LADGROUP LIMITED

LADGROUP NIGERIA LIMITED

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED LADGROUP SHEANUT FACTORY EXPANSION PROJECT IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE

(DRAFT REPORT)

SUBMITTED TO

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DRAFT EIA REPORT

OF

THE PROPOSED LADGROUP SHEANUT FACTORY EXPANSION PROJECT IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE

BY

LADGROUP NIGERIA LIMITED

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LIST OF ACRONYMS AND ABBREVIATIONS

%	-	Percentage
µm	-	Micro meter
µS/cm	-	Micro Siemens per Centimeter
$\mu W/m^2$	-	Micro Watt per meter square
^0C	-	Degree Celsius
AAS	-	Atomic Absorption Spectrophotometer
ALARP	-	As Low as Reasonably Practicable
ANSI	-	American National Standards Institute
AoI	-	Area of Influence
APHA	-	American Public Health Association
ASTM	-	American Society for Testing and Materials
Ave.	-	Average
BAT	-	Best Available Technology
BDL	-	Below Detection Limit
BOD_5	-	5-day Biological Oxygen Demand
Ca	-	Calcium
CAP	-	Chapter
$CaCO_3$	-	Calcium Carbonate
Cd	-	Cadmium
cfu	-	Colony Forming Unit
cm	-	Centimeter
CH_4	-	Methane
CO	-	Carbon monoxide
CO_2	-	Carbon dioxide
COD	-	Chemical Oxygen Demand
Cu	-	Copper
Cr	-	Chromium
CSR	-	Corporate Social Responsibility
dBA	-	Decibel (A-weighted)
DO	-	Dissolved Oxygen
EMS	-	Environmental Management System
EHS	-	Environment, Health and Safety
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EnvAccord	-	Environmental Accord
ERP	-	Emergency Response Plan
ESA	-	Environmentally Sensitive Area
et. al	-	and others

Fe	-	Iron
FMEnv	-	Federal Ministry of Environment
GHG	-	Greenhouse Gases
GIS	-	Geographic Information System
GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communications
H_2S	-	Hydrogen Sulphide
Hg	-	Mercury
HUB	-	Hydrogen Utilizing Bacteria
HUF	-	Hydrogen Utilizing Fungi
HSE	-	Health, Safety and Environment
HUB	-	Hydrocarbon Utilizing Bacteria
HUF	-	Hydrocarbon Utilizing Fungi
IEE	-	Initial Environmental Evaluation
IFC	-	International Finance Corporation
ILO	-	International Labour Organization
ITCZ	-	Inter Tropical Convergence Zone
ITD	-	Inter Tropical Discontinuity
IUCN	-	International Union for Conservation of Nature
K	-	Potassium
Kcal	-	Kilocalorie
Kg	-	Kilogram
Kg/cm^2	-	Kilogram per Centimeter Square
L/d	-	Litre/day
LFN	-	Law of Federation of Nigeria
LGA	-	Local Government Area
Long.	-	Longitude
m	-	Meter
m^2	-	Meter square
m/s	-	Meter per second
Max.	-	Maximum
Mg	-	Magnesium
mg	-	Milligram
mg/L	-	Milligram per Litre
mg/m^3	-	miligram per cubic meter
mg/kg	-	miligram per kilogram
ml	-	Millilitre
mm	-	Millimeter
mS/cm	-	Micro Siemens per centimeter
Na	-	Sodium

ND	-	Not Detected
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
NH_3	-	Ammonia
Ni	-	Nickel
NiMet	-	Nigerian Meteorological Agency
NIR	-	Non-Ionizing Radiation
NO_2	-	Nitrogen dioxide
NPC	-	National Population Commission
NTU	-	Nephelometric Turbidity Unit
OSHA	-	Occupational Safety and Health Administration
OSH	-	Occupational Safety and Health
Pb	-	Lead
pH	-	Potential of Hydrogen
PM	-	Particulate Matter
PPE	-	Personal Protective Equipment
ppm	-	Parts per million
QA	-	Quality Assurance
QC	-	Quality Control
QHSE	-	Quality Health, Safety and Environment
RH	-	Relat Humidity
SHE	-	Safety, Health and Environment
SO_2	-	Sulphur dioxide
SOP	-	Standard Operating Procedures
SPM	-	Suspended Particulate Matter
TC	-	Tropical Continental
tCO2-e	-	Tonnes of Carbon Dioxide Equivalent
TDS	-	Total Dissolved Solid
THB	-	Total Heterotrophic Bacteria
THC	-	Total Hydrocarbon Content
THF	-	Total Heterotrophic Fungi
TOC	-	Total Organic Carbon
ToR	-	Terms of Reference
TSP	-	Total Suspended Particulate
TSS	-	Total Suspended Solids
UNEP	-	United Nations Environment Programme
UPS	-	Uninterrupted Power Supply
USEPA	-	United States Environmental Protection Agency
VOC	-	Volatile Organic Compounds
WHO	-	World Health Organization

WMP	-	Waste Management Plan
Yrs	-	Years
Zn	-	Zinc

EIA PREPARERS

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

Ladgroup Limited (Ladgroup or the "Company") was incorporated in 1971 and is involved in trading activities, particularly in food and agro-based commodity products. The Company started business by exporting agricultural produce, namely Ginger, Sheanuts, Coffee and Gum Arabic.

Ladgroup became the largest exporter of Sheanuts and Cocoa after the product became deregulated under the defunct marketing board who assumed sole responsibility for its export and became highly successful in exports which led to winning two major awards from the Nigerian Export Import Bank (NEXIM) namely "Best Exporter of the Year" and "Best Cocoa Exporter".

Today, the Company remains a leader in the exports of sheanuts from Nigeria and is pioneering the processing of sheanuts into sheabutter and other products in Nigeria. To achieve this, the Company has invested in an oil seed processing factory, at Ikenne, Ogun State with a design capacity of 39,000 metric tonnes (MT) per annum.

In compliance with the provisions of the Environmental Impact Assessment (EIA) Act No 86 of 1992 (now codified as the EIA Act Cap E12 Law of the Federation of Nigeria 2004) as well as in consonance with corporate policy of Ladgroup on the protection of environment and human health, an EIA study of the proposed factory Expansion Project has been conducted.

The purpose of the EIA study is to ensure that the potential environmental and social impacts associated with the proposed Project are identified, assessed and appropriately managed. The EIA study covers the entire life cycle of the proposed Project and involves the following activities carried out in a stepwise manner: literature review, scoping, consultation with relevant stakeholders, field data gathering, laboratory analysis of field samples, potential impact identification and evaluation, development of mitigation measures and environmental management plan, report writing and disclosure.

The applicable legal and administrative framework to the Project and the EIA study includes, amongst others:

- National Policy on the Environment, 1989 (revised in 1999 and 2017);
- EIA Act Cap E12 LFN 2004;

- S.I. 8, National Environmental Protection (Effluent Limitation) Regulations, 1991;
- S.I. 9, National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991;
- S.I. 15, National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991;
- National Environmental (Sanitation and Wastes Control) Regulations, 2009, S.I. 28;
- National Environmental (Noise Standards and Control) Regulations, 2009, S.I. 35;
- National Environmental (Surface and Groundwater Quality Control) Regulations, 2011, S.I. 22;
- National Environmental (Ozone Layer Protection) Regulations, 2009, S.I. 32;
- National Environmental (Soil Erosion and Flood Control) Regulations 2011, S.I. 12;
- National Environmental (Protection of Endangered Species in International Trade) Regulations, 2011, S.I. 11;
- National Agency for Food and Drug Administration and Control Act, CAP N 1, LFN 2004;
- Nigerian Urban and Regional Planning Act, Cap. N138, LFN 2004;
- Labour Act, CAP L1 LFN 2004;
- Ogun State Environmental Management (Miscellaneous) Provisions Law of 2004 as well as the Ogun State Water Supply (Groundwater Quality Control) Regulations, 2017
- World Bank Group Environmental, Health and Safety (EHS) General Guidelines;
- United Nations Framework Convention on Climate Change;
- Declaration of the United Nations Conference on Human Environment.

2.0 PROJECT JUSTIFICATION

Need for the Project

The need for the proposed expansion Project arises as a result of the high demand both locally and internationally for sheanut products. The project will also reduce the export of raw kernel and unrefined sheabuter, as export of the raw kernel and unrefined shea butter usually yield low profit marginwhen compared to the processed products.

Project Benefits

The potential benefits of the proposed Project include:

- Stimulation of economic activities in the Project area.
- Improvement in livelihood enhancing activities in the Project area
- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Model for development as the successful implementation and operation of the proposed Project will form a template for similar projects across the country.
- Technology transfer and acquisition of new skills during construction and operation.
- Unlock the wealth potentials of Nigerian agricultural sector.
- Generate employment and strengthen the involvement of the private sector operators in the processing subsector of the agricultural commodities value chain.

Envisaged Sustainability of the Project

Technical Sustainability: The proposed Project design, construction and operation will be handled by properly trained and experienced personnel according to the pre-established standard methods and procedures.

Environmental Sustainability: All Project facilities shall be designed and constructed to keep environmental impacts at the minimum and acceptable levels. All operations shall be carried out to conform to all relevant international and national environmental regulations and standards.

Economic Sustainability: The design, construction and installations shall be funded by financial intermediaries, There are market opportunities for sheanut products both locally and internationally, the Project will provide employment opportunities and support the local and regional economy.

Social Sustainability: A detailed Stakeholder consultation process has been carried out throughout the EIA process to assist in ensuring that all the identified stakeholders have had the opportunity to provide input into the Project planning process. This has also assisted in laying a good foundation for building long term relationships with the stakeholders. Ladgroup shall ensure that the stakeholder consultation process is sustained throughout the Project life cycle.

Project Alternatives

Site Alternatives: The proposed site for the expansion Project is within the existing 17 hectares factory. The existing facilities such as road networks, water supply system, power supply system, fire-fighting suppressing system etc. within the immediate Project environment will contribute positively towards the development of the proposed expansion Project.

Alternative to the present choice of location considered includes siting the proposed Project within a green field. This was however rejected due to its significant environment and social implications including potential for physical and economic displacement.

Technology Alternatives: The proposed expansion will involve the processing and refining of sheabutter, soya beans and other oil seed commodity. Raw materials for the production will be sourced from local suppliers. Equipment will also be supplied by local vendors, but in situations where specifications cannot not be met locally, international suppliers will be contracted to fill the gap.

The selection of plans and design for the Project have been conducted by taking into consideration some important factors such as land area available, availability of raw material, energy required for operations, storage requirements, cost, etc. The proposed technology and equipment to be installed will be consistent with internationally best available technologies. Specifically, the technology to be adopted will run a close loop system. such that water used during the production process will not be discharged into the environment but reused continually during subsequent production process. Also, hexane which is the primary chemical used in the extraction of sheabutter will not be discharged into the environment but decanted form each produced batch and reused for subsequent extraction of sheabutter from new batches.

Project Development Options

No Project Option: Choosing the no project option will mean a loss of preliminary investments made by the proponent on the Project. It will also mean that potential benefits to the prospective customers and the associated employment opportunities will be lost. In addition, such a decision will not be in accordance with the Federal Government's efforts to boost the Nigeria economy. These and other related issues make it difficult to adopt the no project option.

Delayed Option: This option implies that the planned Project will be delayed until a much later date. Such option is usually taken when conditions are unfavourable to project implementation such as in a war situation, or where the host community is deeply resentful of the Project. But none of these conditions is applicable. The delayed option is considered unviable for the Project.

Go Ahead Option: The inherent benefits of allowing the Project to go ahead as planned are multifarious both to the proponent and the Nigeria populace. Job opportunities for Nigerian professionals, skilled and semi-skilled craftsmen will increase. The proposed expansion Project will generate revenue for government and other businesses.

3.0 PROJECT DESCRIPTION

The proposed project site is a flat fenced land that lies within latitude 6.884193°N – 6.877846°N and longitude 3.684771°E – 3.691560°E. The site is located along the Sagamu – Benin Expressway, Ikenne LGA, Ogun State and has a land size of about 17 hectares, the existing processing unit include a 39,000 tons Sheanut Processing Factory consisting of an oil mill, solvent extraction plant and a pelleting plant. Other ancillary facilities include water treatment plant and storage, 1MW diesel powered plant, warehouses for raw products and materials, processed butter storage tanks, etc. The plant design is flexible to crush other oil seeds like palm kernel cake, groundnut and soya beans.

The planned expansion will cover the construction of a 60MT/Day edible oil refinery and associated facilities (only 3,948m^2 of land will be required for this); construction of a 2,023m^2 truck park, construction of 1.4km Internal road, construction of drainages etc. The overall products portfolio will comprise shea butter (raw and refined), refined(bulk) palm kernel oil, palm kernel cooking oil, soybean cooking oil, soybean cake and sheanut de-oiled cake. The planned expansion will be integrated in to the existing infrastructure such that operational and working efficiencies of the factory will be achieved.

No additional land will be required for the project other than the existing 17 hectares of land.

The EIA study has been initiated to cover both the refurbishing of the existing facilities and planned expansion project; the different key components are further highlighted below.

Existing components:

- 39,000 tons Sheanut processing factory consisting of the following;
  - Seed intake section equipped with a seed cleaner and a silo

  - Seed preparatory section with a cracker and a cooker
  - Three screw presses or expellers arranged in parallel
  - A solvent extraction plant which comprise the extractor, the distillation units and the desolventiser-toaster.
  - conveyors and elevators, connecting all the above machineries.
- Other ancillary facilities include fresh water treatment plant and storage tanks, 1MW diesel powered plant, weighbridge building, warehouses for raw products and materials, processed butter storage tanks

Planned expansion:

- Construction of a 60MT/day edible oil refinery and associated facilities;
- Construction of a truck park,
- Construction of Internal roads,
- Construction of drainage

Ladgroup will have ultimate oversight over labour and working conditions for all phases of the Project. It is envisaged that during construction, about 60 skilled and unskilled workers will be employed. The majority of low skilled employment opportunities associated with the Project would be from the nearby local communities.

The main use of water during the operational phase is for the production process, cleaning and sanitary use. It is estimated that the water demand when the factory becomes fully operational will peak at 2,448m^3 monthly. The water for production activities will be treated before use. Water for both construction and the operational phase will be sourced from existing borehole within the factory.

Electricity is very important for factory operations. It is mainly used for the operation of machines, office equipment and lighting. The current source of power (electricity) supply is through the national grid while the 1MW diesel powered generator serves as a backup. It is estimated that when the expansion project is completed the fuel consumption will be about 21, 822 Litres of AGO monthly.

The different waste streams associated with the Project development and operations include general refuse, garbage, inert construction materials, metal scraps, empty containers, excavated spoil, used paper, etc. Generally, wastes associated with the proposed Project shall be managed using the following prioritized program:

- **Reduction at source** – This involves elimination or minimization of waste generation through installation of pollution abatement equipment and equipment modifications.

- **Reuse** –Involves using an item for its original purpose, or similar purpose, in its original form. For example, excavated materials generated during foundation works will be used for back-filling.
- **Recycling** – conversion of waste materials (e.g. scrap metals) into reusable objects.
- **Residue Disposal** - disposal of non-reusable wastes in a government approved dumpsite.

4.0 DESCRIPTION OF THE ENVIRONMENT

Data and information for the environmental description of the study area were based on field data gathering (primary data) as well as literature review of relevant materials (secondary data). The field sampling was carried out during the wet season while the secondary data for the dry season study were obtained from the FMEnv-approved EIA reports relevant to the study area including the final EIA report of the proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility in Ogere, Ikenne Local Government Area of Ogun State, Nigeria, 2019.

A 2km radius from the centre of the Project site was selected as the spatial boundary (study area) for the field sampling. The rationale for the spatial boundary was based on the consideration of potential environmental and social aspects of the proposed Project, observations noted during the reconnaissance survey, and feedback from stakeholder consultation during the scoping phase of the EIA.

The environmental and social condition of the Project's AoI is summarized as follows:

Climate and Meteorology: Ogun State is located in the moderately hot, humid tropical climate zone of South-west, Nigeria. The climate in the area is tropical with alternating wet and dry seasons and it is strongly influenced by Inter-Tropical Convergence Zone (ITCZ) weather patterns. The long-term climatic data of the area obtained from the Nigerian Meteorological Agency (NiMet) indicate that a total of about 1,732.99 mm of rainfall is recorded annually. The overall maximum annual average daily temperature is 30.53^{o}C. The study area is characterized by relatively high Relative Humidity as a result of the prevailing dry north-east trade winds blowing over the area almost all the year round.

Geology: The geology of Ogun State comprises sedimentary and basement complex rocks. The rocks are soft and brittle, but in some places, cemented by iron and silicon

containing materials. The basement complex is essentially non-porous and water can only be contained in the crevices of the complex.

Air Quality and Noise: The concentrations of air quality parameters recorded at eleven (11) different sampling locations in the study area were generally below the National Ambient Air Quality Standards and the World Health Organization (WHO) Air Quality Guidelines. For example, Total Suspended Particulate (TSP) ranged from 0.024mg/m^3 to 0.081mg/m^3. The TSP values were below the FMEnv maximum permissible limit of 0.25 mg/m^3. The measured noise levels in the study area ranged from 40.5 to 76.3dB (A) with a mean value of 55.5dB (A), which was below the FMEnv limit of 90dB (A)

Soil Quality: A total of eleven (11) locations were sampled for soil quality in the study area. The dominant soil type recorded in the area was clay based on the grain size analysis. No heavy metal and hydrocarbon pollution was recorded in the soil samples.

Groundwater Quality: Groundwater samples were collected from four (4) different boreholes in the study area. The concentrations of parameters analyzed in the groundwater samples were generally within the FMEnv and WHO limits for substances and characteristics affecting the acceptability of groundwater for domestic use.

Terrestrial Flora: A total of 42 species belonging to 28 families were encountered during the study. The richest plant families were Fabaceae, Asteraceae and Malvaceae with 4 taxa each, Verbenaceae with 3 taxa while others ranged between 1-2 taxa. Based on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Version 2020-2, no endangered or threatened plant species were recorded in the study area.

Terrestrial Fauna: Fauna species recorded in the study area include: arthropoda, reptilia, aves, amphibians, and mammals. The observed arthropod species belong to the Class Insecta (27 species), class Diplopoda (2 species) and Class Arachnida (2 species). The vertebrate species observed during the study included members which transcended vertebrate Classes, including; Class Amphibia, Reptilia, Aves and Mammalia. A total of twenty-two (22) vertebrate species were reported in the area. Based on the IUCN Red List of Threatened Species classification, no threatened or endangered fauna species were recorded in the study area.

Land use: The temporal change of 20 years (2000 to 2020) in the land use of the project area was considered. Present land use characteristic of the wider study area

(2km radius from the centre of the project site) is considered to be divided into two (2) major classes which are categorized as; built up areas and secondary vegetation, this is at complete variance with the land use characteristics in 2000 which had four (4) land use classes, they include built up areas, secondary vegetation, bare land and forest.

Climate Change assessment: The historical climate change characteristics of the wider study area indicates that two land use change greatly contributed to the sequestration of GHG from the atmosphere, this include the transition from forest to secondary vegetation and secondary vegetation to secondary vegetation , the former sequestrated 134,560 tCO_2-e , which was the highest of all landuse change type, these high values are attributed to the forest which were a major land use type in the early part of 2000, this was closely followed by the secondary vegetation to secondary vegetation which sequester about 41,652 tCO_2-e toward the early period of 2000 and 51,149 tCO_2-e in the years leading to 2020.

A review of GHG footprint of the project indicates that diesel consumption would be the major contributor to GHGs emissions with an estimate of 15,455 tCO_2-e , this was closely followed by built up area with 6,106 tCO_2-e, with regards to GHG sequestration the vegetation within the project site will sequester about 843 tCO_2-e of GHG with its soil being the primary sink. At the end of the 25 years life cycle of the project it is estimated that about 20,718 tCO_2-e of GHG would have been emitted with an annual net emission of 829 tCO_2-e.

Socio-economic and Health: There are no residential buildings within the land property earmarked for the proposed Project. However, within the 2km AoI, the identified communities are Ikenne community, approximately 1 km South East and Illisan-Remo community, approximately 1.8km North East of the project site.

The socio-economic characteristics of Ikenne and Illisan-Remo based on information gathered through focus group discussions, key informants interviews, direct observations, and household surveys are summarized as follows:

- The communities are relatively homogenous in terms of ethnicity, religion, culture and language.
- Traditional, Islam and Christianity are the most prevalent religions in the communities.
- The housing pattern in the community is nucleated and most houses are built with cement blocks and aluminum roofing sheets
- Lands are owned by individuals and can be sold, leased, shared and gifted.

- Trading, white and blue-collar jobs are the common livelihood activities in the communities
- Each of the community has a market located in an accessible environment.
- Traders mostly sell goods such as farm produce, cooked food and other items such as cloths, plastics
- Majority of the young people in the community are either self-employed engaging in trading and transportation business.
- The communities have relatively good social infrastructure such as town hall, tarred road. However, the internal road networks are not paved.
- The communities have healthcare centers, designated market and Police command unit.
- There are government hospital, private hospital, and pharmaceutical outlets.
- Electricity and telecommunication infrastructure are available in the communities.
- Common health problems reported in the study area are malaria, cough and diabetes.
- There are private hospitals, public hospital and pharmacies within the study area
- The Doctor/Patient ratio is 1/35

Members of community interviewed were positively disposed to the proposed Project. They believed that the Project would improve the economic values of the community and create job opportunity. Their expectations include: provision of employment opportunities for community members; skill acquisition opportunity for women and children.

5.0 POTENTIAL AND ASSOCIATED IMPACTS

Potential environmental and social impacts (including health and safety issues) associated with the proposed Project were assessed using a modified Leopold Interaction Matrix. Impact significance was also determined. In determining the significance of impacts, the factors considered included: magnitude of impacts (which is a function of the combination of the following impact characteristics: extent, duration, scale and frequency); value/sensitivity/fragility and importance of relevant environmental and social receptors; legal/regulatory requirements; and public perceptions (based on stakeholder consultation). The potential negative impacts identified were mostly of minor to moderate significance. The potential impacts of the proposed Project are summarized as follows:

Pre-construction Phase

The potential impacts associated with the pre-construction phase of the Project include: decrease in ambient air quality due to vehicular emissions and dust generation; increase in ambient noise level; increase in traffic volume including potential for road accident; vegetation loss; loss of individual or localized population of fauna species; and soil compaction.

Construction Phase

The potential impacts associated with the construction phase include: reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms; decrease in groundwater quality; decrease in ambient air quality; increase in ambient noise level; traffic build-up; community health and safety, including risks posed by influx of workers; and occupational health and safety issue.

Operations Phase

The potential impacts associated with the operations phase of the proposed Project include: increase in ambient noise level, decrease in ambient air quality, decrease in groundwater water quality, and occupational health and safety issues.

6.0 MITIGATION MEASURES

In proffering mitigation measures for the identified impacts of the Project, preference was given to avoidance or prevention of adverse impacts and where not feasible, measures which are practicable and cost-effective using best available technology were provided to reduce and/or minimize the impacts while compensation/offset was considered as the last resort, in line with best practices.

The summary of the identified impacts, including the recommended mitigation measures, is provided as follows:

Pre-construction Phase

The proffered mitigation measures for the potential impacts associated with the pre-construction phase of the Project include, amongst others:

- Project vehicles with efficient engine performance and with minimal emissions (through regular servicing and maintenance) shall be selected and used.
- Journey Management Plan shall be developed and implemented.
- All construction materials (e.g. sand) with potential to result in dust emissions shall be covered during transport.
- Driver's competency shall be assessed and where required, additional training shall be provided.

- A grievance procedure that will track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.
- Work areas shall be clearly marked to prevent clearing or disturbance outside areas designated for project development.
- Use of herbicides for vegetation clearing shall be avoided.
- Hunting or deliberate killing of animals in the Project area by project personnel shall be prohibited.
- Awareness on environmental protection regarding terrestrial fauna and flora species shall be provided to workers.
- Areas of exposed soil and soil stockpiles shall be reduced as much as practicable.
- Site clearing equipment shall be operated and maintained under optimum fuel efficient conditions.
- Site clearing equipment/machinery shall be turned off when not in use.

Construction Phase

Mitigation measures for the potential impacts associated with the construction phase of the Project include:

- Soil conservation measures shall be implemented such as stockpiling topsoil for the remediation of disturbed areas.
- Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.
- Disturbed areas shall be rehabilitated as soon as possible to prevent erosion.
- Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.
- Any hydrocarbons, fuels, lubricants and chemicals to be used shall be stored in properly labelled oil storage tanks (surrounded with bund wall), with hoses and gauges kept within the bund.
- Construction equipment shall be turned off when not in use
- Use of adequate Personal Protective Equipment (coverall, helmets, noise masks, ear muffs, safety boots, etc.) shall be ensured.
- Regular maintenance and servicing of construction equipment that contribute to air emission shall be implemented.
- Only modern and well maintained equipment and machinery for construction activities shall be selected and used.
- Construction equipment with lower sound power levels shall be selected and used.

- Ladgroup shall ensure that engines and other noise making equipment are in good working order and well maintained, and that all have noise suppression equipment (e.g. mufflers) intact and in working order.
- A grievance procedure (which tracks grievances and responses; and respond in a timely manner with corrective actions identified where appropriate) shall be developed and implemented. The grievance procedure shall be communicated to the local community.
- Ladgroup shall ensure that construction contractors develop a means of monitoring access to the site, prohibiting unauthorized access to the site.
- Training of workforce on communicable diseases and community interactions in general shall be undertaken.

Operation Phase

Mitigation measures for the potential impacts associated with the operation phase of the Project include:

- The factory machineries shall be operated and maintained as per manufacturer's specification and recommendations.
- Acoustic enclosures shall be installed on equipment casing radiating noise.
- Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.
- Periodic maintenance of the factory components shall be carried out.
- All pipes shall be periodically tested for any leakages.
- Appropriate training on emergency response procedures shall be provided to staff.
- Human resources (HR) policy relevant to scale of the Project shall be implemented.
- Occupational health and safety policy and procedures including emergency plan shall be developed and implemented. Staff shall be trained on emergency preparedness and responses.
- Provision of medical insurance scheme for all employees shall be ensured.

7.0 ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) has been developed as part of the key elements of the EIA study to satisfy long term objectives of managing and monitoring the environmental and social impacts of the proposed Project. It covers the entire life cycle of the Project and also includes desired outcomes; performance indicators; monitoring (parameters to be monitored and frequency); timing for actions; responsibilities and cost estimates required for implementation.

Ladgroup is committed to the implementation of the EMP and shall work with relevant agencies at local, state and national levels to ensure full compliance. The Company shall have principal responsibility for all measures outlined in the EMP, but may delegate responsibility to its contractors, where appropriate and monitor the implementation. The relevant regulatory authorities at Federal, State and Local Government levels shall also be involved in the monitoring of the EMP implementation.

8.0 REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

Decommissioning refers to the process of removing and managing all operating assets of a project after completion of its life cycle. The proposed expansion Project is being developed for a projected 25-year operational life time. However, with regular maintenance, it is anticipated that the useful life of the Project could extend well beyond the designed life span. The decommissioning activities will typically include the following:

- Dismantling and removal of equipment and structures;
- Removal of any surface installations;
- Waste generation and management;
- Rehabilitation of any impacted environmental component (e.g. soil).

In the event of decommissioning, Ladgroup shall ensure that the decommissioned site is left in a safe and environmentally acceptable condition, following the dismantling and removal of equipment.

The potential impacts associated with the Plant decommissioning include decrease in groundwater and soil quality, decrease in air quality, increased noise level, road traffic, occupational health and safety, loss of job, and community health and safety.

The potential impacts will be addressed through appropriate mitigation measures and management actions including implementation of effective waste management plan; provision of training to workers; consultation with relevant stakeholders; ensuring that employees are fully informed about the decommissioning and how it will affect them before the project finally closes; building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase; provision of training to transfer project-learned skills to alternative and secondary industries tailored to respond to market economy; and implementation of appropriate site rehabilitation programs (including re-vegetation of the site with native plant species) to return the Project environment to its original status (as much as practicable).

The decommissioning and abandonment programme shall be managed by a team of competent personnel including the representatives of local, state and national regulatory authorities.

9.0 CONCLUSION AND RECOMMENDATIONS

The EIA of the proposed Ladgroup factory expansion Project in Ikenne LGA, Ogun State has been undertaken in accordance with the EIA Act CAP E12 LFN 2004 as well as the relevant international guidelines.

The potential negative effects identified were mostly of minor to moderate significance. The significance levels of the identified negative impacts can generally be reduced by implementing the recommended mitigation measures including good industry practices.

Based on the nature and extent of the proposed Project and the findings of the EIA, it is believed that the potential negative impacts associated with the proposed Project can be mitigated to as low as practicable. Also, an EMP has been established to assess the efficiency and effectiveness of the recommended mitigation measures and ensure long-term monitoring of the Project.

Ladgroup shall ensure the proposed Project is developed and operated in an environmentally sustainable manner by properly managing the processes/activities that may bring about disturbances to the environment through the implementation of the recommended mitigation measures throughout the Project life cycle.

ACKNOWLEDGEMENTS

Ladgroup will like to thank the EIA Consultant – Environmental Accord Nigeria Limited for their commitment to the success of the EIA study. We also thank the Federal Ministry of Environment, the Ogun State Ministry of Environment, Ikenne Local Government Council and other stakeholders for their valuable contributions.

CHAPTER ONE:

INTRODUCTION

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Ladgroup Limited (Ladgroup or the "Company") was incorporated in 1971 and is involved in trading activities, particularly in food and agro-based commodity products. The Company started business by exporting agricultural produce, namely Ginger, Sheanuts, Coffee and Gum Arabic.

Ladgroup became the largest exporter of Sheanuts and Cocoa after the product became deregulated under the defunct marketing board who assumed sole responsibility for its export and became highly successful in exports which led to winning two major awards from the Nigerian Export Import Bank (NEXIM) namely "Best Exporter of the Year" and "Best Cocoa Exporter".

Today, the Company remains a leader in the exports of sheanuts from Nigeria and is pioneering the processing of sheanuts into sheabutter and other products in Nigeria. To achieve this, the Company has invested in an oil seed processing factory, at Ikenne, Ogun State with a design capacity of 39,000 metric tonnes (MT) per annum.

The facility consists of an oil mill, solvent extraction plant and a pelleting plant and is designed to crush other oil seeds like palm kernel, groundnut and soya beans in the off-season of Sheanut, with this investment, the Company will achieve the dual objective of adding significant value to the raw material and opening up wide market opportunities in the semi-finished and finished products market both locally and internationally. It will also support the huge Sheanut economy in the producing areas that relies on a steady market for their production. As part of its business plan, Ladgroup proposes to retrofit its existing factory and expand its operations to include an edible oil refinery in Ikenne, Ogun State.

The tenets of sustainable development dictate that in addition to economic considerations, projects are developed with good thinking for relevant environmental, social and health issues.

In compliance with the provisions of the Environmental Impact Assessment (EIA) Act No 86 of 1992 (now codified as the EIA Act Cap E12 Law of the Federation of Nigeria, LFN, 2004), Ladgroup commissioned Environmental Accord Limited (EnvAccord), an accredited environmental and sustainability consulting firm, to conduct an EIA study of the proposed sheanut factory expansion Project. The EIA study is also in line with the requirements of the relevant international standards such as the World Bank's Environmental and Social Safeguard Policies, the African Development Bank (AfDB)

Operational Safeguards and the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability as well as the corporate policy of Ladgroup on environmental protection.

EIA is a strategic and targeted means of predicting the likely significant impacts (positive and negative; short and long term; primary and secondary; reversible and irreversible) of any prospective human development activity. It serves also as a decision-making tool employed in the management of industrial activities to foster sustainable development. In EIA studies, all actions that will result in physical, chemical, biological, economic, cultural and social modifications of the environment as a result of a proposed project are assessed and documented. Mitigation measures are then developed and incorporated into the project to eliminate or offset adverse environmental impacts or to reduce them to acceptable levels, and to enhance potential benefits.

The EIA study covers the entire life cycle of the proposed Project i.e. pre-construction, construction and operation.

1.2 Objectives of the EIA Study

The overall objective of this EIA is to proactively identify and evaluate potential impacts that could arise from implementation of activities under the proposed Project, as well as to propose appropriate environmental options for the mitigation of those impacts. This is to ensure that the planned project activities are executed in a sustainable manner.

The specific objectives of the EIA are to:

- Assist Project design and planning by identifying and quantifying those aspects of location, construction, operations and decommissioning which may cause adverse environmental, social, health and economic effects.
- Inform, consult and engage the potentially affected communities and other relevant stakeholders about the proposed Project.
- Establish the existing state of the Project environment and identify any sensitive components of the environment.
- Identify and assess the potential environmental and social impacts of the proposed Project including potential cumulative impacts due to the existing infrastructure projects and other future projects in the immediate surroundings of the Project site.
- Recommend measures during construction, commissioning, operations and decommissioning to avoid and mitigate adverse effects and enhance beneficial impacts.
- Develop an appropriate Environmental Management Plan (EMP) for the proposed Project including monitoring programs.

- Provide the basis for co-operation, consultation and compliance with regulatory authorities and other stakeholders.
- Prepare a detailed report presenting clear and concise information on the findings of the EIA.

1.3 Scope of the EIA

The EIA scope of work covers the following:

- Review of applicable National and International laws, regulations and industry codes;
- Scoping and stakeholder engagement;
- Literature review of relevant materials and information pertaining to the Project area;
- Description of all actions/activities that will be carried out in the course of the proposed Project;
- Baseline data gathering and laboratory analysis of field samples;
- Analysis of data obtained, and description of the study area prior to the proposed Project activities;
- Identification and evaluation of potential impacts of the Project;
- Recommendation of appropriate and cost-effective mitigation measures including EMP;
- Preparation of EIA Report.

1.4 EIA Terms of Reference

In line with the National EIA Procedural Guidelines, a Terms of Reference (ToR) for the study was prepared and submitted to the FMEnv. The ToR section highlighted the general scope of the EIA including the overall data requirements on the proposed Project environment.

The EIA study has also been conducted in compliance with the relevant requirements of applicable international standards including the IFC Performance Standards on Environmental and Social Sustainability, 2012, the World Bank Environmental and Social Framework, 2016 and the African Development Bank (AfDB) Operational Safeguards (OS), 2013 as summarized in Table 1.1 under sub-section 1.6.4.1.

1.5 EIA Process

The EIA study has been conducted in line with the Nigerian (FMEnv) EIA Procedural Guidelines as well as the relevant International Standards and Guidelines. The Nigerian EIA process is summarized in Figure 1.1.

The EIA involves a number of key activities carried out in a stepwise manner. These include: scoping, literature review, field data gathering, laboratory analysis of field samples, stakeholder engagement, impact identification and evaluation, development of mitigation measures and EMP, report writing and disclosure. Each of the key activities involved in the EIA study is explained in details in the subsequent chapters of this report.

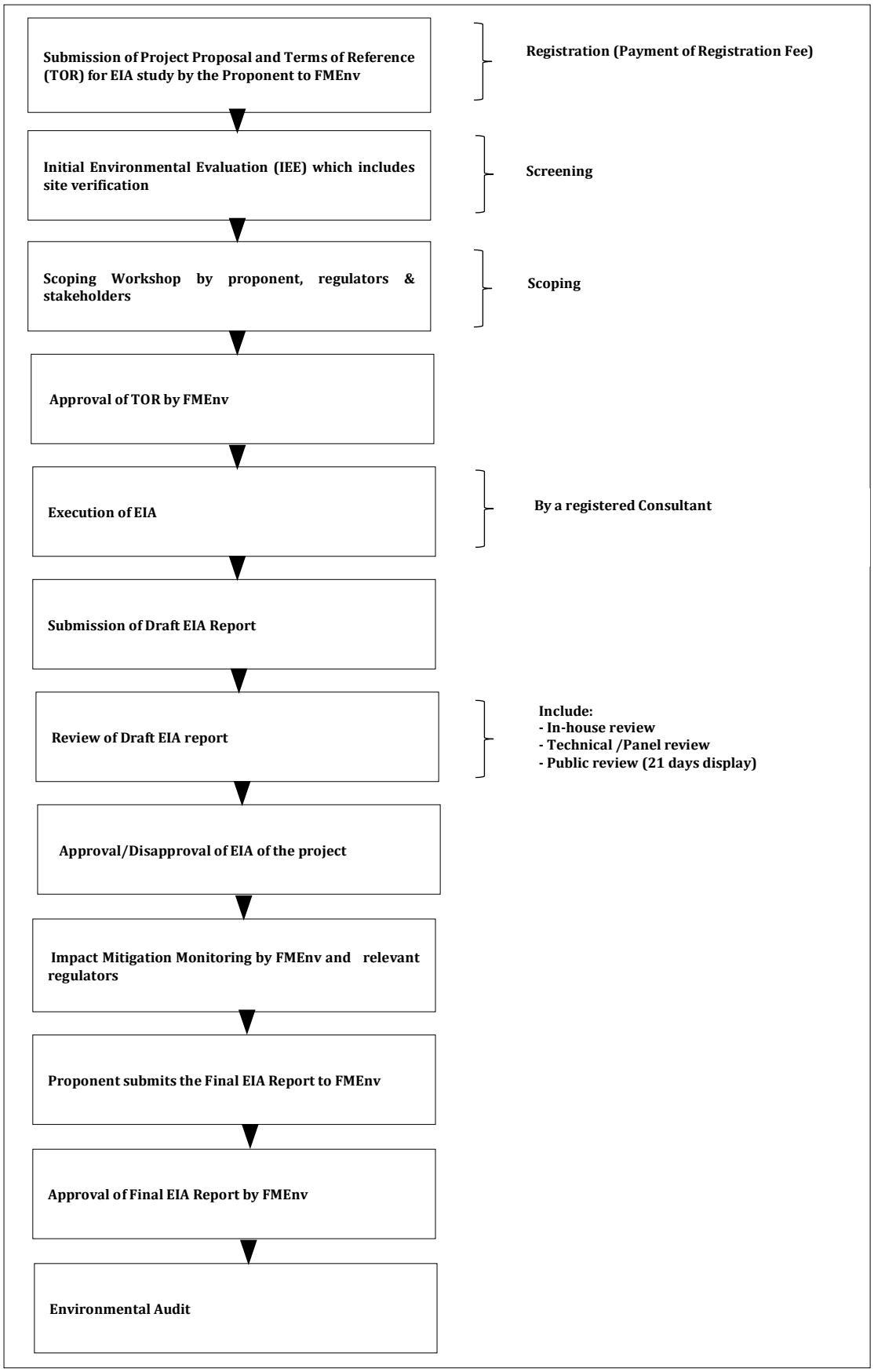

Figure 1.1: Overview of Nigeria EIA Process
(Source: FMEnv 2014)

1.6 Legal and Administrative Framework

This section presents the legislation and policy context as well as environmental and social regulations that apply to the proposed Project and the EIA study. The Project shall ensure compliance with the applicable local and international regulations and standards throughout its life cycle.

1.6.1 National Policy, Guidelines and Regulations

1.6.1.1 Federal Ministry of Environment (FMEnv)

The FMEnv was created in 1999 and is the primary authority for the regulation and enforcement of environmental laws in Nigeria. The Ministry is saddled with the responsibility of ensuring that all development and industry activity, operations and emissions are within the limits prescribed in the national guidelines and standards, and comply with relevant regulations for environmental pollution management in Nigeria as may be released by the Ministry.

In furtherance of her mandate, the FMEnv developed laws, guidelines and regulations on various sectors of the national economy. The specific policies, acts, guidelines enforced by FMEnv that are applicable to the proposed Project are summarized in the following paragraphs:

- *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. 8 National Environmental Protection (Effluent Limitation) Regulations, 1991*

The Effluent Limitation Regulation makes it mandatory for industries to install anti-pollution and pollution abatement equipment on site. Appropriate penalties for contravention are also prescribed.

- *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 the comprehensive list of chemicals and chemical waste by toxicity categories.

- *EIA Act CAP E12 LFN 2004*

The EIA Act is the primary Act governing EIA in Nigeria. It was promulgated in order 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 for the purpose of facilitating public access to records relating to environmental assessments. Public review to which interested members of the public are invited to provide comments on EIA of a proposed project are a key part of the approval process by the FMEnv.

- *National Environmental Impact Assessment Procedural and Sectoral Guidelines*

In response to the promulgation of the EIA Act, the FMEnv developed National EIA Procedural Guidelines and other set of guidelines on various sectors of the National economy. Applicable to this study is the EIA Sectoral Guidelines for Manufacturing Industries (Industrial Food Processing Sub-sector) 2017.

The guidelines have been developed by the FMEnv to assist proponents in conducting detailed environmental and social assessment with regards to all new major projects by manufacturing industries in Nigeria. This EIA study has taken into consideration the relevant provisions of the guidelines including requirements of the General Checklist for Industrial Projects and the general EIA writing format.

1.6.1.2 National Environmental Standards and Regulations Enforcement Agency

The National Environmental Standards and Regulations Enforcement Agency (NESREA) was established in 2007 by the Federal Government of Nigeria as a

parastatal of the FMEnv. The Agency is charged with the responsibility of enforcing the environmental laws, guidelines, standards and regulations in Nigeria, specifically during the operational phase of developmental projects. The NESREA's regulations applicable to the expansion Project include:

- *S.I. 28 National Environmental (Sanitation and Wastes Control) Regulations, 2009,*

The purpose of this regulation is the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

- *S.I.35 National Environmental (Noise Standards and Control) Regulations, 2009,*

This regulation highlights the permissible noise levels to which a person may be exposed; control and mitigation of noise; permits for noise emissions in excess of permissible levels; and enforcement. NESREA's permissible noise level for ambient environment is 85 dB(A).

- *S.I.22 National Environmental (Surface and Groundwater Quality Control) Regulations, 2011,*

The purpose of this regulation is to enhance and preserve the physical, chemical and biological integrity of the groundwater and surface water resources.

Other NESREA regulations relevant to the expansion Project are:

- National Environmental (Ozone Layer Protection) Regulations, 2009, S.I.32: The provisions of this Regulation seek to prohibit the importation, manufacture, sale and the use of ozone-depleting substances.
- National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations, 2011, S.I.15: The principal thrust of this Regulation is to prevent and minimize the destruction of ecosystem through fire outbreak and burning of any materials that may affect the health of the ecosystem through the emission of hazardous air pollutants.
- National Environmental (Soil Erosion and Flood Control) Regulations 2011, S.I12: The overall objective of this Regulation is to regulate all earthing-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.
- National Environmental (Protection of Endangered Species in International Trade) Regulations, 2011, S.I.11: The major objective of this Regulation is to protect species of endangered wildlife from extinction through the prohibition of trade, importation, etc.

- National Environmental (Air Quality Control) Regulations, 2013: The objective of this Regulation is to ensure the control of air pollutants that may affect the ambient environment.

1.6.1.3 National Agency for Food and Drug Administration and Control Act, CAP N 1, LFN 2004

The National Agency for Food and Drug Administration and Control (NAFDAC) was officially established in 1992 to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, medical devices, packaged water, chemicals and detergents (regulated products). The Agency was established by Decree No. 15 of 1993 as amended by Decree No. 19 of 1999 and now the National Agency for Food and Drug Administration and Control Act Cap N1 Laws of the Federation of Nigeria (LFN) 2004. The NAFDAC directorate applicable to this project is:

1.6.1.4 Nigerian Urban and Regional Planning Act, Cap. N138 LFN 2004

This Act establishes a Development Control Department (DCD) charged with the responsibility for matters relating to development control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdiction.

1.6.1.5 Harmful Waste (Special Criminal Provisions) Act, CAP H1 LFN 2004

This Act prohibits and declares unlawful all activities relating to the purchase, sale, importation, transit, transportation, deposit, storage of harmful wastes. Appropriate penalties for contravention are prescribed.

