD)</li> <li>• Coliform analysis</li> </ul>	Once every month during construction and 3 months after construction	Water bodies around the site	FMEnv, SMEnv, LGA
Sediment Quality	<ul style="list-style-type: none"> <li>• Ph</li> <li>• THC</li> </ul>	Once every month during construction and 3 months after construction	Water bodies around the site	FMEnv, SMEnv, LGA
Hydrobiological Components (plankton, benthos)	<ul style="list-style-type: none"> <li>• Diversity and abundance</li> <li>• Stress</li> </ul>	At the end of construction and then on a one (1) year interval	Water bodies around the site	FMEnv, SMEnv, LGA
Biodiversity (vegetation/fore st resources and wildlife)	<ul style="list-style-type: none"> <li>• Diversity and abundance</li> <li>• Pressure on species</li> </ul>	6 months interval from beginning to end of project	Project site	FMEnv, SMEnv, LGA
Socio-economic	<ul style="list-style-type: none"> <li>• Population</li> <li>• Health status</li> <li>• Infrastructure</li> </ul>	At the project peak and before commissioning	Identified host community of the Project	BASG

### 7.7.6 Guideline for Waste Management General

The provision of adequate waste management guideline and disposal facility is vital to the implementation of the proposed project. Table 7.6 presents overview of waste stream in all phases of the project and specifies proactive management approach to prevent environmental pollution and degradation. Waste shall be managed in accordance with Bauchi State Ministry of Agriculture Waste Management Plan. The principle of waste reduction, recycling, recovery and reusing shall be practiced.

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Some of the waste management options and waste disposal systems that shall be considered for this project are highlighted below:

**(a) Solid Waste / Used Containers (Garbage and Inert Materials)**

Bauchi State Ministry of Agriculture shall apply the following principles in handling of general garbage (wood, plastics, paper, and food wastes):

- Segregate components such as wood, plastic and paper, for recycling or reuse.
- Reduce packaging wastes such as paper and plastic by the use of bulk handling systems.
- Dispose all wastes at government designated dump sites.
- Refilling and reusing of containers.

All construction waste shall be collected segregated and transported to a third party contractor management and disposal. No dumping of waste in water bodies shall be permitted.

**(b) Sanitary Waste**

Appropriate septic tanks shall be provided. Sewage shall be treated to residual chlorine level of 0.8 – 2.0mg/l before disposal.

**Waste Handling Guidelines**

Wastes handling and disposal procedures shall be well defined at source and a waste inventory register kept. The waste contractor shall define, and document appropriately, all wastes generated and transferred in the course of his work. The general information required, as a minimum, for adequate definition of wastes include: Waste stream identification; Proper waste categorization; Waste segregation; Appropriate handling and disposal practice; and Recommended Management practices.

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### **Waste Minimization Guidelines**

The four principles of waste minimization process; recycle, reduce, reuse and recovery shall be adopted as applicable, to ensure reduction to the possible extent, of the volume or relative toxicity of liquid or solid wastes.

A large proportion of the excavated material shall be used for landscaping or other remedial works on site. All wastes associated with hydrocarbons, oils, hydraulic fluids, oily sump water, etc. shall be treated and channeled to the waste treatment facility.

### **Waste Segregation Guidelines**

All wastes to be generated from the proposed project shall be segregated at source, into clearly designated bins at strategic locations.

### **Waste Disposal Guidelines**

All debris, spoil materials, rubbish and other waste, except excavated soil, shall be cleared regularly from the site and disposed of accordingly at government designated sites for such wastes. Instructions on material safety handling sheet (MSDS) shall be strictly adhered to and shall form the basis for the disposal of wastes related to such products. Adequate treatment measures shall be undertaken, where applicable, in line with applicable guidelines, for all waste before final disposal. All wastes in transit shall be tracked by waste consignment note. The waste consignment note records shall be kept and should include as a minimum the following information: Date of dispatch, Description of waste, Waste quantity/container type, designated disposal site and method, Consignee /driver name and means of transportation, and Confirmation of actual disposal (time and date).

**Table46: Waste Streams and Management**

S/NO	SOURCE	WASTE TYPE	WASTE STREAMS	MANAGEMENT
<b>PRE-CONSTRUCTION</b>				
1	Movement of vehicles on earth road and engine exhaust	Gaseous Emission and Particulates	CO <sub>x</sub> , SO <sub>x</sub> , NO <sub>x</sub> , CO, Particulate Matter	<ul style="list-style-type: none"> <li>• Use water suppression to prevent dust emission</li> <li>• Maintain vehicles and machineries to reduce emission</li> <li>• Maintain low speed to reduce dust and gaseous emission.</li> </ul>
2	Installation of temporary workers camp, offices and workshops	Non-Hazardous solid waste	<ul style="list-style-type: none"> <li>• Vegetal Waste /Overburden waste</li> <li>• Industrial Waste: Metal scraps, packaging waste</li> </ul>	<ul style="list-style-type: none"> <li>• Vegetal waste shall be supplied to farmers for use as compost.</li> <li>• Woody vegetal shall be supplied to host communities for domestic uses including as fuel wood for cooking.</li> <li>• Overburden waste shall be stockpiled for backfilling of pit and levelling of landscape.</li> <li>• Segregated and stored on site to be collected at least once a month for reuse or recycle through licensed third-party facilities.</li> </ul>
3	Spills of oil and fuels from vehicles and equipment	Hazardous liquid waste	Spent oil and used grease from repairs of mechanical device	Stored and reuse/ sold to vendors were available in much quantity
4	Workers' camp	Domestic and Sanitary	<ul style="list-style-type: none"> <li>• Food remnant, kitchen wastes. Food packaging etc.</li> <li>• Domestic Sewage</li> </ul>	<ul style="list-style-type: none"> <li>• To be transferred to locals for use as compost and animal feeds.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> <li>• Use of Mobile toilets and transferred to licensed carrier for disposal</li> </ul>
<b>CONSTRUCTION</b>				
1	Movement of vehicles on earth road and engine exhaust	Emission	CO <sub>x</sub> , SO <sub>x</sub> , NO <sub>x</sub> , CO, Dust	<ul style="list-style-type: none"> <li>• Use water suppression to prevent dust emission</li> <li>• Maintain vehicles and machineries to reduce emission</li> <li>• Maintain low speed to reduce dust and gaseous emission.</li> </ul>



2	<p>Construction of access roads, civil works on site, installation of equipment.</p> <p>Workers' camp/offices</p>	Non-Hazardous /Industrial	<p>Waste Packaging such as Scrap, wood, scrap metal, steel, glass, plastic, paper and cardboard, empty metal containers, excess concrete, broken equipment, or components</p> <p>Domestic-type waste: waste paper and food scraps, metal cans</p>	<ul style="list-style-type: none"> <li>• Segregated and kept securely in closed containers on site. To be transferred to approved recycling third parties for reuse/recycling.</li> <li>• Non-recyclables to be removed by approved BASEPA waste contractor for onward disposal at approved sites.</li> <li>• To be transferred to locals for use as compost and animal feed.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> </ul>
3	Civil works on site, construction of different complexes/building section	Hazardous Waste	<p><b>Solid Wastes:</b> Domestic-type waste: wastepaper and food scraps, metal cans, Material waste (pipes, planks, empty metal containers, excess concrete, broken equipment etc.)</p> <p><b>Liquid Waste:</b> spent lubricating oils, hydraulic fluids, brake fluids, battery electrolyte, and dielectric fluids, chemical cleaning agents, paints, primers, thinners, and corrosion control coatings; sealants and adhesives etc.</p>	<ul style="list-style-type: none"> <li>• Segregated and kept securely in closed containers on site. To be transferred to approved recycling third parties for reuse/recycling.</li> <li>• Non-recyclables to be removed by approved BASEPA waste contractor for onward disposal at approved sites.</li> <li>• To be transferred to locals for use as compost and animal feed.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> </ul> <p>Stored on site in closed containers with secondary containment and evacuated by an accredited waste management contractor with off-site permitted hazardous waste treatment, storage, or disposal facilities</p>
	Civil works	Waste Water	Waste water from equipment washing and concrete production	Discharged to the ground as only very small quantity is envisaged at this stage.
4	Workers' camp	Domestic and Sanitary	<p>Food remnant, kitchen wastes. Food packaging etc. Domestic Sewage</p>	<ul style="list-style-type: none"> <li>• To be transferred to locals for use as compost and animal feeds.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> <li>• Use of Mobile toilets and transferred to licensed carrier for disposal</li> </ul>

**OPERATION AND MAINTENANCE**

1	Movement of vehicles on unpaved surface and engine exhaust	Emission	CO <sub>x</sub> , SO <sub>x</sub> , NO <sub>x</sub> , CO, Dust	<ul style="list-style-type: none"> <li>• Use water suppression to prevent dust emission</li> <li>• Maintain vehicles and machineries to reduce emission</li> <li>• Maintain low speed to reduce dust and gaseous emission.</li> </ul>
2	Maintenance of facilities  Workers' camp/offices	Non-Hazardous /Industrial	<ul style="list-style-type: none"> <li>• Packaging waste, scrap metals, plastic, paper and cardboard, empty metal containers, broken equipment, or components</li> <li>• Domestic-type waste: wastepaper and food scraps, metal cans</li> </ul>	<ul style="list-style-type: none"> <li>• Segregated and kept securely in closed containers on site. To be transferred to approved recycling third parties for reuse/recycling.</li> <li>• Non-recyclables to be removed by approved BASEPA waste contractor for onward disposal at approved sites.</li> <li>• To be transferred to locals for use as compost and animal feed.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> </ul>
3	Maintenance of facilities	Hazardous	<p><b>Solid Wastes:</b> Domestic-type waste: wastepaper and food scraps, metal cans, Material waste (pipes, planks, empty metal containers, excess concrete, broken equipment etc.)</p> <p><b>Liquid Waste:</b> spent lubricating oils, hydraulic fluids, brake fluids, battery electrolyte, and dielectric fluids, chemical cleaning agents, paints, primers, thinners, and corrosion control coatings; sealants and adhesives etc.</p>	<ul style="list-style-type: none"> <li>• Segregated and kept securely in closed containers on site. To be transferred to approved recycling third parties for reuse/recycling.</li> <li>• Non-recyclables to be removed by approved BASEPA waste contractor for onward disposal at approved sites.</li> <li>• To be transferred to locals for use as compost and animal feed.</li> <li>• Plastic and other packaging to be recycled through licensed recycling third parties.</li> </ul> <p>Stored on site in closed containers with secondary containment and evacuated by an accredited waste management contractor with off-site permitted hazardous waste treatment, storage, or disposal facilities</p>
	Emissions from high temperature ovens	Hazardous	Volatile organic components	Using appropriate control technologies (e.g. diversion of stack emissions through boilers; installation of scrubbers with activated carbon slurries; or incineration of extracted vapors in a combustion system).

**DECOMMISSIONING**

1	Movement of vehicles on unpaved surface and engine exhaust	Hazardous	CO <sub>x</sub> , SO <sub>x</sub> , NO <sub>x</sub> , CO, Dust	<ul style="list-style-type: none"> <li>• Use water suppression to prevent dust emission</li> <li>• Maintain vehicles and machineries to reduce emission</li> <li>• Maintain low speed to reduce dust and gaseous emission</li> </ul>
2	Demolition of structures	Nonhazardous	Concrete, scrap metals, woods, plastic,	<ul style="list-style-type: none"> <li>• Segregated and kept securely.</li> <li>• To be transferred to approved recycling third parties for reuse/recycling.</li> <li>• Non-recyclables to be removed by approved BASEPA waste contractor for onward disposal at approved sites.</li> </ul>
3	Removal of Industrial plant and other equipment	Hazardous	Spent lubricating oils, hydraulic fluids, brake fluids, battery electrolyte, and dielectric fluids, sealants and adhesives etc.	<ul style="list-style-type: none"> <li>• Reuse materials in other construction site.</li> <li>• Recycle materials through licensed third parties</li> <li>• Waste materials shall be stored on site in closed containers with secondary containment and transferred to a registered waste contractor with off-site permitted hazardous waste treatment, storage, or disposal facilities.</li> </ul>

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### **7.7.7 Emergency Response Plan**

This Emergency response plan is to address unexpected occurrence within or adjacent to the project site which could give rise to any or several of the following consequences. It may be impossible to anticipate every eventuality or combination of circumstances, but the following are foreseeable emergency situations that may arise:

- An Emergency Preparedness and Response Plan (EPRP) will be prepared to assist project staff in effectively responding to emergencies associated with project hazards. The EPRP will comply with the IFC Occupational Safety guidelines and performance standards. The EPRP will include:
  - Roles and responsibilities of emergency personnel;
  - Emergency contacts and communications systems/protocols, including procedures for interaction with local and regional emergency authorities;
  - Specific emergency response procedures;
  - Design and implementation of an emergency alarm system audible across the entire site at the sub-stations;
  - An evacuation plan will be read and practice by all employees and contractors. The evacuation plan will include emergency escape routes, procedures for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation;
  - Identification of supplies and resources to be utilized during an emergency event, including emergency equipment, facilities, and designated areas; and
  - A training plan, which includes specific training and drill schedules for personnel
  - Who are responsible for rescue operations, medical duties, spill response, and fire response?