1.6.1.6 Criminal Code Act, Cap C38 LFN 2004

The Act contains the basic criminal law offences that relate to damage to the environment, public health and natural resources. Some environmental offences include: causing a public nuisance; fouling the water of any spring, stream, well or reservoir of a place; and violating the atmosphere in any place so as to make it noxious to the health of persons in general in the neighbourhood.

1.6.1.7 Labour Act, CAP L1 LFN 2004

The Labour Act is the primary law protecting the employment rights of individual workers. The Act covers protection of wages, contracts, employment terms and conditions, and recruitment; and classifies types of workers and special workers.

1.6.1.8 Factories Act, CAP F1 LFN 2004

The Factories Act is the primary law regulating health, safety and welfare of workers in factories/facilities in the country. The law holds management and staff personally responsible for violations of the provisions in the Act. With respect to safety, there are general provisions as to the securing, fixing, usage, maintenance and storage of

machinery, hoists and lifts, chains, ropes and lifting tackle, and other lifting machines. There are in addition to these, standards set for the training of workers, safe access to any work place, and fire prevention.

1.6.1.9 Land Use Act, CAP L5 LFN 2004

The Land Use Act No. 6 was enacted in 1978 (and revised in 1990 and 2004). The Act vests all land in the territory of each State (except land vested in the Federal Government or its agencies) solely in the Governor of the State, who holds such land in trust for the people and is solely responsible for the allocation of land in all urban areas to individuals resident in the State and to organizations for residential, agricultural and commercial purposes. The proposed Project will be sited along the Shagamu- Benin Expressway, Ikenne, Ogun State.

1.6.1.10 National Policy on Occupational Safety and Health, 2016

The National Policy on Occupational Safety and Health (2016) stipulates that the health, safety and welfare of all persons in employment must be safeguarded and not endangered or abused.

1.6.1.11 Trade Unions (Amendment) Act, 2005

This Act contains provisions with respect to the formation, registration and organization of trade unions. It includes stipulation of equal pay for equal workers without discrimination on account of sex, or any other ground whatsoever'.

1.6.1.12 Employees Compensation Act, 2010

This Act repeals the Workmen's Compensation Act W6 LFN 2004 and makes comprehensive provisions for payment of compensation to employees that suffer from occupational diseases or suffer injuries from accident at workplace or in the course of the employment.

1.6.1.13 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 with the responsibility of optimizing agriculture and integrating rural development for the transformation of the Nigerian economy, with a view to attaining food security and positioning Nigeria as a net food exporter for socio-economic development.

In order to carry out its mandate, the Ministry develops and implements policies which are directed towards the key areas of interest in the agricultural sector. These policies are the synthesis of the framework and action plans of 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 fulfill the irreducible 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 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 under value 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.

- *Policy integrity* – focusing policy instruments on measures for sanitizing the business environment for agriculture, in terms of accountability, transparency and due process of law, ensuring efficient allocation and use of public funding and fighting corruption on all programmes involving public resources.

- *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.

1.6.1.14 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;
- encourage the evolution of economic-size rural settlements that will reap the economies of scale in the provision of social infrastructures;

- 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 nontraditional 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.

1.6.2 State Laws

The Project site falls within the jurisdiction of Ogun State Government. The key State administrative authorities and legal instruments that apply to the Project are briefly described below:

- Ogun State Ministry of Environment

The Ministry of Environment was established in 2003 with the aim of creating better living and conducive environment for the entire people of Ogun State.

The functions of the Ministry include nature and biodiversity conservation; management and conservation of threatened and endangered species; ground and surface water monitoring; sewage and water quality monitoring; managing environmental impact assessment and review of major projects in Ogun State in conjunction with the FMEnv in line with the EIA Act.

In addition, the Ministry administers the Ogun State Environmental Management (Miscellaneous) Provisions Law of 2004 as well as the Ogun State Water Supply (Groundwater Quality Control) Regulations, 2017 which regulates underground water drilling and use for industrial activities in the State.

- Ogun State Environmental Protection Agency Law of 1995

Ogun State Environmental Protection Agency (OGEPA) is an agency charged with protecting the environment in the State. Specifically, to coordinate the waste management aspect of the environment, domestic and industrial pollution control and ensures Environmental Compliance to environmental laws in the State.

- Ogun State Policy on Environment (2013)

Ogun State Policy on environment aims at:

I. Preventative activities to reduce the negative impact of social and economic development on the environment;

II. Broad strategies to tackle environmental problems and promote sustainable environmental protection and management of systematic and sub-systematic levels;
III. Ensuring consistent assessment of the impacts of developmental projects on the state of the environment.

- Ogun State Ministry of Urban and Physical Planning

The Ministry is charged with the responsibility for the formulation of physical planning policies and the coordination of physical development within the State. It derives its statutory functions from Section 3 of the State Urban and Regional Planning Law No. 20 of 2005.

- Ogun State Ministry of Agriculture

The main policy thrusts of the Ogun State Ministry of Agriculture as contained in the State Agricultural Policy Document, which was conceived and launched in April, 1989, include the following: to enhance self-sufficiency in food production, provide raw materials for agro-based industries, generate employment opportunities, as well as obtain desirable levels of exports in order to improve the country's foreign exchange earnings.

1.6.3 Local Government Laws on Environmental Protection

The site for the proposed project falls within Ikenne LGA of Ogun State. The LGA has an Environmental Health Department which ensures compliance with environmental sanitation law, which includes maintaining good housekeeping at the proposed expansion Project.

1.6.4 International Guidelines and Conventions

In addition to the FMEnv EIA process, this study has been conducted to comply with the requirements of the applicable International Guidelines and Standards as discussed in the sub-sections below:

1.6.4.1 International Guidelines and Standards

❖ *The World Bank Environmental and Social Framework*

The World Bank Environmental and Social Framework was released in August 2016 to replace the following Operational Policy (OP) and Bank Procedures (BP): OP/BP4.00, Piloting the Use of Borrower Systems to Address Environmental and Social safeguard Issues in Bank-Supported Projects; OP/BP4.01, Environmental Assessment; OP/BP4.04, Natural Habitats; OP4.09, Pest Management, OP/BP4.11, Physical Cultural Resources; OP/BP4.12, Involuntary Resettlement, OP/BP4.36, Forests; and OP/BP4.37, Safety of Dams.

The Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are

designed to support borrowers' projects. It consists of ten (10) Environmental and Social Standards that the borrower will meet throughout the project life-cycle. These standards are as follows:

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Environmental and Social Standard 2: Labor and Working Conditions
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management
- Environmental and Social Standard 4: Community Health and Safety
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
- Environmental and Social Standard 8: Cultural Heritage
- Environmental and Social Standard 9: Financial Intermediaries
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure.

In addition to the relevant local requirements, the EIA study for the proposed Project has been conducted to ensure, as much as possible, compliance with the World Bank Environmental and Social Standards as summarized in Table 1.1, along with the IFC Performance Standards and AfDB Operational Safeguards.

❖ *World Bank Group Environmental, Health and Safety (EHS) Guidelines*

The World Bank Group EHS Guidelines are technical reference documents designed to assist project managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, reducing, and controlling potential EHS impacts during the construction, operation, and decommissioning phase of a project, particularly in those aspects related to pollution prevention and occupational and community health and safety.

The World Bank Group EHS guidelines that are applicable to the proposed Project are:

- EHS General Guidelines (2007);
- EHS Guidelines for Vegetable oil production and processing (2015).

❖ *IFC Performance Standards on Environmental and Social Sustainability*

The IFC Performance Standards on Environmental and Social Sustainability are a set of standards which the IFC requires its clients to apply while undertaking due diligence for corporate or project financing.

The Performance Standards, totalling eight (8) in number, provide a robust framework for assessing and managing the environmental and social risks and impacts associated with projects to be financed so that development opportunities are enhanced.

- *African Development Bank (AfDB) Operational Safeguards*

The environmental and social safeguards of the AfDB are a cornerstone of the Bank's support for inclusive economic growth and environmental sustainability in Africa. The Integrated Safeguards Policy Statement sets out the basic tenets that guide and underpin the Bank's approach to environmental safeguards. In addition, the Bank has adopted five operational safeguards (5 OSs), limiting their number to just what is required to achieve the goals and optimal functioning of the Integrated Safeguards System (ISS).

The World Bank Environmental and Social Standards (ESS), the African Development Bank (AfDB) Operational Safeguards (OS) and the IFC Performance Standards (PS) are largely similar and the applicability of each of the standards to the proposed Project is summarized in Table 1.1 below.

Table 1.1: World Bank ESSs/IFC PS / AfDB OS and their applicability to the proposed Project

World Bank ESS	IFC PS	AfDB's OS	Cross-cutting Requirements	Applicability and Rationale	Sections of the EIA report that will address the requirements
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	OS 1: Environmental and Social Assessment)	Require that the environmental and social risks and impacts of the Project are identified, evaluated and managed through appropriate management system.	ESS 1, PS 1 and OS1 are applicable. The proposed Sheanut Factory Expansion Project in Ikenne LGA, Ogun State has associated environmental and social aspects which may affect the environment.	Chapter 3 – Project Description Chapter 4 – Description of the Environment Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7–Environmental Management Plan (EMP)
ESS 2: Labour and Working Conditions	PS 2: Labour and Working Conditions	OS 5: Labour conditions, health and safety	Require the Project to promote safety and health at work and to conduct its activities in a manner consistent with the four core labour standards (child labour, forced labour, non-discrimination etc.)	ESS 2, PS 2 and OS5 are applicable. The Project will engage direct and indirect workers during construction and operation. It is necessary to maintain appropriate labour and working conditions for these workers.	Chapter 3 – Project Description Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7 - EMP
ESS 3: Resource Efficiency and Pollution Prevention and Management	PS 3: Resource Efficiency and Pollution Prevention	OS 4: Pollution prevention and control, hazardous materials and resource efficiency	Require the Project to promote the sustainable use of resources, including energy, water and raw materials. And also to consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid or where avoidance is not possible, reduce potential adverse impacts on human health and the environment during the entire project life-cycle.	ESS 3, PS 3 and OS4 are applicable. The Project will involve the use resources such as water and diesel. Also generate wastes (e.g. general refuse, construction waste, etc.) which need to be appropriately managed.	Chapter 3 – Project Description Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7 - EMP

World Bank ESS	IFC PS	AfDB's OS	Cross-cutting Requirements	Applicability and Rationale	Sections of the EIA report that will address the requirements
ESS 4: Community Health and Safety	PS 4: Community Health, Safety and Security	OS 5: Labour conditions, health and safety	The Project is required to evaluate the risks and potential impacts to the health and safety of the Affected Communities during the Project's life-cycle and require establishing preventive and controlling measures consistent with good international industry practice.	ESS 4, PS 4 and OS5 are applicable. There are communities within 2km radius of the Project site. Potential activities such as influx of workers during construction, traffic related issues, etc. may have potential impacts on the communities.	Chapter 3–Project Description Chapter 4 –Description of the Environment Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7 –EMP
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	PS 5: Land Acquisition and Involuntary Resettlement	OS2: Involuntary resettlement land acquisition, population displacement and compensation	The Project is required to avoid involuntary resettlement or, when unavoidable, minimize involuntary resettlement by exploring project design alternatives; avoid forced eviction; mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use; and conceive and execute resettlement activities as sustainable development programs.	EES 5, PS 5 and OS2 are applicable. The proposed expansion site will be sited within the existing 17 hectares of land owned by Ladgroup in Ikenne LGA, Ogun State. The land was purchased from families in Ikenne Community.	Chapter 3 – Project Description Chapter 4 – Description of the Environment Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7 –EMP
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	OS3: Biodiversity and ecosystem Services	Require the Project to protect and conserve biodiversity and habitats, avoid or mitigate potential impacts to biodiversity in the design and implementation of projects and as well as promote sustainable management of living natural resources.	ESS 6, PS 6 and OS3 are applicable. The Project site can be classified as a modified habitat.	Chapter 4- Description of the Environment Chapter 5 – Potential and Associated Impacts; Chapter6-Mitigation measures Chapter 7 – EMP

World Bank ESS	IFC PS	AfDB's OS	Cross-cutting Requirements	Applicability and Rationale	Sections of the EIA report that will address the requirements
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	PS 7: Indigenous Peoples	-	Require the Project to foster respect for the human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples/Sub-Saharan African Historically underserved Traditional Local Communities	Not Applicable. There are no known Indigenous Peoples (as defined by the IFC[1]) within the Project's area of influence based on knowledge of the area, desktop review of relevant literature and interviews with relevant stakeholders including government authorities.	Not applicable -
ESS 8: Cultural Heritage	PS 8: Cultural Heritage	-	Require the Project to comply with relevant national laws on the protection of cultural heritage, including national laws implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural And Natural Heritage and other relevant international laws.	Not Applicable. There is no known cultural site within the Project site based on interviews with relevant stakeholders, preliminary site visit observations and desktop review of relevant literature.	Not applicable
ESS 9: Financial intermediaries	-	-	Set out how the Financial Institutions will assess and manage Environmental and Social risks and impacts associated with the subprojects it finances.	The project is partly financed by a financial intermediary.	Chapter 2 – Project Justification
ESS 10: Stakeholder Engagement and Information Disclosure	-	-	Require the Project to establish systematic approach to stakeholder engagement and maintain a constructive relationship with stakeholders, in particular project affected parties	The stakeholders relevant to the Project include, but are not necessarily limited to the following: government agencies in charge of environmental protection; potentially affected communities, etc. ESS 10 is therefore applicable to the Project.	Chapter 1 – Introduction Chapter 4 – Description of the Environment Chapter 7 – EMP

[1]"Indigenous Peoples" refers to a distinct social and cultural group possessing the following characteristics in varying degrees: i) Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; ii) Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; iii) Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or iv) a distinct language or dialect, often different from the official language or languages of the country or region in which they reside.

1.6.4.2 International Conventions

The Nigerian Government is an important player in the International support for the protection of the environment. As such, the country is a signatory to some International laws and conventions, which are targeted towards conservation and protection of the environment in order to ensure sustainable development. Some International conventions and regulations that are applicable to the proposed Project include:

- *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 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 make 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.

- *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.

- *International Health Regulations*

The International Health Regulations (IHR) is an international legal instrument that is binding on 196 countries across the globe, including all the Member States of World Health Organisation (WHO). This binding instrument of international law entered into force on 15 June 2007. The purpose and scope is "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks and which avoid unnecessary interference with international traffic and trade".

- *Declaration of the United Nations Conference on Human Environment*

United Nations Conference on the Human Environment proclaims that "a point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences."

The principles of this Declaration relevant to the Project are summarized below:

Principle 2: The natural resources of the earth, including the air, water, land, flora and fauna especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Principle 3: The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

Principle 4: Nature conservation, including wildlife, must receive importance in planning for economic development.

Principle 15: Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all.

Principle 18: Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind.

- *The Rio Declaration on Environment and Development*

The Declaration was made in 1992 in Rio de Janeiro reaffirming the declaration of the United Nations Conference on Human Environment adopted at Stockholm in 1972. The Principle works towards international agreement which respects the interest of all and protects the integrity of the global environment and development. The relevant principles include:

Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 17: EIA as a national instrument shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

- *International Labour Organisation (ILO): ILO-OSH 2001 - Guidelines on Occupational Safety and Health (OSH) Management Systems*

These guidelines call for coherent policies to protect workers from occupational hazards and risks while improving productivity. The guidelines present practical approaches and tools for assisting organizations, competent national institutions, employers, workers and other social partners in establishing, implementing and improving occupational safety and health management systems, with the aim of reducing work-related injuries, ill health, diseases, incidents and deaths.

At the organizational level, the guidelines encourage the integration of OSH management system elements as an important component of overall policy and management arrangements. Organizations, employers, owners, managerial staff, workers and their representatives are motivated in applying appropriate OSH management principles and methods to improve OSH performance. Nigeria ratified the guidelines in 2001.

1.7 Ladgroup's Environmental policy

Ladgroup is committed to conducting all its business activities responsibly with due regard to environmental impact and sustainable performance. The Company believes that the environment is everybody's responsibility and all employees are accountable for environmental performance.

The Company seeks to achieve steady improvement in meeting its environmental standards while working to minimize any negative impact on the local and global environment as the Company grows its business.

1.8 Report Structure

In line with the FMEnv guidelines, this EIA report has been organized into nine (9) chapters, which is similar to the indicative outline of an ESIA provided by the World Bank in its Environmental and Social Framework, 2016. The EIA report is structured as follows:

- **Preliminary Sections**: These include Table of Contents, List of Tables, Figures and Plates, and Executive Summary

- **Chapter One**: Introduction containing an overview of the proposed Project, the EIA objectives and process and applicable legal and administrative framework.

- **Chapter Two**: Project Justification containing a rationale for the proposed expansion Project as well as the analysis of Project alternatives.

- **Chapter Three**: Project Description containing the technical elements of the Project. It concisely describes the proposed expansion Project and its geographic context, including the Project's associated infrastructure and facilities.

- **Chapter Four**: Description of the Environment. It details the baseline data that are relevant to decisions about the Project location, design, and operation.

- **Chapter Five**: Potential and Associated Impacts. This takes into account all relevant environmental and social risks and impacts of the expansion Project, including cumulative impacts.

- **Chapter Six**: Mitigation measures for the identified environmental and social impacts.
- **Chapter Seven**: is the EMP for the Project. It summarizes the key measures and actions and the timeframe including responsibility for the implementation of the recommended measures.

- **Chapter Eight**: presents an overview of remediation plan after Project decommissioning and closure.

- **Chapter Nine**: Conclusions and Recommendations

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CHAPTER TWO:

PROJECT JUSTIFICATION

CHAPTER TWO

PROJECT JUSTIFICATION

This chapter presents the rationale for the proposed Ladgroup sheabutter factory expansion Project as well as the description of alternatives considered for the Project.

2.1 Need for the Project

The need for the proposed expansion Project arises as a result of the high demand both locally and internationally for sheanut products. The project will also reduce the export of raw kernel and unrefined sheabuter, as export of the raw kernel and unrefined shea butter usually yield low profit margin when compared to the processed products.

The proposed Project will bring additional benefits such as employment opportunities and increased income to the local communities in the area, particularly the empowerment of rural women down the supply chain of the Sheanut business as they are the major source of Sheanut supply to the Ikenne factory.

2.2 Project Benefits

The potential benefits of the proposed Project are presented below:

- Stimulation of economic activities in the Project area.
- Improvement in livelihood enhancing activities in the Project area
- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Model for development as the successful implementation and operation of the proposed Project will form a template for similar projects across the country.
- Technology transfer and acquisition of new skills during construction and operation.
- Unlock the wealth potentials of Nigerian agriculture.
- Generate employment and strengthen the involvement of the private sector operators in the processing subsector of the agricultural commodities value chain.

2.3 Value of the Project

The anticipated cost of the proposed Project is ₦1,902, 775,336 (One Billion, Nine Hundred and Two Million, Seven Hundred and Seventy-Five Thousand, Three Hundred and Thirty-Six Naira). A substantial amount of this fund will be injected into the local economy through various contracts and sub-contracts. In addition, the Project has local and national economic values in terms of employment opportunities for various categories of Nigerian professionals, skilled and semi-skilled craftsmen.

2.4 Envisaged Sustainability

2.4.1 Technical Sustainability

The proposed Project design, construction and operations shall be handled by properly trained and experienced personnel according to the pre-established standard methods and procedures. In addition, standard operating manuals and appropriate documentation regarding the operation and maintenance of the Project shall be developed. These documents will be used as the basis for providing facility-specific training to relevant personnel prior to start-up to further ensure technical sustainability of the Project. The Engineering, Procurement and Construction (EPC) contractors for the expansion Project are yet to be finalised.

2.4.2 Environmental Sustainability

- All Project facilities shall be designed and constructed to keep environmental impacts at the minimum and acceptable levels.
- All operations shall be carried out to conform to all relevant international and national environmental regulations and standards.
- Handling, storage and disposal of wastes shall be in accordance with the regulatory requirements and the Ladgroup's relevant Standard Operating Procedures (SOPs).
- Efficient utilization and reuse of water and other materials e.g. hexane during the production process at the factory.
- A comprehensive Health, Safety and Environment (HSE) system shall be implemented. Strict adherence to the procedures in the Company's HSE plans shall be maintained to ensure the Project is developed and operated in a safe and environmentally responsible manner.

2.4.3 Economic Sustainability

- The design, construction and installations shall be funded by financial intermediaries.
- There are market opportunities for sheanut products both locally and internationally

- The Project will provide employment opportunities and support the local and regional economy.

2.4.4 Social Sustainability

Detailed Stakeholder consultation process has been implemented throughout the EIA process to assist in ensuring that the identified stakeholders have had the opportunity to provide input into the Project planning process. This has also assisted in maintaining good relationships with the stakeholders.

Ladgroup shall ensure that the stakeholder consultation process is sustained throughout the Project life cycle. In addition, the social sustainability of the Project will be achieved through continuous implementation of Ladgroup's Corporate Social Responsibility Plan for local communities in the Project area.

2.5 Project Alternatives and Options

The analysis of alternatives and development options considered for the Project is presented in the following paragraphs:

2.5.1 Project Alternatives

2.5.1.1 Site Alternative

The proposed site for the expansion Project is within the existing 17 hectares factory. The existing facilities such as road networks, water supply system, power supply system, fire-fighting suppressing system etc. within the immediate Project environment will contribute positively towards the development of the proposed expansion Project.

Alternative to the present choice of location considered includes siting the proposed Project within a green field. This was however, rejected due to its significant environment and social implications including potential for physical and economic displacement.

2.5.1.2 Technology Alternative

The proposed expansion will involve the processing and refining of sheabutter, soya beans and other oil seed commodity. Raw materials for the production will be sourced from local suppliers. Equipment will also be supplied by local vendors, but in situations where specifications cannot not be met locally, international suppliers will be contracted to fill the gap.

The selection of plans and design for the Project have been conducted by taking into consideration some important factors such as land area available, availability of raw material, energy required for operations, storage requirements, cost, etc. The proposed technology and equipment to be installed will be consistent with

internationally best available technologies. Specifically, the technology to be adopted will run a close loop system. such that water used by the boiler will not be discharged into the environment but reused continually during subsequent production process. Also, hexane which is the primary chemical used in the extraction of sheabutter will not be discharged into the environment but decanted form each produced batch and reused for subsequent extraction of sheabutter from new batches.

2.5.2 Project Options

2.5.2.1 No Project Option

The no project option implies that the proposed Project will not be executed hence, there is no need to carry out the EIA study. This option though is environmentally favourable, but economically unviable, as no economic returns shall accrue to the Government and the proponent, yet substantial amount of money had already been spent on the feasibility, planning and logistics for the Project. Choosing the no project option will mean a loss of preliminary investments made by the proponent on the Project. It will also mean that potential benefits to the prospective customers and the associated employment opportunities will be lost. In addition, such a decision will not be in accordance with the Federal Government's initiatives to enhance economic and social status of the country. These and other related issues make it impossible to adopt the no project option.

2.5.2.2 Delayed Project Option

This option implies that the planned Project will be delayed until a much later date. Such option is usually taken when conditions are unfavourable to project implementation such as in war situation, or where the host community is deeply resentful of the Project. Also, if the prevailing economic or physical climate is not quite favourable to the Project, then delayed project option may be feasible. But none of these conditions is applicable. Indeed, both the economic and the political environments are most favourably disposed towards the Project. The implication of delayed project option will mean that all the preliminary work and associated efforts/costs incurred would have come to nothing. Also, because of inflationary trends, such a delay may result in unanticipated increase in project costs, which may affect the final profit accruable from the Project. The delayed option is considered unviable for the Project.

2.5.2.3 Go ahead Option

The inherent benefits of allowing the Project to go ahead as planned are multifarious both to the proponent and the Nigeria populace. Job opportunities for Nigerian professionals, skilled and semi-skilled craftsmen will increase. The proposed expansion Project will generate revenue for government and other businesses.

CHAPTER THREE:

PROJECT DESCRIPTION

CHAPTER THREE

PROJECT DESCRIPTION

This chapter provides the technical description of the proposed Project and it covers the following sections:

- Project location
- Project overview
- Project components
- Project activities
- Work force
- Utilities Consumption
- Associated Waste Streams
- Project schedule

3.1 Project Location

The proposed project site is a flat fenced land that lies within latitude 6.884193°N – 6.877846°N and longitude 3.684771°E – 3.691560°E. The site is located along the Sagamu – Benin Expressway, Ikenne LGA, Ogun State, (Figures 3.1 to 3.3; and Plate 3.1).

The proposed project site is bordered to the South by the Shagamu-Benin expressway, to the North, East and West by undeveloped parcel of lands. The proposed Project site is about 400m away from Ikenne community and about 1.5km away from Ilishan-Remo community.

The vegetation of the Project site is largely secondary in nature while its topography is relatively flat. The identified communities within 2km radius of the Project site are Ikenne and Ilishan-Remo communities. Detailed information on the biophysical and socio-economic characteristics of the Project site and its surrounding environment is documented in Chapter 4 of this report.

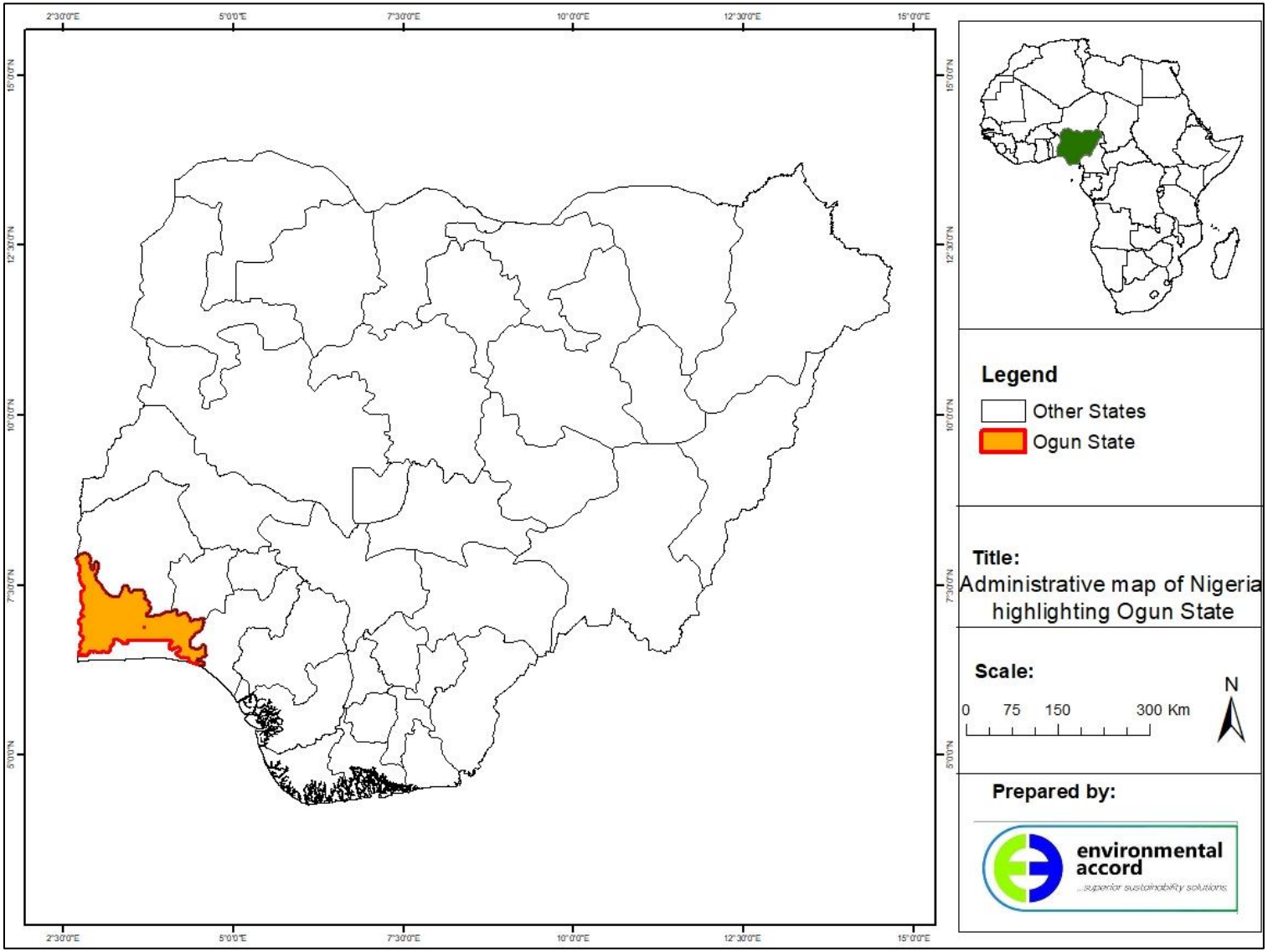

Figure 3.1: Administrative map of Nigeria highlighting Ogun State

Source: EnvAccord GIS, 2020

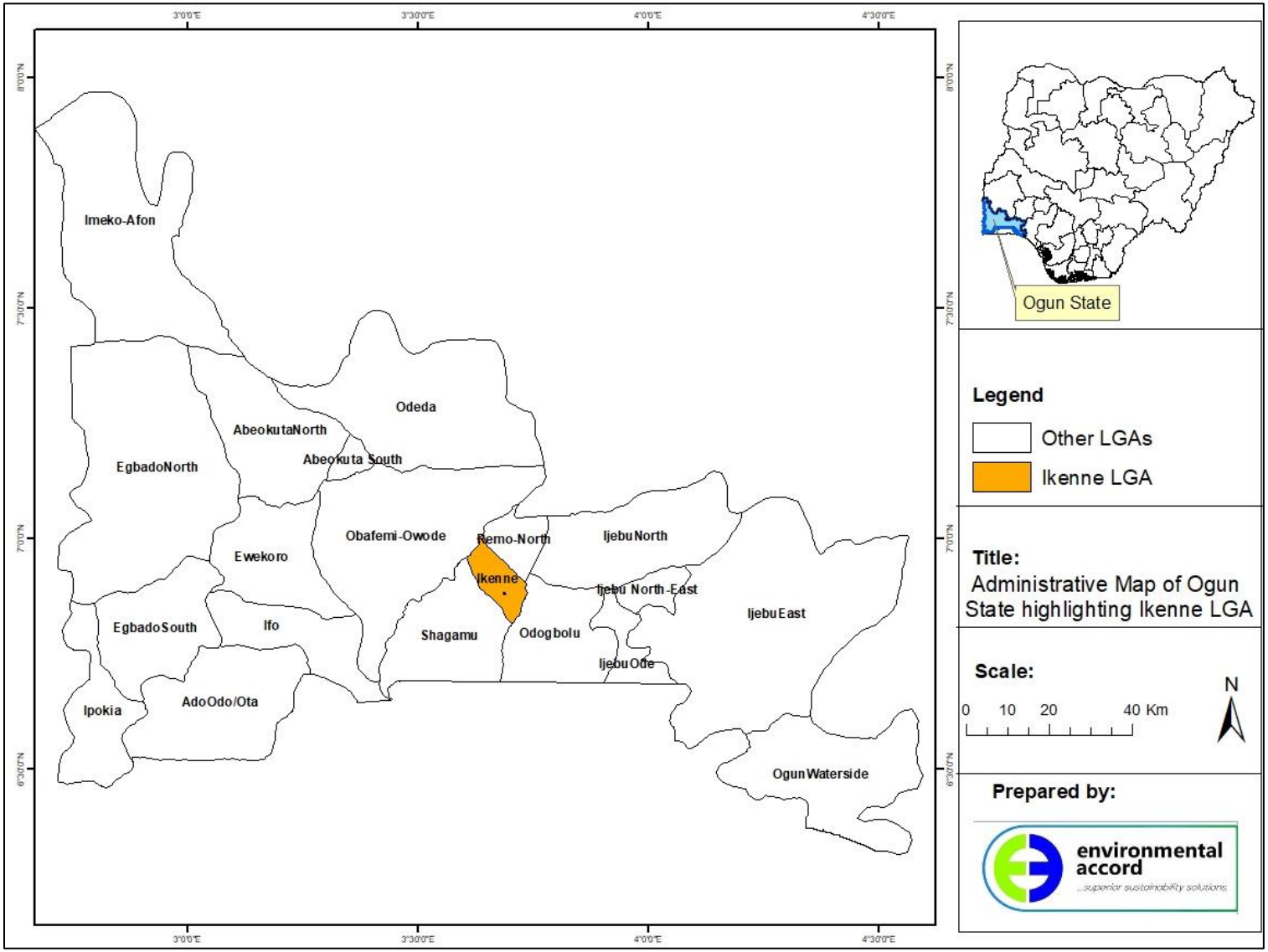

Figure 3.2: Administrative Map of Ogun State highlighting Ikenne LGA

Source: EnvAccord GIS, 2020

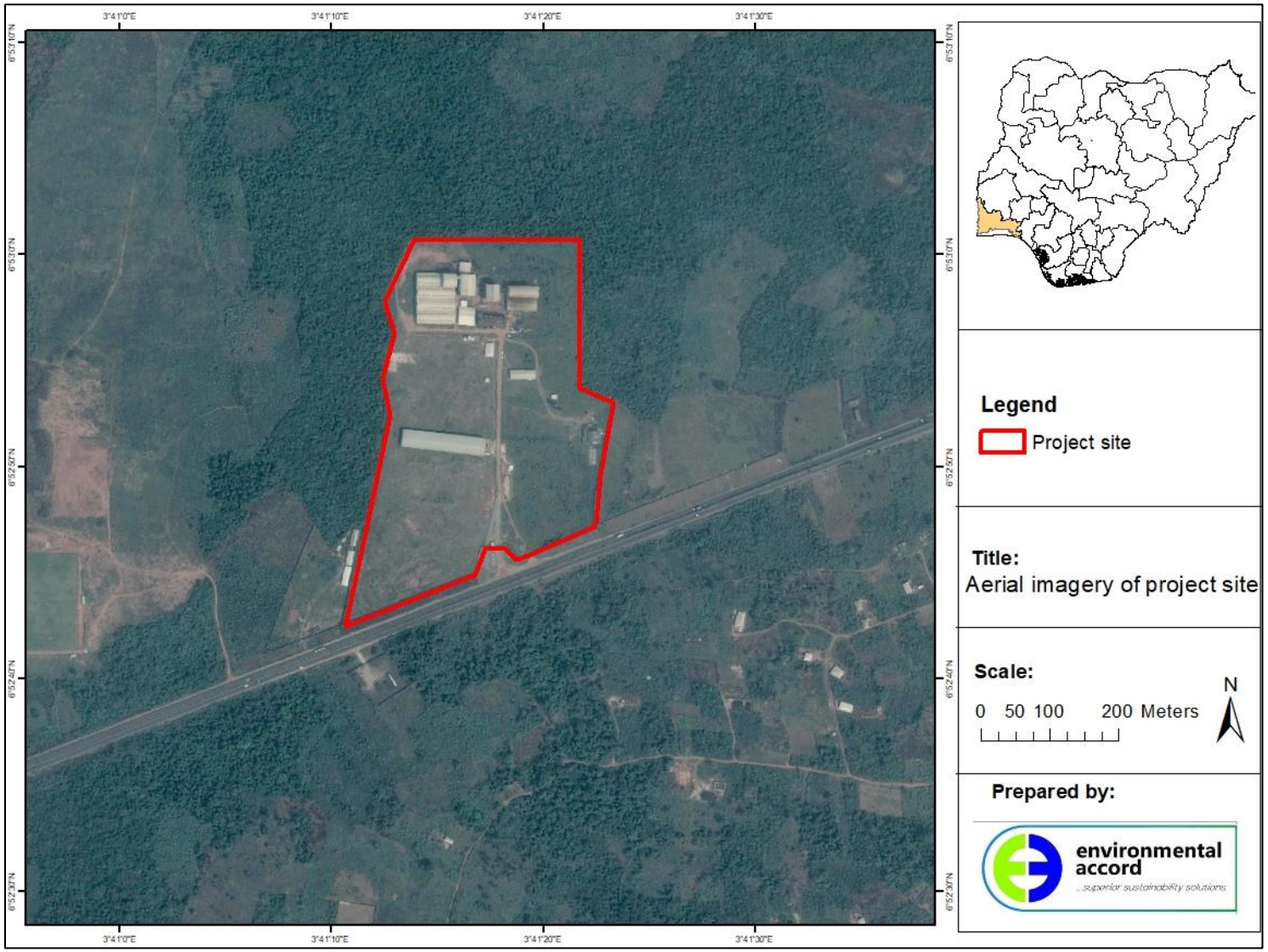

Figure 3.3: Aerial imagery of the Project site

Source: EnvAccord Field Survey, Google Earth 2020

Plate 3.1: Drone imagery of the Project site
Source: EnvAccord Field Survey, 2020

3.2 Project Overview

The project site has a land size of about 17 hectares, the existing processing unit include a 39,000 tons Sheanut Processing Factory consisting of an oil mill, solvent extraction plant and a pelleting plant. Other ancillary facilities include water treatment plant and storage, 1MW diesel powered plant, warehouses for raw products and materials, processed butter storage tanks, etc. The plant design is flexible to crush other oil seeds like palm kernel cake, groundnut and soya beans.

The planned expansion will cover the construction of a 60MT/Day edible oil refinery and associated facilities (only 0.3948ha of land will be required for this); construction of a 0.2023ha truck park, construction of 1.4km Internal road, construction of drainages etc. The overall products portfolio will comprise shea butter (raw and refined), refined(bulk) palm kernel oil, palm kernel cooking oil, soybean cooking oil, soybean cake and sheanut de-oiled cake. The planned expansion will be integrated in to the existing infrastructure such that operational and working efficiencies of the factory will be achieved.

No additional land will be required for the project other than the existing 17 hectares of land.

The expansion is planned to be carried out in phases over a period of 5 years. The site layout showing existing and planned development is presented in Figure 3.4

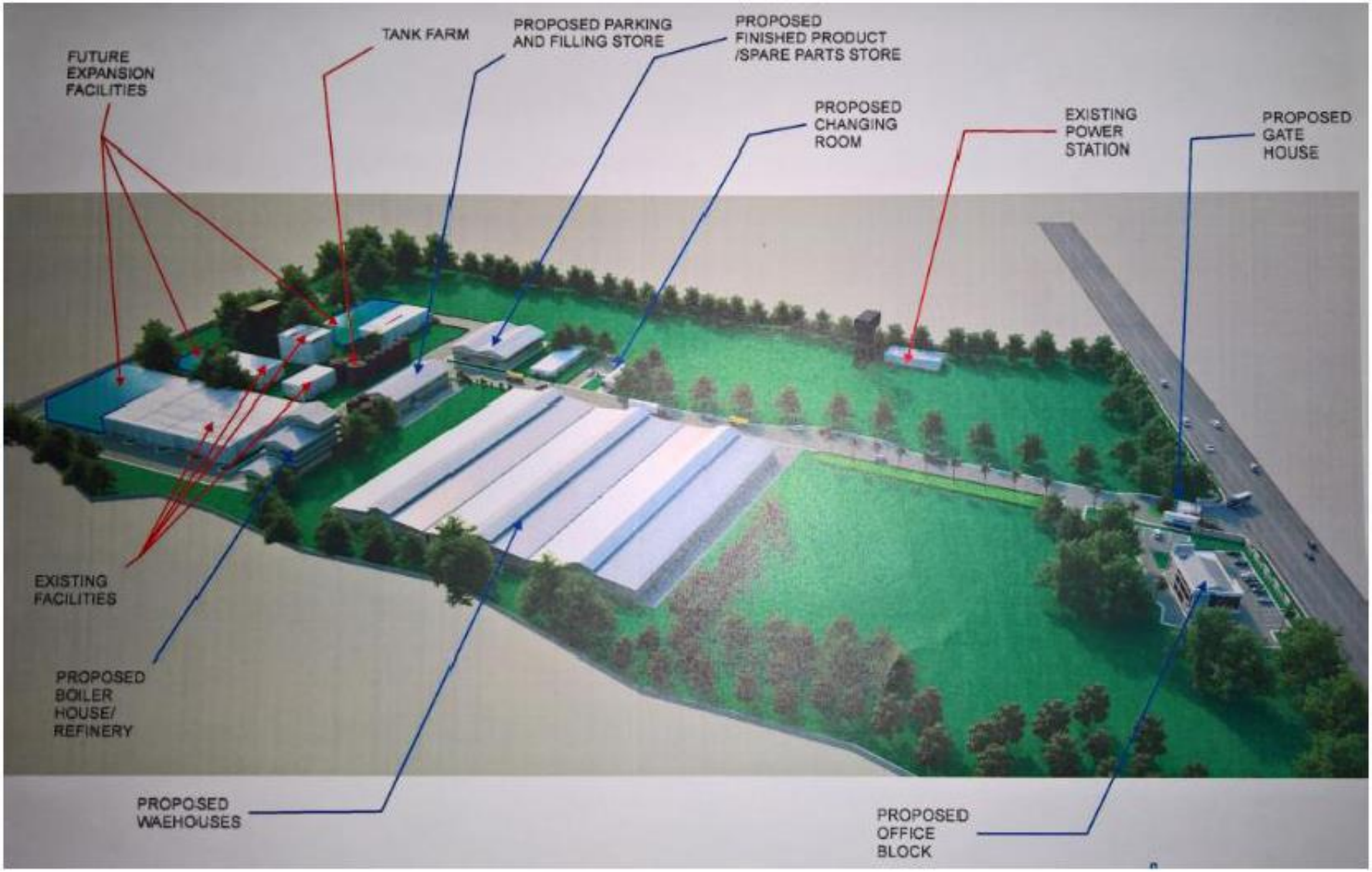

Figure 3.4: Existing and Planned Developments
Source: Ladgroup 2020

3.3 Project Components

The EIA study has been initiated to cover both the refurbishing of the existing facilities and planned expansion project; the different key components are further highlighted below.

Existing components:

- 39,000 tons Sheanut processing factory consisting of the following;
  - Seed intake section equipped with a seed cleaner and a silo
  - Seed preparatory section with a cracker and a cooker
  - Three screw presses or expellers arranged in parallel
  - A solvent extraction plant which comprise the extractor, the distillation units and the desolventiser-toaster.
  - conveyors and elevators, connecting all the above machineries.
- Other ancillary facilities include water treatment plant and storage tanks, 1MW diesel powered plant, weighbridge building, warehouses for raw products and materials, processed butter storage tanks

Planned expansion:

- Construction of a 60MT/day edible oil refinery and associated facilities;
- Construction of a truck park,
- Construction of Internal roads,
- Construction of drainage

3.4 Project Activities

The proposed project activities are grouped as follows:

- ❖ Pre-construction Phase Activities
- ❖ Construction Phase Activities
- ❖ Operational Phase Activities

3.4.1 Pre-Construction Phase Activities

Prior to construction activities, site preparation will be carried out. The site preparation activities will include:

- o Mobilization of personnel and transportation of construction materials to site;
- o Site clearing and preparation.

The environmental aspects associated with this project phase include dust generation, vehicular emission, equipment, and noise generation. Details of the potential impacts associated with the Project activities are provided in Chapter 5 of this report while the proffered mitigation measures to address the identified impacts are documented in Chapter 6.

3.4.2 Construction Activities

The construction activities will involve the following:

- Civil work activities including excavation, foundation works, construction of structures e.g. drainage, internal roads, truck park etc.
- Equipment installation e.g. Sheabutter refinery plant
- Refurbishment of existing mill
- Waste generation (such as construction waste, wood debris etc.) and disposal
- Demobilization of construction equipment from site

As part of the planned expansion, a 1.4km of internal road will be constructed within the facility for ease of haulage. A truck park will also be constructed within the existing facility to minimize impact of traffic on the Sagamu – Benin express road; the estimated land take for the truck park is 0.2023ha. Also, a drainage system with an approximate length of about 700m will be constructed, this will be connected to the public drainage system.