If an emergency develops, all persons on site will be notified immediately and efforts will be coordinated with others in the vicinity surrounding the project area in order to reduce impacts, if applicable. The military personnel and police officials, and all necessary authorities will be immediately notified. If an emergency is imminent, but has not yet begun, steps will be initiated to immediately advise person in the vicinity of the

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emergency to evacuate and notifications will be made to military personnel and police officials and all other authorities which have responsibility regarding the emergency.

If there is a slowly developing emergency or unusual situation where an emergency is not imminent, but could occur if no action is taken, project personnel will notify the military personnel and police officials, and all other authorities of the potential problem and keep them advised of the situation. These agencies will be requested to indicate if there are any immediate actions that should be taken to reduce the risk or severity of the emergency and if necessary, what preventative actions will be implemented. In an emergency situation, equipment and supplies will be needed on short notice. Therefore, the Bauchi SAPZ will maintain an accurate inventory of emergency response equipment and supplies.

The EPRP will include an evacuation plan which will be read and practiced by all employees and contractors. The evacuation plan will include emergency escape routes, procedures, for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation. In general, the following evacuation procedures should be followed:

- Alert the Emergency Response Team to assist in the evacuation.
- Use communications tools that are appropriate for the type of incident and the time of occurrence, such as alarms or loud speakers.
- When communicating an evacuation, speak clearly and succinctly: “we have a [state the type of emergency]. Evacuate to [state the assembly point]”.
- Turn equipment off, if possible.
- Take emergency supplies and staff roasters, if possible.
- Account for personnel.
- Wait at the assembly point for further instructions.

The EPRP will have specific information on the fire safety and explosion response, which will provide additional details specific to these emergencies.

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### **7.7.8 Project Traffic Management Plan**

This Traffic Management Plan describes procedures and protocols for site access, traffic routing and management, and contractor company guidelines with respect to vehicle and employee transportation in delivering their obligations on this intervention project. Public, employee and contractor safety is the primary goal of this plan. It is vital that the Contractor recognizes that the traffic within the project area will be dynamic throughout the course of execution of this works and the safety of other road users is absolutely essential during this time.

#### **General Site Access**

In the interest of site security and public safety, access to operational areas related to the execution of this contract will be restricted to authorized site personnel through the usage of signs and gates where appropriate. Facilities that potentially present danger to persons or wildlife such as the electrical, equipment staging area and workers camp will be fenced or barricaded as appropriate to prevent general access.

#### **Traffic Management**

All traffic on routes to and from the site will be radio controlled. Where this is not possible, signage will be installed at appropriate locations in order to warn the public along these routes. In the event that temporary closure occurs, access to the sites will be further restricted through the use of fences and gates as appropriate. Access to work areas such as temporary excavated places, or confined spaces where work is on going will be securely blocked by means of a temporary but robust barrier or barricade. Buildings and ancillary facilities will be locked and secured. A number of additional general measures related to site access, road management and public safety and construction events notification are presented here:

- Private employee off-road vehicles or private transport buses will be prohibited from entry into the site.
- Signage will be posted near all construction sites.

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- Notifications will be provided for activities that would be carried out over the weekend or public holiday periods. These would be disseminated through existing social institutions such as the village or district heads of communities, Local Government

Councilors and NGO's or CBO's

- Speed limit maintained at 10 km/hr speed limit within or near the communities;
- Install reverse alarm fitted on all trucks, heavy duty equipment and off road vehicles
- Employ or engage the use of a minimum of two flagmen around excavated areas, one for traffic approach and one to direct traffic away from the sites
- In accordance with the Occupational Health and Safety Regulations for public roads, use of flashing devices/trafficators on all vehicles/machinery and equipment that will cross, travel on or may otherwise pose a risk to users of public roads.

#### *Employee Transportation*

To the extent possible employees will use buses provided by the contractor as transportation to and from the site, thereby reducing overall vehicle traffic. Project vehicles or will be utilized by staff, only when necessary.

#### *Speed Limits*

Speed limits will be enforced to and from the site and signage(s) shall be posted along the access and site roads (maximum 40 km/hr, reduced to 20 km/hr at blind corners and bridge crossings. Traffic along other access roads will be radio controlled for safety and speed control. Furthermore, employees and contractors will be educated on safety including traffic protocols and speed limits during mandatory orientation. Routine traffic inspections and/or speed indicator signs will be used to encourage safe and responsible driving.

#### *Communications and Notification Protocols*

It is anticipated that the intervention project will require only single-lane temporary closures. Signage warnings of construction activities on the roads will be placed at appropriate distances from the construction site, in consultation with SPIU, Ministry of Transports,



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department of Highways & Public Works. For significant work activity (those requiring more than one day to complete), written notification will be distributed to residents and the SPIU, Ministry of Transport, department of Highways & Public Works will be notified. A public notice would be posted at multiple locations in the metropolis to communicate to residents any new activities that may be occurring or scheduled. Contact information for the Contractors senior management will be included in this notice and any concerns regarding the intervention work/project or traffic management can be forwarded through this notification system.

### **Traffic Routing and Volumes**

Alternative traffic routing shall be mapped out and provided in the event that there will be complete closure of the road due to this intervention work activity. Traffic officers and appropriate road diversion signage(s) shall be deployed to ensure diversions routes are properly identified and traffic is directed along the mapped route. The flagmen shall be properly kitted in their Personal Protective Equipment (PPE), such as reflector vests and safety boots, to ensure that safety on the job is given due priority.

### **Reporting**

Records on traffic management and implementation of this plan should be kept and updated by the contractor as evidence of on going mitigation compliance, which will be submitted to SPIU as part of routine reports on progress of work.

### **7.7.9 Environmental Health and Safety Plan**

A Health and Safety Plan will be prepared for the construction, operation and decommissioning phases of the project to ensure compliance with the Ministry of Health Guidelines for Occupational Health and Safety and IFC guidelines. To ensure its employees' health and safety plan will address the following topics:

- Safety device to protect employees from injuries or hazardous conditions;
- Safe drinking water;
- Immunizations, as applicable;

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- Clean eating area;
  - First aid facilities;
  - Sanitary conditions;
  - Waste management, including bathrooms, and proper disposal procedures;
  - Appropriate signage;
  - Fire prevention facilities, training, and awareness; and
  - Personal Protective Equipment (PPE).

A safety specialist assigned by Bauchi-SAPZ will be responsible for the preparation, implementation and maintenance of a comprehensive safety program, which will be periodically evaluated. The safety specialist will be provided with written safety instructions including instructions on correct storage handling and disposal of hazardous waste, and written contingency Plans / guidelines of action for accidents, spills, and fire. The responsibility of the safety specialist includes performing safety training and conducting safety inspections, sessions and practice. The safety specialist will also be responsible for the investigation of accidents. A safety committee should be formed by Bauchi-SAPZ and regular safety meetings should be organized.

#### **7.7.10 Spill Contingency Management Plan**

The Bauchi-SAPZ will prepare and implement a spill contingency management plan that identifies this procedure to prevent, contain, cleanup, and report spill and release of fuel oil and their hazardous materials. Mitigation measure to prevent contamination from hazardous materials are primarily aimed at preventing their release into the environment in the first place and will include:

- Keeping equipment maintained.
- Inspecting equipment and containers for spill and leaks, corrosion, or other signs of deterioration
- Maintaining spill response equipment near material storage areas and on heavy equipment.

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- Training employees on material storage, transfer, and transportation procedures, spill response procedures, and reporting requirements.

If a fuel spill occurs at the project sites, prompt action will be taken to contain the leakage or spillage in the event of a spill or leak, all combustible, flammable, and ignition sources (such as running engines) likely to result in a fire will be removed from the vicinity of the spill and anyone in the area will be advised to stay upwind. Spill kits will be kept at the project sites and the transport vehicles to readily clean up small spills. Large spills will be contained by constructing a berm around the spill area to control runoff to surface water.

All soil contaminated by previous spills will be excavated and disposed of in accordance with the Bauchi-SAPZ hazardous waste management procedures.

#### **7.7.11 Contractor Management**

Bauchi-SAPZ will expect its contractors to follow IFC Guidelines for Occupational Health and Safety and Environmental Management. Bauchi-SAPZ will issue a set of Environmental, Social, Health and Safety safeguards to the construction contractor to follow, which include standards that are expected to be followed and programs that the contractors are expected to have in place (e.g. Environmental Health and Safety Management System)

#### **7.7.12 Air Quality: Generation of Air Emissions from Disturbance**

Control techniques for minimizing temporary particulate matter (PM) emission during construction will involve watering of surfaces, chemical stabilization, or surface wind speed with windbreak or source enclosures. Furthermore, surface improvements offer long term control techniques. These include covering the road surface with a new material of lower site content, such as covering a dirt road with gravel or slag. Also, regular maintenance practices, such as grading of gravel roads, help to retain larger aggregate size on the traveled portion of the road and thus help reduce emissions. The amount of emissions reduction is tied directly to the reduction in surface site content.

Other mitigation measures include, maintaining good housekeeping practices throughout the construction phase. These low-cost measures include:

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- Proper site enclosure through appropriate hoarding and screening
  - On-site mixing and unloading operations.
  - Proper handling of cement material.
  - Maintain minimal traffic speed on-site and on access roads to the construction sites.
  - Covering all vehicles hauling materials likely to give off excessive dust emissions.
  - Ensure adequate maintenance and repair of construction machinery and vehicle
  - Avoid burring of material resulting from site clearance
  - Cover any excavated dusty materials or stockpile of dusty materials entirely by impervious sheeting.
  - Proper water spraying when necessary.

#### **7.7.13 Generation of Air Emission from Vehicles and Equipment Engines**

In addition to PM generation, emissions will consist of combustion emission from diesel engine-driven electrical generators and vehicles and diesel-driven mobile construction equipment (such as, concrete trucks, dump trucks, excavators, and backhoes). The engines emit primarily CO<sub>2</sub>, CO, NO<sub>2</sub>, SO<sub>x</sub>, and HC. Measures to reduce combustion emissions include proper truck and engine maintenance, adoption of a traffic management plan while avoiding congested routes, proper maintenance of construction equipment, and the quality of diesel fuel used. In addition, equipment will be turned off when not in use, which would reduce power needs as well as emissions of pollutants. The supervising consultant will have the responsibility of ensuring the implementation of these measures by the contractor.

#### **7.7.14 Degradation of Water Quality due to Storm Water Runoff**

The removal of vegetation and disturbance of soil in the construction work areas may result in erosion and sedimentation causing increased turbidity in water within the project area. Additionally, degradation of water quality may occur from pollutants in storm water runoff from material and equipment storage areas and spills and leaks from construction

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equipment. Special care must be taken to decrease impacts where work is or near the marshland/wetland areas so as to keep disturbance of the ecosystems to a minimum. Prior to commencement of construction activities, Bauchi-SAPZ will require its contractors to prepare and implement an Erosion and sediment Control Plan. Its purpose will be to assist Bauchi-SAPZ, its contractor, and subcontractors in the implementation of control measure for storm waste runoff from the project site, and material storage areas to prevent degradation of water quality. The plan will achieve this purpose by specifying the best management practices, required to assess the effectiveness of construction storm water management practices, especially during the rainy season. Bauchi-SAPZ will demonstrate, to the satisfaction line route will not occur during any stage of construction. Briefly, the erosion and sediment control measures to be implemented during the construction phase of the project include:

- Minimizing land cleaning activities to the project location work areas, access points, and material storage area
- Minimizing the time of exposure of erodible land exposed to storm water runoff during the rainy season
- Maintaining a riparian Management Zone (RMZ) between the construction work areas and surface water bodies to filter sediments in storm water runoff
- Covering open stockpiles of construction materials with tarpaulin or similar fabric during rainstorm events to prevent erosion and resultant sedimentation of receiving waters.
- Compacting soil as soon as the foundations are formed to prevent erosion, especially during the wet season
- Restoring the construction working areas as soon as possible once construction is complete at the location.

#### **7.7.15 Degradation of Water Quality due to accidental spills and leaks**

Bauchi-SAPZ will develop and implement a spill contingency plan to prevent and mitigate spills of oils or hazardous material to surface water bodies and groundwater. Storage of fuel and hazardous material should not occur within 30m of a surface water body. If any pumps are

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needed for removal of water during site construction within 30m of marshland/wetland water body. They will utilize proper secondary containment. Oil leakage or spillage will be contained and cleaned up immediately. Spent oil and lubricants will be collected and stored for recycling or proper disposal. In addition, all fuel tanks and chemical storage areas will be provided with locks and located within secondary containment structure. Oil/water separators will be installed at storm water channels to remove oils from contaminated waters such as from workshops.

#### **7.7.16 Soil Contamination and Erosion due to erosion**

Prior to commencement of construction activities, Bauchi-SAPZ will implement an erosion and sediment control Plan, Bauchi-SAPZ will demonstrate, to the satisfaction of the FMEnv that any substantial risk of increased sediment discharges from the project sites will not occur during any stage of the project. Cleaning of vegetation will be limited to where it is strictly needed so as to decrease the risk of soil erosion, and Riparian Management Zone (RMZ) between the construction areas and surface water bodies. Unpaved roads will be graded so that to decrease the risk of erosion during rainstorms.

- Soils excavated for foundations will be used for re-filling and will not be left exposed to wind or water for long periods
- The contractor will avoid steep terrain during the transportation of material by using alternative routes or use light vehicles where appropriate
- Heavy machinery will be used as needed in the clearance of construction work areas in order to minimize soil compaction, which makes the soil susceptible for erosion.
- Riverine and surface water body associated vegetation will be minimally disturbed during the construction phase to reduce soil erosion and safeguard bank protection
- Disturbed areas will be replanted with local species common in the area to complement natural vegetation regeneration to improve cover
- In areas prone to soil erosion, suitable sediment binding grasses will be planted in degraded substrates.