Some environmental aspects associated with the construction phase include dust generation, vehicular emission, generation of construction waste, occasional oil spill during servicing of construction equipment, noise generation, etc.

Activities associated with this phase also have the likelihood of causing injuries and raising safety concerns; therefore, safety procedures are planned to be implemented.

The procedures are highlighted as follows:

3.4.2.1 Safety Procedures

The construction activities usually require careful approach and appropriate safety procedures. The procedures include:

- Risk Assessment
- Personal Safety
- Site Safety and Security
- Ground Excavation
- Final Clean Up

❖ *Risk Assessment*

This involves assessing all the various risks that are involved in every aspect of the job and educating the different workmen on site as regards the risks identified. The people working around the area shall also be warned of the risk involved i.e. warning signs shall be erected for people to see clearly.

❖ *Personal Safety*

Every staff, workmen, supplier and sub-contractor working on site shall be informed on the need to ensure his personal safety and the safety of the people working around him. Every workman will be instructed to always put on his safety kits (personal protective equipment —PPE) anytime he is on site.

❖ *Site Safety and Security*

The Project site is already enclosed by means of fencing. Security officials shall be positioned within and around the facility day and night. Furthermore, warning signs will be erected around the site and a close circuit video surveillance system.

❖ *Ground Excavation*

This involves digging the ground in order to lay foundations on which the high-rise steel structures will be erected and other supporting structures. Appropriate safety measures shall be implemented and overseen by on-site HSE officer during site excavation and related activities. The excavated soil will be used for backfilling within the site.

❖ *Final Clean Up*

Construction site clean-up would include builder's scrap materials, demolition debris; all scrap materials, if any shall be removed from the area by tidying up of the entire site area prior to demobilization.

3.4.3 Operational and Maintenance Activities

The facility operational activities will include milling and refining operations, Fleet operations and Equipment maintenance and occasional repairs. These are further discussed below.

3.4.3.1 Production, milling and refining operations

The main raw material required is the sheanut from which sheabutter is extracted**.** Shea butter is a vegetable fat extracted from the kernel of the fruit of the shea tree (*Vitellaria paradoxa*), a tree belonging to the family of sapotaceae. The tree is the main indigenous oil producing wild plant spontaneously growing in Africa (Honfo *et al.,* 2012). Sheabutter oil extracted from sheanut is botanically called *Butyrospermum parkii*. It is a soft paste of melted fat with a milky colour in solid form and brownish when melted with a characteristic odour (Eka, 1997). It is an ancient African commodity that plays an important role in village life (Honfo *et al.,* 2012). This native source of edible oil or fat is traditionally used for frying, adding to sauces, as a skin pomade, for medicinal applications, to make soap, oil for lanterns and for cultural purposes at ceremonies, such as births, weddings and funerals. It can also

serve as a cocoa butter equivalent in the manufacture of chocolate as well as an ingredient in cosmetics (Alander, 2004).

Sheanut contains 37-55 % of fats; it is composed mainly of two fatty acids, stearic and oleic, which together account for 85-90 % of the total fatty acids (Ferris *et al.,* 2001; Maranz *et al.,* 2004). Soft sheabutter has high oleic content (Badifu, 1989). Honfo *et al.* (2012) reported that Sheabutter oil contains 2-6 % palmitic acid (C16:0), 15-25 % stearic acid (C18:0), 60-70 % oleic acid (C18:1) and less than 1 % linoleic acid (C18:2) and 5-15 % linolenic acid (C18:3). It contains a high amount of unsaponifiable matter, which ranges from 2.5 to 15 % (Eka, 1997). According to Tella (1979), shea butter oil contains cinnamic acid, a substance that helps protect the skin from harmful ultra-violet rays. Asuquo *et al.,* (2010) reported that unrefined sheabutter oil is superior to refined shea butter oil in that it retains all its natural vitamins, especially vitamins A and E. It also has natural anti-oxidant properties due to its tocopherol content. Sheabutter is an off-white or ivory-colored fat, widely used in cosmetics as a moisturizer, salve or lotion. Sheabutter is edible and is used in food preparation in Africa. Occasionally, the chocolate industry uses sheabutter mixed with other oils as a substitute for cocoa butter, although the taste is noticeably different. The sheanut required for production of sheabutter will be sourced from the North central and Oyo State, Nigeria.

***Preparation of the Seed for Extraction*:** Sheabutter seeds (nuts) when collected are dehulled, cleaned and dried under the sun and later dried in the oven to ensure that moisture content is reduced to the minimum.

Oil Extraction: Two methods are adopted in the extraction of oil at the factory they include the cold press method and the chemical method.

- *Cold Press Method*: The Cold Pressing involves extracting oil and nutrients from the Sheanut using an expeller press. An expeller press is a machine that puts a great amount of pressure on oil-bearing materials like olives, coconuts and, in this case, Sheanut. Heavy friction and continuous pressure releases oil from the Sheanut and the oil seeps through small openings that do not allow solid Sheanut fibers to enter. This method makes use of a press for applying a great deal of pressure to the fine pulverized powder obtained from the grinding/milling steps. The material is first heated to liquefy the oil and then the oil is forced out or expressed by applying great pressure to the warmed material. When the expressed oil is collected and allowed to cool it forms a solid cream known as Sheabutter. The pressed-out cakes are sent to the solvent extraction plant for further extraction.

- *Chemical Method:* Food grade hexane is used for extraction in this process. The pulverized seed is mixed with hexane. This mixing process allows all the oily and fatty constituents of the seed to dissolve in the hexane. The resulting oily –hexane mixture is later separated from the seed residue. The oily –hexane mixture is then treated to remove the hexane to yield the crude Sheabutter. The natural integrity of unrefined sheabutter is interrupted or changed during the chemical extraction process. For safety reasons, Sheabutter prepared by the chemical method, must be refined before it is permitted on the market.

Both the cold pressed and the solvent extracted Sheabutter are filtered to remove fines. The fines are re-introduced into the system for further extraction. The filtered butter is sent to the storage tank as unrefined or raw butter while the de-oiled cake (DOC) from the solvent extraction are bagged and stored in the warehouse.

Refining process: The unrefined Sheabutter is degummed to remove phospholipids; neutralized with sodium hydroxide; centrifuged and hot water washed to remove free fatty acids; bleached and treated with adsorbents to remove pigments and trace metals; sometimes the butter is steamed, distilled or heated to very high temperatures to remove volatile components. Leaving behind a product with the color and consistency of cooking lard and known in the industry as refined Sheabutter. The refined Sheabutter is white in color and odorless. The heating process induces a state change that allows the refined product to have a long shelf life, the added preservatives like sodium hydroxide and sodium carbonate also help the refined Sheabutter last long. The flow chart of the oil refining processes is presented in figure 3.5

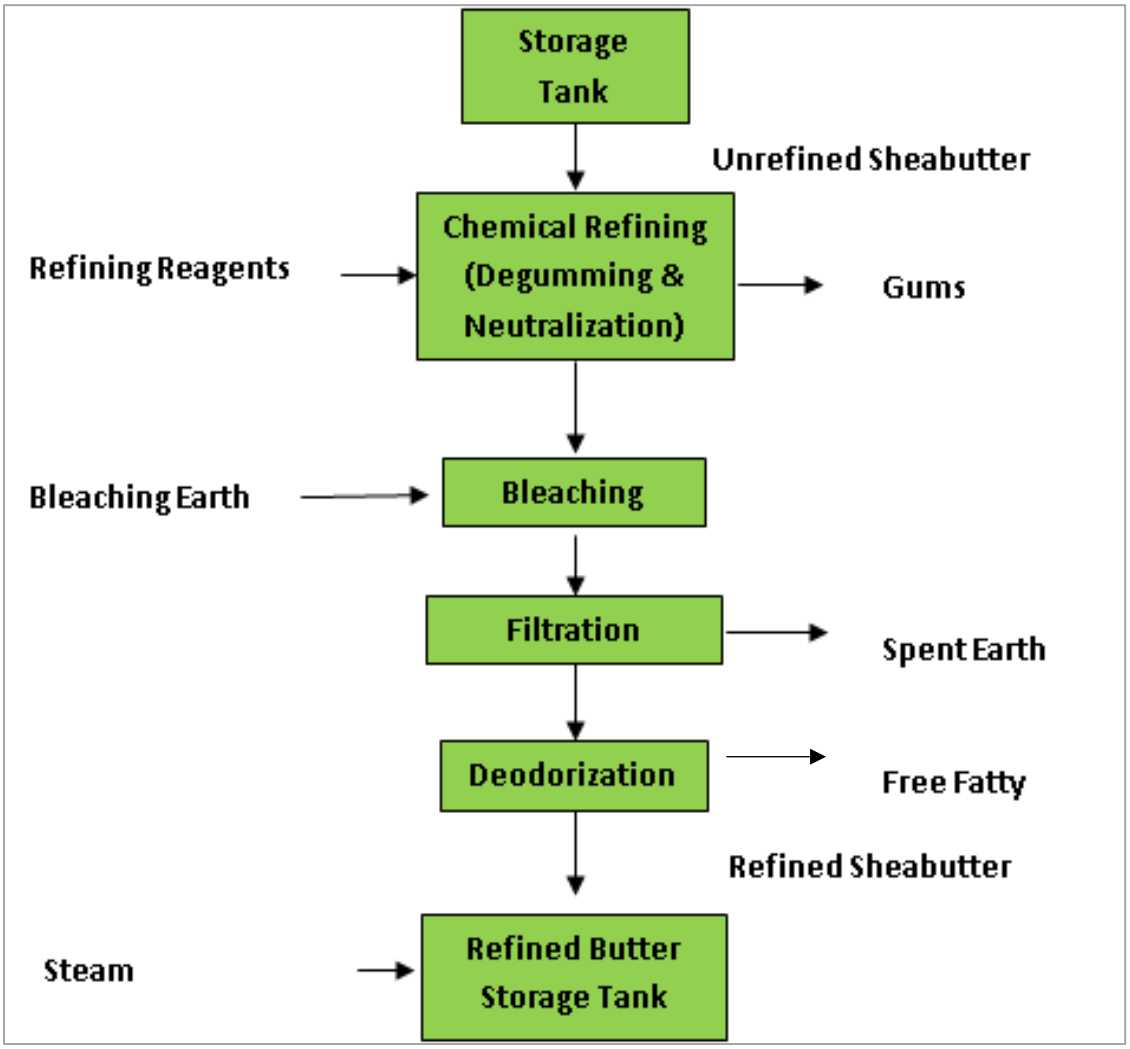

Figure 3.5: Flowchart of shea oil refining process
Source: Ladgroup 2020

The entire production system runs a close loop scheme such that water used during the production process will not be discharged into the environment but reused continually during subsequent production process. Also, hexane which is the primary chemical used in the chemical extraction of sheabutter is not discharged into the environment but distilled form each produced batch and reused for subsequent extraction of sheabutter from new batches.

Grading of Shea Butter Oil

Shea butter extract is a complex fat that in addition to many nonsaponifiable components (substances that cannot be fully converted into soap by treatment with alkali) contains the following fatty acids: oleic acid (40-60%), stearic acid (20-50%),

linoleic acid (3-11%), palmitic acid (2-9%), linolenic acid (<1%) and arachidic acid (<1%). Shea butter melts at body temperature. It is use for skin care and it absorbs rapidly into the skin, acts as a "refatting" agent, and has good water-binding properties.

3.4.3.2 Quality control Procedure and Process Applicable to Ladgroup's Operations

In order to ensure that products from the factory meet the highest standard, Ladgroup has established the following processes and procedures

- There is an existing quality control policy.
- Quality control training for Employees is constantly conducted to cover the following;
    I. Employees are encouraged and instructed to report health conditions that might contaminate the product.
    II. Employees are instructed to wear hair nets and helmets to prevent contamination of product.
    III. Employees are encouraged to wash their hands before touching any product.
- Process Hazard Analysis.
- Critical Control Point Identification.
- Installation of magnets to remove metals
- Installation of Pressure Leaf Filter for fines removal.
- We ensure that food grade and hexane are in use.
- Monthly microbial analysis of product with external Laboratory.

3.4.3.2 Fleet Operations

Transportation plays a key role in the receiving of raw materials and delivery of the finished products from the factory to the costumers. This primarily involves the use of trucks. It is estimated that one hundred (100) trucks will be required monthly for moving raw and finished goods when the expansion project is completed.

3.4.3.3 Equipment maintenance and occasional repairs:

The facility equipment shall be periodically maintained for optimal performance. This will include preventive maintenance program; annual overhaul, and daily routine maintenance activities.

Generally, the environmental aspects associated with these activities include air emission, noise generation etc.

3.5 Workforce

Ladgroup will have ultimate oversight over labour and working conditions for all phases of the Project. It is envisaged that during the construction phase, about 60 workers would be engaged. The majority of low skilled employment opportunities associated with the Project would be from the nearby local communities.

Ladgroup shall ensure that the workforce is managed in accordance with the requirements of the Nigerian Labour Act (CAP L1 LFN 2004) as well the IFC Performance Standard on Labour and Working Conditions

3.6 Utilities Consumption

3.6.1 Water Use

Water is required during both construction and operational phase of the Project. During construction, water demand is driven by the following key requirements: to make concrete for piled concrete mounting structure foundations; and for staff sanitation.

The main use of water during the operational phase is for the production process, cleaning and sanitary use. It is estimated that the water demand when the factory becomes fully operational will peak at 2,448m^3 monthly. The water for production activities will be treated before use.

Water for both construction and the operational phase will be sourced from existing borehole within the factory.

3.6.2 Energy Consumption

Electricity is very important for factory operations. It is mainly used for the operation of machines, office equipment and lighting. The current source of power (electricity) supply is through the national grid while the 1MW diesel powered generator serves as a backup. It is estimated that when the expansion project is completed the fuel consumption will be about 21, 822 Litres of AGO monthly.

3.7 Waste Management

This section discusses the waste streams associated with the proposed Project and the intended management plan.

3.7.1 Philosophy

It is the goal of Ladgroup to design, construct, and operate the proposed Project with environmental excellence. To this end, effective waste management practices shall be implemented during all phases of the Project to avoid or minimize potential impacts on the environment and protect the public health, safety and welfare. This includes spill prevention programs such as construction of bund walls, interceptors, drainage separation, storm water pollution prevention programs etc.

Waste management principles and priorities will be based on an integrated approach which involves using a combination of techniques and programs to manage waste. Source reduction is at the top of the approach, followed by reuse as preferred options to disposal. Waste shall be managed using the following prioritized program:

- **Reduction at source** – This involves elimination or minimization of waste generation through installation of pollution abatement equipment and equipment modifications.
- **Reuse** –Involves using an item for its original purpose, or similar purpose, in its original form. For example, excavated materials generated during foundation works will be used for back-filling.
- **Recycling** – conversion of waste materials (e.g. scrap metals) into reusable objects.
- **Residue Disposal** - disposal of non-reusable wastes in a government approved dumpsite.

3.7.2 Associated Waste Streams

The waste streams associated with the proposed Project are discussed below:

<u>Pre-construction Phase</u>

The waste streams associated with the pre-construction phase of the Project include cleared vegetation (from site preparation), food waste, and general rubbish. The cleared vegetation will be used for composting while the general rubbish will be disposed of at a government-approved dumpsite through an accredited third-party waste contractor.

Construction Phase

The planned activities during the construction phase include foundation works, civil and mechanical works, and equipment installation. The activities will result in the generation of waste materials and also due to the presence of construction workers. The waste streams include non-hazardous (solid) wastes such as refuse, garbage, inert construction materials, metal scraps, concrete waste, food waste and empty containers. All concrete mixing will be undertaken on impermeable plastic lining to prevent contamination of the surrounding areas. All scrap metals generated during the construction phase will be collected for recycling.

Excavated soil generated during the foundation work will be reused to backfill the area as much as possible. All solid waste materials that cannot be reused or recycled will be placed in appropriate on-site storage containers (colour-coded waste receptacles) and periodically disposed of (at least once a week throughout the construction period or on the need basis depending on the volume of the waste) at a designated dumpsite approved by the Ogun State Environmental Protection Agency (OGEPA) through a third party waste contractor.

Hazardous wastes that could be generated during the construction activities include used oil rags, and spent filters from onsite diesel generator for power source during construction. Hazardous wastes shall be stored in a manner that prevents the commingling or contact between incompatible wastes, and stored in properly labelled, closed containers prior to evacuation by a third-party waste contractor approved by OGEPA for treatment.

Operational Phase

Hazardous wastes such as empty chemical containers (e.g. hexane), empty pesticides can, oily rags etc. will be stored in properly labelled and sealed plastic or metal drums that are strategically located within the site where this category of waste may be generated pending disposal by an OGEPA accredited waste contractor. The waste bins shall be in compliance with local standards and regulations and will comply with the requirement of ISO 14001:2015.

Sanitary wastes (sewage) generated during the facility operation shall be channelled to a septic tank to be installed onsite. The septic tank shall be of reinforced concrete and will be located away from the groundwater source onsite. As at when due, the contents of the septic shall be evacuated by an accredited waste contractor for treatment at a sewage treatment plant approved by OGEPA.

Non-reusable waste materials that would be generated during operation include office waste such as paper, cardboard and some food waste. Such waste will be placed in appropriate on-site storage containers (colour-coded waste receptacles) at a designated area within the site and periodically disposed of (at least once a week or on the need basis depending on the volume of the waste) at a government approved dumpsite.

The summary of wastes stream associated with the Project is provided in Table 3.1.

Table 3.1: Summary of Wastes Stream associated with the proposed Project and Handling Techniques

Waste Stream	Sources	Waste Generation Phase Construction (C) Operation (O)	Handling Techniques
General rubbish, refuse, and putrescible wastes (food wastes)	Wood splinter, domestic waste, food packs	C, O	On-site waste segregation; disposal of non-reusable waste through a third-party waste contractor approved by OGEPA.
Cleared vegetation	During site clearing and preparation	C	Composting, collection for biomass fuel
Empty hexane and pesticides containers	Milling and refining operations	O	Waste will be managed through a third-party waste contractor accredited by OGEPA.
Scrap metals	Used tubular and casings, metal drums, used iron rods	C, O	Scrap metals will be collected for recycling
Excavated materials	Foundation works	C	Excavated materials generated during foundation works will be used for back-filling. Excess excavated spoil will be stockpiled and reused as part of materials for construction of plant buildings.
Sanitary waste	Office/Administrative area	C, O	Periodic evacuation of content of the septic tank by OGEPA accredited third party waste contractor.
Gaseous waste and noise pollution	Milling and refining operations/ Vehicular activities	C, O	Incorporating air pollution control devices (e.g. catalytic converters) and noise suppression equipment (e.g. mufflers)
Diesel/ petrol/engine oil/lubricant	Vehicular activities	C, O	Use of spill absorbent kits. Used absorbent materials to be disposed of by OGEPA

Waste Stream	Sources	Waste Generation Phase Construction (C) Operation (O)	Handling Techniques
			accredited third party waste contractor.
De-oiled cake	Milling operations	O	Sold out to third-party vendors who use it for animal feed

3.8 Project Schedule

The tentative Project schedule is summarized below in Table 3.2.

Table 3.2: Tentative Project Schedule

Activities	Year		
	2020	2021	2022
EIA study and approval			
Civil Works			
Construction of Refinery Building and Associated Structures			
Purchase of Refinery Equipment			
Commissioning/ Demobilization from site			

CHAPTER FOUR :

DESCRIPTION OF THE ENVIRONMENT

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

4.1 Introduction

This chapter provides a description of the existing environmental and socio-economic conditions of the Project area against which the potential and associated impacts of the proposed Project have been assessed.

Data and information for the environmental description of the study area were based on field data gathering (primary data) as well as literature review of relevant materials (secondary data). The field sampling was carried out during the wet season while the secondary data for the dry season study were obtained from the FMEnv-approved EIA reports relevant to the study area including the final EIA report of the proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility in Ogere, Ikenne Local Government Area of Ogun State, Nigeria, 2019.

The environmental and social components of the study area described in this chapter cover the following:

- Climate and meteorology;
- Geology and hydrogeology;
- Air quality and noise;
- Groundwater;
- Soil;
- Terrestrial flora;
- Terrestrial fauna;
- Land use;
- Climate Change;
- Traffic survey;
- Socio-economic and health.

As illustrated in Figure 4.1, the Study Area/Project's area of influence (AoI) considered for this study covers the following:

- The proposed Project site (direct footprint), occupying land areas of about 17 hectares
- The immediate surroundings of the Project site up to 2km radius taken from the centre of the Project site.

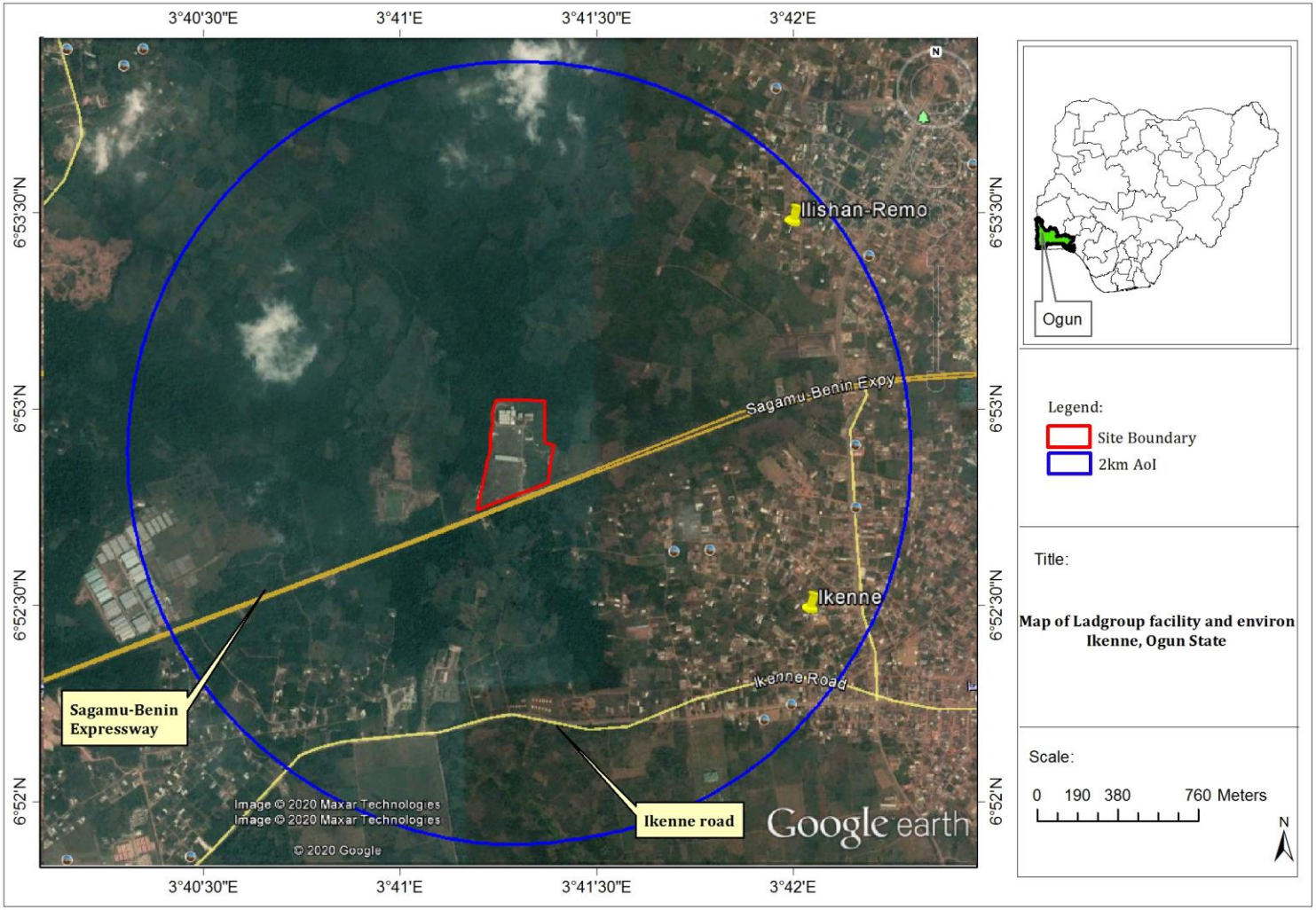

Figure 4.1: The Project's Area of Influence (AoI)
Source: Google Earth 2020 and EnvAccord Field Survey, 2020

4.2 Baseline Data Collection

Baseline data acquisition exercise involved a multi-disciplinary approach and was executed within the framework of Quality, Health, Safety, and Environment (QHSE) management system. This approach assured that the required data and samples were collected in accordance with the approved scientific and regulatory requirements using appropriate equipment, materials and personnel.

The study approach includes the following:

- Review of existing reports relevant to the Project environment;
- Designing and development of field sampling strategies to meet the scope of the EIA and regulatory requirements;
- Pre-mobilization activities (including calibration/pre-testing of field equipment, review of work plan with team members);
- Mobilization to site and fieldwork sampling (sample collection, in-situ measurements; samples handling, documentation, and storage);
- Demobilization from field; and
- Transfer of field samples to the laboratory for analysis.

4.2.1 Desktop Studies/Literature Review

Desktop studies involved the acquisition of relevant background information on the bio-physical and socio-economic environment of the study area. Information was sourced from the relevant government authorities including the Nigerian Meteorological Agency (NiMet); the National Bureau of Statistics (NBS); and the FMEnv. Other sources of secondary information include: Final Environmental Impact Assessment (EIA) report for the Proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility in Ogere, Ikenne Local Government Area of Ogun State, Nigeria; relevant publications, textbooks, articles, maps as well as online sources.

4.2.2 Field Sampling and Laboratory Analysis

4.2.2.1 Field Sampling

In order to effectively characterise the environment of the study area, field sampling was conducted from 7th to 9th of July 2020 and witnessed by representatives of the FMEnv. The objective of the field exercise was to obtain the baseline data of the Project's AoI and describe the integrated environmental context of the area. Sampling locations were identified using recent satellite imagery of the study area. The basis of the sampling design was informed by a preliminary characterization of the study area through desktop research and nearby sensitive receptors.

Sampling locations were selected to cover as much as possible the land area for the proposed Project as well as the existing sensitive receptors that could be indirectly or directly affected by the proposed Project. All sampling locations were geo-referenced using Garmin Map-62 series Global Positioning System (GPS) handsets.

The field sampling activities were carried out in line with the FMEnv-approved ToR for the EIA study, and appropriate quality assurance and quality control procedures were implemented to maintain the integrity of the field samples. Samples (e.g. soil and groundwater samples) collected during the field sampling were appropriately preserved and transported to the laboratory for analysis. Plate 4.1 shows some pictures of the field sampling activities.

Plate 4.1: Sample photographs of Field Sampling Activities at the Study Area
Source: EnvAccord Field Survey, 2020

Figure 4.2 summarizes the management program put in place to safeguard the integrity of the field samples collected during the baseline data gathering.

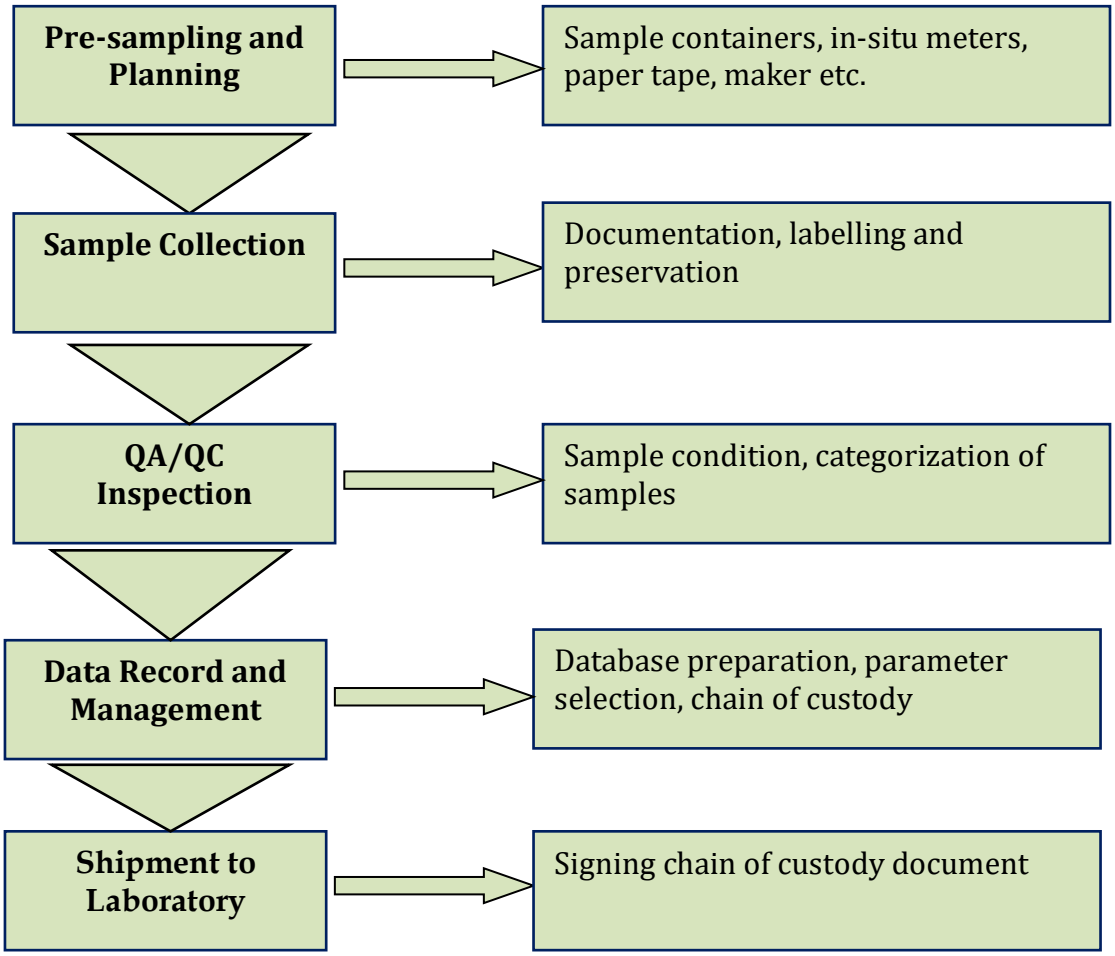

Figure 4.2: Management program employed for field sampling
Source: EnvAccord Internal Document

4.2.2.2 Laboratory Analysis of Field Samples

The field samples were analysed for physico-chemical parameters at EnvAccord Laboratory located at 13 Alabi Street off Oguntona Crescent Gbagada Phase 1, Lagos. The Laboratory is accredited by the FMEnv, the National Environmental Standards and Regulations Enforcement Agency (NESREA), the Institute of Public Analysts of Nigeria (IPAN), and the Nigeria National Accreditation Service.

The laboratory analyses were consistent with the approved standard methodologies such as those recommended by ASTM International (formally called American Standards for Testing and Materials) and American Public Health Association (APHA). Some of the analytical methods used are highlighted in Table 4.1.

Table 4.1: Analytical methods employed for field samples analysis

S/N	Parameters	Analytical Methods	Units	
			Water sample	Soil sample
1.	Total Suspended Solids	Gravimetric method	mg/l	-
2.	BOD	Dilution method	mg/l	-
3.	COD	Closed Reflux dichromate method	mg/l	-
4.	Oil and Grease	N-Hexane Extraction Method	mg/l	mg/kg
5.	Alkalinity	Titration method	mg/l	-
6.	Total Hardness	EDTA/Titration method	mg/l	-
7.	Nitrate	Spectrophotometric method	mg/l	mg/kg
8.	Sulphate	Spectrophotometric method	mg/l	mg/kg
9.	Phosphate	Spectrophotometric method	mg/l	mg/kg
10.	Nitrite	UV/VIS Spectrophotometry	mg/l	mg/kg
11.	Sodium	Flame photometric method	mg/l	mg/kg
12.	Potassium	Flame photometric method	mg/l	mg/kg
13.	Calcium	Titration with ethylenediamine tetra-acetic acid method	mg/l	mg/kg
14.	Magnesium	Titration with EDTA method	mg/l	mg/kg
15.	Lead	Atomic Absorption Spectrophotometry	mg/l	mg/kg
16.	Nickel	Atomic Absorption Spectrophotometry	mg/l	mg/kg
17.	Cadmium	Atomic Absorption Spectrophotometry	mg/l	mg/kg
18.	Zinc	Atomic Absorption Spectrophotometry	mg/l	mg/kg
19.	Copper	Atomic Absorption Spectrophotometry	mg/l	mg/kg
20.	Chromium	Atomic Absorption Spectrophotometry	mg/l	mg/kg
21.	Manganese	Atomic Absorption Spectrophotometry	mg/l	mg/kg
22.	Total Iron	Atomic Absorption Spectrophotometry	mg/l	mg/kg
23.	Mercury	Cold Vapour Atomic Absorption Spectroscopy	mg/l	mg/kg

Source: EnvAccord Field Survey, 2020

The laboratory analysis was witnessed by FMEnv representatives (Plate 4.2).

Plate 4.2: Witnessing of analysis of field samples by FMEnv official at EnvAccord laboratory

A list of field equipment used during the field sampling is presented in Table 4.2.

Table 4.2: Field Equipment for Sampling

S/N	Environmental component	Equipment/Tool
1.	Ambient Air Quality (pollutant gases)	▪ Aeroqual series 500 (with the following gas sensors: CO; CO_2; SO_2; H_2S; NH_3; CH_4; NO_2; and VOC).
2.	Ambient Air Quality (particulate matter)	▪ Aerocet 531 ▪ Gray Wolf particle counter
3.	Insitu climate and meteorology	Kestrel Meter 4500 Weather Meter
4.	Soil	Stainless Steel Augers
5.	Ground water (in-situ water testing for parameters with short holding time namely pH, electrical conductivity, DO, Salinity, TDS, temperature)	▪ Extech Digital DO700 meter ▪ Hanna Digital meter
6.	Ambient Noise Levels	Extech Integrating Sound Level Meter (Model No: 407780)
7.	Vegetation (Flora) and Wildlife (Fauna)	Binocular; hand lens, camera, etc.

Source: EnvAccord Field Survey, 2020

The data gathering approach is summarized below:

❖ ***Climate and Meteorology***

The regional long-term climatic data of the Project area was sourced from the NiMet and spanned from 1990 to 2019. This was supplemented with Insitu climatic and meteorology characteristics of the Project area collected from eleven (11) stations.

❖ ***Air Quality and Noise***

Eleven (11) in-situ air quality measurements were conducted with the use of pre-calibrated digital hand-held monitoring equipment for the following parameters: Sulphur (IV) Oxide (SO_2), Nitrogen (IV) Oxide (NO_2), Methane (CH_4), Carbon Monoxide (CO), Carbon (IV) Oxide (CO_2), Volatile Organic Compounds (VOC), Ammonia (NH_3), Hydrogen Sulphide (H_2S) and Total Suspended Particulate (TSP).

Ambient noise levels were measured using an Extech Integrated Sound Level Meter with a detection range of 30 dB(A) to 130 dB(A). Noise Level measurements were taken at a height of approximately 2m above ground level and the response time was set to slow and read on the 'A' frequency weighting scale in unit decibels. Noise sampling satation were co-located with air quality stations.

- ***Groundwater Sampling***

Groundwater samples were collected from four (4) different boreholes within the Project area inclusive of the control point. At each sampling location, groundwater samples were collected into a 2-litre polyethylene bottle for general physico-chemical analysis, while samples for Oil & Grease determination were collected in 1-litre glass bottle and preserved with concentrated sulphuric acid. Samples for heavy metals were fixed with concentrated nitric acid. Pre-sterilized 50ml McCartney bottles were used for samples meant for microbial analysis. *In-situ* measurements of pH, Conductivity, Total Dissolved Solids (TDS), Temperature, and Dissolved Oxygen (DO) were taken at each location using Extech Digital DO700 meter.

- ***Soil Sampling***

A total of eleven (11) soil sampling stations top (0-15cm) and subsoil (15-30cm) were established at the study area resulting into a total of twenty-two (22) samples. Soil sampling was carried out using a stainless-steel auger and transferred to an aluminum foil. The soil samples collected with aluminum foil sheet and sub samples were taken for microbial and physico-chemical analysis. Sub samples for microbial analysis were put in sterilized 50ml McCartney bottles. All samples collected were preserved and transported to the laboratory for analysis.

- ***Terrestrial Flora and Fauna***

A flora assessment of the Project's AoI was undertaken with a view to providing information on the following: vegetation types, floristic composition, species diversity, inventory of economic/medicinal plants and general biodiversity assessment. The survey was conducted in accordance with the standard botanical field sampling procedures. Plant species encountered were identified to species level both *in-situ* and *ex-situ* in the herbarium using appropriate references, manuals and monographs. The ecological status of the species was evaluated and classified appropriately according to the International Union for Conservation of Nature (IUCN).

Sampling techniques for terrestrial fauna assessment include footprint, nest type feeding site, voice, physical appearance, faecal samples, and shell types.

- ***Socio-economic and Health Survey***

The study methodologies employed for socio-economic and health baseline data gathering include questionnaire administration, key informants' interviews, focus group discussions, field observations and literature review. Detailed description of these methodologies is presented in Section 4.4 of this chapter.

4.3 Description of Environmental Characteristics of the Project Area

4.3.1 Climate and Meteorology

Climate controls the natural forces that act on virtually all the components of the ecosystem. In addition to determining the components of the environment, it also modifies the structural differences between them in the process of maintaining equilibrium. Ogun State is located in the moderately hot, humid tropical climate zone of South-west, Nigeria. The climate of the area is tropical with alternating wet and dry seasons. It is strongly influenced by Inter-Tropical Convergence Zone (ITCZ) weather patterns. Maritime tropical air masses, characterized by warm, humid south-westerly winds and the continental air mass, characterized by hot, dry north-easterly winds, converge in the ITCZ. The alternating wet season and dry season phenomenon is determined by the north-south oscillation of air masses in the ITCZ. Movement of these air masses results in two main seasons; a wet season from April to October, and a dry season from November to March. During the dry season there are periods when the harmattan (a period characterized by dry dusty winds and relatively low temperatures) is experienced. This typically occurs during the months of December and January.

Table 4.3 summarizes the monthly mean climatic characteristics of the Project area in Ogun State from 1990 to 2019.

Table 4.3: Monthly Mean Climatic Characteristics of the Project Area in Ogun State (1990-2019)

Month	Temperature (^{0}C)		Rainfall (mm)	Humidity (%)		Sunshine Hours	Wind Speed (m/s)
	Min.	Max.	Mean	09:00Hr	15:00Hr		
January	24.29	31.12	23.86	77.72	69.76	5.54	3.5
February	26.07	32.27	36.61	79.48	71.96	5.40	3.7
March	26.61	32.48	64.96	79.76	73.92	5.24	4.1
April	26.37	32.26	139.22	80.84	75.32	5.74	4.1
May	25.64	31.53	216.86	82.40	76.80	5.65	3.9
June	24.37	29.72	413.06	87.12	81.12	4.27	3.7
July	23.96	28.34	232.73	87.88	82.92	3.01	4.9
August	23.88	28.16	115.24	87.68	82.00	2.59	5.1
September	24.18	28.76	232.13	87.92	82.80	3.10	4.7
October	24.62	29.99	192.31	84.72	79.64	4.84	4.1
November	25.80	30.14	52.31	81.76	75.84	6.18	3.8
December	25.36	31.56	13.70	80.44	71.36	5.74	3.7
Total			1,732.99			57.3	
Min	23.88	28.16	13.7	77.72	69.76	2.59	3.5
Max.	26.61	32.48	413.06	87.92	82.92	6.18	5.1
Mean	25.09	30.53	144.42	83.14	76.95	4.78	4.1

Source: NiMet 2020

i) Rainfall

The rainfall pattern in the area is characterized by high precipitation in the months of April to October (wet season) while the lowest mean rainfall amount is recorded in December. The total annual rainfall is about 1,732.99 mm, out of this amount about 1,541.55 mm is recorded during the wet season (April – October) while only 191.44 mm is recorded in the dry season (November to March) as shown in Figure 4.3 below.

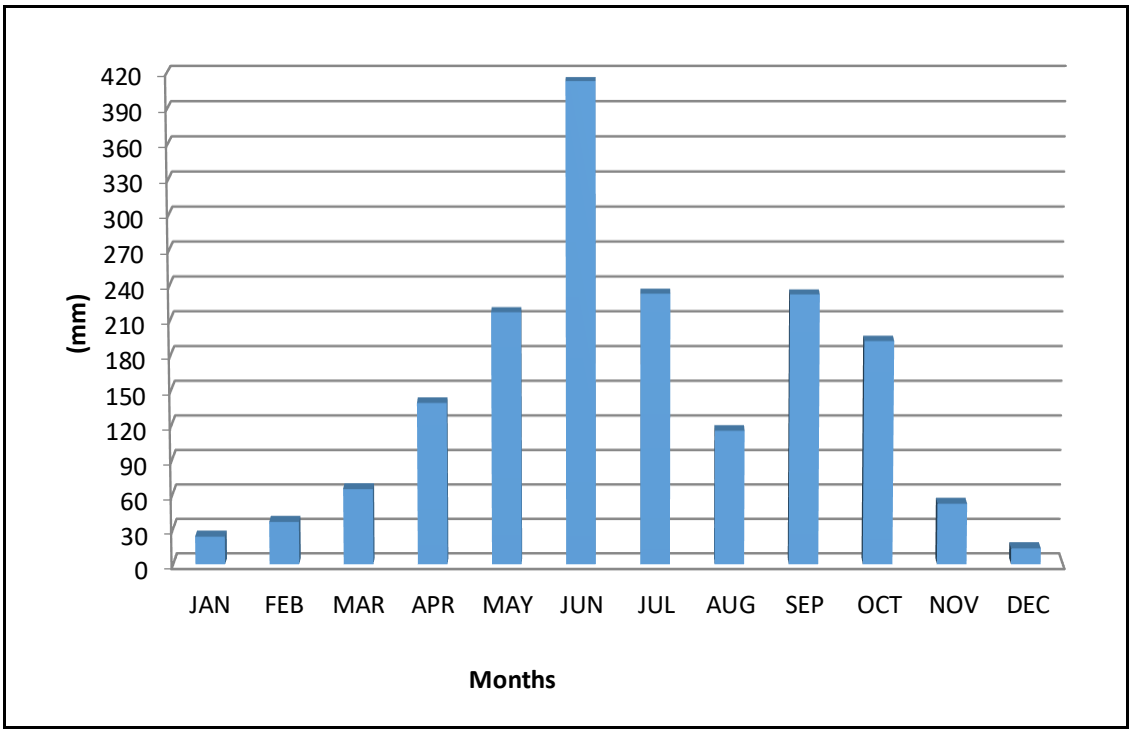

Figure 4.3: Average rainfall characteristics of the Project area (1990- 2019)
Source: NiMet 2020

ii) Ambient Temperature

Temperature is relatively high all the year round in view of the location of the study area around the tropic. The highest temperature values are recorded in the dry season months and the lowest at the peak of wet season period (Figure 4.4).

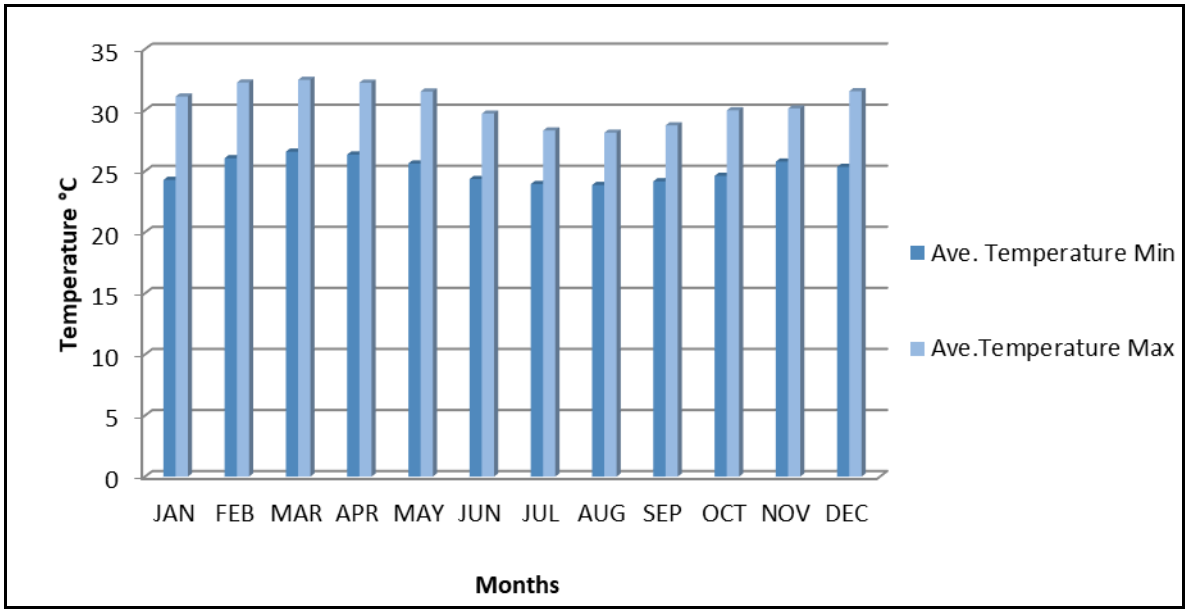

Figure 4.4: Monthly Mean Temperature Characteristics of the Project Area (1990-2019)
Source: NiMet 2020

iii) Relative Humidity

High relative humidity is experienced in the area as a result of the prevailing Tropical Maritime (Tm) air mass that blows over the environment almost all the year round. Data for Ogun State indicates that humidity measured in the morning ranges between 77.72 % in January and 87.92 % in September while at night the value ranges from 69.76 % (in January) to 82.92% (in July) as shown in Figure 4.5.

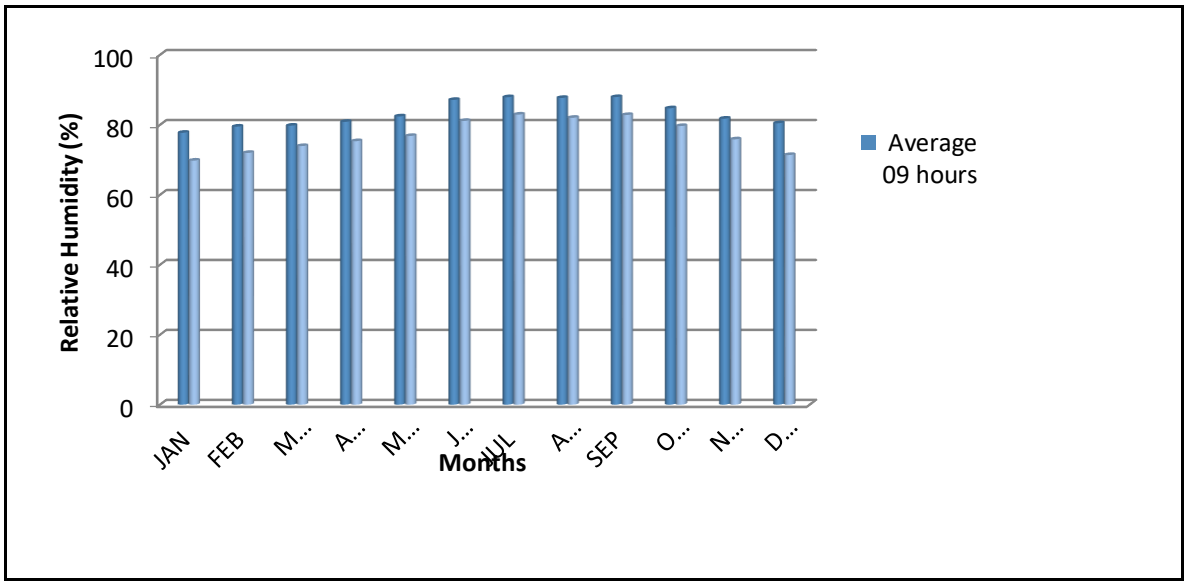

Figure 4.5: Monthly Relative Humidity Characteristics of the Project Area (1990-2019)
Source: NiMet 2020

iv) Wind Direction and Speed

Wind follows the distinctive pattern of the Tropical continental, (Tc) (Northeast) and Tropical maritime, Tm (Southwest) directions depending on the apparent location of the sun and the dominant of the two. The moisture laden and rain bearing Southwesterly from the Atlantic predominates during the wet season. It is calmer due to its higher moisture load. The Tc is of less intensity and prevails between December and March. The two major wind patterns are however modified marginally by warm Benguela Current and the North-East Harmattan winds.

The monthly average wind speed in the Project area ranges from 3.5 m/s to 5.1 m/s (Figure 4.6), while the dominant wind direction is towards the south west (Figure 4.7),

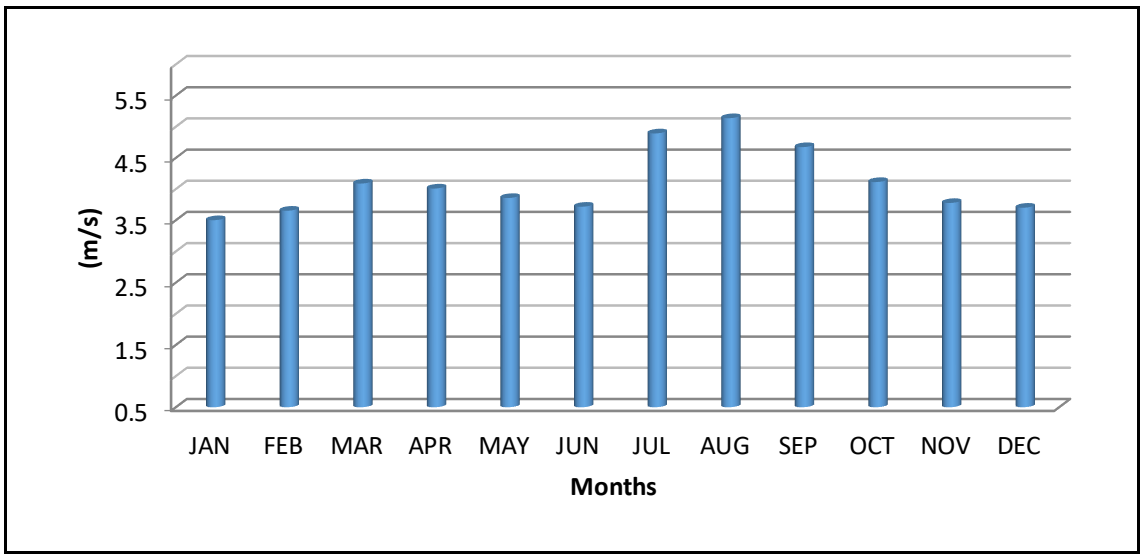

Figure 4.6: Monthly Average Wind Speeds of the Project Area (1990- 2019)
Source: NiMet 2020

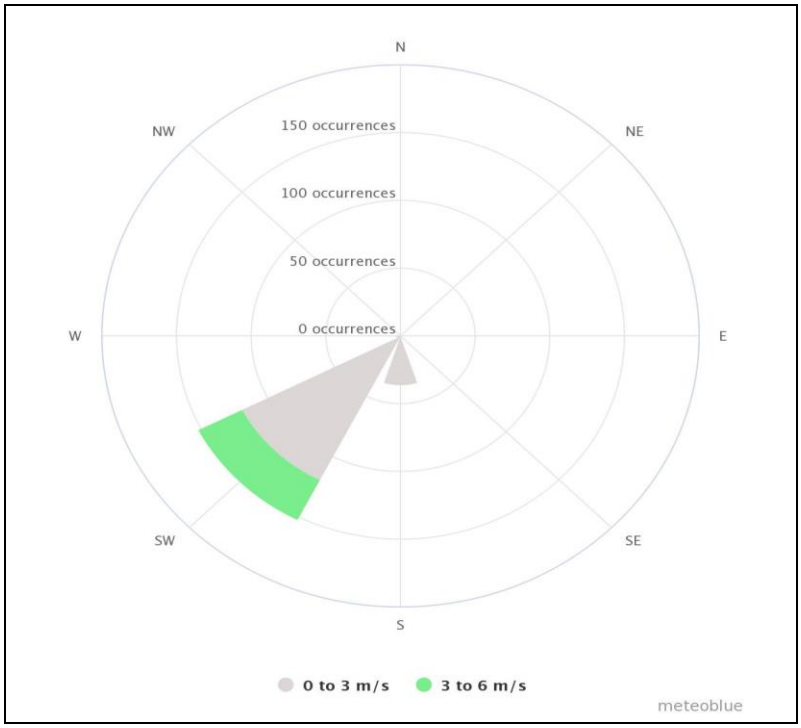

Figure 4.7: Windrose of the Project Area
Source: www.meteoblue.com

v) Sunshine Hours

A general assessment of the sunshine hours for the Project area revealed that the lowest sunshine hours (2.59 – 3.10) are at the peak of the rainy season (July and September) while the brightest months occur in November (Figure 4.8). Total annual sunshine hours are about 57.3 hours, which represent an average of about 5 hours of bright sky per day.

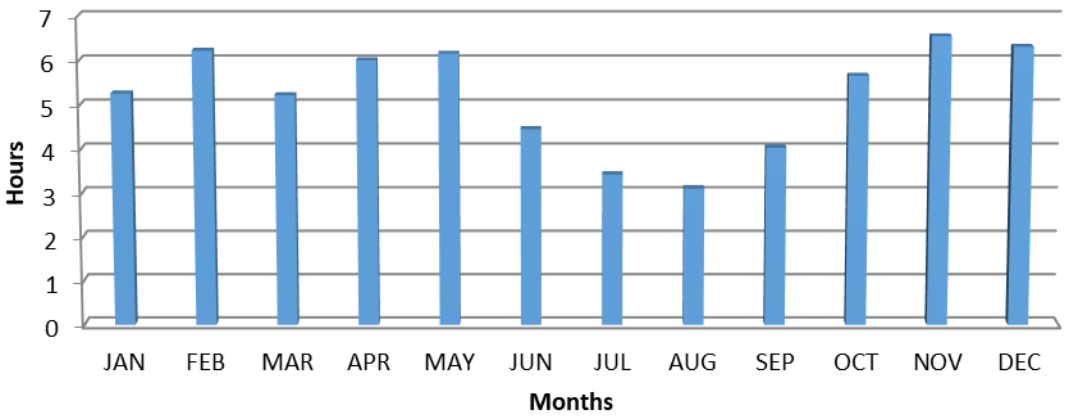

Figure 4.8: Monthly Average of Sunshine Hours for the Project Areas in Ogun State (1990-2019)
Source: NiMet 2020

The insitu climate and meteorology characteristics of the Project Area is presented in table 4.4 values obtained during the data gathering exercise were generally consistent with the data obtained from NiMet.

Table 4.4: Insitu climate and meteorology characteristics of the Project Area

Sampling Code	Humidity (%)	Wind speed	Temperature(^{0}C)	Wind direction	Coordinates	
					Latitude (N)	Longitude (E)
MET 1	75	5.1	22.4	SW	6.88245	3.68896
MET 2	79	6	24.8	SW	6.88337	3.68916
MET 3	80	4.6	23.8	SW	6.88346	3.68781
MET 4	76	4.4	23.7	SW	6.88213	3.68689
MET 5	82	4.6	23.0	SW	6.87984	3.68795
MET 6	81	5	24.8	SW	6.88503	3.70285
MET 7	79	4.4	23.4	SW	6.89545	3.70342
MET 8	77	4.3	23.4	S	6.86798	3.69453
MET 9	81	4.6	23.7	S	6.86723	3.68127
MET 10	84	4.4	24.9	SW	6.87369	3.67299
MET 11	77	4.7	23.5	SW	6.87159	3.65908

Source: EnvAccord Field Survey, 2020

4.3.2 Geology and Hydrogeology

The geology of Ogun State comprises sedimentary and basement complex rocks. The rocks are soft and brittle, but in some places, cemented by iron and silicon containing materials. The basement complex is essentially non-porous and water can only be contained in the crevices of the complex. This basement complex primarily underlies the sedimentary layers which consist of Cretaceous, Tertiary and Quaternary sediments deposited in the coastal basin. The sedimentary rock of Ogun State consists of the Abeokuta formation, which lies directly above the basement complex and is in turn overlain by the Ewekoro, Oshosun and Ilaro formations. The proposed project site is located on the Abeokuta formation (Figure 4.9).

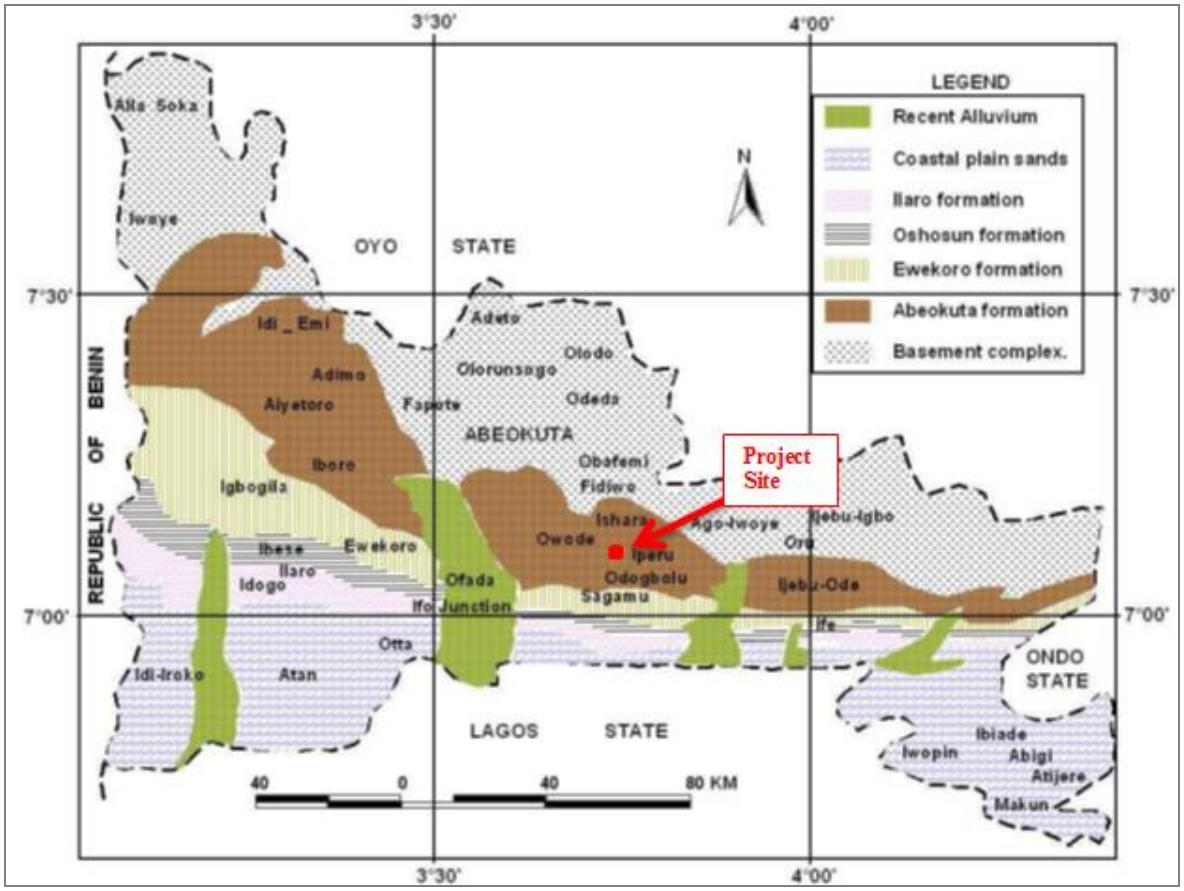

Figure 4.9: Geological map of Ogun State showing the Study area
Source: Olurin *et al.*, 2015

The relief of Ogun State has a wide area of undulating lowlands belonging to the coastal sedimentary rocks of western Nigeria. There are scattered hills that are interfluves between the different river valleys. Some remnants of a large planation in the state include the out-crop inselbergs found at Abeokuta the Olumo Rock at the southern edge of the Western uplands. The relief of the project area is characterized by gentle undulations as presented in Figure 4.10

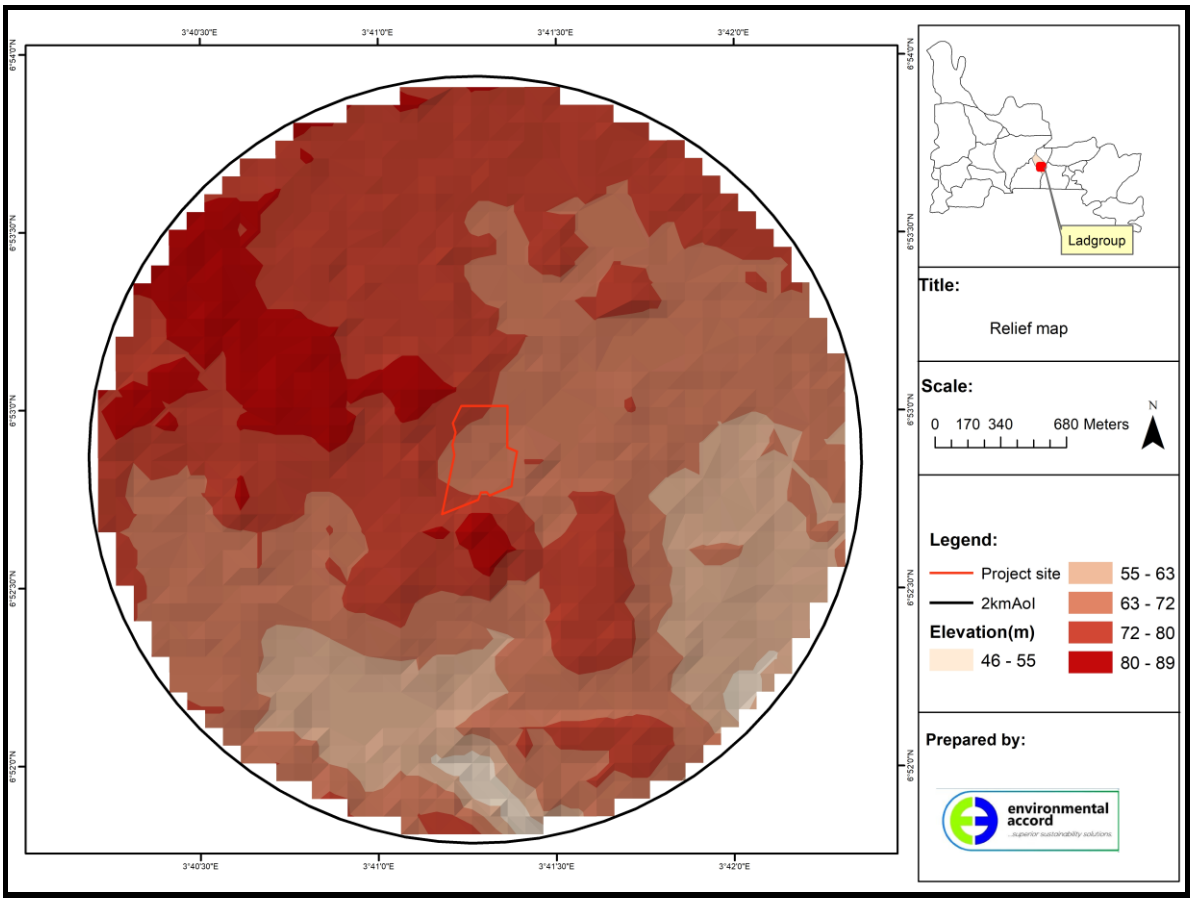

Figure 4.10: Relief map of project area
Source: Adapted from https://earthexplorer.usgs.gov/

Ogun State is traversed by many rivers which flow southward either as tributaries or main rivers into the coastal lagoons and the Atlantic Ocean. These include Ogun, Osun, Yewa, Yemoji, Ona, Sasa, Oni, Ohu, Ohia, Abafon, Oyan, lju and others. Most of the state is well-drained by these streams and rivers, much of which dry up during the dry season. There are no water bodies around the project AoI, however the project area is well drained, the local natural drainage indicates that surface runoff for the project area drains towards the south/south east (figure 4:11)

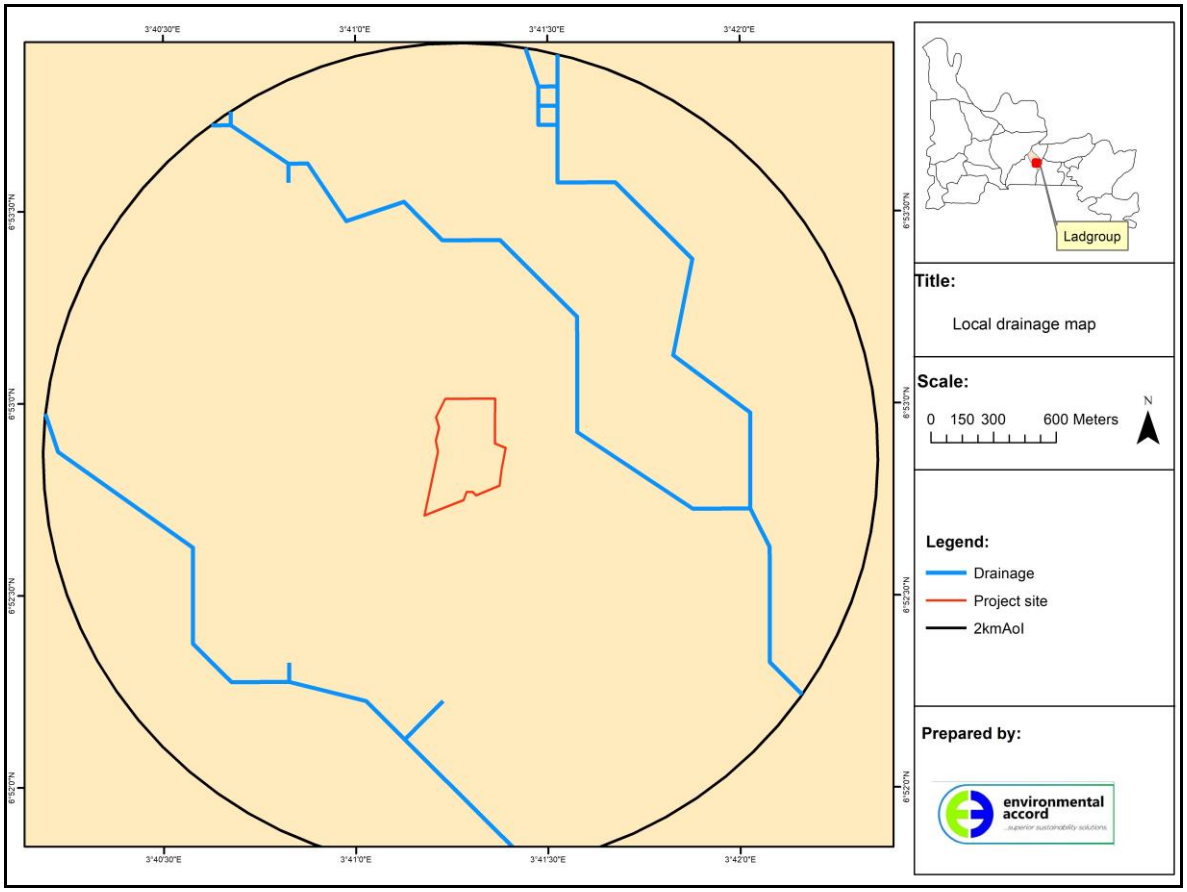

Figure 4.11: Natural drainage network
Source: Adapted from https://earthexplorer.usgs.gov/

4.3.3 Ambient Air Quality and Noise

A total number of eleven (11) sampling locations were established in the study area for ambient air quality and noise studies. The air quality and noise sampling locations map is shown in Figure 4.12.

4.3.3.1 Air Quality Standards

Due to the dangers of excessive release of air pollutants into the atmosphere from anthropogenic activities, particularly the disturbance of the dynamic equilibrium in the atmosphere, which ultimately affect man and his interest, attempts have been made to limit the volume of noxious gases and particulates, which are discharged indiscriminately into the atmosphere. In present times, air quality is being judged increasingly against legally adopted standards.

The concentrations of air quality parameters recorded at the study area were compared to the Nigerian Ambient Air Quality Standards (NAAQS) as well as the World Health Organization (WHO) Air Quality Guidelines. The summary of these limits is provided in Table 4.5. The noise levels recorded in the study area were compared to the FMEnv. Noise Exposure Limits (Table 4.6).

Table 4.5: Ambient Air Quality Standards

Parameter	Averaging Time	Nigeria Standards FMEnv Limit (µg/m³)	WHO Ambient Air Quality Guidelines (µg/m³)
CO	1-hour	11, 400	-
NO_2	1-hour	75-113	200
SO_2	1-hour	260	20 (24hr)
TSP	1-hour	250	-

Source: FMEnv, 1991 and World Bank General EHS 2007

Table 4.6: Noise Exposure Limits for Nigeria

Duration per Day, Hour	Permissible Exposure Limit dB(A)
8	90
6	92
4	95
3	97
2	100
1	105

Source: Guidelines and Standards for Environmental Pollution Control in Nigeria (FEPA {now FMEnv}, 1991)

4.3.3.2 Air Quality of the Project Area

The aim of air quality baseline study is to obtain the spatial coverage of the current atmospheric pollutants in the study area as may be needed in establishing the potential impact of the proposed Project on the air quality of the environment. The geographical coordinates of the air sampling points are presented in Table 4.7 while the sampling map is presented in Figure 4.12

Table 4.7: Air quality sampling locations

Sampling Code	Latitude (N)	Longitude (E)
Project site		
AQ1	6.88245	3.68896
AQ2	6.88337	3.68916
AQ3	6.88346	3.68781
AQ4	6.88213	3.68689
AoI		
AQ5	6.87984	3.68795
AQ6	6.88503	3.70285
AQ7	6.89545	3.70342
AQ8	6.86798	3.69453
AQ9	6.86723	3.68127
Buffer/Control Points		
AQ10	6.87369	3.67299
AQ11	6.87159	3.65908

EnvAccord Field Survey, 2020

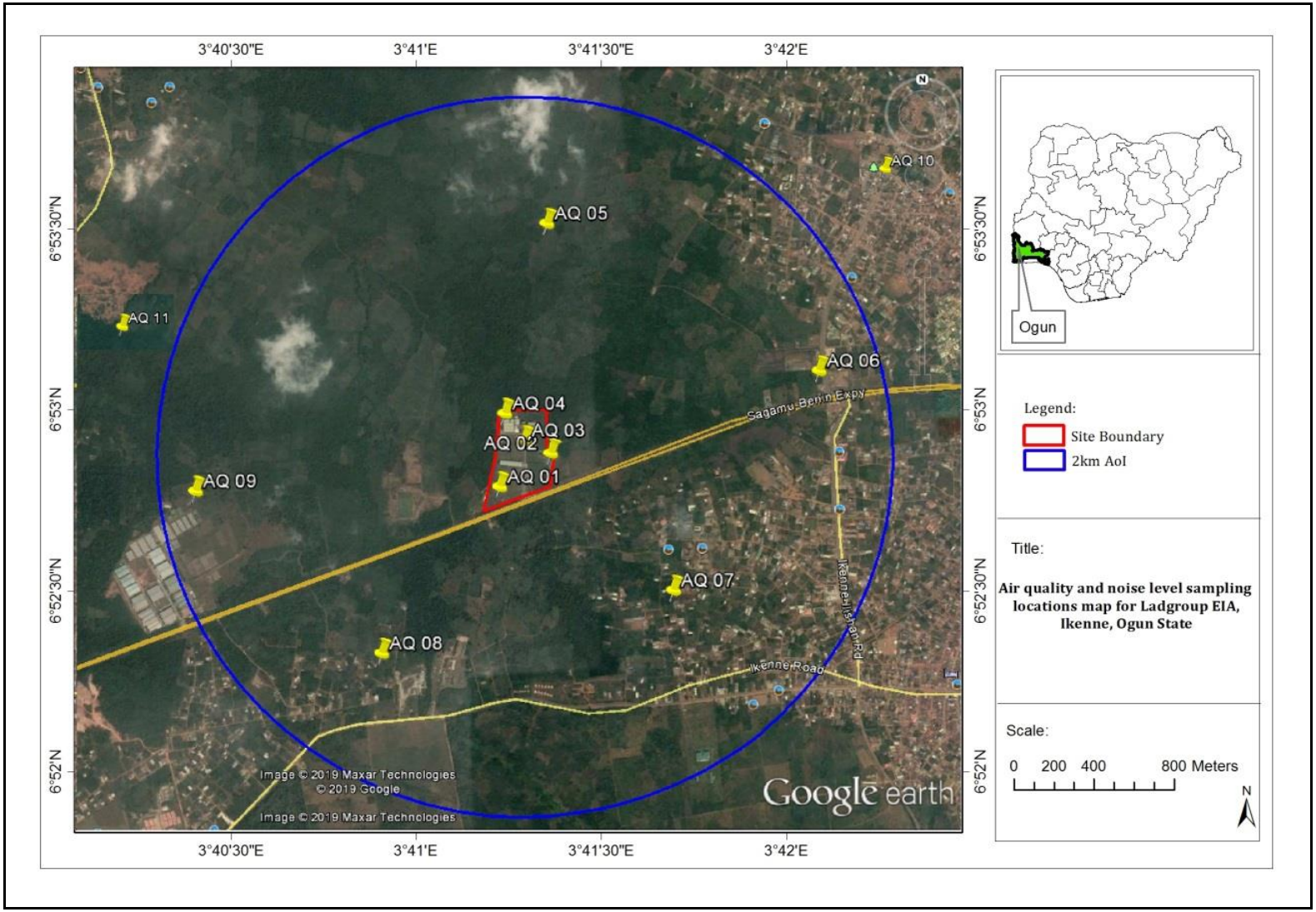

Figure 4.12: Air quality/ Noise sampling locations

Source: Google Earth 2019 and EnvAccord Field Survey, 2020

The results of air quality study conducted in the Project's AoI are presented below in Table 4.8a and 4.8b.

Table 4.8a: Concentration of ambient air quality and noise level in the Project area (wet Season)

Station	CO_2	CO	SO_2	NO_2	VOC	NH_3	H_2S	O_3	CH_4	TSP	Noise
	mg/m³										dB(A)
Project site											
AQ1	897	BDL	BDL	0.005	0.51	BDL	BDL	BDL	BDL	0.081	49.5
AQ2	929	BDL	BDL	BDL	0.71	BDL	BDL	BDL	BDL	0.036	61.4
AQ3	901	BDL	BDL	BDL	0.33	BDL	BDL	BDL	BDL	0.040	42.1
AQ4	889	BDL	BDL	BDL	0.41	BDL	BDL	BDL	BDL	0.048	43.8
AoI											
AQ5	967	BDL	0.01	0.005	0.32	BDL	BDL	BDL	BDL	0.073	40.5
AQ6	986	BDL	BDL	BDL	0.34	BDL	BDL	BDL	BDL	0.024	76.3
AQ7	962	BDL	BDL	BDL	0.41	BDL	BDL	BDL	BDL	0.029	60.8
AQ8	990	BDL	BDL	BDL	0.38	BDL	BDL	BDL	BDL	0.038	50.7
AQ9	945	BDL	BDL	BDL	0.64	BDL	BDL	BDL	BDL	0.066	64.1
Buffer/Control Points											
AQ10	869	BDL	BDL	BDL	0.63	BDL	BDL	BDL	BDL	0.055	67.5
AQ11	893	BDL	BDL	BDL	0.44	BDL	BDL	BDL	BDL	0.035	48.2
Max	990	-	0.01	0.005	0.71	-	-	-	-	0.081	76.3
Min	869	-	-	-	0.32	-	-	-	-	0.024	40.5
Mean	929.8	-	-	-	0.47	-	-	-	-	0.049	55.5
FMEnv limit	-	**11.4**	**0.26**	**0.113**	-	-	-	-	-	**0.25**	**90**
WHO limit	-	-	**0.5**	**0.2**	-	-	-	-	-	**-**	**-**

BDL= Below Detection Limit (Equipment Detection Limit for the parameters are: NO_2, 0.001; SO_2, 0.01; CH_4, 0.01; H_2S, 0.01; VOC, 0.01; CO, 0.01)

Source: EnvAccord Field Survey, 2020

Table 4.8b: Concentration of ambient air quality and noise level in the Project area (dry Season)

Station	CO2	CO	SO_2	NO_2	VOC	H_2S	CH_4	TSP	Noise (dB
	(mg/m³)								
FAN AQ1	910	<0.01	0.021	0.013	<0.01	0.23	<0.01	0.032	55.5
FAN AQ2	874	<0.01	0.023	0.032	<0.01	0.26	<0.01	0.042	58.5
FAN AQ3	882	<0.01	0.019	0.012	<0.01	0.15	<0.01	0.061	57.1
FAN AQ4	811	<0.01	0.021	0.041	<0.01	0.22	<0.01	0.078	78.2
FAN AQ5	990	<0.01	0.022	0.011	<0.01	0.18	<0.01	0.062	59.2
FAN AQ6	821	<0.01	0.013	0.069	<0.01	0.19	<0.01	0.033	60.5
FAN AQ7	859	<0.01	0.018	0.018	<0.01	0.25	<0.01	0.045	57.8
FAN AQ8	1001	<0.01	0.019	0.072	<0.01	0.24	<0.01	0.041	80.1
FAN AQ9	928	<0.01	0.012	0.079	<0.01	0.21	<0.01	0.035	79.4
FAN AQ10	859	<0.01	0.018	0.054	<0.01	0.22	<0.01	0.044	62.1
FAN AQ11	986	<0.01	0.011	0.071	<0.01	0.18	<0.01	0.035	69.8
FAN AQ12	974	<0.01	0.014	0.066	<0.01	0.17	<0.01	0.032	65.6
Max	1001	-	0.023	0.079	-	0.26	-	0.078	80.1
Min	811	-	0.011	0.011	-	0.15	-	0.032	55.5
Mean	907.92	-	0.018	0.044	-	0.21	-	0.045	65.32
FMEnv limit	**-**	**11.4**	**0.26**	**0.113**	**-**	**-**	**-**	**0.25**	**90**
WHO limit	**-**	**-**	**0.5**	**0.2**	**-**	**-**	**-**	**-**	**-**

Source: Final EIA report for the Proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility. 2019

Carbon Monoxide (CO): Carbon monoxide is a colourless, odourless and tasteless gas that is slightly less dense than air. It is produced from the partial oxidation of carbon containing compounds**.** The CO concentration recorded in the study area during the wet season was below detection limit of the analytical equipment while that if the dry season was below 0.01. The CO values obtained were below the FMEnv limit of 11.4 mg/m^3 for 1hr averaging time for both the wet and dry season studies.

Sulphur dioxide (SO_2): SO_2 is a colourless gas which has long been recognized as a pollutant because of its role, along with particulate matter, in forming smog. Source of SO_2 emissions include combustion of fuel. The concentrations of SO_2 recorded were generally below the detection limit of the analytical equipment except station AQ5 which recorded a value of $0.01mg/m^3$, while the concentration during the dry season range between $0.011mg/m^3$ and $0.023mg/m^3$. When comparing the seasonal variation, the dry season values were generally higher than the wet season values; however, they were both below the FMEnv limit of $0.26mg/m^3$ and the WHO limit of 0.5 mg/m^3.

Nitrogen dioxide (NO_2): Nitrogen dioxide (NO_2) belongs to a family of highly reactive gases called nitrogen oxides (NOx). These gases are formed when fuel is burned at high temperatures, and come principally from vehicle exhaust and stationary sources such as electric utilities**.** The results of air quality measurement conducted in the study area during the wet season show that the NO_2 values were generally below the detection limit of the analytical equipment except station AQ1 and AQ5 which had a value of $0.005mg/m^3$, while the dry season recorded a range of 0.011 to $0.079mg/m^3$. Both seasons were below the FMEnv threshold limit of 0.113 mg/m^3 and WHO guideline value of 0.2 mg/m^3 respectively for 1hr averaging time.

Total Suspended Particulate (TSP): The concentrations of TSP recorded in the study area during the wet season ranged from 0.024 to 0.081 mg/m^3 while the dry season ranged between 0.032 to 0.078 mg/m^3. The TSP values recorded for both seasons were below the FMEnv 1hr averaging time limit for TSP concentration (0.25 mg/m^3). This implies that the ambient air of the study area in terms of TSP could be considered to be good. No elevated concentrations of TSP were obtained in any of the locations sampled.

Carbon dioxide (CO_2): CO_2 is an asphyxiant gas and not classified as toxic or harmful in accordance with Globally Harmonized System of Classification and Labeling of Chemicals Standards of United Nations Economic Commission for Europe by using the OECD (Organization for Economic Cooperation and Development) Guidelines for the Testing of Chemicals. However, in higher concentrations 1% (18,000 mg/m^3) will make some people drowsy. Concentrations of 7% (126,000 mg/m^3) to 10% (180,000 mg/m^3) may cause suffocation, manifesting as dizziness headache, visual and hearing dysfunction and unconsciousness within a few minutes to an hour (USEPA, 2000). The concentrations of CO_2 measured in the study area ranged between 869 to 990 mg/m^3

for the wet season while the values recorded for the dry season ranged between 811 to 1001 mg/m^3

Methane (CH_4): The concentrations of the measured CH_4 were below the detection limit of the equipment for both wet and dry season.

Noise: The noise levels recorded in the Project's area for the wet season study ranged from 40.5 to 76.3 dB (A) while the dry season study ranged between 55.5 and 80.1 dB (A), these values are below the FMEnv permissible noise exposure limit of 90 dB (A). However, the predictive noise model of the wider project area as presented in Figure 4.13 reveals that vehicular activities primarily accounts for high noise levels particularly along major roads. In some cases, predicted noise values were close to the FMEnv regulatory limit of 90 dB (A). The traffic volume and type of vehicular activities associated with the project area are further discussed under traffic survey (Section 4.3.10)

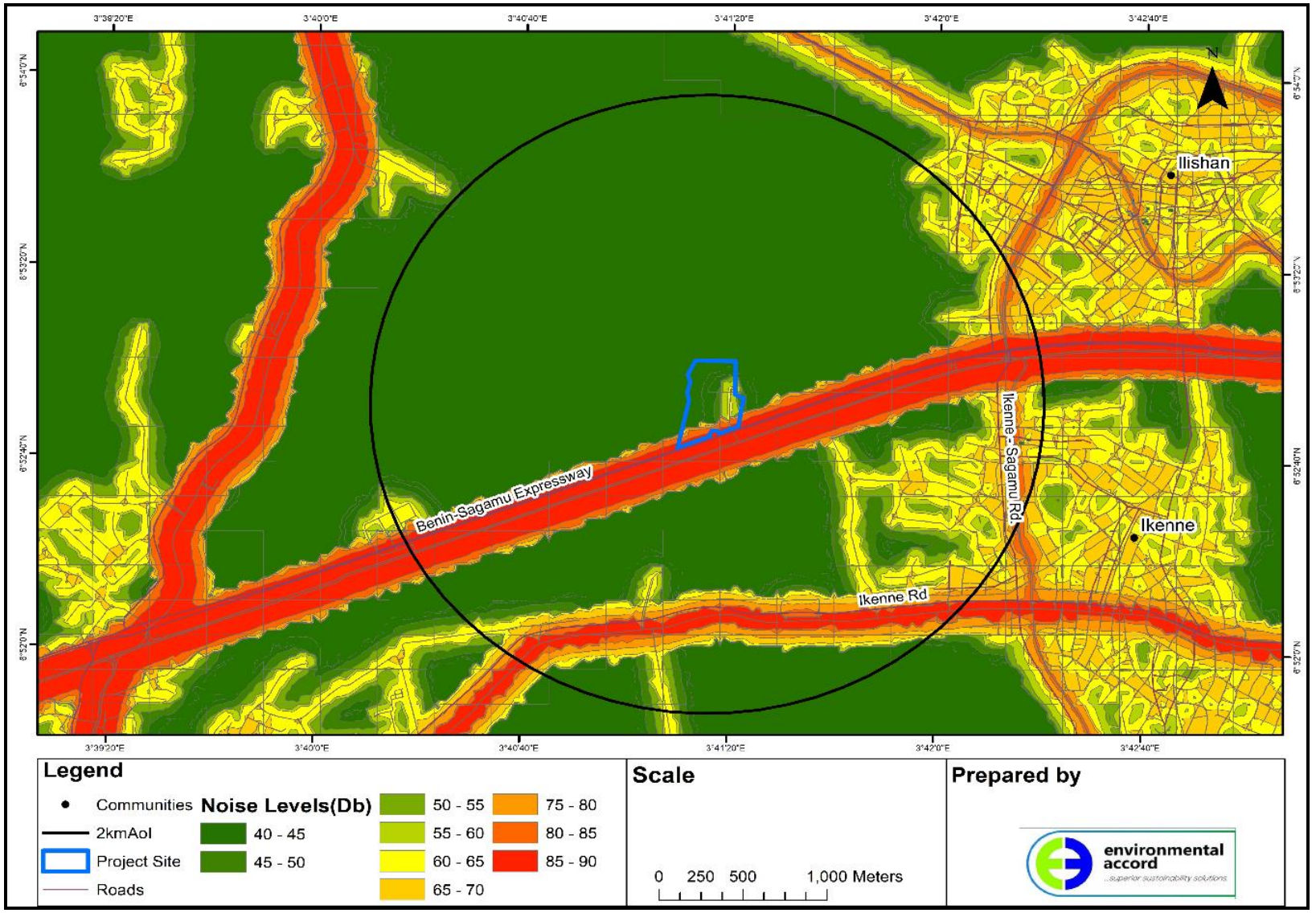

Figure 4.13: Noise profile of the project area
Source: EnvAccord Field Survey, 2020

In summary, the ambient air quality and noise levels of the study area could be said to be good based on the results of in-situ measurement conducted in the area. No elevated concentrations/levels beyond the regulatory limits were recorded for the criteria air pollutants and ambient noise levels measured in the study area.

4.3.4 Soil Quality

Soil is an important component of the ecosystem that serves as a footprint of impacts. The critical properties of soil that usually form the basis for impact evaluation include physical properties, fertility indices, and chemical and microbial composition.

4.3.4.1 Soil Sampling

A total of eleven (11) locations were sampled for soil quality studies (Table 4.9). The sampling locations map is shown in Figure 4.14.

Table 4.9: Soil Sampling Locations

Sampling Code	Latitude (N)	Longitude (E)
Project site		
SO1	6.88245	3.68896
SO2	6.88337	3.68916
SO3	6.88346	3.68781
SO4	6.88213	3.68689
AoI		
SO5	6.87984	3.68795
SO6	6.88503	3.70285
SO7	6.89545	3.70342
SO8	6.86798	3.69453
SO9	6.86723	3.68127
Buffer/Control Points		
S10	6.87369	3.67299
S11	6.87159	3.65908

Source: EnvAccord Field Survey, 2020

The physico-chemical and microbial results of soil samples from the study area are provided in Tables 4.10 (a, b,) and 4.11 (a, b).