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### 7.7.17 Noise Management

Typical mitigation measures that will be enforced during construction to minimize noise levels are:

- Effectively utilizing material stockpiles and other structures, where feasible; to reduce noise from on-site construction activities
- Choosing inherently quiet equipment
- Operating only well-maintained mechanical equipment on-site
- Keeping equipment speed as low as possible
- Shutting down or throttling down to minimum equipment that may be intermittent in use, between work periods
- Utilizing and properly maintaining silencer or mufflers that reduce vibration on construction equipment during construction works
- Restricting access to the site for truck traffic outside of normal working hours
- Utilizing proper site logistics and planning
- Limiting site working hours the morning hour
- Scheduling noisy activities strictly during the morning hours
- Consulting with local communities and informing the locals when noisy activities are planned
- Enforcing noise monitoring
- Enforce the use of hearing protection actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140dB(C), or the average maximum sound level reaches 110db(A)
- Installing warning signs in area high noise levels
- Consider the use of acoustic insulating materials, isolation of the noise source, and other engineering controls to minimize noise impact.



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The noise control measure will be included within the construction contracts and be considered as requirements from contractors. The supervising consultant will have the responsibility of ensuring the implementation of these measure.

#### **7.7.18 Hazardous Materials Management**

Bauchi-SAPZ will require its contractor to prepare and implement a spill contingency Plan that identifies the procedures to prevent, contain, cleanup, and report spills and releases of oil and hazardous material Mitigation measures to prevent contamination from hazardous materials are primarily aimed at preventing their release into the environment in the first place and will include:

- Storing oil and hazardous materials within secondary containment structures in designated area.
- Using portable oil collection pans during refueling operations.
- Storing pesticides and herbicides in designated areas according to FAO Guideline standards any pesticides to be used will be manufactured, packaged, labeled, handled, stored, disposed of, and applied according to standards such as the minimum standards of FAO's Guidelines for packaging and storage of pesticides, Guidelines on Good labeling practice for pesticides.
- Ensuring that no storage of oil and hazardous materials occurs within 30m of a surface waste body
- Keeping equipment maintained
- Inspecting equipment and containers for spill and leaks, corrosion, or other signs of deterioration
- Maintaining spill response equipment near material storage areas and on heavy equipment
- Ensuring all working dealing with such substances are adequately informed about the risks
- Training employees on material storage, transfer, and transportation procedures, spill response procedures, and reporting requirements.

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Bauchi-SAPZ will keep an accurate inventory of all oil, hazardous material, and waste stored on site and material safety Data sheets will be available for these material.

If a fuel/oil spill occurs at the project site, on any of the access roads to the site, or into a water body or wetland, prompt action will be taken to contain the leakage of spillage. In the event of a spill or leak, all combustibles, flammables, and ignition sources (such as running engines) likely to result in a fire will be removed from the vicinity of the spill and anyone in the area will be advised to stay upwind. Spill kits will be kept at the project site and on the transport vehicles to readily clean up small spills. Large spills will be contained by constructing a berm around the spill area to control runoff surface water, or deploying a spill boom if the spill is in a water body. All soil contaminated by the spills will be excavated and disposed of in accordance with the Bauchi-SAPZ hazardous waste management procedures.

#### **7.7.19 Recurring Environmental and Social Issues**

Environmental and Social issues and their management plan. They include public/ stakeholders' consultation, labour and gender-based violence.

##### **• Public / Stakeholders Awareness Consultations Management Plan**

- Regular public sensitization and meetings during the project implementation to reduce incidences that may arise as a result of ignorance, incomplete knowledge and forgetfulness of the basic rules that guide the site.
- Have bi-Monthly Public/Stakeholders consultation and awareness meetings geared towards review, revalidate and documentation of the ESMP.
- Environmental Committee (EC) shall be formed and chaired by ESO.
- There must be representatives of the stakeholders, farmers and women among the committee.
- EC shall oversee the coordination of public stakeholder consultations and awareness on Environmental and Social Management issues.

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- EC shall hold meetings twice every month, and more during emergency.
  - The meetings shall read out and review its rules including health and safety rules among others.
  - Flyers that contain basic rules shall be printed and shared to participants if need be.
  - The minutes of meetings and consultations if adopted shall be inculcated in the rules.
  - Each participant shall be able to know his obligation, roles and reasonability as a stakeholder.

• **Labour Management Plan**

- Workers admitted as labourers must be of age 18 years and above.
- Community members who possess the required skills and are ready to work shall be given preferential treatment during recruitment.
- Payment of wages shall be made as and when due.
- The Contractor shall be responsible for the safety and Health of its employees at the work place.
- He shall provide PPE, train and inform all workers of any known hazards on the site.
- Workers shall not be allowed to form labour unions in the site.
- Labour Grievance Redress Desk shall be instituted.
- If a labourer is dismissed, he shall be given reasons for dismissal and the right to lodge complaints to Grievance Redress Desk.
- No worker shall be stigmatized due to his or her social status in the communities.
- Physically impaired workers shall be given due considerations.
- Severance allowance should be paid to casual workers during decommissioning.

• **Gender Based Violence Management Plan**

- Females with requisite skills should be given equal consideration as men during hiring

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- No male shall solicit for sex or any kind of favor in exchange for work
  - The management shall advocate against Gender Based violence, sexual exploitation and work place sexual harassment among his team, employees or community members.
  - The Contractor shall accord female employees the same treatment as their male counterpart, such as equal payment for equal work.
  - There shall be no form of physical or verbal abuse of women, especially those depicting them as less important.
  - Female counterpart shall be incorporated in decision making body in the site.
  - Women shall be given due recognition and award like male counterpart when they merited it.
  - No woman or man shall be stigmatized due to his or her social status in their communities.
  - Male workers involved in gender violence shall be penalized.

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## CHAPTER EIGHT

### REMEDIATION PLANS AFTER DECOMMISSIONING/CLOSURE

#### 8.1 Introduction

All project initiatives have a lifespan after which it is decommissioned. The project proponent does not expect to terminate the operation of the Special Agro-Industrial Processing Zone (SAPZ) for at least 50 years. However, a ‘phased-out’ of out-modeled or obsolete machinery may make decommissioning inevitable. Decommissioning involves activities that may result in the stabilization and restoration of unneeded site(s) to a more natural state. For this project, BASG will ‘return’ the project site to its initial and unblemished natural state, through rehabilitation and enhancement under a plan and standard procedures that meet local regulatory requirements and international standards as prescribed by the environmental statutes and in recognition of multi-stakeholders’ decision.

This chapter describes the activities that will be completed to restore the project location to an acceptable condition for its intended use. The incorporation of remediation plans into the overall project planning is essential because it allows proponents to understand the need for restoring the environment into its original, or near its original status when abandonment plans are being conceptualized.

Before decommissioning, BASG will develop plans that include the following:

- Identification of components of the project that will be removed;
- The choice of environmentally sustainable methods for removal, re-use, recycling, or disposal of special wastes that may arise from the decommissioning process.
- Expressly outline the time frame/schedule for the decommissioning and post-decommissioning process, and communicate the same to the Federal Ministry of Environment (FME) and other relevant regulatory agencies as well as the affected or concerned persons and groups;
- Proper rehabilitation and decommissioning process;

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- Appropriate site rehabilitation, remediation, and enhancement techniques and technologies; and
  - There shall be post-decommissioning assessments to compare ameliorated project-related impacts, relative to the baseline conditions.

## **8.2 Consultation**

The project decommissioning and abandonment plan will include consultation with various stakeholders including employees from various departments. The decommissioning team will include competent personnel from the BASG as well as the regulatory authorities.

## **8.3 Reporting**

As required by regulations, a post-decommissioning report will be prepared and submitted to FME. The report will include the following details:

- Overview of decommissioned facilities
- Details of methods used for decommissioning
- Nature of decommissioning (partial or whole)
- Record of consultation meetings
- Details of recyclable/reusable materials/facility components
- Decontaminated facilities
- State of the surrounding environment
- Waste Management Plan
- Plans for restoration and remediation where necessary.

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## **8.4 Decommissioning Activities**

At the end of the facilities utility, all equipment and structures will be decommissioned. All installed facilities on project site will be adequately dismantled and removed to allow for proper remediation of the project site. In general, the activities to be carried out during the decommissioning phase shall include the following:

- Dismantling of all surface equipment and structures
- Dismantling of buildings including excavation
- Removal of foundations
- Removal of decommissioning waste

BASG will ensure the safety of personnel and the public during decommissioning as well as minimize negative environmental and social impacts. Particular attention will be paid to the following:

- Protection from air pollutant emissions;
- Protection from noise; and
- Waste handling

All the components that can be used or recycled will be identified and quantified. Cleared locations will be re-vegetated using fast-growing native plant species, which can either be purchased from a nursery plantations/farms or nursery of these seedlings will be developed by capable agronomists. Disturbed areas on the facility will be identified and restored using native species.

## **8.5 Decommissioning and Abandonment Plans**

Decommissioning of the houses is not foreseen, however, decommissioning of other facilities especially project site offices and workshops are inevitable. BASG will prepare a



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written abandonment plan within 30 days of determining decommissioning. The Plan will detail how the decommissioning will be carried out. The abandonment plan will be subject to approval by BSME FME / NESREA. An Environment Project Report (EPR) will be prepared prior to implementation of this plan, to assess and minimize potential environmental and social impacts arising from the abandonment of operations. This abandonment EPR Study will be submitted to FME / NESREA for consideration. Upon completion of the abandonment operations, an assessment of contaminated land will be prepared recording the final contamination status of the location of the project facilities. This assessment will be subjected to FME /NESREA for approval.

## **8.6 Recommended Mitigation Measures for the Decommissioning Phase**

Some basic mitigation measures will be required to be undertaken once all operational activities of the project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames, prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in Table 8.1

## **8.7 Decommissioning phase ESMP**

In addition to the mitigation measures provided in chapter 6 of this report, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in the table 8.1.

**Table48: Decommissioning phase Environmental and Social Management Plan**

<b>Impact</b>	<b>Mitigation Measures</b>	<b>Responsible Persons</b>	<b>Frequency</b>
Demolition waste	<ul style="list-style-type: none"> <li>• Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Reuse</li> <li>• All buildings, machinery, and equipment, that will not be used for other purposes Shall be removed and recycled/reused as far as possible</li> <li>• All foundations shall be removed and recycled, reused or disposed of at an approved disposal site</li> <li>• Where recycling/reuse of the machinery, equipment, implements, structures, partitions, and other demolition waste is not possible, the materials shall be taken to an approved waste disposal site</li> <li>• Reusable demolition waste shall be donated to charitable organizations, individuals, and institutions</li> </ul>	BASG	Throughout the demolition period
Noise and Vibration	<ul style="list-style-type: none"> <li>• Sensitization of the workforce including drivers of construction vehicles shall be undertaken</li> <li>• Installation of portable barriers to shield compressors and other small stationary equipment where necessary shall be in place</li> </ul>	BASG	Throughout demolition period
	<ul style="list-style-type: none"> <li>• Proper maintenance of all equipment shall be carried out</li> <li>• Workers in the vicinity of high-level noise shall wear safety and protective ear-mug</li> </ul>		
Dust	<p>BASG shall;</p> <ul style="list-style-type: none"> <li>• Spray demolished piles of earth with water</li> <li>• Avoid pouring dust materials from elevated areas to ground</li> <li>• Cover all trucks hauling soil, sand and other loose materials</li> <li>• Provide dust screen where necessary</li> </ul>	BASG	Throughout demolition period
Site degradation	<p>BASG shall</p> <ul style="list-style-type: none"> <li>• Implement an appropriate re-vegetation programme to restore the site to its original status as much as possible.</li> <li>• Consider use of indigenous plant species in revegetation</li> </ul>	BASG	Throughout the demolition period

*Source: Field study, 2024*

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## **8.8 Remediation Plans after Decommissioning**

The incorporation of remediation plans into the overall project planning is essential because it allows proponents to understand the need for restoring the environment to its original, or near its original status when abandonment plans are being conceptualized. Operating projects beyond the designed lifespan makes it economically unproductive as returns from such investment become unattractive. Therefore, investors make appropriate plans for either temporarily or permanent closures of facilities after the expiration of the project useful life. The useful life of any project is determined by a number of factors, among which are:

- Specifications of materials,
- Durability of equipment and machinery,
- Profitability of the proposed project and
- Importance of the end product.

The activities to be carried out during the decommissioning phase shall include the following:

- Dismantling of the facility and other ancillary equipment and
- Removal of all structures.

The potential impacts that might result from the decommissioning phase of the proposed project have been earlier identified and discussed in Chapter 5.

The strategy to be adopted for site remediation shall depend on the prevailing biophysical and social-environmental attributes and the attendant impacts that may result from such an action.

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## CHAPTER NINE

### STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESS

#### MECHANISM

##### 9.1 Introduction

Consultations are an important tool in identifying the major environmental and social issues that form a vital aspect of the preparation of this ESIA. A Stakeholder Engagement Plan (SEP) which aims at facilitating the development and sustainable implementation of various stages of the Project's life cycle from (pre-construction to, construction, operations, and decommissioning) was done during preparation of this ESIA document.