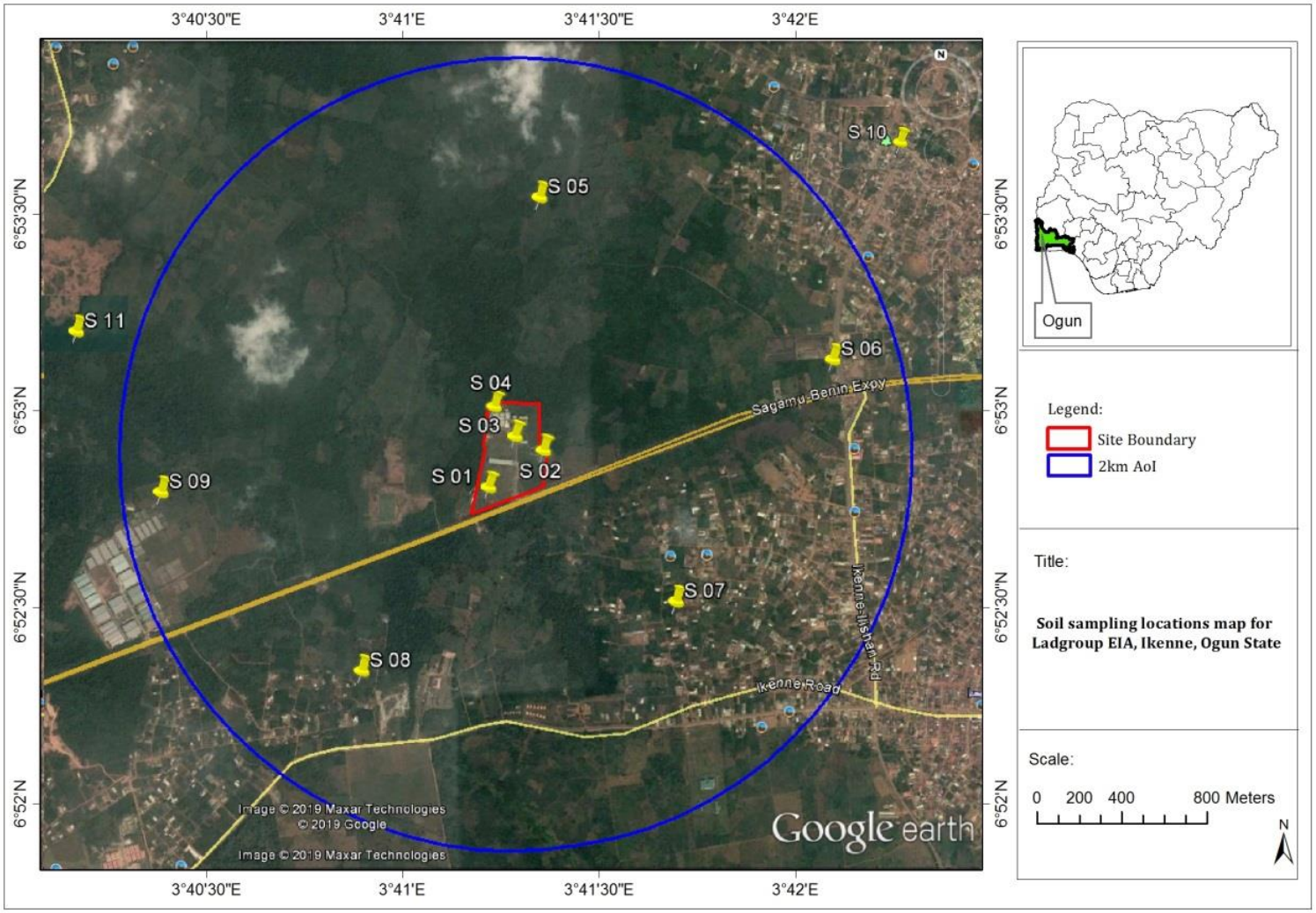

Figure 4.14: Soil Sampling Locations
Source: Google Earth 2019 and EnvAccord Field Survey, 2020

Table 4.10a: Physico-chemical and Microbial properties of top soils (0 – 15cm) from the study area (wet Season)

Sample ID	Project site				AoI					Buffer/Control		Descriptive statistics		
	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	Max	Min	Mean
pH	7.22	6.77	6.65	6.88	6.73	7.53	6.74	5.99	6.74	6.84	6.58	7.53	5.99	6.78
Moisture Content (%)	2.79	2.78	1.69	2.28	2.68	2.59	1.79	1.87	2.58	2.39	2.56	2.79	1.69	2.34
TOC %	1.91	2.33	1.94	1.77	1.92	1.88	2.11	1.63	2.36	1.97	2.18	2.36	1.63	2.00
Chloride mg/Kg	10.521	11.386	14.508	9.273	14.492	13.942	15.172	21.083	13.475	12.975	16.668	21.083	9.273	14.14
Nitrate mg/Kg	0.313	0.117	0.142	0.033	0.131	0.097	0.016	0.028	0.147	0.123	0.057	0.313	0.016	0.118
Sulphate mg/Kg	8.156	10.470	6.539	3.879	4.776	15.598	11.453	8.64	13.41	12.61	12.49	15.598	3.879	9.80
Phosphate mg/Kg	0.416	0.927	1.708	0.574	1.802	0.603	0.647	1.542	0.355	1.125	0.609	1.802	0.355	0.95
Copper mg/Kg	0.038	0.099	0.032	0.106	0.075	0.052	0.054	0.068	0.112	0.102	0.063	0.112	0.032	0.07
Lead mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Iron mg/Kg	105.7	106.2	97.6	89.7	84.6	106.4	78.7	78.8	89.7	85.2	102.3	106.4	78.7	93.1
Zinc mg/Kg	0.193	0.086	1.313	0.075	0.229	0.117	0.121	0.039	0.094	0.064	0.056	1.313	0.039	0.288
Nickel mg/Kg	BDL	BDL	BDL	BDL	0.127	0.055	0.087	0.068	0.081	0.053	0.123	0.13	0.05	0.09
Cr mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Mn mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
V mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Ba mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Hg mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Na mg/Kg	80.594	72.036	65.748	65.863	74.353	59.717	61.605	62.215	81.921	87.164	68.313	87.164	59.717	71.26
K mg/Kg	2.514	1.860	3.568	1.336	0.254	1.912	1.234	0.423	1.504	2.945	1.539	3.568	0.254	1.76
Ca mg/Kg	8.456	6.327	8.639	7.476	9.569	10.081	11.535	9.548	11.424	8.281	10.782	11.535	6.327	9.22
Mg mg/Kg	4.254	3.609	4.219	4.138	3.287	3.441	5.386	6.151	8.453	6.134	6.858	8.453	3.287	5.20
Sand %	16.62	16.20	15.28	14.61	9.23	8.70	6.74	5.20	10.52	10.30	16.60	16.62	5.20	11.68
Silt %	4.17	3.39	3.28	2.39	3.66	3.53	5.78	3.76	1.99	3.71	5.54	5.78	1.99	3.77
Clay %	79.21	80.41	81.44	83.00	87.11	87.77	87.48	91.04	87.49	85.99	77.86	91.04	77.86	84.44
Oil and Grease mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
THB cfu/ml x10^6	3.6	2.8	5.0	4.3	3.6	1.8	1.6	4.9	2.4	3.3	4.2	5	1.6	3.39

Sample ID	Project site				AoI					Buffer/Control		Descriptive statistics		
	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	Max	Min	Mean
THUB cfu/g x10^3	1.3	1.0	3.0	2.3	2.2	1.0	1.0	2.5	1.9	2.1	3.0	3	1	1.94
THF cfu/g x10^3	2.0	1.0	1.5	2.5	1.1	1.8	4.0	1.9	2.0	1.8	2.7	4	1	2.1
THUF cfu/g x10^2	1.0	2.0	3.0	2.0	2.0	1.0	2.0	3.0	1.0	1.0	1.0	3	1	1.76
Coliform x10^4	5.7	1.01	2.9	1.5	4.4	1.2	4.8	3.5	2.6	1.5	4.5	5.7	1.01	3.1

*** BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; Hg, 0.001; oil and grease, 0.001**
Source: EnvAccord Field Survey, 2020

Table 4.10b: Physico-chemical and Microbial properties of top soils (0 – 15cm) from the study area (dry Season)

Parameters	FAN S01	FAN S02	FAN S03	FAN S04	FAN S05	FAN S06	FAN S07	FAN S08	FAN S09	Mean
pH	6.17	5.42	6.98	5.32	4.98	6.95	6.95	7.21	7.03	6.33
Conductivity µS/cm	33.00	68.00	196.00	236.00	122.00	98.00	220.00	70.00	100.00	127.00
Colour	Reddish	Dark brown	Brownish	Brownish	Blackish	Brownish	Blackish	Blackish	Reddish	-
TOC %	1.42	2.67	1.45	1.74	3.21	1.67	2.80	2.34	1.27	2.06
Moisture Content %	1.22	1.76	1.17	1.30	1.06	1.44	1.06	1.80	1.67	1.39
Chloride mg/Kg	15.231	14.372	9.870	8.971	10.452	12.963	12.291	16.292	16.228	12.96
Nitrate mg/Kg	0.194	0.099	0.218	0.213	0.052	0.132	0.109	0.118	0.350	0.17
Sulphate mg/Kg	6.403	7.592	7.458	6.373	5.324	3.362	4.134	5.275	4.276	5.58
Phosphate mg/Kg	2.160	1.130	2.530	0.290	0.750	1.360	1.880	0.830	1.000	1.33
Carbonate mg/Kg	4.82	4.11	4.58	3.93	3.53	5.74	4.62	4.08	4.49	4.43
Cu mg/Kg	0.033	0.012	0.052	0.228	0.114	0.041	0.406	0.281	<0.01	0.15
Pb mg/Kg	<0.04	<0.04	<0.04	0.41	0.86	0.31	0.96	0.85	0.09	0.50
Zn mg/Kg	0.093	0.124	0.191	2.012	1.908	0.920	2.687	2.363	0.162	1.16
Cd mg/Kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Cr mg/Kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-
Ni mg/Kg	0.013	0.024	0.011	0.027	<0.05	0.025	0.139	0.235	0.044	0.06
Mn mg/Kg	0.823	1.445	5.383	1.999	1.824	2.393	2.839	2.250	1.392	2.26
Fe mg/Kg	118.02	87.31	106.50	95.70	119.14	116.68	137.86	107.28	119.27	111.97
Ca mg/Kg	3.20	1.93	2.29	2.19	2.67	2.27	1.89	3.02	2.19	2.41

Parameters	FAN S01	FAN S02	FAN S03	FAN S04	FAN S05	FAN S06	FAN S07	FAN S08	FAN S09	Mean
Mg mg/Kg	1.89	0.89	1.78	1.67	1.78	1.43	0.78	1.54	1.86	1.51
Na mg/Kg	5.37	6.47	6.03	5.22	5.28	4.27	5.27	6.27	4.28	5.38
K mg/Kg	1.07	1.52	1.18	4.07	2.78	3.37	5.13	6.57	0.68	2.93
Sand %	21.81	32.01	25.17	18.56	25.51	19.59	14.96	11.88	17.92	20.82
Silt %	19.15	13.17	14.81	14.42	5.85	7.69	78.74	67.89	7.42	25.46
Clay %	59.05	54.81	60.02	67.03	68.63	72.71	6.30	20.23	74.66	53.72
Oil and Grease	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
Total Heterotrophic Bacteria x 10^6 cfu/g	1.22	1.00	2.00	1.80	1.53	2.00	1.25	1.06	2.22	1.56
Total Heterotrophic Fungi x 10^4 cfu/g	2.00	2.20	3.00	3.50	1.00	2.00	2.00	1.00	1.50	2.02
Hydrocarbon Utilizing Bacteria x 10^2 cfu/g	1.12	1.30	2.00	0.80	1.20	2.00	1.65	1.46	0.89	1.38
Hydrocarbon Utilizing Fungi x 10^1 cfu/ml	1.20	0.50	1.00	0.80	1.40	1.00	1.14	0.98	1.25	1.03

Source: Final EIA report for the Proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility. 2019
ND: Not Detected

Table 4.11a: Physico-chemical and Microbial properties of top soils (15 – 30cm) from the study area (wet season)

Sample ID	Project site				AoI					Buffer/Control		Descriptive statistics		
	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	Max	Min	Mean
pH	6.95	6.80	7.45	6.95	6.53	7.60	7.29	6.17	6.55	7.14	6.61	7.60	6.17	6.91
Moisture Content (%)	2.95	2.86	1.80	2.89	2.74	2.08	1.94	2.84	2.79	1.96	2.78	2.95	1.80	2.49
TOC %	1.67	2.71	1.87	1.89	2.19	1.92	2.24	1.79	2.18	1.85	2.13	2.71	1.67	2.06
Chloride mg/Kg	12.970	11.611	12.976	10.521	13.721	12.094	15.654	18.392	13.178	8.043	14.449	18.392	8.043	13.08
Nitrate mg/Kg	0.143	0.165	0.097	0.073	0.114	0.061	0.123	0.023	0.177	0.166	0.023	0.177	0.023	0.10
Sulphate mg/Kg	5.481	11.449	7.517	6.246	5.464	14.416	11.804	9.47	11.36	15.87	10.60	15.874	5.464	10.07
Phosphate mg/Kg	0.759	0.896	1.421	0.517	1.009	0.464	0.549	1.346	0.415	1.048	0.611	1.421	0.415	0.83
Copper mg/Kg	0.055	0.081	0.036	0.103	0.084	0.056	0.058	0.057	0.098	0.105	0.059	0.105	0.036	0.07

Sample ID	Project site				AoI					Buffer/Control		Descriptive statistics		
	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	Max	Min	Mean
Lead mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Iron mg/Kg	102.543	104.563	90.832	85.473	83.555	101.698	80.578	74.588	97.583	87.362	99.761	104.563	74.588	91.36
Zinc mg/Kg	0.175	0.067	1.235	0.081	0.265	0.115	0.175	0.031	0.074	0.068	0.634	1.235	0.031	0.322
Nickel mg/Kg	BDL	BDL	BDL	BDL	0.086	0.083	0.045	0.088	BDL	0.045	0.105	0.11	0.05	0.08
Cr mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Mn mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
V mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Ba mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Hg mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
Na mg/Kg	76.342	74.959	64.582	64.669	62.248	53.160	58.114	55.367	88.832	83.811	72.268	88.832	53.160	68.95
K mg/Kg	2.321	2.262	2.595	1.802	0.157	2.011	1.135	0.381	1.401	1.421	1.507	2.595	0.157	1.52
Ca mg/Kg	7.159	8.362	8.954	8.024	6.767	9.187	11.684	7.322	13.357	9.573	13.374	13.374	6.767	9.53
Mg mg/Kg	5.361	2.717	6.265	4.284	5.44	6.238	7.249	9.326	6.396	5.699	4.437	9.326	2.717	5.80
Sand %	17.28	18.24	12.08	9.09	8.57	7.40	9.36	8.67	11.52	7.69	16.95	18.24	7.40	11.73
Silt %	3.86	3.14	3.67	3.71	4.47	2.92	5.68	2.55	1.68	5.21	4.84	5.68	1.68	3.78
Clay %	78.86	78.62	84.25	87.20	86.96	89.68	84.96	88.78	86.80	87.10	78.21	89.68	78.21	84.56
Oil and Grease mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	-
THB cfu/ml10^6	5.1	5.8	3.7	4.4	2.5	4.1	2.7	1.2	2.3	3.7	3.1	5.8	1.2	3.5
THUB cfu/g10^3	2.1	3.3	1.5	2.5	1.3	2.1	1.2	1.1	1.6	1.7	2.2	3.3	1.1	1.92
THF cfu/g10^3	1.6	1.4	1.7	2.0	3.0	2.3	1.9	1.6	2.3	1.9	2.1	3	1.4	2.01
THUF cfu/g10^2	2.0	4.0	2.0	3.0	2.0	1.0	3.0	1.0	1.0	1.0	1.0	4	1	2
Coliform10^4	4.3	8.0	7.0	3.2	5.7	3.2	6.0	4.2	2.2	2.6	4.9	8	2.2	4.73

BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; Hg, 0.001; oil and grease, 0.001
Source: EnvAccord Field Survey, 2020

Table 4.11b: Physico-chemical and Microbial properties of sub soils (15 – 30cm) from the study area (dry season)

Parameters	FAN S01	FAN S02	FAN S03	FAN S04	FAN S05	FAN S06	FAN S07	FAN S08	FAN S09	Mean
pH	5.98	5.79	6.36	5.69	5.09	7.13	6.98	6.89	6.31	6.25
Conductivity µS/cm	39.00	74.00	150.00	210.00	139.00	87.00	190.00	86.00	120.00	121.67
Colour	Reddish	Dark brown	Brownish	Brownish	Blackish	Brownish	Blackish	Blackish	Reddish	-
TOC %	1.66	2.89	1.82	1.44	2.89	1.88	3.01	1.94	1.07	2.07
Moisture Content %	1.58	1.65	1.68	1.47	1.29	1.83	1.56	1.98	1.89	1.66
Chloride mg/Kg	12.530	11.281	8.289	13.938	14.281	14.352	7.281	15.241	12.700	12.21
Nitrate mg/Kg	0.112	0.109	0.191	0.156	0.034	0.089	0.089	0.100	0.300	0.13
Sulphate mg/Kg	4.672	5.372	6.426	4.237	3.423	7.252	2.476	3.298	2.465	4.40
Phosphate mg/Kg	1.780	1.040	2.450	0.210	0.680	1.250	1.630	0.450	0.750	1.14
Carbonate mg/Kg	3.47	4.08	4.41	3.68	3.62	5.82	4.62	3.98	4.27	4.22
Cu mg/Kg	0.016	0.020	0.020	0.277	0.107	0.065	0.421	0.290	0.007	0.14
Pb mg/Kg	0.02	<0.04	<0.04	0.61	0.76	0.43	1.07	0.58	0.17	0.52
Zn mg/Kg	0.161	0.169	0.723	2.811	1.098	0.594	2.552	2.439	0.133	1.19
Cd mg/Kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Cr mg/Kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-
Ni mg/Kg	0.024	0.020	0.015	0.041	0.030	0.025	0.186	0.222	0.056	0.07
Mn mg/Kg	0.619	2.844	3.344	2.040	1.716	3.404	2.500	1.680	3.421	2.40
Fe mg/Kg	112.08	111.38	88.930	118.58	118.47	109.71	133.24	99.67	103.78	110.65
Ca mg/Kg	2.22	3.29	1.68	2.22	1.90	2.02	1.88	2.78	2.02	2.22
Mg mg/Kg	1.03	0.67	0.94	1.24	1.18	1.08	1.67	1.29	1.45	1.17
Na mg/Kg	5.02	4.33	5.78	4.26	5.00	4.02	4.37	5.89	3.93	4.73
K mg/Kg	1.02	0.94	1.68	3.53	2.67	5.24	5.52	6.56	1.19	3.15
Sand %	24.81	25.51	25.22	19.25	24.81	17.2	12.3	11.22	17.81	19.79
Silt %	18.48	14.09	12.51	12.02	6.18	5.94	82.76	67.03	6.74	25.08
Clay %	56.70	60.4	62.26	68.74	69.00	76.86	4.94	21.75	75.45	55.12
Oil and Grease	ND	ND	ND	ND	ND	ND	ND	ND	ND	-
Total Heterotrophic Bacteria x 10^6 cfu/g	1.38	2.15	2.30	3.00	2.78	2.56	1.40	1.78	3.50	2.32
Total Heterotrophic	2.00	2.48	3.70	4.00	2.00	3.20	2.67	1.80	2.00	2.65

Parameters	FAN S01	FAN S02	FAN S03	FAN S04	FAN S05	FAN S06	FAN S07	FAN S08	FAN S09	Mean
Fungi x 10^4 cfu/g										
Hydrocarbon Utilizing Bacteria x 10^2 cfu/g	1.00	1.15	1.30	0.80	1.20	1.00	3.65	2.25	1.38	1.53
Hydrocarbon Utilizing Fungi x 10^1 cfu/ml	1.00	1.00	1.00	1.25	1.50	1.00	1.20	1.23	1.60	1.20

Source: Final EIA report for the Proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility. 2019

ND: Not Detected

Soil Physical properties (Sand, Clay, and Silt): The soil texture is determined by the balance of clay, silt and sand particles and by the organic humus content of the soil and usually evaluated using the soil texture triangle (Figure 4.15). For practical considerations, soil texture and related soil structure influence soil workability, drainage and management. In general, the soils within the project area can be described as clay

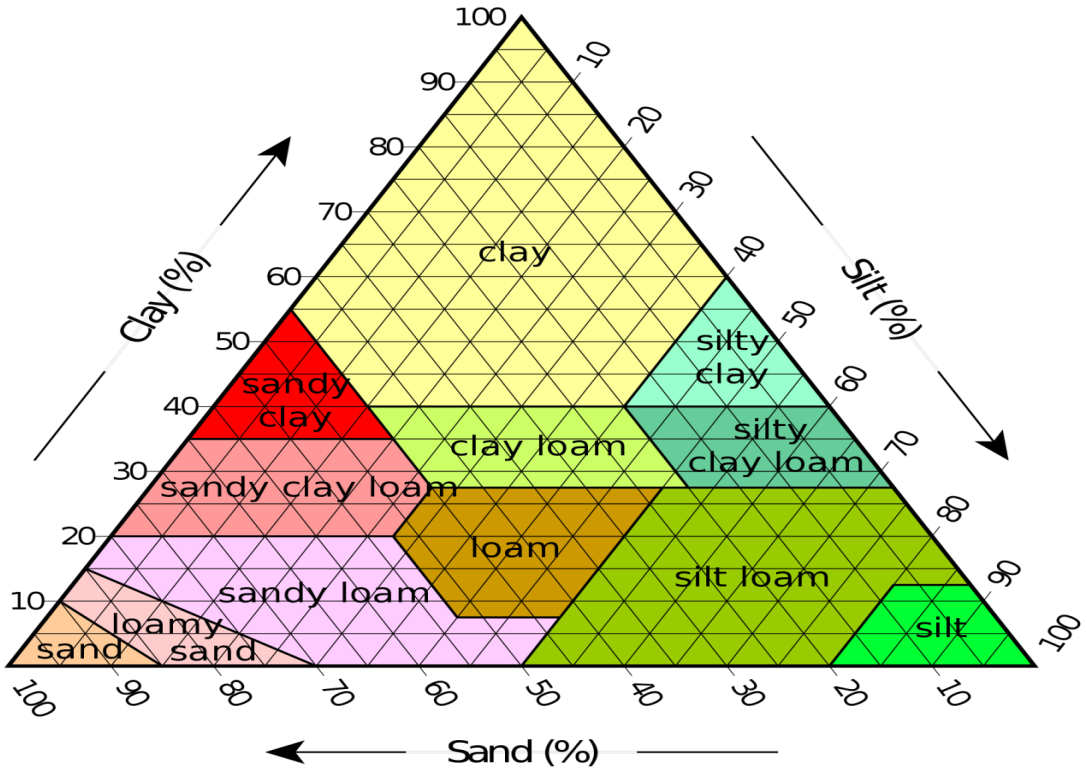

Figure 4.15: Soil texture triangle
Source: https://www.nrcs.usda.gov

Soil pH (soil reaction): Soil reaction, which is given in terms of pH values, measures the free H^+ and OH^- concentration of soil solutions. The importance of soil reaction lies in the fact that it provides a variety of useful information such extent of H^+ formation by hydrolysis of aluminum and degree of dissociation of H^+ from cation exchange sites. The pH of soil samples from the study area recorded a mean value of 6.78 and 6.91 for the top and bottom wet season samples respectively while the dry season samples recorded mean values of 6.33 and 6.25, indicating a slightly acidic soil.

Moisture Content: The amount of moisture in soil depends on many factors which include soil type, soil organisms, soil organic matter, climatic conditions etc. The wet season moisture contents of soil samples in the study area recorded a mean value of 2.34 and 2.49 for top and bottom samples, while the dry season samples recorded mean values of 1.39 and 1.66 for top and bottom soil samples

respectively, the higher values recorded during the wet season could be attributed to higher precipitation usually accociated with the wet season.

Soil Anions: Soil anions include sulphate, nitrate, chloride, carbonate and phosphate. Chloride recorded the highest concentrations among the cations in both wet and dry season samples, top soil recorded values of 14.14 and 12.96 mg/kg while sub soil recorded mean values of 13.08 and 12.21 mg/kg. The anion with the least concentration for both wet and dry season sampling was nitrate which recorded mean values of 0.118 and 0.17 mg/kg for top soil of the wet and dry season samples respectively while the sub soil recorded mean values of 0.10 and 0.13 mg/kg. Concentrations of anions measured in the soil were generally within the prescribed limits for tropical soil.

Soil Cations: The concentrations of Sodium, Calcium, Potassium and Magnesium recorded in soil samples from the Project area fall within natural occurrence levels for tropical soils as prescribed by Alloway (1991). Sodium for wet season samples recorded mean values of 71.26 and 68.95 mg/kg for top and sub soils, while dry season samples recorded mean values of 5.38 and 4.73 mg/kg for top and sub soils respectively. Potassium in the wet season samples had mean concentrations of 1.76 and 1.52 mg/kg while the dry season samples recorded mean concentrations of 2.93 and 3.15 mg/kg for top and sub soil respectively.

Heavy Metals: Heavy metals are metals having a mass number greater than 20 and a specific gravity greater than 5.0 g/cm^3. Soil naturally contains trace levels of metals. The concentration of metals in uncontaminated soil is primarily related to the geology of the parent material from which the soil was formed. Heavy metals occur naturally in the environment at low concentrations (Table 4.12) Based on the results of laboratory analysis conducted on soil samples from the Project area, no heavy metal pollution was recorded in any of the soil samples. Lead (Pb), Cadmium (Cd), Chromium (Cr), Mecury (Hg) and Vanadium(V) were generally below the equipment detection limits. Iron recorded the highest concentration of all heavy metals with mean concentrations of 93.11 and 91.36 mg/kg for wet season sample (top and sub soil respectively), while the dry season recorded concentrations of 110.65 and 111.97 mg/kg. these high concentrations could be attributed to the local geology. The concentrations of Zinc (Zn) recorded in the soil samples from the wet season samples had a mean concentration of 0.288 and 0.322 mg/kg, while the dry season samples recorded mean concentrations of 1.16 and 1.19 mg/kg (top and sub soil respectively).

Table 4.12: NESREA heavy metals limits

Parameters (mg/kg)	NESREA Limit(mg/kg)
Copper	100
Zinc	421
Cadmium	3
Lead	164
Chromium	100
Nickel	70
Mercury	4

Source: NESREA (Food, Beverage and Tobacco Sector) Regulation, 2009

Soil Microbiology: Microorganisms are one of the major components of soil. Microbial community in soil make important contributions to biogeochemical cycling and the carbon, nitrogen, sulfur, iron and manganese cycle.

The population counts of Total Heterotrophic Bacteria (THB) in the soil samples for wet season sample was 3.39 and 3.5 x 10^6 cfu/g for top and sub soil, while the dry season samples recorded populations of 1.56 2.32 x 10^6 cfu/g. Total Heterotrophic Fungi (THF) in top and sub soil samples for the wet season samples recorded mean populations of 2.01 and 2.1 10^3 cfu/g, while the dry season samples recorded mean populations of 2.02 and 2.65 x 10^4 cfu/g for top and sub soils respectively.

4.3.5 Groundwater Quality

Naturally, groundwater contains mineral ions. These ions slowly dissolve from soil particles, sediments and rocks as the water travels along mineral surfaces in the pores or fractures of the unsaturated zone and the aquifer. They are referred to as dissolved solids or suspended solids as the case may be. Some dissolved solids may have originated in the precipitation water or river water that recharges the aquifer. Dissolved solids in groundwater can be divided into three groups namely: major constituents (such as Na^+, Ca^{2+}, SO_4^{2-}, Cl^-), minor constituents (e.g. K^+, NO_3^-, CO_3^{2-} and trace elements (e.g. heavy metals).

Except for natural organic matter originating from topsoil, all of these naturally occurring dissolved solids are inorganic constituents: minerals, nutrients, and trace elements, including trace metals. In most cases, trace elements occur in such low concentrations that they are not a threat to human health. However, high concentrations of trace metals can be found in ground water near contaminated sources, posing serious health threats.

Microbial matter is also a natural constituent of ground water. Just as microbes are ubiquitous in the environment around us, they are very common in the subsurface, including groundwater (Harter 2003). Human activities can alter the

natural composition of groundwater through the disposal of chemicals and microbial matter at the land surface and into soils, or through injection of wastes directly into groundwater.

In order to assess the quality of existing ground water in the study area, groundwater samples were collected from existing boreholes in the study area and analyzed. The results of the physico-chemical and microbial characteristics of the analyzed groundwater samples were compared with the WHO standards (highest desirable level and maximum permissible limits for substances and characteristics affecting the acceptability of water for domestic use) as well as the FMEnv prescribed limits for drinking water as highlighted in the National Guidelines and Standards for Water Quality in Nigeria, 1999.

4.3.5.1 Groundwater Sampling

Groundwater samples were collected from four (4) different boreholes in the study area including the control point. Table 4.13 shows the coordinates of the groundwater sampling points while Figure 4.16 shows the sampling locations map.

Table 4.13: Groundwater sampling locations

Sampling Code	Latitude (N)	Longitude (E)
Project site		
GW 01	6.88190	3.68813
AoI		
GW 02	6.87215	3.70571
GW03	6.89389	3.70865
Buffer/Control Point		
GW 04	6.86527	3.65498

Source: EnvAccord Field Survey, 2020

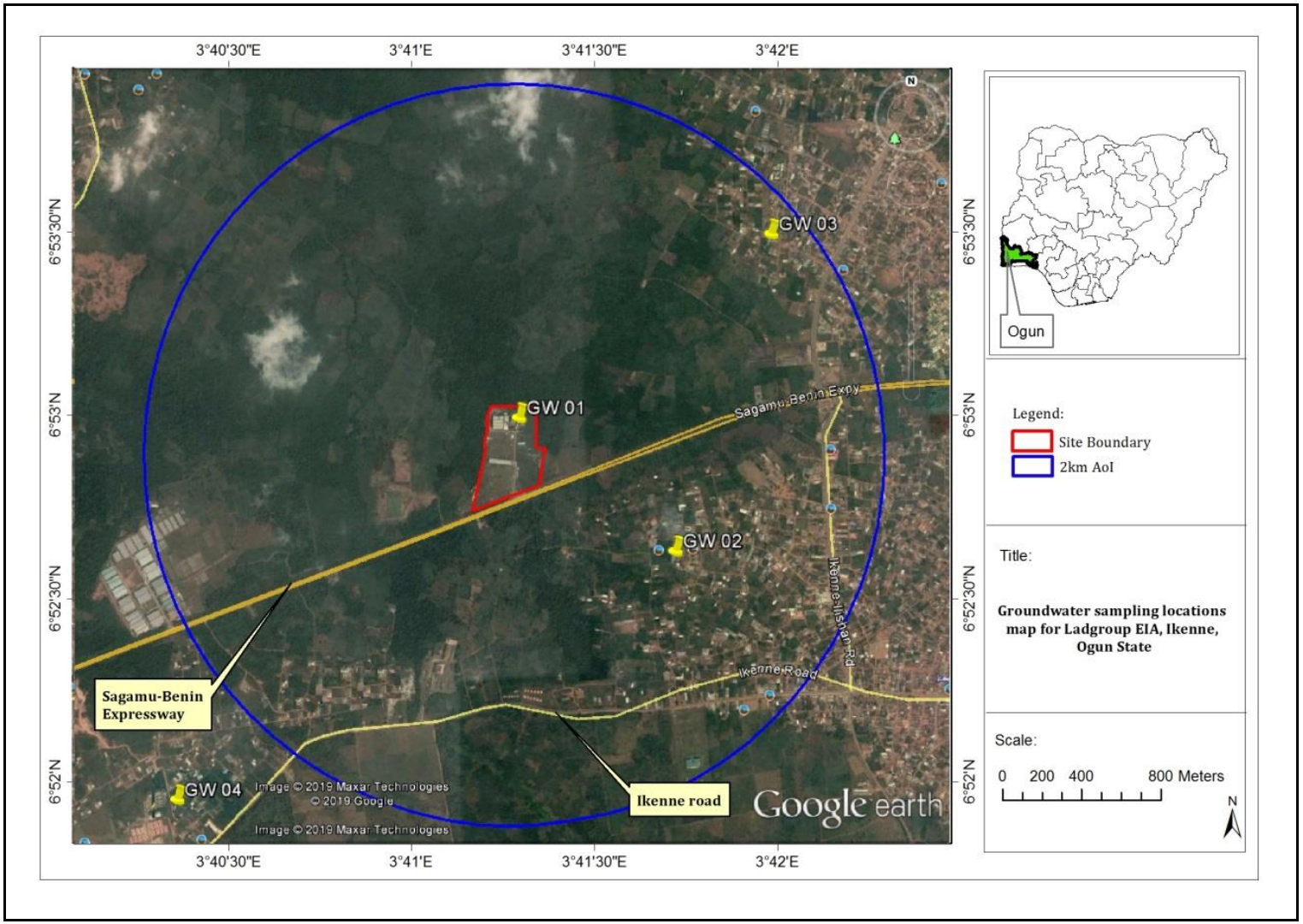

Figure 4.16: Groundwater Sampling Locations
Source: Google Earth 2019 and EnvAccord Field Survey, 2020

4.3.5.2 Physico-chemical and microbial Characteristics of Groundwater Samples

The results of physico-chemical and microbial analyses conducted on groundwater samples collected from the study area are presented in Tables 4.14a and 4.14b

Table 4.14a: Physico-chemical and microbial characteristics of groundwater samples from the study area (wet season)

Parameter /Sample ID	Project site	AoI		Buffer/Control	Descriptive statistics			Regulatory limits		
								WHO Limits		FMEnv. Limits
	GW01	GW02	GW03	GW04	Max	Min	Mean	Highest Desirable Level	Max. Permissible Level	
pH	5.22	5.39	5.81	5.43	5.81	5.22	5.48	7.0-8.5	6.5-9.2	6.5-8.5
Temperature 0C	26.90	27.30	26.30	27.00	27.30	26.30	26.85	NS	NS	<40
Odour	odourless	odourless	odourless	odourless	-	-	-	NS	NS	NS
Conductivity µS/cm	35	122	39	50	122	35	67.17	NS	1000	-
TDS mg/L	18	61	19	25	61	18	33.67	200	500	500
Appearance	Clear	Clear	Clear	Clear	-	-	-	NS	NS	NS
Total Hardness mg/L	40.80	66.00	34.00	38.00	66.00	34.00	46.47	100	500	200
Alkalinity mg/L	18	18.8	24	22	24	18	20.80	NS	NS	NS
Colour PtCo	10	10	10	10	10	10	10	NS	NS	NS
Salinity ppt	0.09	0.10	0.08	0.09	0.10	0.08	0.09	NS	NS	NS
Turbidity NTU	0.25	0.71	0.89	0.61	0.89	0.25	0.60	NS	NS	1
Dissolved Oxygen mg/L	3.80	4.20	4.00	3.60	4.20	3.60	3.90	NS	NS	7.5
BOD mg/L	0.20	0.40	0.60	0.30	0.60	0.20	0.38	NS	NS	0
COD mg/L	24.23	30.84	36.06	26.91	36.06	24.23	29.72	NS	NS	NS
Chloride mg/L	9.491	13.990	9.824	12.987	13.990	9.491	11.629	NS	NS	250
Nitrate mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	10
Sulphate mg/L	BDL	BDL	BDL	BDL	-	-	-	200	400	500
Phosphate mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	5
Carbonate mg/L	6	8	14	10	14	6	9.67	NS	NS	NS

Parameter /Sample ID	Project site	AoI		Buffer/Control	Descriptive statistics			Regulatory limits		
								WHO Limits		FMEnv. Limits
	GW01	GW02	GW03	GW04	Max	Min	Mean	Highest Desirable Level	Max. Permissible Level	
Copper mg/L	BDL	BDL	BDL	BDL	-	-	-	0.05	1.5	1
Lead mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	0.05
Iron mg/L	0.078	0.061	0.082	0.080	0.082	0.061	0.074	0.1	1.0	1.0
Zinc mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Nickel mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	<1
Cd mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	<1
Cr mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Mn mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Vandium mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Barium mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Mercury mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	NS
Na mg/L	20.422	17.611	18.316	15.784	20.422	15.784	18.057	NS	NS	NS
K mg/L	3.366	2.091	2.114	2.073	3.366	2.073	2.514	NS	NS	NS
Ca mg/L	6.942	6.193	5.135	6.023	6.942	5.135	6.062	75	200	-
Mg mg/L	3.711	2.804	6.730	3.778	6.730	2.804	4.426	30	150	-
Oil/Grease mg/L	BDL	BDL	BDL	BDL	-	-	-	NS	NS	0.05
THB cfu/ml x10^5	3.3	2.6	4.9	2.9	4.9	2.6	3.43	NS	NS	NS
THUB cfu/ml	ND	ND	ND	ND	-	-	-	NS	NS	NS
THF cfu/ml x10^3	1.97	4	ND	ND	1.49	-	-	NS	NS	NS
THUF cfu/ml	ND	ND	ND	ND	-	-	-	NS	NS	NS
Coliform	ND	ND	ND	ND	-	-	-	NS	NS	NS

BDL= Below Detection Limit. Equipment Detection Limits are as follows: Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; Mn, 0.03; Hg, 0.001; oil and grease, 0.001.
NS= Not Specified
Source: EnvAccord Field survey, 2020

Table 4.14b: Physico-chemical and Microbial characteristics of groundwater samples from the study area (dry season)

Parameter / Unit	FAN GW 01	FAN GW 02	FAN GW 03	FAN GW 04	Mean	WHO Limits		FMEnv. Limits
						Highest Desirable Level	Max. Permissible Level	
pH	4.76	5.10	5.03	4.93	4.95	7.0-8.5	6.5-9.2	6.5-8.5
Temperature ^{0}C	28.2	30.1	30.5	30.8	29.77	NS	NS	<40
Conductivity µS/cm	61.00	68.00	48.00	50.00	57.17	NS	1000	-
TDS mg/L	31.00	34.00	24.00	25.00	28.67	200	500	500
Appearance	Clear	Clear	Clear	Clear	-			
TSS mg/L	0.382	0.563	1.038	0.088	0.53	NS	NS	NS
TS mg/L	31.382	34.563	25.038	25.088	29.28	NS	NS	NS
Turbidity NTU	8.10	0.00	1.50	2.00	3.28	NS	NS	1
Dissolved Oxygen mg/L	4.20	4.60	4.80	4.50	4.52	NS	NS	7.5
BOD mg/L	1.88	2.04	1.60	1.20	1.66	NS	NS	0
COD mg/L	48.34	54.28	50.88	46.91	50.27	NS	NS	NS
Salinity ppt	0.00	0.00	0.00	0.00	0.00	NS	NS	NS
Total Hardness mg/l	62.50	57.50	60.00	72.50	63.75	100	500	200
Carbonate mg/L	4.21	6.81	6.43	4.50	5.50			
Chloride mg/L	16.490	13.180	8.980	14.975	13.18	-	-	250
Nitrate mg/L	0.000	0.000	0.000	0.000	0.00	NS	NS	10
Sulphate mg/L	5.930	3.620	1.730	7.110	4.54	200	400	500
Phosphate	0.000	0.000	0.000	0.000	0.00	NS	NS	5
Cu mg/L	<0.01	<0.01	<0.01	<0.01	-	0.05	1.5	1
Pb mg/L	<0.04	<0.04	<0.04	<0.04	-	NS	NS	0.05
Fe mg/L	0.082	0.050	0.084	0.006	0.05			
Zn mg/L	0.039	0.035	<0.005	<0.005	0.04	NS	NS	NS
Cd mg/L	<0.01	<0.01	<0.01	<0.01	-	NS	NS	NS
Cr mg/L	<0.04	<0.04	<0.04	<0.04	-	NS	NS	NS
Ni mg/L	<0.05	0.003	0.002	0.011	0.01	NS	NS	NS
Mn mg/L	0.038	0.020	<0.03	0.412	0.18	NS	NS	NS
Na mg/L	2.262	3.271	1.872	1.371	2.24	NS	NS	NS

Parameter / Unit	FAN GW 01	FAN GW 02	FAN GW 03	FAN GW 04	Mean	WHO Limits		FMEnv. Limits
						Highest Desirable Level	Max. Permissible Level	
Ca mg/L	7.271	5.782	5.271	8.372	6.72	75	200	NS
Mg mg/L	7.327	6.381	9.351	8.863	7.94	30	150	NS
K mg/l	0.557	0.469	0.268	0.335	0.41	NS	NS	NS
Oil/Grease mg/L	ND	ND	ND	ND	-	NS	NS	0.05
Total coliform	0.00	0.00	0.25	1.00	0.38	-	-	-

Source: Final EIA report for the Proposed Polyethylene Terephthalate (PET) Bottles Recycling Facility. 2019
ND: Not Detected

The results of the groundwater samples are discussed below:

- pH

The pH of water is a measure of the degree of acidity and alkalinity. The mean pH value recorded for the wet season sample was 5.48 while the dry season sample recorded a mean value of 4.9 (acidic) these values are outside the limit of 6.5 - 8.5 set by the FMEnv. These values could be attributed the local geology of the area.

- Temperature

The ambient temperature values recorded in the groundwater samples had a mean of 26.85 for wet season samples and a mean of 29.77 ^{0}C for dry season samples, both seasons comply with the FMEnv recommended limit of <40 ^{0}C for potable water.

- Electrical conductivity and TDS

Electrical conductivity (EC) is a measure of the ability of the water to pass an electrical current and it is directly proportional to TDS and salinity. The mean EC values recorded in the groundwater samples for the wet season is 67.17 µS/cm, while the dry season recorded a mean value of 57.17µS/cm which is below the maximum permissible level of 1000 µS/cm set by WHO. The mean TDS value recorded for wet season sample was 33.67 mg/l while the dry season samples recorded 28.67 mg/l, these values are below the FMEnv limit of 500 mg/L

- Heavy Metals

Heavy metals in the groundwater samples were recorded in trace concentrations and in most cases below the regulatory limits. The mean Iron (Fe) recorded for wet season samples was 0.074mg/l while 0.05 was recorded for dry season samples (below the FMEnv. limit of 1.0 mg/l) while Zinc (Zn) was below the detection limit of the analytical equipmet for the wet season study but recorded 0.04 mg/l for the dry season study. Nickel (Ni), Cadmium (Cd), Vandium(V), Barium (Ba), Chromium (Cr) and Mercury (Hg) were below the detection limit of the analytical equipment in the groundwater samples. This implies that the groundwater samples from the study area are not polluted with heavy-metal.

- Oil and Grease

The concentrations of oil & grease in the groundwater samples were below the detection limit in both wet and dry season samples (i.e. less than 0.001 mg/l).

- Microbiology

The mean population of Total Heterotrophic Bacteria (THB) recorded in the groundwater samples was 3.43 x 10^5 cfu/ml for the wet season study. The mean

population of Total Heterotrophic Fungi (THF) was 1.49 x10^3 cfu/ml for the wet season study.

4.3.6 Habitat and Terrestrial Flora

4.3.6.1 Introduction

Plants provide valuable information about site environmental conditions. The occurrence and relative abundance of certain plants and their physiological and ecological tolerance provide evidence of environmental conditions that are of importance for understanding the nature of the site, potential human health and ecological risk, and the feasibility of different restoration alternatives. Typically, plant ecology investigations include four types of studies: plant species survey; estimate of the percentage cover and age structure of dominant, perennial plant species; evaluation of the composition, relative abundance and distribution of plant association and vegetation mapping.

The study of ecosystem is crucial before a developmental project takes off because of its position as most complex ecological set up which life has achieved with a high order of dynamic organization and many unique features of morphology, life history and community interactions.