It describes the process by which stakeholders were identified; the means by which they were consulted; and the outcomes of the consultations to date. It also describes the actions that the Project took to disclose pertinent information to stakeholders.

##### 9.2 Stakeholder Engagement

A Stakeholder Engagement Plan (SEP) is the process of managing stakeholder expectations which influences project decisions throughout the life cycle of the project. This process provides a plan to interact effectively with stakeholders and support the project interest. It is very important to plan these activities well so that they appraise the contribution of stakeholders on projects, manage their expectations also achieve project objectives. Stakeholder engagement process focusing on free, prior and informed consultation (FPIC) shall be conducted with the community and other stakeholders, and take into account modalities of vulnerable and marginalized communities may be involved. The consultation shall include prior disclosure of information in a manner accessible and understandable to communities, key informant interviews, focus group discussion (male & female, youth) and public consultation. The consultation shall be documented with required facts, figures and evidence including participant list with contact details, photographs. Information shall be disclosed as per the requirement of

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National Regulations EIA Act No. 86 of 1992 (as amended by the EIA Cap E12 LFN 2004) and the African Development Bank's Integrated Safeguards System.

### **9.3 Objectives of Stakeholder Engagement**

The objectives of public participation in an ESIA are to provide sufficient and accessible information to potentially interested and affected parties/stakeholders in an objective manner to assist them identify issues of concern, and provide suggestions for enhanced benefits and alternatives. The stakeholder engagement process was designed to conform to the Nigerian EIA Act and international standards. For this Project, the key objectives for stakeholder engagement are:

- Identify key stakeholders that can influence the Project and its activities;
- Inform and educate stakeholders about the proposed Project;
- Gather local knowledge to improve the understanding of the environmental and social context;
- Better understand the locally-important issues;
- Identify the most effective methods and structures through which to disseminate project information, and to ensure regular, accessible, transparent and appropriate consultation;
- Provide a means for stakeholders to have input into the Project planning Process;
- Take into account the views of stakeholders in the development of effective mitigation measures and management plans; and
- Lay the foundation for future stakeholder engagement.

### **9.4 Disclosure and Participation Plan**

Information disclosure is an important activity not just as a form of engagement but for also enabling the other engagement activities to be undertaken in an informed and participatory manner. This section outlines the process to be followed for the disclosure and participation as part of the EEP implementation.

It is required under the AfDB operational Safeguards that the Proponent will maintain and disclose as part of the environmental and social assessment, a documented record of

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stakeholder engagement, including a description of the stakeholders consulted, a summary of the feedback received and a brief explanation of how the feedback was taken into account, or the reasons why it was not.

#### **9.4.1 Disclosure Mechanism**

The process of information disclosure can be undertaken in two ways: either voluntary disclosure or disclosure as part of the regulatory requirements (EIA requirements, public hearing). While regulatory disclosure involves the provisioning of information as required by the authorities and agencies involved in the project, voluntary disclosure refers to the process of disclosing information to the various stakeholders in a voluntary manner.

This disclosure not only allows for trust to be built amongst the stakeholders through the sharing of information, but it also allows for more constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

#### **9.4.2 Process for Disclosure of Information**

As a standard practice, this ESIA will be released for public review according to the AfDB disclosure procedures, and for a period of 21 days in accordance with Nigerian Regulatory Frameworks. Distribution of the disclosure material will be done by making them available at venues and locations convenient for the stakeholders and places to which the public have unhindered access. The language of the ESIA is in English. The report will be made accessible for the general public at the following locations:

- The EA Department of the Federal Ministry of Environment;
- Bauchi State Ministry of Environment
- Ministry of Agriculture and Natural Resource and
- Other designated public locations to ensure wide dissemination of the materials.

Electronic copies of the ESIA report will be placed on the website of the AfDB. This will allow stakeholders with access to Internet to view information about the planned development and to initiate their involvement in the public consultation process. The mechanisms which will be used for facilitating input from stakeholders will include press

releases and announcements in the media, notifications of the aforementioned disclosed materials to local, regional and national NGOs, relevant professional bodies as well as other interested parties.

### 9.4.3 Timetable for Disclosure

The disclosure process associated with the release of project E&S documentation will be implemented within the following timeframe:

- Placement of the ESIA report in public domain (FMEnv and AfDB website)
- 21-day disclosure period – dates to be confirmed by FMEnv.
- Addressing stakeholder feedback received on the entire disclosure package – Dates to be confirmed by FMEnv and AfDB.

The ESIA will remain in the public domain for the entire period of project development and will be updated on a regular basis as the project progresses through its various phases, in order to ensure timely identification of any new stakeholders and interested parties and their involvement in the process of collaboration with the project. The methods of engagement will also be revised periodically to maintain their effectiveness and relevance to the project’s evolving environment. The table 9.1 summarizes the main stakeholders of the project, types of information to be shared with stakeholder groups, as well as specific means of communication and methods of notification.

**Table 9.1: Stakeholder Engagement and Disclosure Methods**

Stakeholder Group	Project information shared	Means of communication/ disclosure
Project beneficiary	- ESIA report - RAP/eRAP - Regular updates on project development.	- Public/Disclosure notices - Electronic publications and press releases on the Project web-site. - Dissemination of hard copies at designated public locations. - Press release in the local media - Consultation meetings.
AfDB	- ESIA Report - RAP/eRAP - Regular updates on project development.	- Electronic publications and press releases on the AfDB’s web-site. - Submission of hard copies
Non-government Organizations	- ESIA Report - Regular updates on project development.	- Public notices - Electronic publications and press releases on the project web-site. - Dissemination of hard copies at



		designated locations. - Press releases in the local media.
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## 9.5 Grievance Redress Mechanism

The grievance mechanism is a company process that enables stakeholders to make a complaint or a suggestion regarding the way a project is being implemented. This includes ensuring that all grievances that are received are acknowledged, logged and tracked. It also enables complainants to know what to expect in terms of response and when. Generally, grievances may take the form of specific complaints for damages/injury, concerns about routine project activities, perceived incidents or impacts or requests for more information / clarity on project activities. In relation to resettlement, complaints may be related to compensation, land issues, resettlement assistance or housing, or other relevant issues.

The primary objectives of a grievance mechanism are to:

- enhance trust and positive relationships with stakeholders, particularly as resettlement is a sensitive and complex process;
- prevent the negative consequences of failure to adequately address grievances; and
- identify and manage stakeholder concerns and thus support effective risk management in relation to resettlement and the Project overall.

The grievance mechanism allows stakeholders to submit complaints and comments at no cost, without retribution and with the assurance of a timely response. The key principles and overview of an effective grievance mechanism are:

- *Culturally appropriate*: Tailored to the local language.
- *Accessible*: Accessible to all settlements and stakeholder groups within the project area.
- *Inclusive of vulnerable groups*: Available to those less likely to have the means to voice their concerns or opinions within the Nigerian context (e.g., women, elderly, Fulani).
- *Reliable*: The developer will respond to grievances within an agreed timeframe in order to manage expectations.

- *Publicized*: The developer will publicize the grievance mechanism through engagement activities and advertisements to ensure that stakeholders are aware and understand the process.
- *Logged*: Grievances will be logged and tracked, and
- *Confidential*: Grievances will remain confidential and anonymous

## 9.6 Grievance Management Standards

The RAP Grievance Mechanism has been designed in accordance with international best practice as summarised in Table 8.1 below.

**Table 8.1 Grievance Management Standards**

<b>Standard</b>	<b>Summary</b>
Nigerian Legislation	Section 30 of the Land Use Act 1990 6 v states: “Where there arises any dispute as to the amount of compensation calculated in accordance with the provisions of section 29, such dispute shall be referred to the appropriate Land Use and Allocation Committee.”
AfDB Integrated Safeguard System (ISS)	The AfDB ISS includes provisions for establishing a culturally appropriate and accessible grievance and redress mechanism to resolve, in an impartial and timely manner, any disputes arising from the resettlement process and compensation procedures.
International Finance Corporation Performance Standard 5 (IFC PS5)	IFC PS 5 requires that the client establish a grievance mechanism as early as possible in the project development phase. This will allow the client to receive and address specific concerns about compensation and relocation raised by displaced persons or members of host communities in a timely fashion, including a recourse mechanism designed to resolve disputes in an impartial manner.
European Investment Bank (EIB)	EIB Environmental and Social Standard 10 requires that the project promoter shall set up and maintain a grievance mechanism that is independent, free and that will allow prompt addressing of specific concerns about compensation and relocation. The mechanism should be easily accessible, culturally appropriate, widely publicized, and well integrated in the promoter’s project management system. It should enable the promoter to receive and resolve specific grievances related to compensation and relocation by affected persons or members of host communities, and use the grievance log to monitor cases and improve the resettlement process.

As described in the table, key principles of the mechanism include ensuring that the Grievance Mechanism is culturally appropriate, grievances are dealt with in a timely manner and impartially, it should be easily accessible and widely publicised to ensure that it can be accessed by all stakeholders, including vulnerable groups. This includes

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providing adequate assistance for those who may face barriers including language, literacy, awareness, finance, distance or fear of reprisal.

## 9.7 Roles and Responsibilities in Grievance Management

This outlines the key bodies that are involved in the Grievance Mechanism process. These include the following:

- **Project Staff:** The Project Community Liaison Officer (CLO) and Resettlement Coordinators (RC) will likely be the first point of contact for complainants and is responsible for receiving, recording and communicating the grievance to the Grievance Officer (GO), or equivalent. The GO is responsible for processing and resolving the grievance with relevant departments and stakeholders, including the complainant, Community Resettlement Committee (CRC) and Land Use and Allocation Committee (LUAC). All resettlement related grievances will be signed off by the Resettlement Manager (RM). Level 3 grievances will also require sign off by the Country Manager (CM).
- **Community Resettlement Committee (CRC):** If needed, the CRC particularly Community Leaders, will assist community members in accessing the grievance mechanism and ensure the Project is aware of the grievance. Additionally, depending on the type and priority level of the grievance, the CRC will play an active role in resolving the grievance. All the members of the CRC have been trained on their responsibilities, including grievance management responsibilities, which includes where required by PAPs and the Developer:
  - reporting grievances raised by PAPs if needed to the Project CLO;
  - keeping the aggrieved parties updated on the progress with respect to addressing their grievance; and
  - supporting the development of solutions to the grievance if the grievance is not resolved.
- **Resettlement Steering Committee (RSC):** As with the CRC, if needed, the RSC or individual members will play an advisory role in grievance resolution at the highest level, and will intervene in the case that it is not resolved.

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- **Land Use and Allocation Committee (LUAC):** The LUAC is a key stakeholder regarding the management of land. They will be required to assist with the resolution of grievances related to replacement land allocation.

All bodies will work closely together to ensure that grievances are dealt with fairly and transparently.

Under the PIU, there will be an established Safeguard Unit. This unit will work with the Grievance Redress committee that would be established for this specific purpose comprising administrative heads or an appointed representative of Bauchi local governments, community and/or village Heads/Mai Angwa's, Sarki, NGOs/CBOs and other relevant Government organs that will be set up to address complaints. For this reason, handling grievances will begin with the Local Government. A grievance log will be established by the project and copies of the records kept with all the relevant authorities.

The existence, location, purpose and composition of this committee will be publicized, so that complainants are knowledgeable about the availability of this committee for resolving any grievance.

## **9.8 Expectations when Grievances Arise**

When people present their grievances, they expect to receive one or more of the following: acknowledgement of their problem, an honest response to questions/issues brought forward, an apology, adequate compensation, modification of the conduct that caused the grievance and some other fair remedies. In voicing their concerns, they also expect to be heard and taken seriously. The company, contractors, or government officials must therefore convince people that they can voice grievances and work to resolve them without retaliation.

## **9.9 Setting up a Grievance Redress Mechanism**

During the time of implementing of the ESIA, the PIU shall establish a Grievance Redress Mechanism that incorporates the use of existing local grievance redress mechanism available in the community. It will be effective and result oriented to work with existing

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and functional local structures of dispute resolution than to design an entirely new one, which may be alien to the people.

### **9.9.1 Membership of the Grievance Redress Committee (GRC)**

Membership of the GRC for the 3 levels of grievance uptakes shall comprise as follow:

#### GRC at the Site/community Level:

- The traditional Ruler/District head of Gubi communities at the AIH or a person appointed by them from the council;
- The village heads of Azare, Rampa, Alkaleri and Galam communities in the ATC's project location site;
- The Woman leader in the communities or her secretary;
- A woman leader of an affinity association;
- 2 Representatives of PAPs including at least a woman;
- 2 members of the site committee including at least a woman.

#### GRC at the PIU Level:

It is recommended that the state project coordinator shall constitute a team within the PIU to receive, hear and address complaints arising from the project. The Social and Livelihood Officer/Safeguards Officer will head the team. Membership of the team shall be as follow:

- Social and Livelihood Officer;
- Communication officer/ Public relations officer;
- Environmental officer
- Monitoring and Evaluation officer, and
- The project engineer

#### GRC at the State Steering Committee Level:

The committee at this level shall be headed by the Permanent Secretary/Commissioner, Bauchi State Ministry of Agriculture, while the Project Coordinator shall serve as the secretary of the committee.

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Membership of the GRC at this level shall constitute as follows:

- The Permanent Secretary Bauchi State Ministry of Agriculture;
- Director Ministry of Land & Survey
- Director Ministry of Agriculture;
- Director Ministry of Environment
- The State Project Coordinator

### **9.10 Grievance Redress Process Procedure**

The GRM Process would comprise:

#### ***Registration***

It may be less depending on the severity of the matter under consideration. The first step is the presentation of a grievance at the uptake point at any level. The social contact person or secretary of the committee will receive grievance from the complainant, register and acknowledge receipt of grievance to the grievant within 2 days. The registration will capture the following data: name of the complainant, date of the grievance, category of the grievance, persons involved, and impacts on complainant life, proofs and witnesses. A registration form will have all these bits of information.

#### ***Verification***

The verification determines among other things whether the matter has relationship with the project activities, and whether the matter can be handled/resolved at the level where it is presented. This will determine if the matter should be referred to the next level or not. Part of the investigations may also be to assess the cost of lost or risk involved in the grievance.

#### ***Processing***

The processing step is when options for the approach to resolving the case are weighed and determined. Parties involved in the case are brought together for the first attempt at resolution with suggestions from the parties on practical steps to be taken which may also involve site visit for physical inspection and determination of the claim.

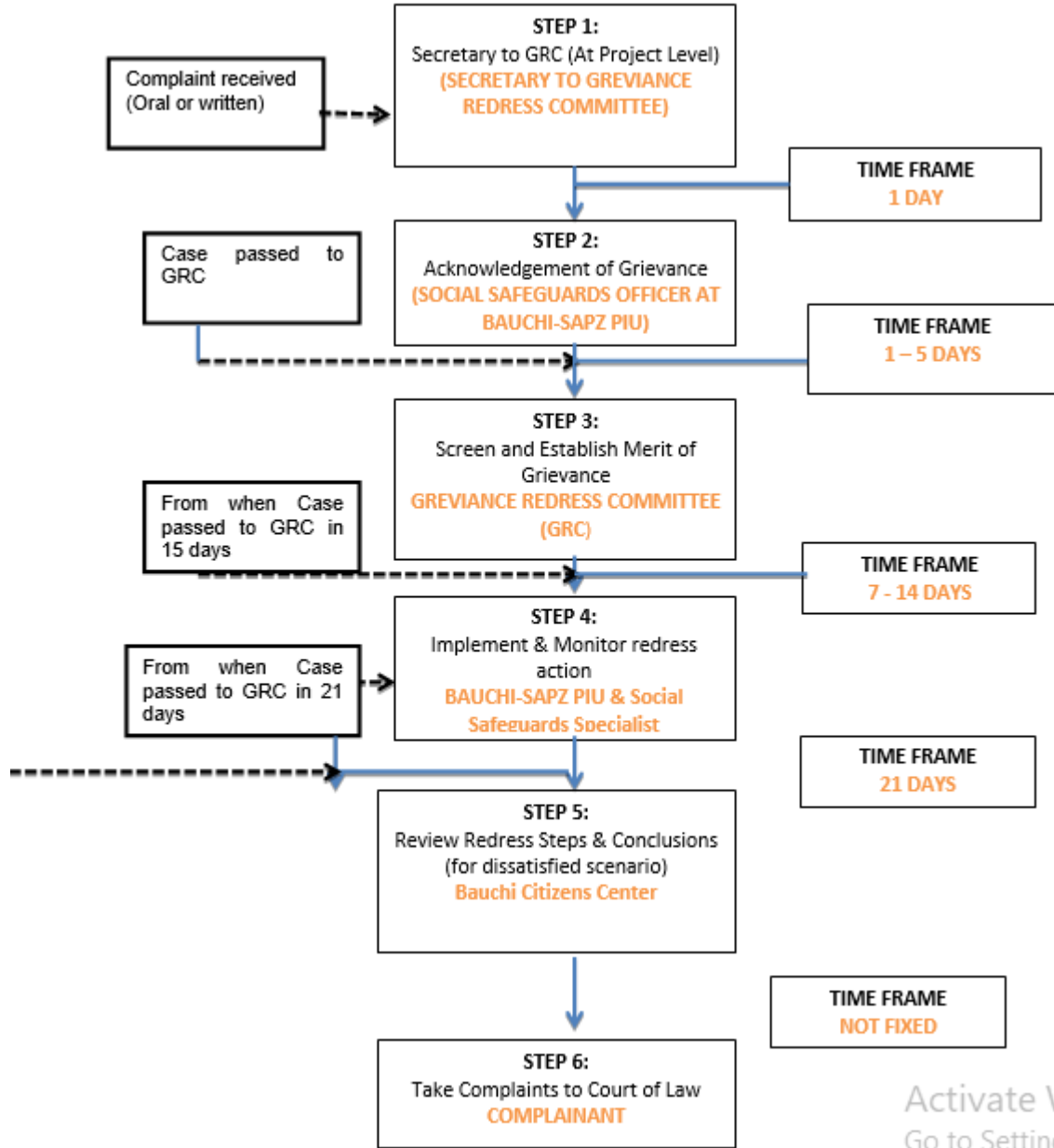
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***Feed back***

All responses to the complainant in a grievance redress process that moves beyond a unit level must be communicated in writing and/or by verbal presentation to the complainant. This will include a follow up on the corresponding authority where cases are referred, to ascertain the status of reported cases. Feedback on outcome of each case should get to the complainant through the secretary of committee or social contact/safeguard person as the case may be. It is expected that reported complaints at each level will be resolved and determined within 21 days from date of receipt of the complaint.

Details are shown in the flow chart illustrated in Figure 9.1.





Details are shown in the flow chart illustrated in Figure 9.1.

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## CHAPTER TEN

### CONCLUSION

#### 10.1 Introduction

The conduct of this ESIA for the proposed Special Agro-Industrial Processing Zone (SAPZ) project in Bauchi State was executed in strict compliance with acceptable National and International regulatory requirements. The ESIA process involved an extensive literature review, wide-ranging consultation with all the identified communities and stakeholders, sampling and determining the conditions of the project area's biophysical, social and health environmental components. The study sought the views and concerns of the host communities on essential aspects of the proposed project through special interaction and incorporated in the impact assessment process.

This ESIA has identified and assessed both positive and negative impacts of the proposed project and accordingly evaluated the associated and potential negative effects on the environment (biophysical), socio-economic and health characteristics of the project area in detail and mitigation measures have also been prescribed for significant negative impacts. An Environmental and Social Management Plan (ESMP) has been developed to effectively implement the recommended mitigation measures to ensure environmental sustainability during the construction and operation phases of the proposed Bauchi-SAPZ project.

The Environmental and Social Impact Assessment also revealed that the project will have significant transformative impacts on the socio-economic life of the host communities and Bauchi State in particular as well as the national economy in general.

The proposed SAPZ would pose limited environmental and social risks, taken into account the proposed mitigation measures. It is recommended that environmental performance should be regularly monitored to ensure compliance and that corrective measures be taken if necessary. In addition, it is very necessary that this information should be made available to the host communities on a regular basis.

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The Environmental and Social Management Plan (EMP) should be used as an on-site reference document during all phases (Planning, Construction and Operation) of the proposed SAPZ project.

Environmental auditing should be regularly undertaken, in order to determine compliance with the proposed EMP, and parties responsible for the implementation of the EMP should be held responsible for any inadequacy during the implementation process.

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## **APPENDICES**



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## **APPENDIX 1**

**LIST OF ATTENDANCE DURING SITE  
VERIFICATION EXERCISE**

**FEDERAL MINISTRY OF ENVIRONMENT**

**DEPARTMENT OF ENVIRONMENTAL ASSESSMENT**


**SITE VERIFICATION EXERCISE**

**Attendance Sheet**

PROJECT: Special - Agro - Industrial Processing Zone  
 PROPONENT: Bauchi State Ministry of Agriculture  
 LOCATION: Nguba - Village, Gwandu LGA, Bauchi State  
 Date: 26

S/N	Name	Organization	Email	Phone	Sign
1.	Abel Agada	Fahamu Nig Ltd	medugu@gmail.com	0732495392	
2.	NASIRU IDRES	Fahamu NGR	nasimensue.com	080235758	
3.	EGOPAJA AWAJIOWA	Fahamu Nig Ltd.	awajiwawa@gmail.com	0803017150	
4.	MBA HARRISON	Fahamu Nig Ltd.	emadimbas@gmail.com	08058437700	
5.	Jonathan Apeh	Fahamu Nig Ltd.	apehboett@gmail.com	08157161998	
6.	Samuel Sule	MUBREKH	suleloymeh@gmail.com	0807792572	
7.	Daniel Kyau	Fahamu/Bau	Kyaukdaniel25@gmail.com	0816305234	
8.					
9.					
10.					
12.					
13.					
14.					
15.					
16.					




















**ATTENDANCE LIST FOR STAKEHOLDERS' ENGAGEMENT**



**FEDERAL MINISTRY OF ENVIRONMENT**

**ENVIRONMENTAL IMPACT ASSESSMENT (ETA)**

Special - Agr - Industrial processing Zone  
 Bauchi state Ministry Of Agriculture, Gubi  
 Village, Gunguma LGA, Bauchi State

S/N	NAME	TEL. No.	ADDRESS	SIGN
1	Aminu Adame	08032400069	Bauchi	
2	Yusuf Sulaiman	0806422668	Bauchi	
3	ILiyasu yakehu	08033199109	Bauchi	
4	ALI G. MOHAMMAD	08061170856	Bauchi	
5	ABDURAZAK ABDULLAH	07065311430	Bauchi	
6	ATTAMAD NUSA MALAM	080581681102	Bauchi	
7	MODIBRO NUSA	08036557146	DASS LGA	
8	MOHA SHEHU ITO	08032160777	ITAGADA	
9	SALISU TUKU BURE	08069567151	TORO	
10	Amwal Garba	08027977534	Ita	
11	Straja Al-Wali	0703214265	Gunguma	
12	Amayi Emmanuel	07036181074	Yankari Bafra	
13	Zubairu Sale		Gunguma	
14	Umaru Musa	08084536632	Gunguma	
15	Umar Alubakar	08036403856	Gunguma	
16	Alalullahi M. Korau	08089987141	Gunguma	
17	ALHASI JUREW	08030633331	GAMAWA	
18	Laklan Lawler	07082293188	Tattata Bakur	
19	HABIRWA	08081119721	GADUKWA	
20	ISA UMAR UMAR	08088984477	ORANGAMA	

LIST OF ATTENDANCE AT GUBI, GANJUWA LGA, BAUCHI STATE



FEDERAL MINISTRY OF ENVIRONMENT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Special Agro-Industrial processing Zone  
Bauchi State Ministry of Agriculture  
Gusi Village, Ganjuwa LGA, Bauchi State

S/N	NAME	TEL. No.	ADDRESS	SIGN
1	GARIB IMAM	09167219104	BARKALKA	
2	ABDURAZAK GARBA	08038458012	GUBI	
3	HARUNA MUHAMMAD	0906193473	GUBI	
4	ADAMU LIMAN	08026406712	RUDILANGA	
5	Ezekiel Markus Gyet	08108721400	Gubi Village	
6	Gambo Hassan	0902327055	KUKHU	
7	MUHAMMAD ABIMU ALI	08103336922	TORO LGA	
8	Haruna Umar	08064545115	TORO -	
9	DAKYAU DANDA	07037493206	BEHORO	
10	MUHAMMAD AMALU	08166666041	ZAKI	
11	MUHAMMAD ISMAIL	08160501086	ZAKI	
12	Jacob Samuel	09038690796	Gubi	
13	A ABDELWAHAB	08036197730	Nigeria Air Force	
14	Sulaiman Abdullahi	07016512050	BARKALKA	
15	Salihu SHEHU	08125186938	KUKHU	
16	Hanna Adama A.	08064066775	B.S.A.D.P	
17	Zainab L. Rice	07036999021	B.S.A.D.P	
18	Amlorse A. Amba	08034256592	AIBU Bauchi	
19	ABUBAKAR JBRIN	08080130585	G J W	
20	ALI Magari	08035796331	SHIRI LGA	



**LIST OF ATTENDANCE AT ALKALERI  
FOCUS GROUP DISCUSSION**

ATTENDANCE OF THE MEETING - DN 26/1/24			
Sl. No.	NAME	PHONE	Sign
1	Faisal Isahassen	011 37275770	[Signature]
2	Asubakor mudi	09133844738	[Signature]
3	Babayo - Garba	08032289943	[Signature]
4	Muhammad Ali	0802631329	[Signature]
5	Yusufu Ibrahim	08022611104	[Signature]
6	Babayo Baya	070533771333	[Signature]
7	Adamu Usman	07067776005	[Signature]
8	Adamu Sulaiman	09030697581	[Signature]
9	Muhammad Adamu	07039110903	[Signature]
10	Muhammad Chams	06057235796	[Signature]
11	Abdullahi Hamud	07055363052	[Signature]
12	Isah Mohammed	08164153265	[Signature]
13	Alhaji K. Y. Y.	08070492301	[Signature]
14	Muhammad Saifur Abubakar	08072552219	[Signature]
15	Sami Abdullahi	08024189533	[Signature]
16	Muhammad Tajjaji Asub	07068449027	[Signature]
17	Muhammad Umar Jalil	08051110938	[Signature]
18	Baba Ibrahim	07053335526	[Signature]
19	Luta M. Baya	07067060572	[Signature]
20	ADAMU TALBAN PALI	070612121448	[Signature]
21	Muhammad Abdullahi	08107220418	[Signature]
22	Baba Gid YALO	07048730644	[Signature]
23	Sami Umar G.	09060501511	[Signature]
24	Sali Lu Adamu	09036412281	[Signature]
25	KADUNA GANA	080731580309	[Signature]
26	GATIBO YUSUF	08151357703	[Signature]
27	Tajjaji Umar	09067402748	[Signature]
28	Abdulkadir Mohammed	08028383568	[Signature]
29	SUKKI A. JIBINI	07064640376	[Signature]
30	BARANGIRI MAHAMMAD	08031550729	[Signature]
31	UMUSA MAIKERI	07039617307	[Signature]