The ecological zones in Nigeria, based on Keay (1949), defined from South to North as follows: Mangrove Swamp and Coastal Vegetation, Freshwater Swamp Forest, Lowland Rain Forest, Derived Savanna, Guinea Savanna, Sudan Savanna, and Sahel Savanna. A few mountainous areas are found in the Jos Plateau, Adamawa, Taraba and Northern part of Cross-River State. The project area falls within the lowland forest area.

4.3.6.2 Sampling Methodology

Vegetation analysis of the project site and its environment was carried out by randomly establishing thirteen (13) sampling points in total. Vegetation assessment was properly carried out within the project site which covers 17 hectare and Area of influence (AoI) covering 2km radius from the center of the project site. Out of the 13 sampling points established, nine (9) sampling points (SP1-SP9) were within the project site and four (4) sampling points (AoI 1-AoI 4) were within the project AoI. The Quantitative assessment was carried out using the quadrat method with quadrat size of 10 × 10m^2 adapted from Keighery (1994). The assessment involved identification and estimation of the population of species encountered within the quadrats and geo-referenced using Garmin hand-held GPS device. Literature used for *in situ* and *ex situ* identification include Hutchinson and Dalziel (1954) and Akobundu and Agyakwa (1998) and classification into families was based on APG III (2009) and Abiodun and Yong

(2012), Gbile (1980), Burkill (2000) and Flora of West Tropical Africa (Huchinson and Dalziel, 1963: keay, 1989). In instances where on-site assessment was not possible, representative taxa were collected and pressed using appropriate equipment before taken to the Herbarium, Forestry Research Institute of Nigeria (FRIN) for further keying and identification. Group of elders and youths within the community were interviewed on the local names (Yoruba), domestic and ethno-botanical uses of the encountered taxa while other information was obtained from published reference materials and plant database. The conservation status of the encountered species was investigated using International Union for conservation of nature web-service (version 2020-2).

4.3.6.3 IUCN Categorization of Plant Species

The conservation status of each encountered species was determined using the International Union for Conservation of Nature (IUCN) Red List of Threatened Species version 2020-2. The nine IUCN categories (depicted in Figure 4.17) against which the species were assessed include; Not Evaluated **(NE)**, Data Deficient **(DD)**, Least Concern **(LC)**, Near Threatened **(NT)**, Vulnerable **(VU)**, Endangered **(EN)**, Critically Endangered **(CR)**, Extinct in the Wild **(EW)**, and Extinct **(E)**. Table 6 provides the result of the assessment of species.

Figure 4.17: Categories of IUCN Red List of Threatened Species

Source: IUCN

4.3.6.4 Result and Discussion

Floristic composition study is a vital tool used in determining the vegetation type of a geographical location. The same is applicable in assessment of plant biodiversity status of the study area. The ecological zone of the study area falls within the Tropical Rainforest characterized by high rainfall, tall evergreen trees and rich biodiversity**.** The topography of the project site is generally flat with some undulation. The vegetation on the project site and AoI looks far from being natural; it has been highly modified by human activity as there is systematic bush clearing and farming activities, leading to loss of indigenous vegetation. The most dominant plant forms were herbs they covered 57% (18 species) followed by climber, shrub and tree as it covers 12% (5 species), while grass was the least as it covers 7% (Figure 4.18).

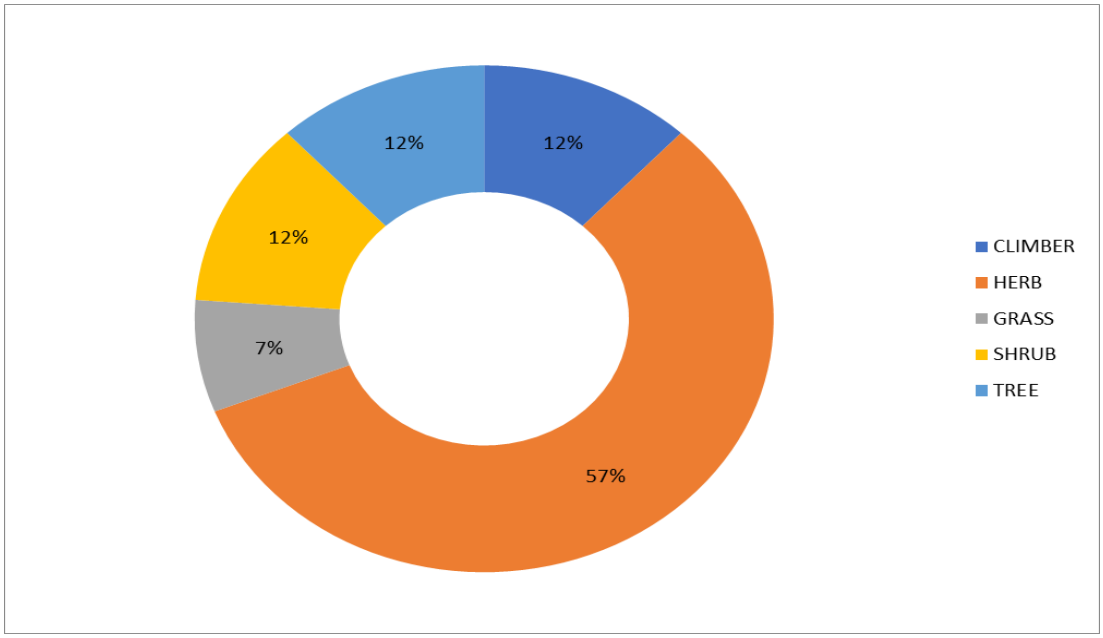

Figure 4.18: Percentage Distribution of Encountered species into different plant form.
Source: EnvAccord Field survey, 2020

A total of 42 species belonging to 28 families were encountered during the study despite agro-economic and construction activities practiced on the study area. The richest plant families were Fabaceae, Asteraceae and Malvaceae with 4 taxa each, Verbenaceae with 3 taxa while others ranged between 1-2 taxa (figure 4.19 & table 4.19).

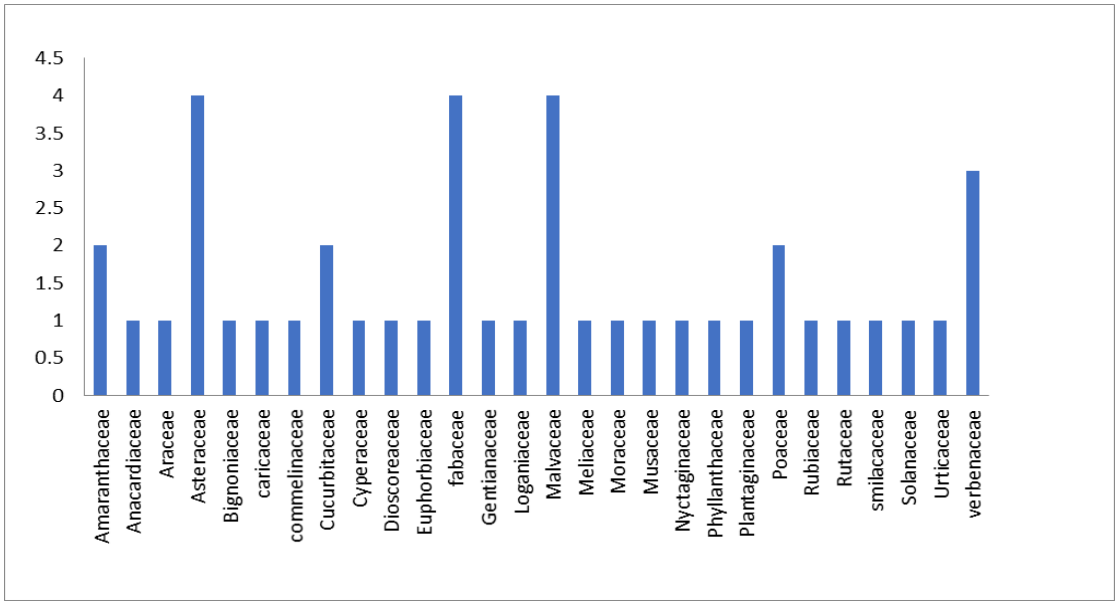

Figure 4.19: family distribution across the study areas.
Source: EnvAccord Field survey, 2020

On the project site, 32 plant species were recorded across 9 quadrats established, of which SP 9 had the highest plant diversity with 20 species

followed by SP 7, 14 species while other sampling points had less than 14 species (Table 4.15). Comparatively, AoI had the highest species diversity with 35 taxa while project site had a total of 29 taxa (Table 4.19) due to loss of some species to anthropogenic factors. Thus, the species diversity on the project site and AoI slightly varied. Dominant species on the project site includes *Andropogon tectorum* (Eruwa dudu) {occurrence value = 9, frequency = 22%, relative density = 18.98% and abundance value = 198}, followed by *Tridax procumbens* (Adegbile) {occurrence value =9, frequency = 9.4%, relative density = 8.14% and abundance value = 85} and *Spermacoce verticillata* (Irawo ile) {occurrence value = 8, frequency = 9.1%, relative density = 6.9% and abundance value = 73} among others. While the dominant species on AoI includes *Ageratum conyzoiodes* {occurrence value = 4, frequency = 16%, relative density = 7.36% and abundance value = 64}, *Chromoleana odorata,* {occurrence value = 4, frequency = 20%, relative density = 9.2% and abundance value = 80}, *Euphorbia heterophylla,* {occurrence value = 4, frequency = 9.2%, relative density = 4.25% and abundance value = 37} and *Waltheria indica* {occurrence value = 4, frequency = 12.7%, relative density = 5.86% and abundance value = 51} (table 4.17 &4.18). All taxa encountered are of great economic importance as they serve different purposes which includes; medicine, food, fodder, ornament and socio-cultural purposes. About 98% of the taxa on the study areas were medicinal *Clerodendrum volubile* (Marugbo), *Lagenaria breviflora* (Tagiiri) and *Phyllanthus amarus* (Eyin olobe), edible fruits includes; *Mangifera indica* (Mangoro) and *Citrus aurantium* (Osan), fodder; *Ageratum conyzoiodes* (Imi-esu), *Aspilia Africana* (Ako-yunyun) and *Euphorbia heterophylla* (Egele), ornamental plant; *Caladium bicolor* and socio-cultural ; *Luffa cylindrical* (Kankan oyinbo) and *Newbouldia laevis* (Akoko). Major tree species identified includes; *Mangifera indica* (Mangoro), *Citrus aurantium* (osan) and *Carica papaya* (ibepe). On the study area, taxa encountered were of no conservation significant according to IUCN red list (Table 4.20) while details of the local names and economic uses of the encountered species are shown in table 4.21. The proposed project would no doubt lead to loss of plant species and diversity. However, flora assessment conducted shows that representative taxa on the project site were present and abundant on the AoI.

4.3.6.5 Biodiversity Profile of the Study Area

Biodiversity is 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. In line with the requirements of the IFC Performance Standards 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), this section provides vegetation profile on flora composition, plant diversity and inventory of economic plants of the ecological units (sampling points-SP) for the project site and AoI.

Table 4.15: Vegetation Analysis of the Ecological Units of the Project Site.

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
1	N6.88218^0 E003.68917^0	*Chromolaena odorata*	Herb	Asteraceae	Ewe akintola	15
		Newbouldia laevis	shrub	Bignonaceae	Ewe akoko	1
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	12
		Amaranthus spiosus	Herb	Amaranthaceae	Tete-elegun/dagunro	3
		Luffa cylindrical	Climber	Cucurbitaceae	Kankan oyinbo	2
		Dioscorea alata	Climber	Dioscoreaceae	Ise-ewura	1
		Tridax procumbens	Herb	Asteraceae	Adegbile	11
		Mimosa pigra	Herb	Fabaceae	Patanmo	10
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	24
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	3
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	7
		Sida acuta	Herb	Malvaceae	Osepotu	5
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	2
2	N6.88223^0 E003.68924^0	*Tridax procumbens*	Herb	Asteraceae	Adegbile	6
		Mimosa pigra	Herb	Fabaceae	Patanmo	10
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	17
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	9
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	5
		Sida acuta	Herb	Malvaceae	Osepotu	7
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	6
		Aspilia Africana	Herb	Asteraceae	Ako-yunyun	3
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	11
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	7
		Amaranthus spiosus	Herb	Amaranthaceae	Tete-elegun/dagunro	4
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	10
3	N6.88222^0 E003.68945^0	*Mariscus alternifolia*	Grass	Cyperaceae	Alubosa eranko	18
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	11
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	6
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	9

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
		Sida acuta	Herb	Malvaceae	Osepotu	6
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	3
		Amaranthus spiosus	Herb	Amaranthaceae	Tete-elegun/Dagunro	2
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	13
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	22
		Commelina diffusa	Climber	commelinaceae	Godogbo	11
		Tridax procumbens	Herb	Asteraceae	Adegbile	8
		Mimosa pigra	Herb	Fabaceae	Patanmo	11
		Physalis angulata	Herb	Solanaceae	Koropo	5
4	N6.88282^0	*Luffa cylindrical*	Climber	Cucurbitaceae	Kankan	2
	E003.68939^0	*Dioscorea alata*	Climber	Dioscoreaceae	Isu-ewura	1
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	13
		Mimosa pigra	Herb	Fabaceae	Patanmo	2
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	24
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	5
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	10
		Sida acuta	Herb	Malvaceae	Osepotu	18
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	4
		Lantana camara	Herb	Verbenaceae	Ewon-adele	5
		Eleusine indica	Grass	Poaceae	Ese-kanna	8
5	N6.88291^0	*Tridax procumbens*	Herb	Asteraceae	Adegbile	7
	E003.68896^0	*Mimosa pigra*	Herb	Fabaceae	Patanmo	5
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	26
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	10
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	13
		Lantana camara	Herb	Verbenaceae	Ewon-adele	4
		Sida acuta	Herb	Malvaceae	Osepotu	10
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	1
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	13
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	9

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
6	N6.88340^0 E003.68911^0	*Spermacoce verticillata*	Herb	Rubiaceae	Irawo-ile	11
		Sida acuta	Herb	Malvaceae	Osepotu	10
		Eleusine indica	Grass	Poaceae	Ese-kanna	9
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	12
		Tridax procumbens	Herb	Asteraceae	Adegbile	8
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	23
		Smilax anceps	Herb	Smilacaceae	Ekanamagbo	2
		Physalis angulata	Herb	Solanaceae	Koropo	4
		Scoparia dulcis	Herb	Plantaginaceae	Aya	3
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	8
		Spigelia anthelmia	Herb	Loganiaceae	Ewe eran	8
		Urena lobata	Herb	Malvaceae	Ake iri	9
7	N6.88340^0 E003.68924^0	*Calopogonium mucoloides*	Climber	Fabaceae	-	8
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	6
		Smilax anceps	Herb	Smilacaceae	Ekanamagbo	4
		Gompherena celosoides	Herb	Amaranthaceae	-	9
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	19
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	10
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	9
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	7
		Laportea aestuans	Herb	Urticaceae	-	7
		Crotalaria retusa	Herb	Fabaceae	-	2
		Eleusine indica	Grass	Poaceae	Ese-kanna	11
		Commelina diffusa	Herb	Commelinaceae	Godogbo	10
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	4
		Tridax procumbens	Herb	Asteraceae	Adegbile	10
8	N6.88246^0 E003.68936^0	*Urena lobata*	Herb	Malvaceae	Ake iri	8
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	10
		Eleusine indica	Grass	Poaceae	Ese-kanna	12
		Newbouldia laevis	Shrub	Bignoniaceae	Akoko	2
		Commelina diffusa	Herb	Commelinaceae	Godogbo	12

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
		Spigelia anthelmia	Herb	Loganiaceae	Ewe eran	15
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	10
		Tridax procumbens	Herb	Asteraceae	Adegbile	10
		Boerhavia diffusa	Herb	Nyctaginaceae	Ewe-etiponola	9
		Gompherena celosoides	Herb	Amaranthaceae	-	13
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	20
		Physalis angulata	Herb	Solanaceae	Koropo	4
9	N6.88329^0 E003.68937^0	*Tridax procumbens*	Herb	Asteraceae	Adegbile	12
		Boerhavia diffusa	Herb	Nyctaginaceae	Ewe-etiponola	9
		Gompherena celosoides	Herb	Amaranthaceae	-	18
		Mariscus alternifolia	Grass	Cyperaceae	Alubosa eranko	7
		Eleusine indica	Grass	Poaceae	Ese-kanna	11
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	23
		Smilax anceps	Herb	Smilacaceae	Ekanamagbo	3
		Physalis angulata	Herb	Solanaceae	Koropo	3
		Scoparia dulcis	Herb	Plantaginaceae	Aya	4
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	10
		Spigelia anthelmia	Herb	Loganiaceae	Ewe eran	6
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	8
		Spermacoce verticillata	Herb	Rubiaceae	Irawo ile	11
		Sida acuta	Herb	Malvaceae	Osepotu	17
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	5
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	10
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	12
		Laportea aestuans	Herb	Urticaceae	-	5
		Urena lobata	Herb	Malvaceae	Ake iri	5
		Laganaria breviflora	Shrub	Cucurbitaceae	Tagiri	3

SP-Sampling Points, **F**-Frequency, **Y**-Yoruba

Table 4.16: Vegetation Analysis of the Ecological Units of the Area of Influence.

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
1	N6.87944^0 E003.68910^0	*Waltheria indica*	Herb	Malvaceace	Korikodi	20
		Tridax procumbens	Herb	Asteraceae	Adegbile	13
		Boerhavia diffusa	Herb	Nyctaginaceae	Ewe-etiponola	11
		Mariscus alternifolius	Grass	Cyperaceae	Alubosa eranko	14
		Eleusine indica	Grass	Poaceae	Ese-kanna	15
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	23
		Smilax kraussiana	Herb	smilacaceae	Ekanamagbo	7
		Senna occidentalis	Shrub	Fabaceae	Abo rere	9
		Physalis angulata	Herb	Solanaceae	Koropo	10
		Scoparia dulcis	Herb	Plantaginaceae	Aya	10
		Stachytarpheta indica	Herb	Verbanaceae	Ogan akuko	13
		Spigelia anthelmia	Herb	Loganiaceae	Ewe eran	14
		Phyllathus amarus	Herb	Euphorbiaceae	Eyin-olobe	10
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	18
		Sida acuta	Herb	Malvaceae	Osepotu	20
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	11
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	14
		Calopogonium mucunoides	Climber	Fabaceae	-	12
		Mimosa pigra	Herb	Fabaceae	Patanmo	11
		Clerodendrum volubile	Shrub	Verbenaceae	Marugbo	20
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	16
2	N6.87969^0 E003.68984^0	*Spigelia anthelmia*	Herb	Loganiaceae	Ewe eran	12
		Azadirachta indica	Shrub	Meliaceae	Dogoyaro	2
		Tridax procumbens	Herb	Asteraceae	Adegbile	16
		Ficus sp.	Tree	Moraceae	-	2
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	14
		Spermacoce verticillata	Herb	Rubiaceae	Irawo-ile	10
		Sida acuta	Herb	Malvaceae	Osepotu	22
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	7
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	20
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	21

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
		Urena lobata	Herb	Malvaceae	Ake iri	11
		Walteria indica	Shrub	Malvaceae	Korikodi	9
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	15
		Abelmoschus esculentus	Herb	Malvaceae	Ila	11
		Andropogon tectorum	Grass	Poaceae	Eruwa dudu	24
		Physalis angulata	Herb	Solanaceae	Koropo	12
3	N6.88146^0 E003.69213^0	*Calopogonium mucunoides*	Climber	Fabaceae	-	9
		Clerodendrum volubile	Shrub	Verbenaceae	Marugbo	15
		Citrus aurantium	Tree	Rutaceae	Sweet orange	2
		Carica papaya	Tree	Caricaceae	Ibepe	3
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	12
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	21
		Urena lobata	Herb	Malvaceae	Ake iri	15
		Walteria indica	Shrub	Malvaceae	Korikodi	10
		Stachytarpheta indica	Herb	Verbenaceae	Ogan akuko	19
		Senna occidentalis	Herb	Fabaceae	Abo rere	5
		Aspilia Africana	Herb	Asteraceae	Ako-yunyun	6
		Sida acuta	Shrub	Malvaceae	Esokute	10
		Mariscus alternifolius	Grass	Cyperaceae	Alubosa eranko	12
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	8
		Laportea aestuans	Herb	Urticaceae	-	8
		Caladium bicolor	Herb	Areaceae	-	9
4	N6.88166^0 E003.69272^0	*Calopogonium mucunoides*	Climber	Fabaceae	-	12
		Clerodendrum volubile	Shrub	Verbenaceae	Marugbo	17
		Citrus aurantium	Tree	Rutaceae	Sweet orange	1
		Carica papaya	Tree	Caricaceae	Ibepe	2
		Anthocleista dijaloensis	Tree	Gentianaceae	Sapo	1
		Ficus sp.	Tree	Moraceae	-	3
		Musa sapientium	Shrub	Musaceae	Ogede	6
		Senna occidentalis	Herb	Fabaceae	Abo rere	3
		Mangifera indica	Tree	Anacardiaceae	Mangoro	3

SP	COORDINATE	ENCOUNTERED SPECIES	HABIT	FAMILY	LOCAL NAME(Y)	F
		Spigelia anthelmia	Herb	Loganiaceae	Ewe eran	12
		Tridax procumbens	Herb	Asteraceae	Adegbile	20
		Phyllanthus amarus	Herb	Euphorbiaceae	Eyin-olobe	14
		Spermacoce verticillata	Herb	Rubiaceae	Irawo ile	10
		Sida acuta	Herb	Malvaceae	Osepotu	20
		Euphorbia heterophylla	Herb	Euphorbiaceae	Egele	11
		Ageratum conyzoiodes	Herb	Asteraceae	Imi-esu	18
		Chromolaena odorata	Herb	Asteraceae	Ewe akintola	22
		Urena lobata	Herb	Malvaceae	Ake iri	13
		Walteria indica	Shrub	Malvaceae	Korikodi	12
		Laganaria breviflora	Climber	Cucurbitaceae	Tagiiri	2
SP-Sampling Points, **F-**Frequency, **Y-**Yoruba						

Table 4.17: Statistical distribution of encountered plant species on the Project Site.

S/N	ENCOUNTERED SPECIES	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	NOS	F (%)	R.F(%)	D(m^3)	R.D(%)	A
1	*Ageratum conyzoiodes*	12	10	13	_	_	_	6	_	10	5	10.2	4.760	0.51	4.889	51
2	Amarathus spinosus	3	4	2	_	_	_	_	_	_	3	3	1.400	0.09	0.862	9
3	*Andropogon tectorum*	24	17	22	24	26	23	19	20	23	9	22	10.267	1.98	18.983	198
4	*Aspilia africana*	_	3	_	_	_	_	_	_	_	1	3	1.400	0.03	0.287	3
5	*Boerhavia diffusa*	_	_	_	_	_	_	_	9	9	2	9	4.200	0.18	1.725	18
6	*Calopogonium muconoides*	_	_	_	_	_	_	8	_	_	1	8	3.733	0.08	0.7670	8
7	*Chromolaena odorata*	15	7	11	_	9	_	9	_	12	6	10.5	4.900	0.63	6.040	63
8	*Commelina diffusa*	_	_	11	_	_	_	10	12	_	3	11	5.133	0.33	3.163	33
9	*Crotalaria retusa*	_	_	_	_	_	_	2	_	_	1	2	0.933	0.02	0.191	2
10	*Dioscorea alata*	1	_	_	1	_	_	_	_	_	2	1	0.466	0.02	0.191	2
11	*Eleusine indica*	_	_	_	8	_	9	11	12	11	5	10.2	4.760	0.51	4.889	51
12	*Euphorbia heterophylla*	2	6	3	4	1	_	_	_	5	6	3.5	1.633	0.21	2.013	21
13	*Gomphrena celosoides*	_	_	_	_	_	_	9	13	18	3	13.33	6.222	0.4	3.835	40
14	*Laganaria breviflora*	_	_	_	_	_	_	_	_	3	1	3	1.400	0.03	0.287	3
15	*Lantana camara*	_	_	_	5	4	_	_	_	_	2	4.5	2.100	0.09	0.862	9
16	*Laportea aestuans*	_	_	_	_	_	_	7	_	5	2	6	2.800	0.12	1.150	12
17	*Luffa cylindrical*	2	_	_	2	_	_	_	_	_	2	2	0.933	0.04	0.383	4
18	*Mariscus alternifolius*	_	11	18	_	13	12	10	10	7	7	11.57	5.400	0.81	7.766	81

S/N	ENCOUNTERED SPECIES	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	NOS	F (%)	R.F(%)	D(m³)	R.D(%)	A
19	*Mimosa pigra*	10	10	11	2	5	_	_	_	_	5	7.6	3.547	0.38	3.643	38
20	*Newbouldia laevis*	1	_	_	_	_	_	_	2	_	2	1.5	0.700	0.03	0.287	3
21	*Phyllanthus amarus*	3	9	6	5	10	_	7	_	8	7	6.857	3.200	0.48	4.602	48
22	*Physalis angulata*	_	_	5	_	_	4	_	4	3	4	4	1.866	0.16	1.534	16
23	*Scoparia dulcis*	_	_	_	_	_	3	_	_	4	2	3.5	1.633	0.07	0.6711	7
24	*Sida acuta*	5	7	6	18	10	10	_	_	17	7	10.42	4.867	0.73	6.999	73
25	*Smilax anceps*	_	_	_	_	_	2	4	_	3	3	3	1.400	0.09	0.862	9
26	*Spermacoce verticillata*	7	5	9	10	13	11	7	_	11	8	9.125	4.258	0.73	6.999	73
27	*Spigelia anthemia*	_	_	_	_	_	8	_	15	6	3	9.66	4.511	0.29	2.780	29
28	*Stachytarpheta indica*	_	_	_	_	_	8	4	10	10	4	8	3.733	0.32	3.068	32
29	*Tridax procumbens*	11	6	8	13	7	8	10	10	12	9	9.44	4.407	0.85	8.149	85
30	*Urena lobata*	_	_	_	_	_	9	_	8	5	3	7.33	3.422	0.22	2.109	22
SP: Sampling Points, **NOS-**Number of occurrences, **F-**frequency, **RF-**Relative frequency, **D-**Density, **RD-**Relative density, A- Abundance																

Table 4.18: Statistical distribution of encountered plant species on the Area of Influence.

S/N	ENCOUNTERED SPECIES	SP1	SP2	SP3	SP4	NOS	F(%)	R.F(%)	D(m³)	R.D(%)	A
1	*Abelmoschus esculentus*	_	11	_	_	1	11	3.151	0.11	1.265	11
2	*Ageratum conyzoiodes*	14	20	12	18	4	16	4.584	0.64	7.364	64
3	*Andropogon tectorum*	23	24	_	_	2	23.5	6.733	0.47	5.408	47
4	*Anthocleista dijaloensis*	_	_	_	1	1	1	0.286	0.01	0.115	1
5	*Aspilia africana*	_	_	6	_	1	6	1.719	0.06	0.690	6
6	*Azadirachta indica*	_	2	_	_	1	2	0.573	0.02	0.230	2
7	*Boerhavia diffusa*	11	_	_	_	1	11	3.151	0.11	1.265	11
8	*Caladium bicolor*	_	_	9	_	1	9	2.578	0.09	1.035	9
9	*Calopogonium mucunoides*	12	_	9	12	3	11	3.151	0.33	3.797	33
10	*Carica papaya*	_	_	3	2	2	2.5	0.716	0.05	0.575	5
11	*Chromoleana odorata*	16	21	21	22	4	20	5.730	0.8	9.205	80
12	*Citrus sp.*	_	_	2	1	2	1.5	0.429	0.03	0.345	3
13	*Clerodendrum volubile*	20	_	15	17	3	17.33	4.966	0.52	5.983	52
14	*Eleusine indica*	15	_	_	_	1	15	4.297	0.15	1.726	15
15	*Euphorbia heterophylla*	11	7	8	11	4	9.25	2.650	0.37	4.257	37
16	*Ficus sp.*	_	2	_	3	2	2.5	0.716	0.05	0.575	5
17	*Laganaria breviflora*	_	_	_	2	1	2	0.573	0.02	0.230	2

S/N	ENCOUNTERED SPECIES	SP1	SP2	SP3	SP4	NOS	F(%)	R.F(%)	D(m^3)	R.D(%)	A
18	*Laportea aestuans*	_	_	8	_	1	8	2.292	0.08	0.920	8
19	*Mangifera indica*	_	_	_	3	1	3	0.859	0.03	0.345	3
20	*Mariscus alternifolius*	14	_	12	_	2	13	3.724	0.26	2.991	26
21	*Mimosa pigra*	11	_	_	_	1	11	3.151	0.11	1.265	11
22	*Musa sapientium*	_	_	_	6	1	6	1.719	0.06	0.690	6
23	*Phyllathus amarus*	10	14	_	14	3	12.66	3.629	0.38	4.372	38
24	*Physalis angulata*	10	12	_	_	2	11	3.151	0.22	2.531	22
25	*Scoparia dulcis*	10	_	_	_	1	10	2.865	0.1	1.150	10
26	*Senna occidentalis*	9	_	5	3	3	5.66	1.623	0.17	1.956	17
27	*Sida acuta*	20	22	10	20	4	18	5.157	0.72	8.285	72
28	*Smilax kraussiana*	7	_	_	_	1	7	2.005	0.07	0.805	7
29	*Spermacoce verticillata*	18	10	_	10	3	12.66	3.629	0.38	4.372	38
30	*Spigelia anthelmia*	14	12	_	12	3	12.66	3.629	0.38	4.372	38
31	*Stachytarpheta indica*	13	15	19	_	3	15.66	4.489	0.47	5.408	47
32	*Tridax procumbens*	13	16	_	20	3	16.33	4.680	0.49	5.638	49
33	*Urena lobata*	_	11	15	13	3	13	3.724	0.39	4.487	39
34	*Waltheria indica*	20	9	10	12	4	12.75	3.653	0.51	5.868	51
SP: Sampling Points, **NOS-**Number of occurrences, **F-**frequency, **RF-**Relative frequency, **D-**Density, **RD-**Relative density, **A-** Abundance											

Table 4.19: Comparison of Flora Diversity between Project site and AoI

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	Project site	AOI
1	*Abelmoschus esculentus* (L.) Moech.	Malvaceae	Herb	Okro	Ila		√
2	*Ageratum conyzoiodes* L.	Asteraceae	Herb	Billy goat weed	Imi-esu	√	√
3	*Amaranthus spinosus L.*	Amaranthaceae	Herb	Spiny amaranth	Tete-elegun	√	
4	*Andropogon tectorum* Schumach. & Thonn.	Poaceae	Grass	Horse grass	Eruwa dudu	√	√
5	*Anthocleista dijaloensis* A. Chev.	Gentianaceae	Tree	Cabbage	Sapo		√
6	*Aspilia africana* (Pers.) C.D. Adams	Asteraceae	Herb	Haemorrhage plant	Ako-yunyun	√	√
7	*Azadirachta indica* A. Juss.	Meliaceae	Shrub	Neem	Dogoyaro		√
8	*Boerhavia diffusa L.*	Nyctaginaceae	Herb	Hogweed	Ewe-etiponola	√	√
9	*Caladium bicolor* (Aito) Vent.	Araceae	Herb	Heart of Jesus	_		√
10	*Calopogonium mucunoides* Desv.	fabaceae	Climbers	Calopo	_	√	√

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	Project site	AOI
11	*Carica papaya L.*	caricaceae	Tree	Pawpaw	Ibepe		√
12	*Chromolaena odorata* (L.) R.M. King & H. Rob	Asteraceae	Herb	Siam weed	Ewe-akintola	√	√
13	*Citrus aurantium* L.	Rutaceae	Tree	Sweet orange	Osan		√
14	*Clerodendrum volubile* P. Beauv.	verbenaceae	Shrub	White butterfly	Marugbo		√
15	*Commelina diffusa* Burm.f.	commelinaceae	Herb	Climbing dayflower	Godogbo	√	
16	*Crotalaria retusa* L.	Fabaceae	Herb	Devil beans	_	√	
17	*Dioscorea alata* L.	Dioscoreaceae	Climber	Water yam	Isu-ewura	√	
18	*Eleusine indica* (L.) Gaertn.	Poaceae	Grass	Indian goose grass	Ese-kanna	√	√
19	*Euphorbia heterophylla* L.	Euphorbiaceae	Herb	Annual poinsettia	Egele	√	√
20	*Ficus sp.*	Moraceae	Tree	-	-		√
21	*Gomphrena celosoides* Mart.	Amaranthaceae	Herb	Bachelor's button	_	√	
22	*Lagenaria breviflora* (Benth.) Roberty	Cucurbitaceae	Climber	Wild colocynth	Tagiiri	√	√
23	*Lantana camara* L.	verbenaceae	Herb	Common lantana	Ewon-adele	√	
24	*Laportea aestuans* (L.) Chew	Urticaceae	Herb	West Indian woodnettle	_		√
25	*Luffa cylindrical* (Linn.) M.J. Roem.	Cucurbitaceae	Climber	Loofah gourd	Kankan oyinbo	√	
26	*Mangifera indica* L.	Anacardiaceae	Tree	Mango	Mangoro		√
27	*Mariscus alternifolius* Vahl.	Cyperaceae	Grass	Mariscus	Alubosa eranko	√	√
28	*Mimosa pigra* L.	Fabaceae	Herb	Sensitive plant	Patanmo	√	√
29	*Musa sapientium* L.	Musaceae	Shrub	French plantain	Ogede		√
30	*Newbouldia laevis* (P. Beauv.) Seem.	Bignoniaceae	Shrub	Boundary tree	Akoko	√	√
31	*Phyllanthus amarus* schumach. & Thonn	Phyllanthaceae	Herb	Carry me seed	Eyin olobe	√	√
32	*Physalis angulata* L.	Solanaceae	Herb	Angular winter-cherry	Koropo	√	√
33	*Scoparia dulcis* L.	Plantaginaceae	Herb	Licorice weed	Aya	√	√
34	*Senna occidentalis* (L.) Link	Fabaceae	Herb	Coffee senna	Abo rere		√
35	*Sida acuta* Burm. F.	Malvaceae	Shrub	Wire weed	Esoketu	√	√
36	*Smilax anceps* Willd.	smilacaceae	Climber	Smilax	Ekanamagbo	√	√
37	*Spermacoce verticillata* L.	Rubiaceae	Herb	Shrubby false buttonweed	Irawo ile	√	√
38	*Spigelia anthelmia* L.	Loganiaceae	Herb	Worm grain	Ewe eran	√	√
39	*Stachytarpheta indica* (L.) Vahl	Verbenaceae	Herb	_	Ogan akuko	√	√
40	*Tridax procumbens* L.	Asteraceae	Herb	Coatbuttons	Adegbile	√	√
41	*Urena lobata* L.	Malvaceae	Herb	Caesarweed	Ake iri	√	√
42	*Waltheria indica* L.	Malvaceae	Herb	Uhaloa	Korikodi		√
Total Number of Plant Species						**29**	**35**

Table 4.20: IUCN Categorization of encountered species on project site and area of influence.

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	IUCN Categories*								
						NE	DD	LC	NT	VU	EN	CR	EW	EX
1	*Abelmoschus esculentus* (L.) Moech.	Malvaceae	Herb	Okro	Ila	*								
2	*Ageratum conyzoiodes* L.	Asteraceae	Herb	Billy goat weed	Imi-esu			*						
3	*Amaranthus spinosus L.*	Amaranthaceae	Herb	Spiny amaranth	Tete-elegun	*								
4	*Andropogon tectorum* Schumach. & Thonn.	Poaceae	Grass	Horse grass	Eruwa dudu	*								
5	*Anthocleista dijaloensis* A. Chev.	Gentianaceae	Tree	Cabbage	Sapo			*						
6	*Aspilia Africana* (Pers.) C.D. Adams	Asteraceae	Herb	Haemorrhage plant	Ako-yunyun/ako yunriyun	*								
7	*Azadirachta indica* A. Juss.	Meliaceae	Shrub	Neem	Dogoyaro			*						
8	*Boerhavia diffusa L.*	Nyctaginaceae	Herb	Hogweed	Ewe-etiponola	*								
9	*Caladium bicolor* (Aito) Vent.	Araceae	Herb	Heart of Jesus	_	*								
10	*Calopogonium mucunoides* Desv.	fabaceae	Climbers	Calopo	_	*								
11	*Carica papaya L.*	caricaceae	Tree	Pawpaw	Ibepe		*							
12	*Chromolaena odorata* (L.) R.M. King & H. Rob	Asteraceae	Herb	Siam weed	Ewe-akintola	*								
13	*Citrus aurantium* L.	Rutaceae	Tree	Sweet orange	osan	*								
14	*Clerodendrum volubile* P. Beauv.	verbenaceae	Shrub	White butterfly	Marugbo	*								
15	*Commelina diffusa* Burm.f.	commelinaceae	Herb	Climbing dayflower	Godogbo			*						
16	*Crotalaria retusa* L.	Fabaceae	Herb	Devil beans	_	*								
17	*Dioscorea alata* L.	Dioscoreaceae	climber	Water yam	Isu-ewura	*								
18	*Eleusine indica* (L.) Gaertn.	Poaceae	Grass	Indian goose grass	Ese-kanna			*						
19	*Euphorbia heterophylla* L.	Euphorbiaceae	Herb	Annual poinsettia	Egele	*								
20	*Ficus sp.*	Moraceae	Tree	-	-									
21	*Gomphrena celosoides* Mart.	Amaranthaceae	Herb	Bachelor's button	-	*								
22	*Lagenaria breviflora* (Benth.) Roberty	Cucurbitaceae	Climber	Wild colocynth	Tagiiri	*								
23	*Lantana camara* L.	verbenaceae	Herb	Common	Ewon-adele	*								

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	IUCN Categories*								
						NE	DD	LC	NT	VU	EN	CR	EW	EX
				lantana										
24	*Laportea aestuans* (L.) Chew	Urticaceae	Herb	West Indian woodnettle	_	*								
25	*Luffa cylindrical* (Linn.) M.J. Roem.	Cucurbitaceae	Climber	Loofah gourd	Kankan oyinbo	*								
26	*Mangifera indica* L.	Anacardiaceae	Tree	Mango	Mangoro		*							
27	*Mariscus alternifolius* Vahl.	Cyperaceae	Grass	Mariscus	Alubosa eranko	*								
28	*Mimosa pigra* L.	Fabaceae	Herb	Sensitive plant	Patanmo	*								
29	*Musa sapientium* L.	Musaceae	shrub	French plantain	Ogede	*								
30	*Newbouldia laevis* (P. Beauv.) Seem.	Bignoniaceae	Shrub	Boundary tree	Akoko	*								
31	*Phyllanthus amarus* schumach. & Thonn	Phyllanthaceae	Herb	Carry me seed	Eyin olobe	*								
32	*Physalis angulata* L.	Solanaceae	Herb	Angular winter-cherry	koropo		*							
33	*Scoparia dulcis* L.	Plantaginaceae	Herb	Licorice weed	Aya	*								
34	*Senna occidentalis* (L.) Link	Fabaceae	Herb	Coffee senna	Abo rere	*								
35	*Sida acuta* Burm. F.	Malvaceae	Shrub	Wire weed	esoketu	*								
36	*Smilax anceps* Willd.	smilacaceae	Climber	Smilax	Ekanamagbo	*								
37	*Spermacoce verticillata* L.	Rubiaceae	Herb	Shrubby false buttonweed	Irawo ile	*								
38	*Spigelia anthelmia* L.	Loganiaceae	Herb	Worm grain	Ewe eran	*								
39	*Stachytarpheta indica* (L.) Vahl	Verbenaceae	Herb	_	Ogan akuko	*								
40	*Tridax procumbens* L.	Asteraceae	Herb	Coatbuttons	Adegbile	*								
41	*Urena lobata* L.	Malvaceae	Herb	Caesarweed	Ake iri			*						
42	*Waltheria indica* L.	Malvaceae	Herb	Uhaloa	korikodi	*								

IUCN Categorization: NE-Not Evaluated, **DD**- Data Deficient, **LC**-Least Concerned, **NT**-Near Threatened, **VU**-Vulnerable, **EN**- Endangered, **CR**- Critically Endangered, **EW**- Extinct in the Wild, **EX**- Extinct.

4.3.6.6 Ecosystem Services Review (ESR)

The Millennium Ecosystem Assessment (ME, 2005) defines *ecosystem services* as the benefits that humans derive from ecosystems, produced as a result of interactions within the ecosystem. Ecosystem services include *provisioning*, *regulating*, *cultural* and *supporting services* that directly or indirectly affect people. IFC Performance Standards 6 applies to ecosystem services that have local dimensions and on which project proponents can have direct management control and significant influence. As part of the ecological assessment, a study of the ecosystem services that local people derive from the study areas was conducted. The approach used for the ecosystem service review involved a combination of literature review and expert elicitation from interview held with members of the community host during the stakeholder engagement exercise. Information gathered shows that the natives depend mostly on plant for medicine, food, shelter, fuel and cultural practices (Table 4.21)

Table 4.21: General Information on Encountered Species

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	Ecosystem Service
1	*Abelmoschus esculentus* (L.) Moech.	Malvaceae	Herb	Okro	Ila	Food: edible fruit
2	*Ageratum conyzoiodes* L.	Asteraceae	Herb	Billy goat weed	Imi-esu	Fodder, medicinal herb and insect repellent
3	*Amaranthus spinosus L.*	Amaranthaceae	Herb	Spiny amaranth	Tete-elegun	Food: Edible leave Domestic: source of dye.
4	*Andropogon tectorum* Schumach. & Thonn.	Poaceae	Grass	Horse grass	Eruwa dudu	Fodder Medicine: for treating stomach troubles.
5	*Anthocleista dijaloensis* A. Chev.	Gentianaceae	Tree	Cabbage	Sapo	Medicine: A strong purgative and diuretic, antidiabetic, root decoction as pain killer e.t.c
6	*Aspilia Africana* (Pers.) C.D. Adams	Asteraceae	Herb	Haemorrhage plant	Ako-yunyun/ako yunriyun	Medicine: used as sedative, analgesics e.t.c Fodder plant cultural: for performing magic
7	*Azadirachta indica* A. Juss.	Meliaceae	Shrub	Neem	Dogoyaro	Medicine: for treating malaria and fever
8	*Boerhavia diffusa L.*	Nyctaginaceae	Herb	Hogweed	Ewe-etiponola	Medicine: pregnancy detection plant
9	*Caladium bicolor* (Aito) Vent.	Araceae	Herb	Heart of Jesus	_	Ornamental plant
10	*Calopogonium mucunoides* Desv.	fabaceae	Climbers	Calopo	_	Medicine: Powdered tuber for treating facial skin blemishes. Food: Edible fruit
11	*Carica papaya L.*	caricaceae	Tree	Pawpaw	Ibepe	Bio-control agent: reduce soil temperature, fix nitrogen to the soil & control weed growth.

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	Ecosystem Service
						Medicine: for treating ulcer and diarrhea.
12	*Chromolaena odorata* (L.) R.M. King & H. Rob	Asteraceae	Herb	Siam weed	Ewe-akintola	Medicine: leave for treating malaria Food: edible fruit
13	*Citrus aurantium* L.	Rutaceae	Tree	Sweet orange	osan	Invasive species/fallow species Improve soil fertility.
14	*Clerodendrum volubile* P. Beauv.	verbenaceae	Shrub	White butterfly	Marugbo	Medicine: for treating arthritis and diabetes.
15	*Commelina diffusa* Burm.f.	commelinaceae	Herb	Climbing dayflower	Godogbo	Medicine: antidiabetic, antihyperlipidermic and antihypertension
16	*Crotalaria retusa* L.	Fabaceae	Herb	Devil beans	_	Medicine: leaves are remedy for irregular menstruation. Food: edible leave Domestic: flower as source of dye.
17	*Dioscorea alata* L.	Dioscoreaceae	climber	Water yam	Isu-ewura	Medicine: for treating fever and skin diseases
18	*Eleusine indica* (L.) Gaertn.	Poaceae	Grass	Indian goose grass	Ese-kanna	Food: edible tubers
19	*Euphorbia heterophylla* L.	Euphorbiaceae	Herb	Annual poinsettia	Egele	Fodder Bio-control agent: for erosion control
20	*Ficus sp.*	Moraceae	Tree	-	-	Medicine: root back as febrifuge Domestic: ornamental
21	*Gomphrena celosoides* Mart.	Amaranthaceae	Herb	Bachelor's button	–	Medicine: for treating gastrointestinal and respiratory problems
22	*Lagenaria breviflora* (Benth.) Roberty	Cucurbitaceae	Climber	Wild colocynth	Tagiiri	Medicine: for treating hypertension
23	*Lantana camara* L.	verbenaceae	Herb	Common lantana	Ewon-adele	Medicine: for treating skin itches, leprosy, ulcer, measles and asthma
24	*Laportea aestuans* (L.) Chew	Urticaceae	Herb	West Indian woodnettle	–	Ornamental Medicine: for treating skin itches, asthma e.t.c
25	*Luffa cylindrical* (Linn.) M.J. Roem.	Cucurbitaceae	Climber	Loofah gourd	Kankan oyinbo	Food: edible leave Medicine: pain killer, pulmonary trouble e.t.c
26	*Mangifera indica* L.	Anacardiaceae	Tree	Mango	Mangoro	Food: fruit-fibre Domestic use: fruit (sponge & gourd).
27	*Mariscus alternifolius* Vahl.	Cyperaceae	Grass	Mariscus	Alubosa eranko	Food: edible fruit Fodder

S/N	Scientific Name of Encountered Species	Family	Habit	Common Name	Local Name	Ecosystem Service
						Medicine: for treating malaria.
28	*Mimosa pigra* L.	Fabaceae	Herb	Sensitive plant	Patanmo	Fodder Food: used for sauces, condiment, spices Medicine
29	*Musa sapientium* L.	Musaceae	shrub	French plantain	Ogede	Food: edible fruit
30	*Newbouldia laevis* (P. Beauv.) Seem.	Bignoniaceae	Shrub	Boundary tree	Akoko	Cultural: for religious purposes Medicine: for treating aliment like arthritis. Social: leaves for wrapping food, whole plant for fencing.
31	*Phyllanthus amarus* schumach. & Thonn	Phyllanthaceae	Herb	Carry me seed	Eyin olobe	Medicine: for treating stomach and genitourinary problems.
32	*Physalis angulata* L.	Solanaceae	Herb	Angular winter-cherry	koropo	Medicine: for treating malaria, toothache and liver problems.
33	*Scoparia dulcis* L.	Plantaginaceae	Herb	Licorice weed	Aya	Medicine: for treating digestive problems.
34	*Senna occidentalis* (L.) Link	Fabaceae	Herb	Coffee senna	Abo rere	Medicine: ointment from plant is used for treating skin diseases.
35	*Sida acuta* Burm. F.	Malvaceae	Shrub	Wire weed	esoketu	Medicine: for treating urinary disease.
36	*Smilax anceps* Willd.	smilacaceae	Climber	Smilax	Ekanamagbo	Food: for condiments, spices and flavouting. Medicine: for treating blood disorders.
37	*Spermacoce verticillata* L.	Rubiaceae	Herb	Shrubby false buttonweed	Irawo ile	Medicine: for treating gonorrheal sores, ulcers and leprous conditions.
38	*Spigelia anthelmia* L.	Loganiaceae	Herb	Worm grain	Ewe eran	Medicine: to treat spasmodic and nervous attacks.
39	*Stachytarpheta indica* (L.) Vahl	Verbenaceae	Herb	_	Ogan akuko	Medicine: root decoction used as eyewash. Food: edible leave
40	*Tridax procumbens* L.	Asteraceae	Herb	Coatbuttons	Adegbile	Medicine: used for wound healing Fodder
41	*Urena lobata* L.	Malvaceae	Herb	Caesarweed	Ake iri	Medicine: used for treating skin diseases.
42	*Waltheria indica* L.	Malvaceae	Herb	Uhaloa	korikodi	Medicine: used for treating inflammation, malaria and infectious diseases.

Photo log of flora species and other field observations in the study area are presented in Plate 4.3(a to x)

Physiognomic view of the study area

Plate 4.3a: Physiognomic view of the Project site

Plate 4.3b: Project site with undulating terrain

Plate 4.3c: Physiognomic view of the AOI

Medicinal species

Plate 4.3d: *Clerodendrum volubile* (marugbo)

Plate 4.3e: *Lagenaria breviflora* (tagiiri)

Plate 4.3f: *Phyllanthus amarus* (eyin olobe)

Edible species

Plate 4.3g: Carica papaya (Ibepe)

Plate 4.3h: Mangifera indica (Mangoro)

Plate 4.3i: Citrus aurantium (osan)

Fodder crops

Plate 4.3j: *Euphorbia heterophylla* (egele)

Plate 4.3k: *Aspilia african* (akoyunyun)

Plate 4.3l: *Ageratum conyzoiodes* (imi-esu)

Socio-cultural & Ornamental plants

Plate 4.3m: *Newbouldia laevis* (ewe akoko)

Plate 4.3n: *Caladium bicolor*

Plate 4.3o: *Luffa cylindrical* (Kankan oyinbo)

Dominant Species

Plate 4.3p: *Andropogon tectorum* (eruwa dudu)

Plate 4.3q: *Tridax procumbens* (adegbile)

Plate 4.3r: *Chromolaena odorata* (ewe-akintola)

Anthropogenic activities

Plate 4.3s: Deforestation on the project area

Plate 4.3t: Cow dung on AoI

Plate 4.3u: Farming activities on AOI

Others

Plate 4.3v: *Waltheria indica* (korikodi)

Plate 4.3w: *Stachytarphta indica* (ogan akuko)

Plate 4.3x: *Anthocleista dijaloensis* (Sapo)

Plate 4.3(a-x): Photo-log of site observations and flora species in the study area
Source: EnvAccord Field survey, 2020

4.3.7 *Terrestrial Fauna*

4.3.7.1 Methodology

Different methods were employed to obtain information of the varied animal types in the study area as discussed below:

Insects Assessment:

For insects, two principal methods were employed to obtain information on abundance, diversity and significant of insect community in the study area. The methods are:

Handpicking: This is the picking of insects with fingers (insects that do not bite or sting) or forceps. The specimens were transferred to specimen bottles, labelled and preserved for identification.

Sweep Net: The sweep net consists of net with open end which is 30cm in diameter. It was used for collecting flying and hopping insects on low vegetation. The specimens were transferred to a killing bottle before labelling and pining.

Annelid Assessment:

Direct observation: This was done by looking out for worm casts, burrowing into the soil and actively searching for annelids.

Molluscs Assessment:

Direct Observation: Molluscs assessment was by direct observation of snails on leaves and other plant parts.

Indirect observation: Searching for eggs, droppings and trail left behind

Amphibian Species Assessment:

Direct observation: This involved searching for adult forms, hopping or crawling, as well as those resting on vegetation.

Indirect observation: Searching for eggs and tadpoles in wet areas.

Reptile Species Assessment:

Direct Observation: Direct sighting of reptiles as they craw or limb through thickets.

Indirect Observation: This method focused on observing prints of the crawling paths as well as shed skin from moulting.

Avian / Bird Assessment:

Direct Observation: Bird assessment was conducted during the field survey by direct sightings.

Indirect Observation: This method focused on taking other forms of bird records apart from sight and sound (call), such as feather, droppings and nesting sites. This anecdotal technique was used to support bird observation.

Bird Identification and Biological Nomenclature
Notes (and sometimes photographs) were taken of birds that were not identified in the field for post field identification.

Mammal Assessment:
Animal footpaths in the study area were extensively traversed to locate and identify mammals in the area. The following methods were used to ascertain the presence of mammalian species in the study site:

Direct Observation: recording animals seen or heard in the field. Animal observations were recorded while walking a continuous line transect of 100m to 200m.

Indirect Observation: this involves mammal observation through sighting of signs (e.g. remains of dead individuals, footprints, dens, trails and runways, faeces, and food residues) left by the animals.

Informal interviews and discussions with the communities: focus group and individual interviews were conducted during the mammal assessment to collect information on animal sightings within and around the study sites.

4.3.7.2 Wildlife Resources
The wildlife species prevailing in the study area varied from invertebrates to amphibian, reptiles, birds and mammals.

The invertebrate group consists of several Arthropoda belonging mainly to class insecta with class arachnida and diplopoda being observed as well, other invertebrate phylum observed was phylum Mollusca (Table 4.22).

Arthropods
The observed arthropod species belong to the Class Insecta (27 species), class Diplopoda (2 species) and Class Arachnida (2 species). The area was generally composed of a diverse array of arthropods with different mouth parts and habitat selection which enables them to thrive with limited competition. The insect taxa include Order Orthoptera, Hymenoptera, Odonata, Isoptera, Diptera, Dictyoptera and Lepidoptera.

Molluscs
The observed mollusk group belong to the class Gastropoda represented by three species.

Table 4.22: Checklist of Invertebrates in the transects at the study area

S/N	Order	Common Name	Scientific Name	Project site						AoI	
				1	2	3	4	5	6	7	8
		INSECTA									
1.	Orthoptera	Variegated Grasshopper	*Zonocerus varigatus*	*	*	*		*	*	*	*
2.		Common Stick Grasshopper	Acrida acuminata	*				*		*	
3.		Field Grasshopper	*Chorthippus sp.*	*	*	*	*	*	*	*	*
4.		Migratory Locust	*Locusta migratoria*		*	*			*		
5.		Green grasshoper	*Omocestus viridulus*		*				*		
6.		Red Grasshopper	*Phymateus morbillosus*		*			*		*	*
7.	Mantodea	Praying Mantis	*Mantids spp.*		*					*	*
8.	Heteroptera	Water Striders	*Heteroptera Gerridae*						*	*	*
9.	Odonata	Julia Skimmer	*Orthetrum julia*	**	*	*	***	**	*	*	*
10.		Red-veined dropwing	*Trithemis arteriosa*	**	**	*	**		*	*	*
11.		Yellow Veined Widow	*Palpopleura jucunda*	*					*		
12.		Common Pond Damsel	*Ceriagrion glabrum*	*		*		*			
13.	Dictyoptera	Praying mantis	*Mantis religiosa*			*			*		*
14.	Coleoptera	Asian ladybeetle	*Harmonia axyridis*			*				*	
15.	Diptera	Housefly	*Musca domestica*	***	*	*	**	**	***	**	**
16.		Sandfly	*Phlebotomus sp.*	*	*	*	*	*	*	*	
17.		Flesh Fly	*Sarcophaginae*		*			*		*	*
18.	Hymenoptera	Honey bee	*Apis melifera*				*	*			*
19.		Common wasp	*Vespula vulgaris*			*				*	
20.		Spider wasp	*Dipogon subintermedius,*			*					*
21.		Ants	*Monomorium minimum*	***	**			**	***		**
22.	Isoptera	Termite	*Macrotermes belliscocus*	*** *				*** *			****
23.	Lepidoptera	Handmaiden Moths	*Euchromia polymena*	*	*	*	*		*	*	*
24.		Blue Pansy	*Junonia oenone oenone*	*		*		*	*	*	
25.		Rusty Tussock Caterpiller	*Orgyia antiqua*				*				
26.		Brush-footed butterflies	*Hypolimnas sp.*	*		*	*			*	*
27.		Speckled Wood	*Pararge aegeria*						**		
		ARACHNIDA									
28.	Aranaea	Jumping spider	*Menemerus bivittatus*		*				*		*
29.	Ixodoidea	African blue tick	*Rhipicephalus (Boophilus) decoloratus*							*	*
		DIPLOPODA									
30.	Spirobolida	Millipedes	*Narceus gordanus*								*
31.	Polydesmida	Flat Millipede	*Enoplodesmus saussurii*						*		*
		GASTROPODA									
32.	Panpulmonata	Garden Snail	*Cornu aspersum*	*			*			*	

S/N	Order	Common Name	Scientific Name	Project site						AoI	
				1	2	3	4	5	6	7	8
33.		-	*Archachatina camerunensis*				*				
34.		Land Snail	*Limicolaria sp*					*	*		

Frequency: * - 1-9; **- 10-19; ***- 20- 100; ****- above 100

Source: EnvAccord Field Survey, 2020

The vertebrate species observed during the study included members which transcended vertebrate Classes, including; Class Amphibia, Reptilia, Aves and Mammalia (Table 4.23). A total of twenty-two (22) vertebrate species were reported in the area of which the African Common Toad was the only sighted Amphibian. Six (6) species of Reptilia were reported in which two were observed during the field data gathering and four were reported by our local guide.

A total of ten (10) Aves species were observed during the field data gathering exercise, none of which was in the vulnerable or endangered category. Most of the observed Aves species were resident species belonging to IUCN Least Concern category. The ease of sightings of the Avian species as categorized by BirdLife International for West African birds varied from common, fairly common to uncommon and rear. Only five(5) mammalian species were reported in which four were sigted during field work and the other one was reported by the hunters. Table 4.23 shows the checklist of vertebrates reported in the study area .

Table 4.23: Checklist of Vertebrates in the Project Area

S/N	Taxa/Scientific names	Common Names	IUCN Category
	Class Amphibia		
1	*Bufo regularis*	African Common Toad	LC
	Class Reptilia		
2	*Agama agama*	African rainbow lizard	LC
3	**Varanus albigularis*	Monitor Lizard	NE
4	*Lampropholis guichenoti*	Skink	NE
5	**Python sebae*	African rock python	LC
6	**Bitis gabonica*	Gaboon Viper	NE
7	**Naja melanoleuca*	Forest cobra	NE
	Class Aves		
8	*Ploceus aurantius*	Orange Weaver	LC
9	*Ardea alba*	Great White Egret	LC
10	*Phalacrocorax lucidus*	White breasted Cormorant	NE
11	Corvus albus	Pied Crow	LC
12	Corvus corax	Common Raven	LC
13	Zenaida macroura	Mourning Dove	LC
14	Ardea sp.	Heron	NE
15	Centropus senegalensis	Senegal Coucal	NE
16	Muscicapa striata	Spotted Flycatcher	LC
17	*Pycnonotus barbatus*	Common Bulbul	LC
	Class Mammalia		
18	*Thryonomys swinderianus*	Grass cutter	LC
19	*Cricetomys gambianus*	Gambian pouched rat	LC
20	**Gazella sp.*	Antelope	NE
21	*Sciurus carolinensis*	Tree Squirrel	LC
22	*Bos taurus*	Cattle	NE

* Oral communication with local guide and residents- no direct evidence, **LC**: Least concern; **NE**: Not evaluated

The Photo log of Fauna species observed in the study area are presented in Plate 4.4

Plate 4.4a: *Acronicta oblinita*

Plate 4.4b: *Monomorium minimum*

Plate 4.4c: *Chorthippus sp*

Plate 4.4d: *Harmonia axyridis*

Plate 4.4e: *Archachatina camerunensis*

Plate 4.4f: *Anoplodesmus saussurii*

Plate 4.4g: *Omocestus viridulus*

Plate 4.4h: *Pararge aegeria*

Plate 4.4i: *Termitarium*

Plate 4.4j: *Phymateus morbillosus*

Plate 4.4k: *Narceus gordanus*

Plate 4.4l: Bird nest

Plate 4.4m: *Agama agama*

Plate 4.4n: *Dipogon subintermedius*

Plate 4.4o: *Euchromia polymena*

Plate 4.4p: Spider web

Plate 4.4q: Garden Tiger Moth

Plate 4.4r: *Orgyia antiqua*

Plate 4.4s: *Rhipicephalus decoloratus*

Plate 4.4t: *Junonia oenone oenone*

Plate 4.4u: *Praying Mantis sack*

Plate 4.4v: *Heteroptera Gerridae*

Plate 4.4w: *Sarcophaginae*

Plate 4.4x: *Coccinellidae spp.*

Plate 4.4 (a-x): Photo-log of site observations and common species in the study area
Source: EnvAccord Field Survey, 2020

4.3.8 Land Use

The purpose of this land use study is to understand the historic and existing land use nature and land cover types within the proposed project site and environ. Considering the significance of the potential impact in the project area, a 2km radius from the centre of the proposed project site was considered and selected as the wider study area for the land use study. The land use map was produced from a combination of ground truthing, aerial photograph, and satellite imagery covering the entire area. This will give a clear understanding and visualization of the present land use types within the proposed project area. The result of the land use study is presented under the following sub-headings:

- Existing Land Use within the Project Site
- Land Use in the Wider Study Area (historical and existing)

4.3.8.1 Existing Land Use within the Project Site

The entire expanse of land within the Project site boundary was observed to be majorly of secondary vegetation. Other classes observed within the boundary were built up areas characterised by administrative building, industrial buildings and equipment used by Ladgroup for its operations (Plate 4.5).

Plate 4.5: (A) Built up areas and (B) Secondary vegetation within the Project site

Source: EnvAccord field Survey, 2020

4.3.8.2 Land Use in the Wider Study Area (historical and existing)

The temporal change of 20 years (2000 to 2020) in the land use of the project area was considered. Present land use characteristic of the wider study area (2km radius from the centre of the project site) is considered to be divided into two (2) major classes which are categorized as; built up areas and secondary vegetation, this is at complete variance with the land use characteristics in 2000 which had four (4) land use classes, they include built up areas, secondary vegetation, bare land and forest. The estimated area covered by each land use

type is presented in Table 4.24, while the percentage distribution of land use type within the wider study area is presented in Figure 4.20.

The land use map for 2000 and 2020 are presented in figure 4.21 and 4.22 respectively.

Table 4.24: Historical and existing Land Use within the Wider Study Area

S/N	Land use/ Land cover	2000 Area (Ha)	2020 Area (Ha)
1	Bare Land	77	-
2	Built-up area	8	87
3	Forest	523	-
4	Secondary vegetation	636	1,158
Total		**1,244**	**1,244**

Source: EnvAccord Field Survey 2020

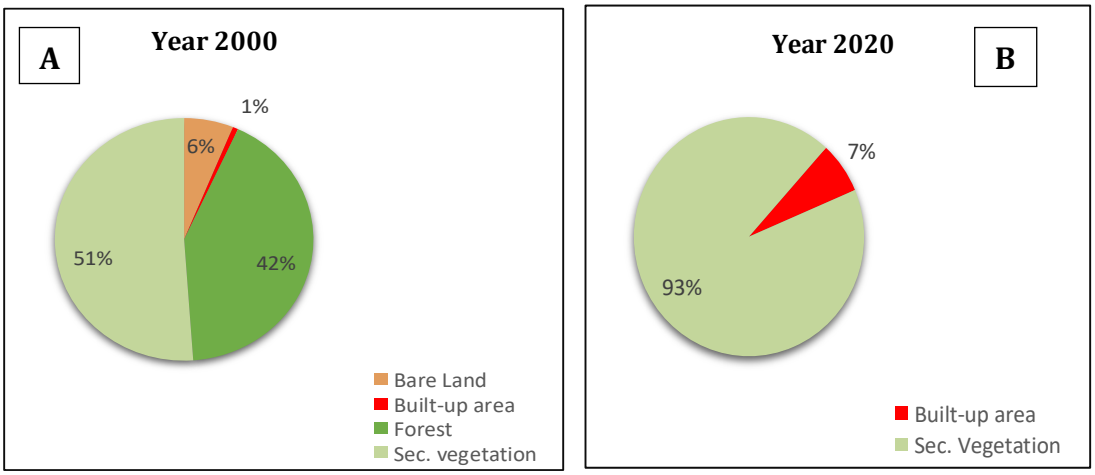

Figure 4.20: Percentage distribution of Land use type within the wider study area

Source: EnvAccord field Survey, 2020

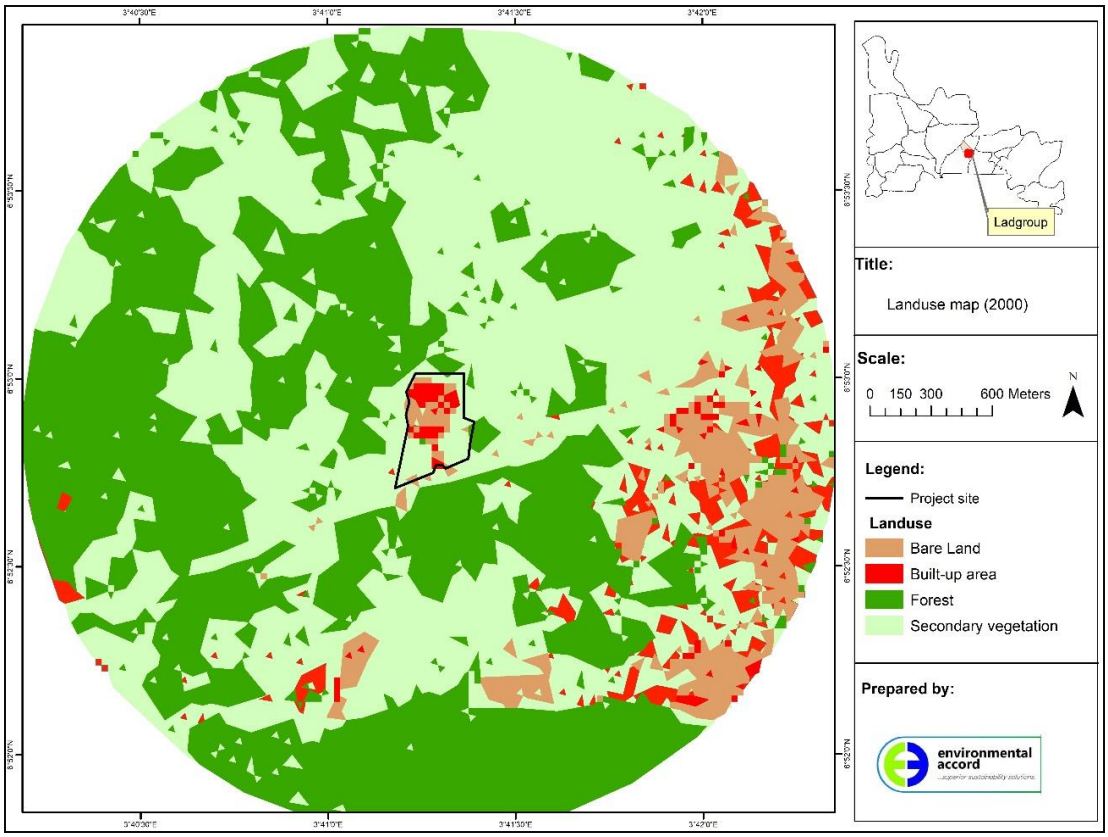

Figure 4.21: Land use map of the project area in 2000
Source: Adapted from Landsat 7 EMT+

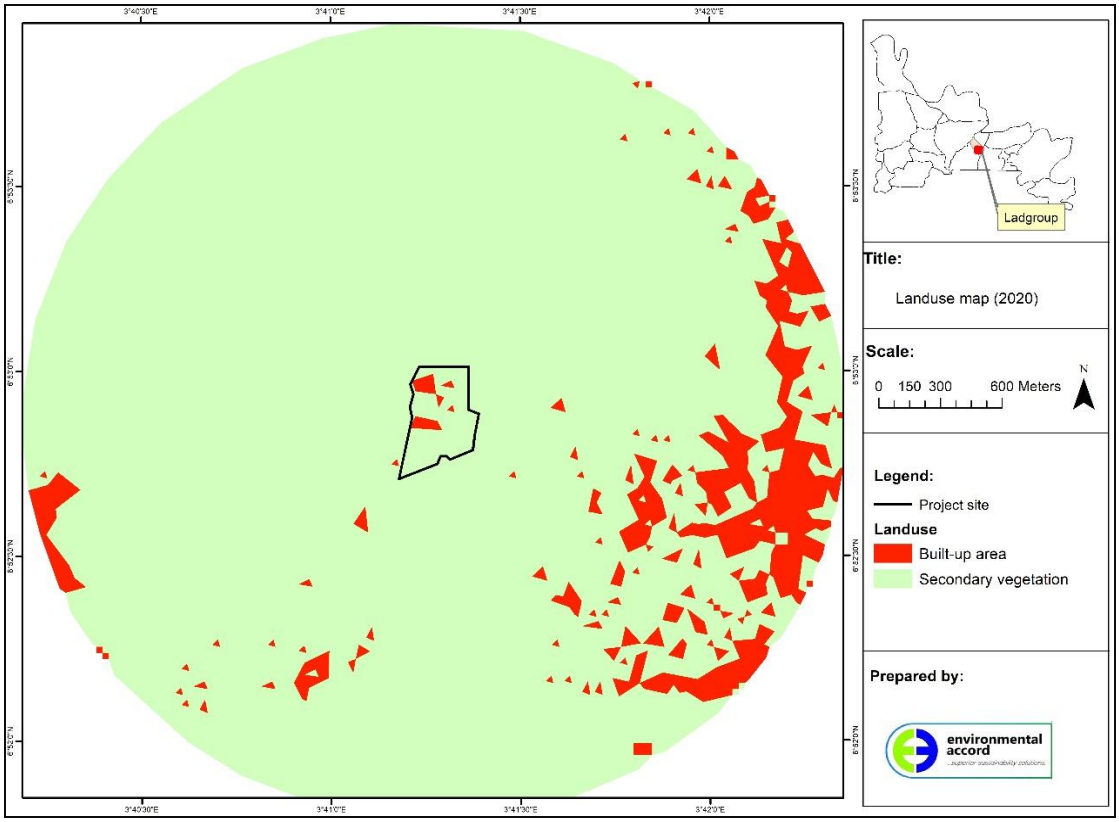

Figure 4.22: Land use map of the project area in 2020
Source: Adapted from Landsat 8 OLI/ EnvAccord field Survey, 2020

Bare Land: In 2000 this land use type accounted for about 77Ha (6%) of the entire land use, Historical aerial imagery suggest that most of such areas were burrow pits were materials had been excavated while others were newly developed areas were the vegetation had been completely cleared in preparation for construction activities. This land use type is completely missing in the year 2020. The land use change suggest that this land use category has been naturally revegetated in some areas while in other areas, they have been converted to built-up areas.

Built-up area: This land use type in 2000 only accounted for 8 Ha (1%) of the project area but in 2020, it slightly increases to 87Ha (7%) Indicating slow urbanization. The two main communities within the project AoI that accounted for this class are Ikenne and Ilishan-Remo. The socio-economic characteristics of the identified communities are further discussed in detail in Section 4.4 of this chapter. The land use change suggests that some bare lands, which were a unique characteristic of the land use in 2000 has been converted to built-up areas, another major contributor to this land use type are the land areas characterised by secondary vegetation. Pictures of the land use type are presented in Plate 4.6

Plate 4.6: Aerial views of (A) Ilishan-Remo and (B)Ikenne
Source: EnvAccord field Survey, 2020

Forest: Forested land in 2000 accounted for about 523Ha (42%) of the total land area but this land use type is completely missing in 2020. The land use change suggests that out of the 523Ha recorded in 2000, about 510Ha has been converted to secondary vegetation while about 11.2Ha was converted to built-up areas. These temporal changes suggest high rate of deforestation within the project area.

Secondary vegetation: This land use type in 2000 accounted for 636Ha (51%) of the total land area, in 2020 the land area for this land use type has been further increased to 1,158 Ha (93%). The land use change suggests that forested land

areas in the 2000 land use is a major contributor to this land use type. Pictures of this land use type is presented in plate 4.7.

Plate 4.7: Sample of aerial views of the secondary vegetation observed around the project area
Source: EnvAccord field Survey, 2020

The graphical representation of some of the land use change discussed above are presented in Figure 4.23 and 4.24

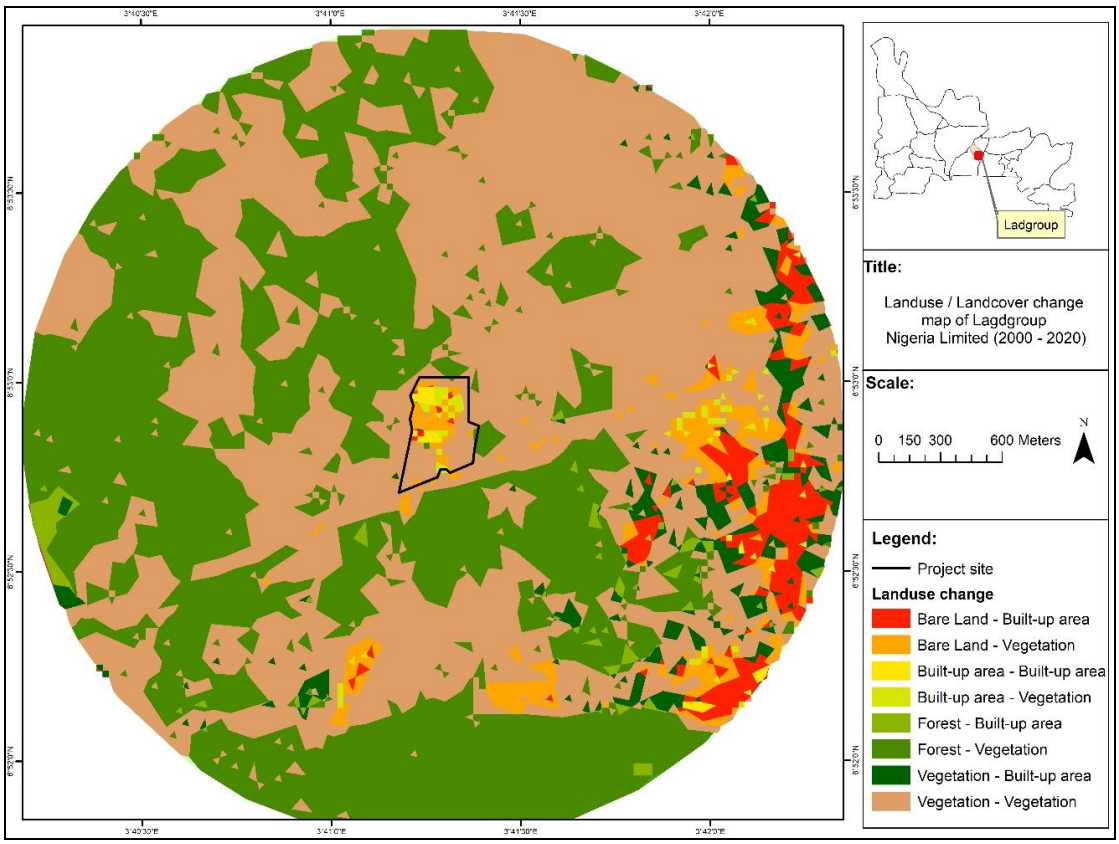

Figure 4.23: Land use change map of the wider study area
Source: Landsat 7 EMT+/ Landsat 8 OLI /EnvAccord field Survey, 2020

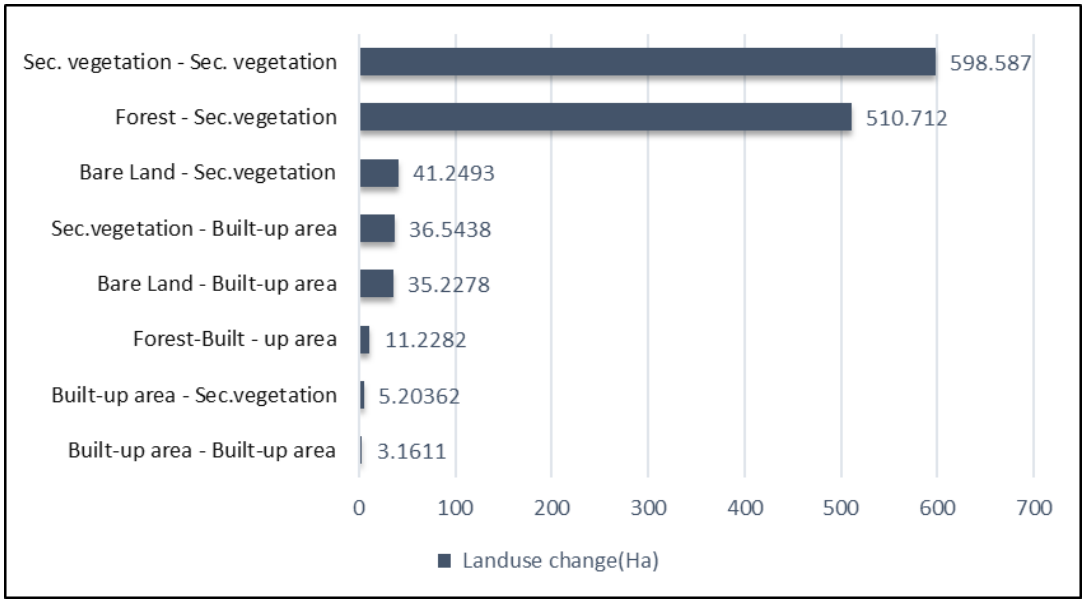

Figure 4.24: Land use change of the wider study area from 2000 to 2020
Source: Landsat 7 EMT+/ Landsat 8 OLI /EnvAccord field Survey, 2020

4.3.9 *Climate Change assessment*

4.3.9.1 Introduction

Climate Change is the defining issue of our time and we are at a defining moment, from shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. Greenhouse Gas (GHG) emissions have been attributed to these changes in our environment. GHGs occur naturally and are essential to the survival of humans and millions of other living things, by keeping some of the sun's warmth from reflecting back into space and making Earth livable, but after more than a century and a half of industrialization, deforestation, and large-scale agriculture, quantities of greenhouse gases in the atmosphere have risen to record levels not seen in three million years(IPCC 2015), As populations, economies and standards of living grow, so does the cumulative level of greenhouse gas (GHGs) emissions. This has led to a global drive to develop strategies on how to mitigate or adapt to the impact of climate change.

In other to quantify / estimate GHG emissions and sequestration within the project area the Ex-Ante Carbon-balance (EX-ACT) Tool (version 8.5.8) was used. The EX-ACT Tool is an appraisal system developed by Food and Agriculture Organization (FAO) providing ex-ante estimates of the impact of agriculture, forestry and other land use development projects on the carbon-balance. The carbon-balance is defined as the net balance of all greenhouse gasses (GHGs), expressed in carbon dioxide (CO_2) equivalents, that were emitted or sequestered due to project implementation.

4.3.9.2 Impact of landuse change on climate change

The emmited and sequestered GHG between 2000 and 2020 (20 years) was quantified for the project AoI and summarized in Table 4.25

Table 4.25: Estimated GHG emissions and sequestration for landuse change

Land use change type	2000	2020	Balance	Share per GHG of the Balance					Result per year		Balance
				CO_2			N_2O	CH_4			
				Biomass	Soil	Others			2000	2020	
Forest to Sec. Vegetation	-134,560	0	-134,560	-127,674	-479	0	-1,313	-5,094	-6,728	0	-6,728
Sec. Vegetation to Sec. Vegetation	-41,652	-51,149	-92,801	-92,560	-241	0	0	0	-2,082.6	-2,557.5	-4,640.1
Other Land use	-3,745	1,694	-2,051	-3,511	1,326	0	102	32	-187.25	84.7	-102.55
Total	-179,957	-49,455	-229,412	-223,745	606	0	-1,211	-5,062	-8,997.9	-2,472.8	-1,1471
Per hectare	-144.66	-39.75	-184.41	-179.86	0.49	0	-0.97	-4.07	-	-	-
Per hectare per year	-7.23	-1.99	-9.22	-8.99	0.02	0	-0.05	-0.20	-7.23	-1.99	-9.22

Note: *Indicates were GHGs was emitted into the atmosphere or had no significant contribution to the atmosphere*

Indicates were GHGs was sequestered from the atmosphere

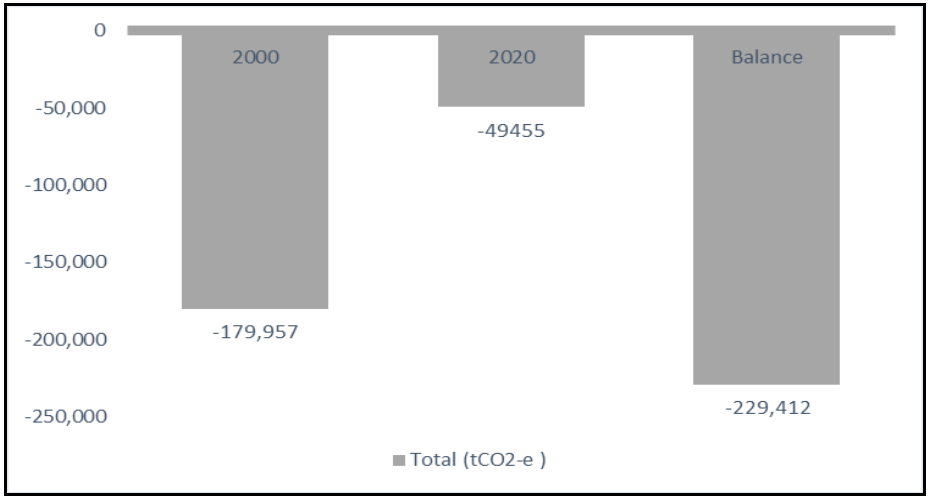

Figure 4.25: Total balance of GHG

Figure 4.26: Share per GHG of the Balance(Plus origin for CO_2)

Two land use change greatly contributed to the sequestration of GHG from the atmosphere, this include the transition from forest to secondary vegetation and secondary vegetation to secondary vegetation , the former sequestrated 134,560 tCO_2-e (Table 4.25)which was the highest of all landuse change type, these high values are attributed to the forest which were a major land use type in the early part of 2000(refer to section 4.3.8 of this report), this was closely followed by the secondary vegetation to secondary vegetation which sequestered about 41,652 tCO_2-e toward the early period of 2000 and 51,149 tCO_2-e in the years leading to 2020, the comparative increase observed in 2020 was as a result of the increase in the secondary vegetation land use type towards 2020. Other land use type only sequestered 3,745 tCO_2-e from the atmosphere towards the beginning of the temporal period been assessed, but was also responsible for emitting 1,694 tCO_2-e into the atmosphere at the later part of the temporal period being assessed. The total net balance of GHG sequestered within the project area for the period of 20 years is 229,412 tCO_2-e, this implies that every hectare of land sequestered about 184.41 tCO_2-e with the yearly sequestration per hectare at 9.22 tCO_2-e. A look at the total GHG sequestered (Figure 4.25) indicates that about 179,957 tCO_2-e was sequestered in 2000, while 49,455 tCO_2-e was sequestered in the years leading to 2020.

The share per GHG for the balance of CO_2, NO_2 and CH_4 indicates that CO_2 was the most sequestered of all GHGs. Specifically, for CO_2, biomass was the major sink which sequestered about 223,745 tCO_2-e accounting for over 97% of sequestered GHG, soil was the major contributor of the total CO_2 (606 tCO_2-e), however this value is insignificant when compared to the total GHG sequestered by biomass (Figure 4.26)

4.3.9.3 Impact of project on climate change

The life span of the project is 25 years, the estimated contribution of GHGs by the project was assessed for the entire life cycle of the project, by first identifying the primary sources of GHGs. Our current understanding of the proposed Project reveals that the use of diesel-powered generator will be the major contributor of GHG by the project, it is estimated that 21,822liters of diesel will be consumed monthly, this implies that at the end of 25 years about 6,546,600 liters of diesel would have been utilized, with regards to land use of the project site it is estimated that about 2.43Ha will account for the built up area, these estimates are based on existing and planned structures to be constructed. Since there are no immediate plans for the remaining 14.57Ha it is assumed that it would be converted to grassland which will be mowed and maintained throughout the project lifecycle, all assumptions stated above were considered and analyzed using the EX-ACT tool and the result is summarized in Table 4.26

Table 4.26: Estimated GHG emissions and sequestration for the project

Components	Project operations	Share per GHG of the balance					Result per year
		CO_2			N_2O	CH_4	
		Biomass	Soil	Others			
Vegetation	-843	0	-843	0	0	0	-34
Diesel consumption	15,455	0	0	15,455	0	0	618
Built up area	6,106	0	0	6,106	0	0	244
Total	20,718	0	-843	21,561	0	0	829
Per hectare	1,218.7	0	-49.6	1268.3	0	0	-
Per hectare per year	48.7	0	-2.0	50.7	0	0	48.7

Note: *Indicates were GHGs was emitted into the atmosphere or had no significant contribution to the atmosphere*

Indicates were GHGs was sequestered from the atmosphere

A review of GHG footprint of the project indicates that diesel consumption would be the major contributor to GHGs emissions with an estimate of 15,455 tCO_2-e , this was closely followed by built up area with 6,106 tCO_2-e, with regards to GHG sequestration the vegetation within the project site will sequester about 843 tCO_2-e of GHG with its soil being the primary sink. At the end of the 25 years life cycle of the project it is estimated that about 20,718 tCO_2-e of GHG would have been emitted with an annual net emission of 829 tCO_2-e.

4.3.9.4 Offseting the impact of the project on climate change

A fundamental aspect of sustainability is looking for areas of improvement and taking advantage of such opportunity to add value. An assessment of the GHG profile of the project reveal diesel usage as being the primary source of GHG emission.

To offset this impact it is recommended that a cleaner source of energy be adopted, for example studies (e.g. Clean energy fuels, 2016)have shown that the use of gas fired generators could reduce GHG emissions associated with diesel fired generators by 30%, it is also recommended that Ladgroup conducts life cycle analysis on their processes to identify areas with high energy requirements so as to enable them source for alternatives to such hot spots, it is also recommended that when purchasing new equipment, priority be given to energy efficiency of such equipment. With regards to sequestration of GHG from the atmosphere it is recommended that Ladgroup maintains the remain 14.57Ha as grass land.

4.3.10 Traffic survey

Traffic volume studies (traffic surveys) are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends.

This survey was conducted as part of the EIA study for the proposed Ladgroup sheabutter factory expansion project in Ikenne, Ogun State. It is imperative to understand the traffic nature of the environment for adequate mitigation measures from the potential impact of the project.

The objectives of this traffic survey are as follows:

- To analyze the characteristics and issues of transportation along the Sagamu – Benin express road;
- To understand the type of vehicles traveling through the area; and
- To serve as baseline for future monitoring of traffic volume in the study area.

❖ Survey Methodology and Analysis

There are two (2) sampling techniques for conducting traffic surveys in order to account for the number, movements, and classifications of vehicles at a given location over a period of time. The techniques are manual and automatic counts.

Manual Counts – The most common method of collecting traffic flow data is the manual method, which consist of assigning a person to record traffic as it passes. This method of data collection can be expensive in terms of manpower, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections.

Automatic Counts – The detection of vehicular movement has historically been performed primarily on road moving vehicles. The exploitation of new electromagnetic spectra and wireless communication media in recent year, has allowed traffic detection to occur in a non-intrusive fashion, at locations above or to the side of the roadway.

The manual count method was adopted for this survey. Owing to the socioeconomic nature of the environment, the peak periods identified for the survey were from 7:30am to 9:00am, 12:00noon to 1:30pm and 4:00pm to 5:30pm. The survey was carried out over two days (7th and 9th July, 2020). Screen lines were selected along the principal route leading to the facility.

4.3.10.1 Selection of Screen Lines

Screen lines are imaginary lines typically drawn along the principal route that leads to a point of interest and thus reduce the focus area for a study. The screen lines for this survey were selected based on the direction of movements that may be impacted during the phases of the project.

As presented in Figure 4.27 below, two (2) screen lines which were principal routes leading to the project site, were identified and surveyed for the two (2) days.