24	RAHMAH ANNA GUSRIYA	08167533951	
25	SUMARSA SORAH HAT	08031370042	
26	ASULAH WIGNI	08065972982	
27	MULIA WIGNI	08164770009	
28	HELALAHNA MULIA	08037634284	
29	MULIA GOROS	07051352541	
40	HOLIBU ISMAIL	08025173226	
41	DARULHILAL ULS	07061096863	
42	SAIN BABA	08130299685	
43	JAMILA MADAWA G.	08027635553	
44	JANIS M. BAGAS	07063081433	
45	DARULHILAL SHALBU	080744160903	
46	SAMMILA YUSUF	08058632234	
47	ALYAH ALMAH ARABI	08065993294	
48	RABTU FIRRI	08082979281	
49	MULIA TAYYI	08062215162	
50	ABDULLAH MULIA	08068250690	
51	TOLA	080053241021	
52	BABATE GOROS - DARULHILAL MINIR	09064540464	
53	ISA FIRRI BIRIM	07033950727	
54	ULBRI FUSUF IDRIS	08024258051	
55	LEAHNA YUSUF ABUWAH	08067376828	
56	MUSA ANASARI	07063612437	
57	LEAHNA TANAWA	08009076366091	
58	MULIA BASAH BAGAS	08142733837	
59	MULIA FUSUF	08053435538	
60	BABATE MULIA	08057188599	
61	KANUN MULIA	08143815283	

61	Kalvin Lawan	0706874839	KP
62	Abdullah Musa	09061660016	guy
63	SAMAILA DEMBO	08056472038	<del>guy</del>
	MUSA ALI	08033678974	MUSA
	Moh'd Moh'd Yus	08068678388	<del>KP</del>
	Luqman'ul Karim	07086888926	<del>KP</del>
	Abdullah Ahsan	08145503843	<del>KP</del>
	Sadiq Abdulhadi	08034163327	<del>KP</del>
	Kamilu Lawan Husaini	0849502656	<del>KP</del>
	Anwar Fadi	08165584341	<del>KP</del>
	Hanza Ibrahim		<del>KP</del>
	Umar Umar	08165271663	<del>KP</del>



**LIST OF ATTENDANCE AT MTRM HALL DURING  
SCOPING WORKSHOP**



**FEDERAL MINISTRY OF ENVIRONMENT**

**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)**

Special - Agro - Industrial Processing Zone  
Bauchi State Ministry of Agriculture  
Gubi Village, Ganjuma L.G.A. Bauchi State

S/N	NAME	TEL. No.	ADDRESS	SIGN
1	Xel Bola Mayi	07030636336	PLG	[Signature]
2	APPAL BUBA	08037686308	BAUCHI L.G.	[Signature]
3	ADA MU YOKUBU	08021459526		[Signature]
4	Saido Umar Leulu	09087569179	[Signature]	[Signature]
5	Abubakar Yahaya	09064669191	GJW	[Signature]
6	Abdul Yahaya Adams	09034923355	GJW	[Signature]
7	Adamu Mulu	08136763849	GJW	[Signature]
8	HARUNA IBRAHIM	08080712240	BAUCHI	[Signature]
9	Zakariya Yohanna	08149083170	Bauchi	[Signature]
10	MUSA BOLA	09138999793	Bauchi	[Signature]
11	Abay Z. Ikram	08035761305	M.A.R.	[Signature]
12	IBRAHIM ABIMU BABA	07011313018	Bauchi	[Signature]
13	TIJANU SHEHU	07087172953	BAUCHI	[Signature]
14	Muhammady Ajija	08085560299	Gubi	[Signature]
15	SHEHU BAWA	08129106307	KISARKI	[Signature]
16	SHEHU S. MALIM	08027613846	S. MALIM	[Signature]
17	MUHAMMAD ADAMU JUMBA	08086756525	S. BAWA	[Signature]
18	Aminu Inadaku	08133150702	Ganjuma	[Signature]
19	KABIR ESTERASTI	08064991167	CADAM F.R.I.	[Signature]
20	Talatu Shehu	08037938054	GJW	[Signature]

LIST OF ATTENDANCE AT MTRM HALL DURING SCOPING WORKSHOP

No	NAME	PHONE NO	LG A	SIGNATURE	RANK
1	Rasmi BRESATI	08064991169	Garumn		Asstagne
2	Amumu Sholeh murti	08153150702	Ganjungs		
3	Abubakar yahaya	0706466970	Ganjung wa		Sevici Kelayan
4	Chunma Sarki	08089987141	Ganjung wa		Sarki S/Kr
5	Farima Ahmade	08081119721	Ganjung wa		Liman
6	Xci Bata Maji	07030636334	SLG		La) office
7	Ali Margari	08035796331	Shiva		DANR
8	Ahwal yahya Adami	07034825357	Ganjungs		shugaba
9	Umar Abubakar	08036403356	G.J.W		Shugaba
10	Isa Umar	08088984417	G.J.W		Shugaba
11	Jacob OJoru Dimp Samuel	07032670776	G.J.W		Pastor
12	ABDULLAZAK CARBA	07032670776	Bilik		STUDENT
13	HARUNA HILHAMMED	07061934713	BUC		STTA
14	YUSUF ADAMU TUNGAN	07011813017	BUC		STUDENT
15	ABUBAKAR JIBRI	08080130535	G.J.W		Shugaba
16	ABDURAZAK ABDULLAH	0705314037	B.H		Staff
17	Saiche Masbas Ceyet	88108721400	Bauchi		Edo Babu
18	Adamu Malu	08136763849	G.J.W		Sarki BK
19	Harima Ibrahimi	08080712740	Bauchi		Wakilin
20	Adamu Yahya	08021459586	B.U-C		Prin
21	Saiche Umar Kudu	08087569170	Bauchi		Imam/tra
22	Adamu Liman	0816721904	G.J.W		Limgaba
23	Zakariya Yohana	08026406741	G.J.W		Liman
24	MUSA GOLA	08149083170	B.U.C		Pastor
25	Umsari MUSA	09138997793	B.U.C		Pastor
26	Sinjio Abdulkali	08084536633	G.J.W		L.MOX
27	Joshua Saifu sewa	09032141265	Ganjung		Liman
28	Ahmad JIBRI	07121953313	Ganjung		Sup. Officer
29	Mohammed Yama Aisa	08030633331	Garumn		Pastor
30		08082113343	Amala		Asst. Dir. Agr.



# ATTENDANCE

Sl. No	NAME	PHONE NO	L.G.A	Sex	Rank
1	SALISU TURKANE BURAI	08069567151	TORO	♂	Supervisor Agric D/DIR S
2	JUTHA ADAMU BAI	08703336722	-	♂	Sen-Agric
3	HARUNA USMAN	08064045115	-	♂	D/AGRIC
4	MUHAMMAD SHEHU IFA	08032160777	T/AS/ASAM	♂	D/DIR
5	ADAMU RUKA	08039688308	BAUCHI	♂	Produce Sect
6	KATHRYN EMMAUEL GIZO	07036181074	IRAKWA/BAUCHI	♀	Limam
7	Sidu Uma	07077569178	Bauchi	♀	Aiya
8	SALGH ZUBIRU		Benjuma	♀	
9	Shehu Salihu	07125186937	Bauchi	♂	Yeving
10	GAMBO HASSAN	07023270531	Bauchi	♂	Shugaban
11	AHMED MUSA	08083481102	Bauchi	♂	Lima
12	SULIMAN ABDULLAHI	07016542050	Bauchi	♂	Shugaban
13	MUHAMMAD A. JUKBIA	08086756525	Bauchi	♂	Sarkin
14	SHEHU BAWA	08129106307	Benjuma	♂	Sarkin
15	Moh'd Agiya	08037530299	Bauchi	♂	Agiya
16	TISHAUI SHEHU	07087171113	Bauchi	♂	Sarkin
17	SHEHU SARKIN MAMMA	08027613806	Bauchi	♂	Sarkin
18	Awal Garba	08027977524	GJU	♂	S. Mambo
19	Dakyalu Dauda	07037493206	BAGORO	♂	D/Agri
20	MODIBBO MUSA	08036587146	DASS	♂	D/Agri
21	MUHAMMAD AMALE	08166666041	ZAKI	♂	ZAKI
22	MALAM KANI TIBHEWA	08160501086	ZAKI	♂	ZAKI
23	HAMMAN ADAMU	08064016775	Bauchi	♂	
24	KANTAN DAUDA	070822931	T/Balewa	♂	
25	Moh'd Murtala Madaki	08068552281	Gannam	♂	Director
26	SAM BELLO	08168500622	T/BALEWA	♂	D/Agri
27	NUHU SHEHU	08066300	ALI	♂	
28	SALE GARBA	08030406061	L.K.L.	♂	
29	Ahmed Hashim	08032163132	ITAS	♂	DOA

NAME	AG	SIGN	RANK
Hashim U. Bulkaduna	MIA		08026007970
Yusuf Sulaiman	MOA		
Aminu Ademu	MOA		
Ali Gialadi Mohammed	MOA		
Garba Mahel Jajah	MOA		
Uyarn Yakeibu	MOA		
Engr. Yohana A Barau	MOA		
Engr. Mahid Sa'idu			
Sagfir Mahid Idris			
Abu Ibrahim Babayo			
Korou Garba			
Bala Ibrahim Yantare			
Dr. Ibrahim Bello M.			
Shelw Adamu			
Aliyu Zubera			
MAYARA GIZO FARMACIA			
Abdulwahab Aliyu			
A-ABDULWAHAB	Nigeria Air force		08036197730
Smailo Saleh	Maths		08069792937
Daniel Kyau	FREEM/BAU		08163052341
Prof. Demo Killa	ATBU Kuma		08028785578 07032445398
Abel Ageda	Falsam Nig. Hd		08157161998
Apel, Jonathan	Fahamu Nig. Hd		080644455102
Dr. Muhammad Garba			08063390240
Prof. Ambrose A. Amba			08034256592

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## APPENDIX 2

### DEMOGRAPHIC INFORMATION

1. Educational qualification: No formal education \_\_\_\_\_  
Primary \_\_\_\_\_ Secondary \_\_\_\_\_ Tertiary \_\_\_\_\_
2. Marital status: Married ..... Single ..... Divorced.....Separated.....Widowed.....
3. Marital Pattern: Polygamy..... Monogamy.....
4. Number of children: Male: \_\_\_\_\_ Female: \_\_\_\_\_
5. Total No. of people in household: Male: \_\_\_\_\_ Female: \_\_\_\_\_
6. Age \_\_\_\_\_ Sex \_\_\_\_\_
7. Are you aware of this project? Yes \_\_\_\_\_ No \_\_\_\_\_

### (B) ECONOMIC INFORMATION

8. What is your occupation?
9. What types of domestic and wild animals do you have around?
10. What is your estimated monthly income: less than N10,000 \_\_\_ N10,000 to N50,000 \_\_\_  
N51,000 to N100,000 \_\_\_ N101,000 to N150,000 More than N200,000\_

### (C) SOCIAL INFRASTRUCTURE

11. Do you have markets? \_\_\_\_\_ (names and the days of function)
12. What recreational facilities do you have in this community? \_\_\_\_\_
13. What communication network is in use here? \_\_\_\_\_
14. From which of the following sources is your water supply? Rain \_\_\_ River \_\_\_\_\_ Stored run-off\_ \_\_\_\_\_  
Pipe borne \_\_\_ borehole \_\_\_\_\_ well \_\_\_ Spring \_\_\_\_\_
15. How is water from each of these sources treated before use? \_\_\_\_\_
16. How is solid waste disposed-off: Burning \_\_\_\_\_ Burying \_\_\_\_\_ Dumping \_\_\_\_\_ Others \_\_\_\_\_
17. How is human waste disposed-off? Defecation in bushes \_\_\_\_\_ pail systems \_\_\_\_\_ pit toilet \_\_\_\_\_  
Water System (WC) \_\_\_ Any other (specify) \_\_\_\_\_

### (D) CULTURE AND RELIGION

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18. Is there any sacred object in the community? (stream, animal, deity, stones, trees etc)

Mention them and location \_\_\_\_\_

19. Do you have any historic or archeological site/monuments in your community? If yes, mention their names and the location \_\_\_\_\_

20. M \_\_\_\_\_  
e \_\_\_\_\_

n  
What are the Dos and Don'ts (taboos) in this community? \_\_\_\_\_  
i \_\_\_\_\_

on the kinds of festivals celebrated in your community and when

21. (E) ENVIRONMENTAL PROBLEMS

22. List the main environmental problems in this community (e.g. deforestation; erosion; dust storm)

S/No.	Environmental problems	Causes

23. How seriously do these problems affect your occupations/jobs?

Little effect\_\_ Serious \_\_\_\_\_ has forced us to stop some activities\_\_\_\_

Further information on any serious effect \_\_\_\_\_

29. Has the government or any other group embarked on any activity to help reduce environmental problems in your community? Yes: \_\_\_\_\_ No: \_\_\_\_\_

30. If yes what type of development programmes; which organization; and what has been the impact?

\_\_\_\_\_

31. How do you think this project will benefit this community?

\_\_\_\_\_  
\_\_\_\_\_

**HEALTH IMPACT ASSESSMENT**

1. What type of health care facility do you use?

S/No.	Type	Name	Address
1	General Hospital		
2	Primary Health Care		
3	Private Clinic		
4	Maternity		
5	Pharmacy		
6	Patent Medicine Store		
7	Traditional Healing Homes		
8	Faith Based		

2. How many children were born in your household in the past 1 year \_\_\_\_\_ 3.

Which sicknesses affected your household in the past 1 year? \_\_\_\_\_

4. Have you been to a healthcare facility for medical check or counseling in the past 2 years?

Yes...../No.....

5. If No, why? \_\_\_\_\_ 6.  
If yes, where? \_\_\_\_\_

**COMMUNITY HEALTH NEEDS**

7. What in your opinion is the most important health needs of your community (score in order of priority)

- Safe Drinking Water
- Health Services/Clinic
- Electricity
- Others



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PROJECT RELATED

8. Do you have any concern about the effect the proposed project may have on the people of the community?

---

9. What benefits do you expect the project will have on the people in the area in order of importance?

- a. Economic Boom (increased commercial activity)
- b. Employment Benefit
- c. Infrastructural Development
- e. Housing
- f. Others. Please specify .....

10. What are your fears about the proposed project in order of importance? a. Loss of land

- b. Damage to farmland
- c. Pollution of Air
- d. Noise Pollution
- e. Water Pollution
- f. Health Problems
- g. Socio-cultural Interference
- h. High cost of living
- i. Increased population
- j. Disruption of business activities
- k. Disruption of traffic

Others – specify.....

Explain your fears in detail

.....

.....

.....

.....

---

11. What causes death in this community most?

.....

12. What are the important needs of the community in order of preference?

.....

.

.....

..

---

Name and position Telephone number

## QUESTIONNAIRE: COMMUNITY PROFILE

### IDENTIFICATION

Town/Village/Settlement.....

Location..... GPS Reading.....

LGA.....

BRIEF HISTORY OF ORIGIN OF COMMUNITY (Describe in a separate sheet)

Field worker.....

S/N	Description	Remarks
1.	<p><b>Leader:</b></p> <p>1. What is the name of the leader in this community?</p> <p>2. What is the predominant tribe and languages spoken?</p> <p>3. What is the average number of household size?</p> <p>4. Are you aware of this project? (probe for baseline knowledge)</p>	
2.	<p><b>Ethnic Group</b></p> <p>a. Major ethnic group</p> <p>b. Minority ethnic group</p>	
3.	<p><b>Culture and Religion</b></p> <p>1. What religions are practiced here?</p> <p>2. Are there any sacred plants, water, animal, artefact or forest?</p> <p>3. What are the festivals celebrated and month of celebration?</p> <p>4. What is regarded as a taboo in this community?</p>	
4.	<p><b>Economic</b></p> <p>1. What are the means of livelihood?</p> <p>2. What are the common crops farmed here?</p> <p>3. What livestock do you keep around here?</p> <p>4. What is the average monthly income?</p>	

5.	<b>Social Infrastructure</b> 1. What types of transportation services are available? 2. Are there markets in this community? 3. Are there financial institutions around here? 4. How does the community manage her waste? 5. What toilet types are available here?	
6.	<b>Number of Houses: (Use census approach)</b> a. Huts b. Bungalows c. Storey Buildings	
7.	<b>Housing characteristics:</b>	

	Bricks, mold, zinc, thatch	
8.	<b>Political structure:</b> 1. Is the community leadership by election, appointment or is it hereditary? ..... Organogram (indicating leadership and hierarchy in community level decisions)	
9.	<b>Groups and Leaders:</b> a. Community Head (Title and Name) b. Chiefs-in-Council c. Men's Group d. Women's Group e. Youth Group	
10.	<b>Social Environment</b> 1. Are there any social groups in this community? 2. What common foods are eaten here?	

11.	<p><b>Demography:</b></p> <ul style="list-style-type: none"> <li>a. Total population</li> <li>b. Number of houses</li> <li>c. Average household size</li> <li>d. Adults.....</li> <li>    Youths</li> <li>    Males.....</li> <li>    Females</li> <li>Infants (0 - 5) Children.....</li> <li>Mortality</li> </ul>	
12.	<p><b>Education:</b></p> <ul style="list-style-type: none"> <li>a. Government nursery school</li> <li>b. Private nursery school</li> <li>c. Government primary school</li> <li>d. Private school</li> <li>e. Government secondary school</li> <li>f. Private secondary school</li> <li>g. Tertiary institutions</li> <li>h. Net enrolment rate</li> <li>i. Gender disparity</li> </ul>	
13.	<p><b>Roads:</b></p> <ul style="list-style-type: none"> <li>a. Tarred roads entering community</li> <li>b. Untarred roads entering community</li> </ul>	
14.	<p><b>Source of domestic water</b></p> <ul style="list-style-type: none"> <li>a. River</li> <li>b. Rain</li> <li>c. Well</li> <li>d. Borehole</li> <li>e. Pipe bone (Tap)</li> </ul>	
15.	<p><b>Available social facilities:</b></p> <ul style="list-style-type: none"> <li>a. Petrol station within 5km radius</li> <li>b. GSM</li> </ul>	

	<ul style="list-style-type: none"> <li>c. Electricity</li> <li>d. Public toilets</li> <li>e. Police stations</li> <li>f. Fire stations</li> <li>g. Markets</li> <li>h. Banks</li> <li>i. Pharmacy</li> <li>j. Chemist/patent medicine store</li> <li>k. Recreational facilities</li> <li>l. Archaeological sites</li> </ul>	
16.	<p><b>Health Facilities:</b></p> <p><b>Government Facility:</b> a. Hospital</p> <ul style="list-style-type: none"> <li>b. Comprehensive health centres</li> <li>c. Maternity/PHC</li> <li>d. Dispensaries</li> </ul> <p>Private health facility: a. Hospital/clinics</p> <ul style="list-style-type: none"> <li>b. TBAs</li> <li>c. Traditional/spiritual homes</li> <li>d. Faith based</li> <li>e. NGOs</li> </ul>	
17.	<p><b>Morbidity:</b> Communicable</p> <ul style="list-style-type: none"> <li>a.</li> <li>b.</li> <li>c.</li> <li>d.</li> </ul> <p>Non communicable</p> <ul style="list-style-type: none"> <li>a.</li> <li>b.</li> <li>c.</li> <li>d.</li> </ul>	

18.	<p><b>Economic Activity: Men</b></p> <p>a.</p> <p>b.</p> <p>c.</p> <p>Women</p> <p>a.</p> <p>b.</p> <p>c.</p> <p>Youth</p> <p>a.</p> <p>b.</p> <p>c.</p>	
19.	<p><b>Waste/Refuse Disposal: a.</b></p> <p>Bush</p> <p>b. Open space within homestead</p>	
	<p>c. Rivers/streams</p> <p>d. Incinerators</p> <p>e. others</p>	
20.	<p><b>Major transport in the community: a.</b></p> <p>Roads</p> <p>b. Water</p> <p>c. Rail</p>	
21.	<p><b>Special features: a.</b></p> <p>Sacred areas</p> <p>b. Shrines</p> <p>c. Forest reserves</p> <p>d. Common taboos</p>	
22.	<p><b>Properties owned by members of the community:</b></p> <p>1. Farmland</p> <p>2. Poultry</p> <p>3. Plantation</p> <p>4. Houses</p> <p>5. Others</p>	



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23.	<b>Pattern of land ownership:</b> 1. Inheritance 2. Tenant/Lease 3. Family 4. Outright purchase 5. Communal	
24.	<b>Farming Methods</b> 1. Garden 2. Fallow 3. Shifting cultivation 4. Rotational bush fallow 5. Others	
25.	<b>Power Source:</b> 1. Electricity 2. Generator 3. Lantern 4. Candle	

## APPENDIX 3

### (RESULT OF LABORATORY ANALYSIS)



#### ABUJA ENVIRONMENTAL PROTECTION BOARD

PLOT 776 CADASTRAL AO OFF Z. MAIMALARI STREET  
CENTRAL BUSSINESS DISTRICT-ABUJA  
PMB 152 GARKI

#### LABORATORY UNIT

ACCREDITED BY FED. MIN. OF ENVIRONMENT  
(REG NO: 0004265)

**FAHAMU NIGERIA LIMITED**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL**  
**PROCESSING ZONES (SAPZ) BAUCHI**

#### CERTIFICATE OF ANALYSIS

Date sample collected: 30/04/2024  
Date sample delivered to the Lab: 01/05/2024  
Time sample received in the lab: 09:0am

**TABLE 1**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE BAUCHI**  
**PHYSICAL/CHEMICAL PARAMETERS OF GROUND WATER SAMPLE.**

S/	PARAMETERS	GW1 kuhu	GW2 Malmo	FMEv LIMIT
		10° 28' 36 .57"N 9° 46' 15.17"E	10° 29' 4 .77"N 9° 47' 4.91"E	
<b>A</b>	<b>PHYSICAL TEST</b>			
1	Odour	Odorless	Odorless	<b>Odorless</b>
2	TEMPERATURE ( °C)	30.4	31.1	<b>&lt;40</b>
3	pH	7.5	7.3	<b>6-9</b>
4	ELECTRICAL CONDUCTIVITY (µS/cm)	315.0	341.0	<b>1000</b>
5	DISSOLVED OXYGEN (mg/l)	3.5	3.7	<b>7.5</b>
6	TOTAL DISSOLVED SOLIDS (mg/l)	158.0	171.0	<b>500</b>
7	SALINITY (%)	0.01	0.01	<b>0.0</b>
8	ALKALINITY (m/l)	26.0	29.0	<b>100</b>
9	TOTAL SUSPENDEDED SOLID mg/l)	0.0130	0.0140	<b>&lt;10</b>
<b>B</b>	<b>CHEMICAL TEST</b>			
10	TOTAL HARDNESS (mg/l)	308.16	291.04	<b>200</b>
11	MAGNESIUM HARDNESS (mg/l)	85.60	85.60	<b>50</b>
12	CALCIUM HARDNESS (mg/l)	222.56	205.44	<b>150</b>
13	PHOSPHATE (mg/l)	0.295	0.488	<b>5</b>
14	NITRATE as NITROGEN (mg/l)	5.40	7.80	<b>10</b>
15	TOTAL CHLORIDE (mg/l)	11.6	7.80	<b>250</b>
16	BOD (mg/l)	-	-	<b>7.5</b>
17	COD (mg/l)	-	-	<b>30</b>
18	SULPHATE (mg/l)	57.9	62.7	<b>250</b>

<b>C</b>	<b>HEAVY METAL</b>			
19	MANGANESE (mg/l)	0.214	0.194	<b>0.2</b>
20	IRON TOTAL (mg/l)	0.398	0.628	<b>1.5</b>
21	COPPER (mg/l)	0.003	0.005	<b>0.1</b>
22	CADMIUM (mg/l)	0.008	0.007	<b>0.05</b>
23	ZINC (mg/l)	0.116	0.158	<b>0.1</b>
24	LEAD (mg/l)	0.0011	0.0016	<b>0.05</b>
25	NICKEL (mg/l)	0.006	0.009	<b>0.05</b>
<b>D</b>	<b>BACTERIOLOGICAL</b>			
26	Total Coliform count (CFU/100ml)	4.1	2.9	<b>1.8</b>
27	Escherichia Coli (cfu/ml)	2.7 X 10 <sup>1</sup>	1.0 X 10 <sup>1</sup>	<b>Absent</b>
28	Salmonella (cfu/ml)	1.8 X 10 <sup>2</sup>	1.1 X 10 <sup>2</sup>	<b>Absent</b>
29	Shigella (cfu/ml)	0.0	0.0	<b>Absent</b>
30	staphylococcus (cfu/100ml)	0.0	0.0	<b>Absent</b>



**ABUJA ENVIRONMENTAL PROTECTION BOARD**

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**LABORATORY UNIT**

ACCREDITED BY FED. MIN. OF ENVIRONMENT

(REG NO: 0004265)

**FAHAMU NIGERIA LIMITED**

**PROPOSED SPECIAL AGRO-INDUSTRIAL**

**PROCESSING ZONES (SAPZ) BAUCHI**

**CERTIFICATE OF ANALYSIS**

Date sample collected: 30/04/2024

Date sample delivered to the Lab: 01/05/2024

Time sample received in the lab: 09:0am

**TABLE 2**

**PROPOSED SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE BAUCHI**

**PHYSICAL/CHEMICAL PARAMETERS OF SURFACE WATER SAMPLE.**

S/	PARAMETERS	SW1	FMEV LIMIT
		10° 28' 18 .06"N 7° 47' 7.83"E	
<b>A</b>	<b>PHYSICAL TEST</b>		
1	Odour	Odorless	<b>Odorless</b>
2	TEMPERATURE ( °C)	31.4	<b>25-35</b>
3	pH	7.1	<b>6-8</b>
4	ELECTRICAL CONDUCTIVITY (µS/cm)	189.0	<b>1000</b>
5	DISSOLVED OXYGEN (mg/l)	3.3	<b>7.0</b>
6	TOTAL DISSOLVED SOLIDS (mg/l)	95.0	<b>1000</b>
7	SALINITY (%)	0.0	<b>0.0</b>
8	ALKALINITY (m/l)	28.5	<b>100</b>
9	TOTAL SUSPENDED SOLID (mg/l)	0.022	<b>&lt;10</b>
<b>B</b>	<b>CHEMICAL TEST</b>		
10	TOTAL HARDNESS (mg/l)	154.08	<b>NS</b>
11	MAGNESIUM HARDNESS (mg/l)	34.24	<b>NS</b>
12	CALCIUM HARDNESS (mg/l)	119.84	<b>NS</b>
13	PHOSPHATE (mg/l)	0.514	<b>5</b>
14	NITRATE as NITROGEN (mg/l)	12.90	<b>10</b>
15	TOTAL CHLORIDE (mg/l)	30.0	<b>0.2</b>
16	BOD (mg/l)	25.4	<b>30</b>
17	COD (mg/l)	100.6	<b>100</b>
18	SULPHATE (mg/l)	62.2	<b>250</b>
<b>C</b>	<b>HEAVY METAL</b>		
19	MANGANESE (mg/l)	0.233	<b>0.3</b>
20	IRON TOTAL (mg/l)	0.685	<b>0.2</b>
21	COPPER (mg/l)	0.208	<b>0.1</b>
22	CADMIUM (mg/l)	0.007	<b>0.02</b>
23	ZINC (mg/l)	0.513	<b>1</b>
24	LEAD (mg/l)	0.004	<b>0.05</b>

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25	NICKEL (mg/l)	0.002	<b>0.05</b>
<b>D</b>	<b>BACTERIOLOGICAL</b>		
26	Total Coliform count (CFU/100ml)	430	<b>400</b>
27	Escherichia Coli (cfu/100 ml)	$2.0 \times 10^2$	<b>0.0</b>
28	Salmonella (cfu/100 ml)	$0.7 \times 10^2$	<b>0.0</b>
29	Shigella (cfu/100 ml)	$0.6 \times 10^2$	<b>0.0</b>
30	Staphylococcus (cfu/100ml)	$2.6 \times 10^2$	<b>0.0</b>



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(REG NO: 0004265)

**FAHAMU NIGERIA LIMITED**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL**  
**PROCESSING ZONES (SAPZ) BAUCHI**

**CERTIFICATE OF ANALYSIS**

**TABLE 3**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE BAUCHI**  
**PHYSICAL/CHEMICAL PARAMETERS OF SOILS SAMPLES**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 1 0-15cm	Bau- SS 1 16-30cm	Bau- SS 2 0-15cm	Bau- SS 2 16-30cm	Bau- SS 3 0-15cm	Bau-SS3 16-30cm
		10° 28' 47.78"N 9° 47' 11.87"E					
	<b>PHYSICAL TEST</b>						
1	TEMPERATURE (°C)	37.4	36.7	37.0	36.7	36.4	36.1
2	PARTICLE SIZES/TEXTURE	SAND/SILT/ CLAY 41.03/48.37/10.6	SAND/SILT/ CLAY 40.16/46.84/13	SAND/SILT/ CLAY 67.18/23.68/9.14	SAND/SILT/ CLAY 71.05/20.74/8.2 1	SAND/SILT/ CLAY 58.64/26.02/15.34	SAND/SILT/ CLAY 41.23/43.80/14.9 7
3	pH	7.21	6.99	7.19	6.87	7.24	6.93
4	MOISTURE CONTENT (%)	1.024	1.007	0.930	0.940	0.894	1.022
5	SOIL POROSITY (%)	28.33	23.33	25.00	30.00	33.33	30.00
6	BULK DENSITY (g/cm <sup>3</sup> )	0.790	0.740	0.810	0.790	0.850	0.970
7	WET DENSITY (g/cm <sup>3</sup> )	0.961	0.862	0.960	1.052	1.240	1.441
8	DRY DENSITY (g/cm <sup>3</sup> )	0.615	0.613	0.740	0.617	0.750	0.514
	<b>ORGANICS</b>						
9	TOTAL ORGANIC CARBON	1.72	1.20	2.00	2.00	3.10	2.13
	<b>EXCHANGEABLE IONS</b>						
10	PHOSPHATE (mg/kg)	13.00	16.31	11.20	7.25	12.25	12.000
11	SULPHATE (mg/kg)	57.0	47.60	49.40	37.63	54.13	45.60
12	NITRATE (mg/kg)	19.05	15.00	19.34	17.15	22.67	20.60

13	CALCIUM (mg/kg)	34.60	36.40	30.40	32.40	34.40	31.10
14	MAGNESSIUM (mg/kg)	17.80	18.50	14.60	16.70	17.10	16.00
15	CHLORIDE (mg/kg)	2.30	3.30	1.84	4.10	5.20	1.09
	<b>HEAVY METALS</b>						
16	MANGANESE (mg/kg)	0.120	0.200	0.230	0.165	0.140	0.190
17	COPPER (mg/kg)	0.585	0.490	0.770	0.710	0.665	0.580
18	IRON (mg/kg)	8.960	10.440	6.540	7.500	8.80	10.30
19	ZINC (mg/kg)	5.860	3.740	4.620	4.505	3.800	4.300
20	CADMIUM (mg/kg)	0.021	0.013	0.015	0.020	0.012	0.015
22	LEAD (mg/kg)	0.010	0.009	0.011	0.008	0.011	0.012
22	NICKEL (mg/kg)	0.004	0.004	0.006	0.006	0.008	0.007
	<b>BACTERIAL ISOLATE</b>						
23	Total Heterotrophic Bacteria (cfu/100 ml)	4.3 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>	5.0 X 10 <sup>2</sup>	4.8 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	4.6 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	3.6 X 10 <sup>2</sup>	3.5 X 10 <sup>2</sup>	4.5 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.0 X 10 <sup>2</sup>	3.1 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	3.1 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>
26	Feacal Coliform Count (FCC) (cfu/ 100 ml)	3.3 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	2.9 X 10 <sup>2</sup>	2.6 X 10 <sup>2</sup>	3.0 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>

**TABLE 4**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE BAUCHI**  
**PHYSICAL/CHEMICAL PARAMETERS OF SOILS SAMPLES**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 4 0-15cm	Bau- SS 4 16-30cm	Bau- SS 5 0-15cm	Bau- SS 5 16-30cm	Bau- SS 6 0-15cm	Bau-SS6 16-30cm
	<b>PHYSICAL TEST</b>						
1	TEMPERATURE (°C)	36.9	36.7	37.2	36.8	36.9	36.5
2	PARTICLE SIZES/TEXTURE	SAND/SILT/ CLAY 45.19/25.6/29.21	SAND/SILT/ CLAY 44.20/46.37/9.43	SAND/SILT/ CLAY 58.02/29.88/12.1	SAND/SILT/ CLAY 48.52/40.91/10.5 7	SAND/SILT/ CLAY 45.65/40.91/13.4 4	SAND/SILT/ CLAY 42.73/43.80/13.4 7
3	pH	7.73	7.43	7.24	6.95	7.32	7.10
4	MOISTURE CONTENT (%)	0.860	1.114	0.920	1.110	0.890	1.020
5	SOIL POROSITY (%)	28.33	23.33	25.00	23.33	23.33	28.67
6	BULK DENSITY (g/cm <sup>3</sup> )	1.340	1.060	1.130	1.090	1.190	0.771
7	WET DENSITY (g/cm <sup>3</sup> )	2.083	1.582	1.630	1.562	1.190	0.665
8	DRY DENSITY (g/cm <sup>3</sup> )	0.593	0.561	0.790	0.624	0.596	0.514
	<b>ORGANICS</b>						



9	TOTAL ORGANIC CARBON	3.60	2.80	2.90	6.00	3.40	5.24
	<b>EXCHANGEABLE IONS</b>						
10	PHOSPHATE (mg/kg)	51.00	39.71	48.10	40.50	48.10	41.00
11	SULPHATE (mg/kg)	63.0	54.20	48.90	41.30	53.00	39.90
12	NITRATE (mg/kg)	16.35	20.19	14.10	18.12	20.13	13.40
13	CALCIUM (mg/kg)	34.10	31.40	36.40	28.40	33.40	32.10
14	MAGNESSIUM (mg/kg)	17.40	16.00	18.10	14.70	17.00	16.70
15	CHLORIDE (mg/kg)	2.138	2.121	1.84	1.350	2.60	1.090
	<b>HEAVY METALS</b>						
16	MANGANESE (mg/kg)	0.160	0.149	0.220	0.118	0.310	0.220
17	COPPER (mg/kg)	0.615	0.490	0.730	0.660	0.465	0.750
18	IRON (mg/kg)	9.130	7.820	10.040	8.560	7.803	11.300
19	ZINC (mg/kg)	6.740	5.140	4.880	6.505	8.400	7.110
20	CADMIUM (mg/kg)	0.026	0.023	0.033	0.027	0.032	0.025
22	LEAD (mg/kg)	0.012	0.010	0.018	0.014	0.018	0.013
22	NICKEL (mg/kg)	0.008	0.007	0.009	0.010	0.010	0.010
	<b>BACTERIAL ISOLATE</b>						
23	Total Heterotrophic Bacteria (cfu/100 ml)	4.6 X 10 <sup>2</sup>	4.6 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	5.0 X 10 <sup>2</sup>	4.5 X 10 <sup>2</sup>	4.7 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	4.1 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	4.4 X 10 <sup>2</sup>	3.8 X 10 <sup>2</sup>	4.0 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.8 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	3.3X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>	2.9 X 10 <sup>2</sup>	3.3 X 10 <sup>2</sup>
26	Feacal Coliform Count (FCC) (cfu/ 100 ml)	3.1 X 10 <sup>2</sup>	2.6 X 10 <sup>2</sup>	2.8 X 10 <sup>2</sup>	2.3 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	2.3 X 10 <sup>2</sup>

**TABLE 5**  
**PROPOSED SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE BAUCHI**  
**PHYSICAL/CHEMICAL PARAMETERS OF SOILS SAMPLES**

S/N	PARAMETERS (Units in mg/kg) accepted stated	Bau- SS 7 0-15cm	Bau- SS 7 16-30cm	Bau- Control 0-15cm	Bau- control 16-30cm

	PHYSICAL TEST				
1	TEMPERATURE (°C)	37.0	36.8	36.9	36.7
2	PARTICLE SIZES/TEXTURE	SAND/SILT/ CLAY 47.34/39.1/13.5 6	SAND/SILT/ CLAY 55.96/36.60/7.44	SAND/SILT/ CLAY 44.92/38.72/16.3 6	SAND/SILT/ CLAY 53.30/38.98/7.72
3	pH	7.56	7.41	7.39	7.28
4	MOISTURE CONTENT (%)	1.180	0.850	1.280	1.011
5	SOIL POROSITY (%)	28.33	20.00	22.33	26.70
6	BULK DENSITY (g/cm <sup>3</sup> )	1.340	1.020	1.250	0.940
7	WET DENSITY (g/cm <sup>3</sup> )	2.083	0.970	1.936	0.806
8	DRY DENSITY (g/cm <sup>3</sup> )	0.593	0.643	0.555	0.654
	<b>ORGANICS</b>				
9	TOTAL ORGANIC CARBON	3.60	2.12	2.32	1.92
	<b>EXCHANGEABLE IONS</b>				
10	PHOSPHATE (mg/kg)	44.00	37.000	37.0	30.0
11	SULPHATE (mg/kg)	64.3	58.60	66.8	57.0
12	NITRATE (mg/kg)	18.12	20.00	17.24	13.85
13	CALCIUM (mg/kg)	35.20	32.40	30.80	31.40
14	MAGNESSIUM (mg/kg)	18.00	16.70	15.70	16.60
15	CHLORIDE (mg/kg)	2.138	2.500	2.600	2.800
	<b>HEAVY METALS</b>				
16	MANGANESE (mg/kg)	0.410	0.320	0.290	0.330
17	COPPER (mg/kg)	0.660	0.580	0.480	0.610
18	IRON (mg/kg)	9.120	7.850	9.800	7.550
19	ZINC (mg/kg)	6.270	4.115	4.800	5.210
20	CADMIUM (mg/kg)	0.027	0.016	0.021	0.019
22	LEAD (mg/kg)	0.019	0.008	0.013	0.011
22	NICKEL (mg/kg)	0.011	0.006	0.010	0.007
	<b>BACTERIAL ISOLATE</b>				
23	Total Heterotrophic Bacteria (cfu/100 ml)	5.2 X 10 <sup>2</sup>	4.8 X 10 <sup>2</sup>	4.7 X 10 <sup>2</sup>	5.9 X 10 <sup>2</sup>
24	Total Heterotrophic fungi (THF) (cfu/100 ml)	4.8 X 10 <sup>2</sup>	4.3 X 10 <sup>2</sup>	3.9 X 10 <sup>2</sup>	4.1 X 10 <sup>2</sup>
25	Total fungi count (TFC) (cfu/100 ml)	3.6 X 10 <sup>2</sup>	3.8 X 10 <sup>2</sup>	3.4 X 10 <sup>2</sup>	3.7 X 10 <sup>2</sup>
26	Feecal Coliform Count (FCC) (cfu/ 100 ml)	3.0 X 10 <sup>2</sup>	2.7 X 10 <sup>2</sup>	3.0 X 10 <sup>2</sup>	2.5 X 10 <sup>2</sup>



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## **APPENDIX 4**

**(FMENV LABORATORY CERTIFICATE)**



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## APPENDIX 5

### LABORATORY ANALYSIS WITNESSING BY FMENV STAFF