- Screen Line 1 (SL 1):to capture the traffic flow from Sagamu to Benin
- Screen Line 2 (SL 2):to capture the traffic flow from Benin to Sagamu

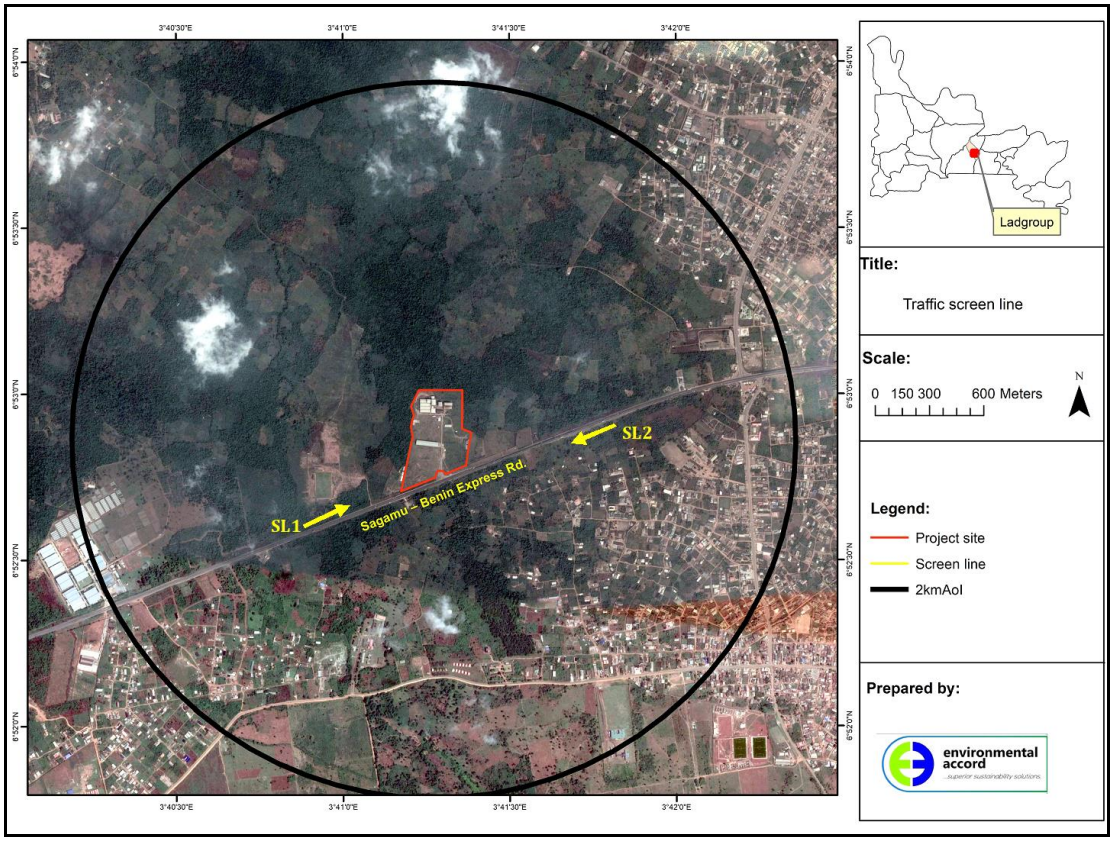

Figure 4.27: Aerial Imagery of the project site showing the screen lines
Source: EnvAccord field Survey, 2020

The data collected by the traffic survey team, was recorded on a traffic survey designed sheets using tally system as shown in plate 4.8. A stopwatch was used to monitor the count intervals. During each count, the survey team classified the vehicles according to their types. The vehicle classification schemes used for this survey are as follows:

Table 4.27: Vehicle Classification Schemes

S/N	Vehicle Classification	Vehicle Types
1.	Trucks/Lorries,	Tankers
		Trucks
		Pick-ups
		Heavy duty vehicles
		Trailers
		Lorries
2.	Buses,	Private buses
		Commercial buses
		Coaster buses
		Mini buses
		Vans
3.	Cars and Sport Utility Vehicles (SUVs),	Cars
		Jeeps
		Space buses
4.	Motorcycles	

Source: Envaccord field survey 2020

To adequately understand the results, obtain from the survey, temporal and modal split analyses were carried out.

Plate 4.8: Traffic count by field observers in the study area
Source: EnvAccord field Survey, 2020

4.3.10.2 Results and Discussion

The proposed project environment is located along the busy Sagamu – Benin express way, which connects Lagos and some other states in the South-west geopolitical zones to other states in Nigeria. Transportation of raw materials, finished products, workers, commercial commuters etc. all contributes to flow of traffic within the proposed project environment. The most significant contributor to the traffic flow within the area is the usage of commercial buses,

which are mainly used for transporting people from one state to another. This was closely followed by trucks and lorries for conveyance of raw materials and finished products. Other prominent means of transportation are cars/SUV which are primary used by private individuals. Motorcycles are the least contributor to traffic flow; this is largely because the road is generally characterized by fast moving vehicles which may pose danger for motorcycle riders. Traffic along the studied route can be described as a free-flowing. Vehicular types observed during the survey are presented in plate 4.9

Plate 4.9: Vehicular types observed during the survey
Source: EnvAccord field Survey, 2020

The surveyed road has two lanes with a combined width of about 20m which are neatly paved but without a drainage system in place and in most cases the road is bounded by vegetation on both sides. There is an intersection about 1.5km east of the project site which leads to Ikenne and Ilishan Remo communities. The predictive noise model conducted around the project area indicates that traffic is the main contributor to noise within the project area (refer to Figure 4.13)

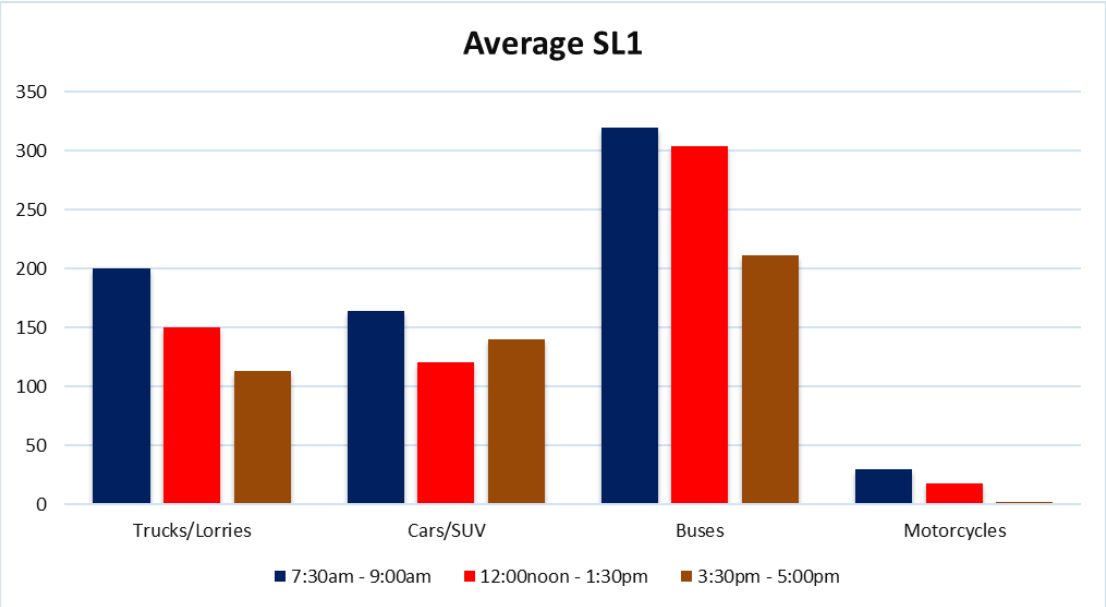

Figure 4.28: Average traffic flow result for screen line 1 (SL1)
Source: EnvAccord field Survey, 2020

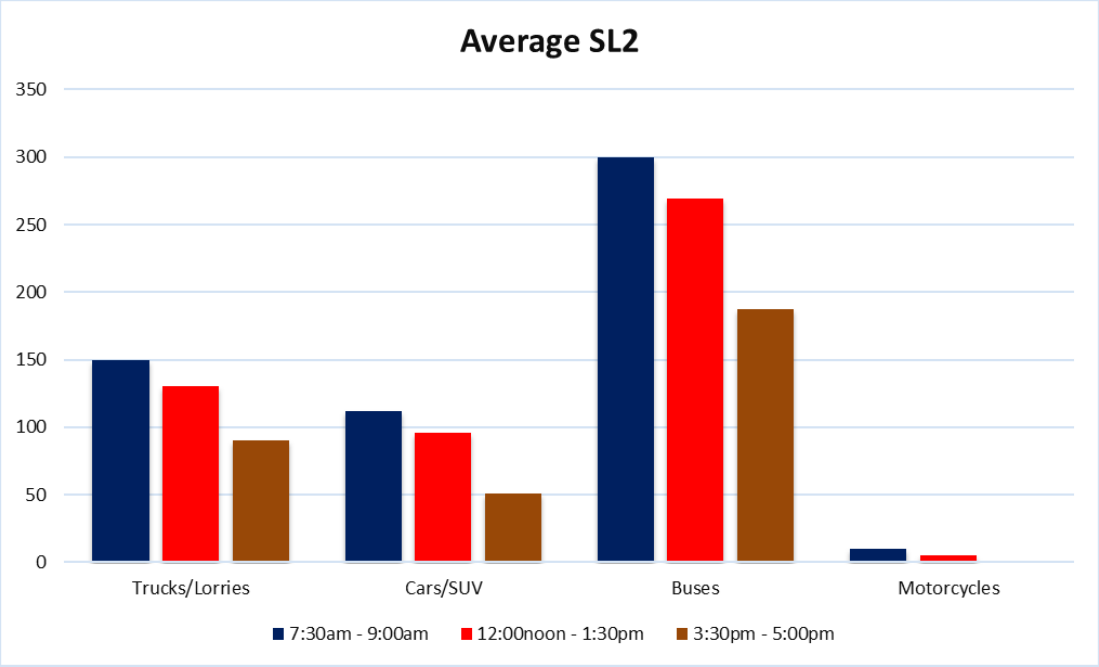

Figure 4.29: Average traffic flow result for screen line 2 (SL2)
Source: EnvAccord field Survey, 2020

4.3.10.3 Conclusion and Recommendations

The traffic nature of the studied area is of a typical busy expressway with high numbers of vehicles and traffic flow. The most commonly used transport means are buses. Heavy duty vehicles such as trucks and lorries are also employed for specific purposes such as transporting raw materials and finished products, buses are used for transporting commercial commuters. Cars/SUV are mainly used by private individual

It is recommended that the following be done by the federal government.

- More traffic signages be installed on the road
- Drainages should be constructed on both sides of the road

4.4 Socio-economic and Health Conditions of the Study Area

4.4.1 Introduction

This section provides information on the socio-economic and health conditions of the two communities, Ikenne and Illisan-Remo, identified within the 2km radius of the Project site. The baseline provides a description of existing conditions, which is essential to the identification and assessment of the potential impacts of the proposed Project. The identified communities and their relative distances to the Project site are as follows:

- Ikenne community, approximately 1 km South East
- Illisan-Remo community, approximately 1.8km North East

4.4.2 Study Approach and Methodology

This study employed a Cross-Sectional research design involving both quantitative and qualitative methods of data gathering, analysis, and reporting. Data were collected at the individual level with the use of a questionnaire, key informant interview, and Focus Group Discussions to assess the socio-economic and health status of the community. Meaningful consultations were held with the community leaders using the Key Informant Interview engagement approach. Furthermore, direct observations were conducted by survey enumerators in addition to the review of relevant secondary information acquired using desktop reviews. The target population for this study were men, women, and youths.

4.4.3 Sampling, Data Collection, Analysis and Reporting

4.4.3.1 Sample Size and Sampling Technique

The study populations were largely homogenous concerning ethnicity, culture and language. The communities do not have a large population. The sample size was calculated using the Cochran Formula.

$$n = \frac{Z^2 pq}{e^2}$$

Where n is the sample size

p is the estimate of the proportion of interest (i.e., 0.29)

q is 1 – p (i.e. 0.71)

e is the desired level of precision (i.e., 0.07)

Hence, $n = 1.96^2 (0.29) (0.71) / 0.07$

n = 180

A 10% non-response rate was added as a standard practice with the speculation that some respondents within the study areas may refuse to participate or some may withdraw in the middle of the interview. Thus, the selected sample size was approximated to 200. A simple random sampling technique was employed to ensure a fair representation of both males and females among the respondents.

For the qualitative data, Focus Group Discussions (FGDs) were conducted with one (1) male group and two (2) female groups making a total of three (3) FGDs. Each FGD includes a minimum of six (6) and a maximum of fifteen (15) participants. Different categories of respondents including youths, adults, males, females, educated and non-educated etc. were included in each FGD session. Key Informant Interview (KII) was held with the Oludotun of Dotun in Ikenne-Remo and the Aremo of Illisan-Remo, and the market leader in Illisan-Remo. In-depth interview was held with a healthcare practitioner (Doctor) in Ikenne.

4.4.3.2 Data Collection, Analysis and Reporting

The quantitative data were collected through the use Computer Assisted Personal Interviewing (CAPI) using KoboToolBox online and offline data gathering tool. The questionnaire was scripted and downloaded on Kobo Collect server, administered using KoboCollect mobile app on Android phone. Community entry was facilitated through the use of gatekeeper, Mr. Alake Oronti, the community liaison officer of Ladgroup. The interviews and focus group discussions were audiotaped using a digital recorder. The data collected were later downloaded into Stata software for analysis while the audiotapes were transcribed for analysis. The report of this study was structured using the Social Framework developed by Smyth and Vanclay in 2017. This framework was adopted for this study due to its overarching understanding, assessing, planning and managing of social issues associated with big projects.

4.4.4 Ethical Considerations

All interviews were undertaken with the informed verbal consent of participants. Confidentiality and anonymity were maintained through secure storage of data in password-protected computers. Participation was voluntary and respondents were allowed to withdraw at any point they feel uncomfortable

to continue with the study. This study itself does not have any negative consequences nor cause any embarrassment or discomfort to study participants.

Sample photographs of socio-economic survey activities in the study area are shown in Plate 4.10 while the field data gathering tools are presented in Appendix 4.1.

Plate 4.10: Sample photographs of socio-economic survey activities
Source: EnvAccord field Survey, 2020

4.4.5 The Socio-Economic Baseline Report Structure

This study adopted the Social Framework Model for reporting its findings. In line with the social framework developed by Smyth and Vanclay in 2017, the socio-economic baseline report is structured as follows:

- Demographic Profile
- 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
- Community Concerns and Perceptions

4.4.5.1 Overview of Key Socio-Economic Indicators

According to the data presented by the World Bank, Nigeria is Africa's most populous country with the 2020 population estimate of 202 million people and based on a population growth rate of 3.2 per cent per annum (NBS, 2018). UN Department of Economic and Social Affairs (2018), projected that Nigeria will add 189 million to her current population between the year 2018 and 2050. Gender distribution revealed that approximately 51 per cent of the national population are male while 49 per cent are female. Nigeria is a multi-ethnic country with socio-cultural differences among its component ethnic groups all of which have resulted in cultural dissimilarities. Although the major ethnic group can be categorized into Hausa, Igbo and Yoruba, each manages separate geographical location distinctive from another. These cultural dissimilarities have been manifested by the differences in culture which include language, diet, dress and choice of social system. Table 4.28 shows key socio-economic indicators for Nigeria.

Table 4.28: Key Socio-economic Indicators for Nigeria

Socio-economic indicator	National Level	Source
Population (m)	202 million (2020)	World Bank https://worldbank.org/en/country/nigeria/overview#1
Population growth rate	3.2% (2018)	Nigeria Bureau of Statistics Report, 2018
Life expectancy (Years)	53.9 (2017)	UNDP Human Development Report 2018 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NGA.pdf

HDI Index Value	0.532 (2017)	UNDP Human Development Report 2018 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NGA.pdf
Religion	Christianity 46.3% Muslim 46% Traditional 7.4% Others 0.3%	ACS ITALIA https://acs-italia.org/wp-content/uploads/Nigeria.pdf
GDP per capita	USD 6,030.4 (2018)	IMF: World Economic Outlook http://nigeria.opendataforafrica.org/pjeqzh/gdp-per-capita-by-country-statistics-from-imf-1980-2023?country=Nigeria
Inflation rate (%)	11.61 (October 2019)	Central Bank of Nigeria https://www.cbn.gov.ng/rates/inflrates.asp
School enrolment, primary	25,591,181 (2016)	Nigeria Education Indicators https://www.nemis.gov.ng/downloads_fold/Nigeria%20Education%20Indicators%202016.pdf
Adult Literacy rate (15 years and above) (%)	61.3 (2010)	UNESCO Institute of Statistics http://www.uis.unesco.org/literacy/Documents/UIS-literacy-statistics-1990-2015-en.pdf
The proportion of total population served with piped water (%)	55.7 (2013)	UNODC Water Supply Statistics, 2013 http://nigeria.opendataforafrica.org/cxwlolg/water-supply
Hospital beds (per 10,000 population)	5 (2004)	World Health Organization (WHO) https://www.who.int/workforcealliance/countries/Nigeria_En.pdf
Estimated adult rate (15-49) of people living with HIV/AIDS (%)	3.2 (2014)	UNAIDS http://data.worldbank.org/indicator/SH.DYN.AIDS.ZS

*The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

4.4.5.2 Demographic Profile

- *Population Distribution*

Nigeria's towns and cities have grown phenomenally with the rate of urban growth consistently above 2 per cent per annum (UNDESA, 2019). In 2017, the urban population for Nigeria was 51.0 per cent of the total population. Over the last 50 years, the urban population of Nigeria has grown substantially from 17.3 to 49.4 per cent rising at an increasing annual rate that reached a maximum of 3.19 per cent in 1981 and then decreased to 1.66 per cent in 2017 (Knoema Nigeria, 2018).

The proposed Project is situated within Ikenne LGA of Ogun State. Ogun State is bordered to the East by Ondo State, to the North by Oyo and Osun States, to the South by Lagos State and the Atlantic Ocean, and to the West by Republic of

Benin, which makes it an access route to the expansive markets of the Economic Community of West African State (ECOWAS). Abeokuta, the capital and largest urban centre, is about 90 kilometers from Lagos and 740 kilometers from Abuja, the capital of Nigeria. However, the State has 16,432 km^2 total land surface area and is ranked 24th among the 36 states in Nigeria by land mass.

Using the NPC 2006 census and with a growth rate of 3.2 per cent (NBS, 2018), Ogun state has a 2020 population Projection estimate of approximately 8.2 million people of which 49.7 per cent are estimated to be male while 50.3 per cent are estimated to be female. The bulk of the state population is skewed towards people who are economically active, with the age group of 15 – 64 years owning approximately 58 per cent of the total population, 37.9 per cent of the population are within the age group of 0 – 14 years while the 4.1 per cent are population in the age of 65 and above.

Ikenne LGA occupies a land size of 114 km^2 and population density of 1,151/km^2 (NBS, 2016). The population projection using the National Bureau of Statistics (NBS)'s population growth rate of 3.2 per cent per annum revealed that the LGA has approximately 173,565 inhabitants; 50.4 per cent of the population being male and 49.6 per cent being female.

- *Marital Status*

In Nigeria, marriage is regarded as a union of two opposite sexes that is man and woman. Also, in some jurisdiction, marriage is viewed as a union of man with more than one woman. According to the 2018 Nigeria Demographic and Health Survey, 70 per cent of women and 57 per cent of men within the age range of 15 – 49 are currently in a marital union. Furthermore, the median age at first marriage among Nigeria women within the age range of 20-49 is approximately 19 years. Women typically get married before men, the median age at first marriage being 27.7 years. By the age of 45 – 49, only 2 per cent of both women and men have never been married. Overall, women in Nigeria are more likely than men to be divorced, separated, or widowed. Women are less likely to be single, with only 25 per cent of women and 42 per cent of men have never been married.

- *Culture, Ethnicity and Religion*

Nigeria has over 250 ethnic groups, the most populous and politically influential are the Hausa and Fulani having a 29 per cent share of the country's population, Yoruba with 21 per cent, Igbo (Ibo) with 18 per cent, Ijaw with 10 per cent, Kanuri with 4 per cent, Ibibio with 3.5 per cent, Tiv with 2.5 per cent and others have 12 per cent share of the population (CIA World Factbook, 2018).

Typical of communities within Ogun State, the host communities in the Project environment belong to the Yoruba ethnic/tribal group of Nigeria. The Yoruba are the second largest ethnic group in Nigeria and constitute approximately 20 percent of the nation's population (NPC, 2006). The language of the identified communities in the Project's AoI is predominantly Yoruba with Ijebu dialect. They all, according to history, migrated from Ijebu land and Ife. The people of Ikenne have a rich culture, saddled with various festivals. However, other religions such as Christianity and Islam are also practiced in the state.

The indigenes of Ogun State are known for their customs and traditional values prior to the advent of western education and to this day. Festivals such as Lisabi, which is done to commemorate the celebration of Egba hero called Lisabi; Oro festival is conducted to worship the genie who is responsible for peace and continuity in the communities; Ojude Oba festival, known as a festival that bring the people of Ijebuland together; Osousi festival among the people of Ago-iwoye and Ikija in Ogun state are celebrated. Egungun Festival is one of the most popular festivals not only in Ogun state but also across South-Western Nigeria. The festival origination is traceable to the old Oyo Empire. Oronna Day, Izangbeto Egun, Igunnuko Festival, Agemo and Ayee Ugborowo festival are all significantly important festive period among the people of Ogun state. It was gathered that masquerades are a symbol of peace and unity within these communities.

Influx of workers into these communities can lead to significant changes in their way of life and/or create pressure on social amenities within the communities. Their cultures are sacred to them. For instance, masquerades are recognised as symbols of peace and unity. Immigrants who do not have prior knowledge of the cultural activities within the communities might overstep their boundaries, thereby constituting nuisance which can lead to accommodative reaction from the community members. Especially in the course of Oro festival, women are not permitted to step out of the house during the worship and celebration of Oro.

Plate 4.11: Masquerade Depiction found in Illisan-Remo
Source: EnvAccord field Survey, 2020

However, the prevalence of traditional religions and festivals is not a deterrence for other major religions in the communities such as Christianity and Islam to function. Despite the differences in religious beliefs and festivities, it was gathered that there is a cordial relationship among the people.

Plate 4.12 (A)Photograph of a mosque in Ilisan-Remo (B)Photograph of a church in Ikenne

Source: EnvAccord field Survey, 2020

- *Migration Status and Patterns*

During the survey, it was revealed that some non-indigenes have become fully integrated into the community. Many of them have grandparents in the community who acquired land and transfer the ownership to their children. It was however gathered that some people have also emigrated from the community to other towns or states for diverse reasons.

- *Crime, Security and Safety*

The 2017 Nigeria Bureau of Statistics reported crime data in Nigeria. The crime statistics on reported offences reflected that a total of 134,663 cases were reported in 2017. Offence against property has the highest number of cases reported with 68,579 of such cases reported. Offence against persons recorded 53,641 cases reported while offence against lawful authority recorded the least with 12,443 cases recorded respectively (Nigeria Bureau of Statistics, 2017).

During the KIIs with leaders of the identified communities, it was expressly stated that the communities are peaceful without any fear of theft and conflict. However, there are minor cases of theft and burglary, although not rampant. It was also noted, especially in Illisan-Remo community that there is an increase in cybercrime, popularly known as "*Yahoo-Yahoo"* among the youths. These youths, also called "*Yahoo Boys"* are known for perpetrating online fraud.

The two communities are well known for community policing. There is an established vigilante responsible for curbing theft and maintaining the safety of properties and individuals in the communities. Ikenne community has a recognised security council and a duty post while Illisan-Remo community has a Police Command Unit stationed in the community.

Plate 4.13: Evidence of security presence in the Communities.
Source: EnvAccord field Survey, 2020

- *Vulnerable or Marginalized 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 community were observed to be elderly men and women. This classification is by virtue of their economic vulnerability based on dependency. The elderly women depend on their husbands, who often are not economically buoyant while the elderly men are often retired civil servants who often have challenges getting their pensions and depend on the remittances from their children to survive. Also, single mothers in female headed household, who's meagre income are meant to take care of themselves and their children without the support of their husbands. However, none of the vulnerable groups identified during study have direct links or derive benefits from the Project site.

- *Host Community Profile*

Box 4.1: Overview of the Project AoI – Demographic Profile

- **The communities are relatively homogenous in terms of ethnicity, religion, culture and language.**
- **Traditional, Islam and Christianity are the most prevalent religions in the communities.**
- **The housing pattern in the community is nucleated and most houses are built with cement blocks and aluminum roofing sheets**
- **Lands are owned by individuals and can be sold, leased, shared and gifted.**
- **Trading, white and blue-collar jobs are the common livelihood activities in the communities**

Ikenne-Remo is a semi-urban community in Ikenne LGA with an estimated household of 1,500. According to the data collected during the baseline survey, it is almost exclusively inhabited by Yoruba people with only a few Hausa and Igbo migrants. Ikenne is a town after Sagamu and before Odogbolu and near Ilisan-Remo. Ikenne is about 8 kilometers from Sagamu and share boundary with Odogbolu, Ayepe and Ilisan township. The people of Ikenne claimed their ancestral lineage to the ancient town of Ile-Ife. It is believed that the first settlers settled at Eesu, also known as Orule, where many houses were built. But due to war and incessant fire out-break, the people had to move away from the Eesu. According to the information provided by Oba Odunayo Sholarin, the Oludotun of Idotun-Ikenne, Itowo II, Ikenne is welcome to visitors and a peaceful community to live in. Ikenne is also home for some prominent Nigerians which includes chief Obafemi Awolowo, a Nigerian nationalist and statesman Plate 4.14

Plate 4.14: Statue of Obafemi Awolowo, one of the most prominent sons of Ikenne community
Source: EnvAccord field Survey, 2020

The name Ikenne was derived from the word "Iken" meaning "We have plenty of Iken" In all indications, all Remo towns and town-lets did not take off from Ile Ife with a name. Their names were derived from prevailing situations and circumstances where they settle in Remoland.

The survey also revealed that the average household size in the study community is 6.8 persons, with males averaging about 4.1 per household than females, averaging 2.7 per household. This reveals that the community has more males than female. The community has an economically active and youthful population in which 51% are within the age group of 18 – 30 years; 39% are within the age group of 31 – 45 years and 10% are within the age group of 46 – 65 years.

The Yoruba (91%) were the dominant tribe in the community, followed by Igbo tribe (7%), then Hausa with an approximate of 2%. Among the respondents, 54.5% claimed to be Christians, 26.5% professed Islam as their religion and an approximate of 20% are traditional worshippers.

The survey results show that 62% of the respondents are males while 38% were females. However, it was observed that interaction between both genders in the study area was not affected by socio-cultural beliefs or customs.

Ilisan-Remo is semi-urban area, located in Ikenne local Government Area of Ogun State. It is believed that the first settlers stayed in Ijebu-Ode before proceeding to settle in Remo land. The community is the fourth largest of the thirty-three towns in Remo Division of the State and one of the first five towns (Akarigbo, Elepe, Alalisan, Alara and Alado) that resulted from the migration from Iremo quarters in Ile-Ife. The community is one of the 33 towns made up of the ethnic group called Remo in Yoruba land popularly called Remo metalelogbon. Ilishan comprises of the seven settlements: Iworu, Idogan, Idokosi, Molado, Orubo, Ile, and Orubo Oko.

The survey also revealed that the average household size in the Illisan-Remo, with males averaging about 6.7 per household and females, averaging 4.3 per household. The age group of the sampled population are economically active and youthful. 59% are within the age group of 18 – 30 years; 24% are within the age group of 31 – 45 years and 17% are within the age group of 46 – 65 years.

The dominant tribe in Illisan is Yoruba. All sampled respondents are Yoruba people. However, the information obtained from the community leader revealed that there are other tribes living in the community for many years. The survey data showed that 74% of respondents were Christians, 16% were Muslims and 10% are traditional worshippers.

The survey results show that 51% of the respondents were males while 49% were females. However, it was observed that interaction between both genders in the study area was not affected by socio-cultural beliefs or customs.

Economic activities in the two communities are mostly trading and artisanship; 90% of respondents are self-employed. The common economic activities observed in the community are artisanship, trading of goods in the market or in the front of their houses, offering of services like barbing salons, bike hailing services, taxi driving, among other activities.

- *Marital Status*

About 55.50% of respondents within the two communities are married; among these married people 57.66% are in monogamous families while 42.34% are in polygamous families. The practice of polygamy is supported by their religion and culture. Also, 44.50% of respondents are single or soon to be married. Some of these people are young adults who are students, while some others are employed or entrepreneurs.

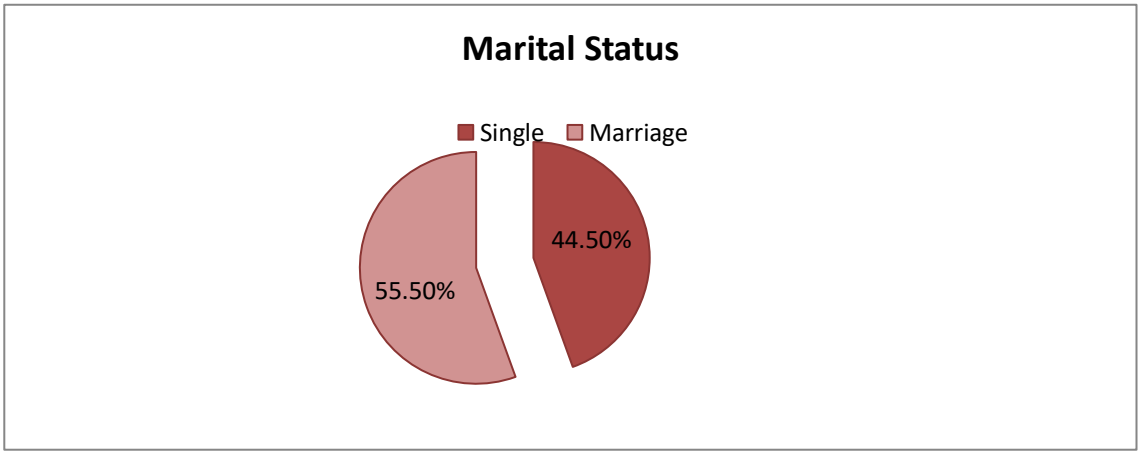

Figure 4.30: Marital status among respondents in the communities
Source: EnvAccord Field Survey, 2020

4.4.5.3 Administrative and Socio-Cultural Institutions

- *Government Institutions*

Ogun state, which has its capital in Abeokuta, comprises of 20 LGAs. The proposed Project site will be located in Ikenne LGA. The LGA is chaired by Hon. Akinsanya Rotimi Fatai. The relevant government ministries in the State that have been consulted in respect of this Project at the State level include:

- Ogun State Ministry of Environment
- Ogun State Environmental Protection Agency
- Ikenne Local Government

- *Traditional Leadership Patterns and Representations*

Traditional leadership remains a strong and respected structure in Ogun State, just like many other States in Nigeria. The powers of traditional leaders are still much relevant in modern times, the respect and ceremony that surround these positions remain strong, and also these leaders retain significant influence over their people.

The communities are governed by traditional rulers, ranging from constitutional monarchs to ceremonial ones. The Oba is an example of the constitutional monarch, while the chiefs are ceremonial and work with the Oba (King) in the promotion of the community's progressive agenda. Power and authority therefore tend to be dispersed both vertically and horizontally. Vertically, from the King through a hierarchy of chiefs (baale) down to the family head (bale) and horizontally from the King through heads/chiefs of territorial sub-units (quarters and compounds) and again terminating at the level of the family head.

During the KII with the traditional leaders of Ikenne community, Oba Odunayo Sholarin, the Dotun of Ikenne-Remo and the Illisan-Remo community, Aremo Babatunde Sonuga, it was learnt that governance of the communities centres on the Oba (king) and his council of chiefs. Although there are different hierarchies of chiefs, the point stressed was that the Oba does not rule alone, but in council. The chieftaincy hierarchy is such that the interests of all citizens are represented, including the women.

- *Community-based Organizations and Other Local Institutions*

Community groups are an important source of social capital in Nigeria, providing social, livelihood, financial and religious support. Most communities in the country typically have a variety of associations, including livelihood-based groups, saving groups, religious groups and other community-based organizations that play an important role in the management of the community. There is open membership opportunity in most of these groups, and there is the possibility of people belonging to more than one group. However, groups such as Elders Forums and Traditional Cultural Groups have restricted participation.

Within the community, the most prevalent groups are youth, men and the women associations. Also, there are motorcycle rider's association and the Ogun State chapter of National Union of Road Transport Workers (NURTW).

- *Social Conflict*

During the data gathering survey, it was recorded that there was no history of conflict between the two communities. It was however mentioned that there are instances of conflicts among the youths, which they usually resolve among themselves. Whenever the conflicts go beyond the capacity of the youths and men in the community, the attention of the community leaders such as the Chiefs and Oba are called address and resolve the conflicts. The community leaders explained, during the Key informant interviews the structure of conflict resolution in their respective community. The *Oba* resolves domestic and minor conflicts within their jurisdictions and when the conflicts go beyond their jurisdiction and capacity, the issue will be transferred to the Nigeria Police command or vigilante group within the community.

4.4.5.4 Livelihood Assets and Activities (Economics, Livelihoods, and Employment)

Box 4.2: Overview of the Project AoI – Livelihood Assets and Activities

- **The principal economic activity in the project area are trading, white- and blue-collar jobs.**
- **Each of the community has a market located in an accessible environment.**
- **Traders mostly sell goods such as farm produce, cooked food and other items such as cloths, plastics**
- **Majority of the young people in the community are either self-employed engaging in trading and transportation business.**

Ogun State's economy is driven largely by commerce, manufacturing and agriculture. This was reflected during the survey as respondents in the communities were into trading and services. Trading activities range from micro and medium scale businesses. Shop outlets are set up in front of residential houses for sale of varieties of household goods and shopping complexes are rented out. The market in Illisan-Remo operates every day, similar to the market in Ikenne. medium scale businesses observed in the study areas include petroleum filling stations, wholesale retail stores and supermarkets.

Plate 4.15: Trading activities observed in the communities
Source: EnvAccord field Survey, 2020

- *Trading*

Trading is a common livelihood activity within the communities involving both men and women. Some people hawk to sell their products while others have shops and stalls in different sizes. During FGDs, some community members claimed to engage in some form of petty trading which was confirmed during field observations. Some of the traders purchase products from the wholesalers outside the community, bring the products down to the community and sell at

profit to the people. Trading activities occur in the designated market areas and within the community.

- *Income Levels and Poverty*

During the household survey, respondents were allowed to provide an estimate of their income per month in their respective livelihood activities; 62.59 per cent of the respondents have a monthly income of N10, 000 – N50, 000; 20.74% have an income between the range of N50, 000 – N100, 000 and 16.67% have an income of over N100, 000.

The household survey was analysed to show distribution of income among the genders. On the average women earn more money than men in the study area. There are 63.57 per cent of women who earn between N50, 000 – N100, 000 while 36.43 per cent of men such income. There are 50.42 per cent of women earning between N10, 000 – N50, 000 per month while only 49.58 per cent of men earn within the range of income. 73.89 per cent of men with an income of over N100, 000 while 26.11 per cent of women earn such income as detailed in Table 4.29 below.

Table 4.29: Distribution of income between the gender

Income	Gender		
	Women	Men	Total
N10,000 - N50,000	50.42%	49.58%	100%
N50,000 - N100, 000	63.57%	36.43%	100%
Over N100, 000	26.11%	73.89%	100%

Source: EnvAccord field Survey, 2020

4.4.5.5 Infrastructure and Services

Box 4.3: Overview of the Project AoI – Infrastructure and Services

- **The communities have relatively good social infrastructure such as town hall, tarred road. However, the internal road networks are not paved.**
- **The communities have concentrated healthcare centre, designated market and Police command unit.**
- **There are government hospital, private hospital, and pharmaceutical outlets.**
- **Electricity and telecommunication infrastructure are available in the communities.**

- *Access to Electricity*

The community is connected to the national grid for electricity supply (Plate 4.16. However, during FGDs and KII in the communities, all participants raised the issue of erratic power supply as a major challenge. There is no public or communally owned generator, but a few residents have privately owned generators to provide back-up electricity for their business activities and residential houses.

Plate 4.16: Electricity Infrastructure Observed in the Study area
Source: EnvAccord field Survey, 2020

- *Access to Water*

Both private boreholes and wells were found in the study area. A high proportion of respondents within the communities stated that they have access to water. Some residents in the communities make use of boreholes owned by private individuals. However, a large number of households buy water from vendors who supply water in kegs and tankers while some buy from nearby residential houses with stationed boreholes.

The survey data revealed that 25 per cent of residents within the study area owns private boreholes, approximately 65 per cent buy water from vendors while the 10 per cent often depend on hand dug wells within their vicinity for water. Public water supply is not available within the communities, and many respondents stated that they purchase water such as "sachet water and table water" for drinking purposes. Their choice is dependent on availability and affordability.

Plate 4.17: A: Private Boreholes, B: Waterkeg cart observed in the study
Source: EnvAccord field Survey, 2020

- *Telecommunication, Transportation and Road Infrastructure*

The surveyed communities have access to all the available mobile telecommunications networks in Nigeria such as MTN, Airtel, Glo and 9mobile. This makes it quite easy to communicate socially and also carry out business transactions within any part of the community.

The common forms of transportation in the community are commercial buses, cars, motorcycles, and bicycles (Plate 4.18). The internal road networks within the communities are untarred in most cases but accessible by vehicles. The major road linking Ikenne and Illisan-Remo is however well tarred. During the period of the survey, there was no traffic congestion observed within the two communities as the traffic was generally free flowing.

Plate 4.18: One of the many road infrastructures and communication mast observed in the study area.
Source: EnvAccord field Survey, 2020

- *Access to Education*

The literacy level within the two communities is high, as shown from the baseline survey data. Majority of respondents during the study had some level of formal education. There are private and public primary and secondary schools within the communities. Respondents with no formal education made up only 5 per cent during the survey. A large percentage, 47 per cent, of respondents have attained at least senior secondary education level, with 21.50 per cent having attended or still attending tertiary institutions. 26.50 per cent of respondents obtained vocational education such as tailoring, hairdressing, trading, among others.

The baseline survey data further revealed the educational attainment among the genders; all respondents who have no formal education are all female. Furthermore, an approximate of 52 per cent of female respondents have attained secondary school education more than male respondents who have an approximate of 48 per cent. There are more male respondents about 70 per cent who have attained tertiary education than female respondents with 30 per cent.

Plate 4.19: Some schools observed in the two communities
Source: EnvAccord field Survey, 2020

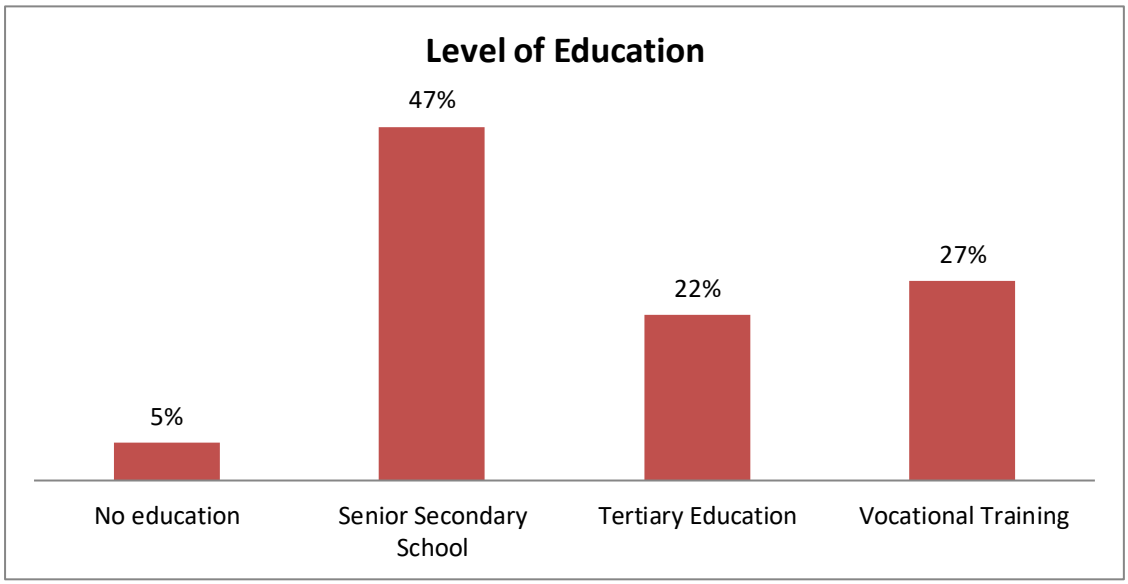

Figure 4.31: Chart showing the level of education among respondents in the study area
Source: EnvAccord Field Survey, 2020

- *Recreation*

The community of study is local and conservative. The survey enumerators observed that the community has designated playgrounds and makeshift place for playing football. The community members also congregate at different points within the community to play local games. The young and old adults make use of viewing centres to watch English Football Association (FA) League and other European football competitions.

4.4.3.5 Housing, Business Structure and Settlement Pattern

The housing structures in the two communities are in nucleated (clustered) settlement patterns. Some of the houses are built with fences to allow for privacy and security. Most of the housing structures are residential houses, churches,

mosques, town hall, and shopping complex for businesses (Plate 4.20). Results from the household survey indicated that about 37.33 per cent of the houses in these communities were tenement houses, while 26.67 per cent were story buildings and 22 per cent were blocks of flat. There are no residential houses close to the project area.

The housing materials used in the construction of the houses are cement blocks with corrugated iron sheets for roofing. The plastering material of most houses is cement. Overall, 100% of the houses in the community were plastered with cement, and all the sampled households were built with cement blocks. This points to a relatively moderate standard of living in the community.

Plate 4.20: Some housing structure observed in the study area
Source: EnvAccord field Survey, 2020

4.4.5.6 Land Acquisition

In the two communities, lands are owned by individuals, families and community. Transfer of ownership is allowed and non-indigenes in the community can own and develop landed properties as they wish. In some cases, rights over lands within a family are handed down from one generation to another. This makes it imperative that any negotiation to lease or acquire any land for personal, corporate or industrial use should be done through the community leaders. This point is supported by the information obtained during the KII held with the community leader of Ikenne. These leaders are in the best position to offer proper guidance concerning ownership. During the KII, the community leader of Ikenne stated that when they are consulted during the process of land acquisition, there is a high possibility of smooth transaction and transition of land documents.

Land in the study areas have been put to use for housing, economic, and infrastructural development purposes. When land is leased, it is for a specific period or duration. It is important to note that women also have rights to own lands and property in the community. The proposed expansion site is within the

existing 17 Hectares of Land purchased from families in Ikenne Community, with the nessesary documentations including the certificate of occupancy (C of O)

4.4.5.7 Project Affected Persons (PAPs)

Project affected persons are the people whose activities may be directly or indirectly affected by the proposed Project. Such people may include farmers that may temporarily cultivate on the Project site or those who navigate the land as access road. During the FGD sessions with men, youths and women in the communities, it was discovered that no member of the communities is engaged in farming or any other economic activities on the Project site as their means of livelihood.

4.4.5.8 Health Profile

Box 4.4: Highlight of the Community Health Profile

- **Common health problems reported in the study area are malaria, cough and diabetes.**
- **Most residents make use of primary healthcare centre**
- **There are private hospitals, public hospital and pharmacies within the study area**
- **A significant number of residents in the Project AoI have access to healthcare facilities such as pharmacies and hospital.**
- **The Doctor/Patient ratio is 1/35**

As of July 2020, COVID-19 is currently a pandemic health challenge for the Nigeria healthcare system. The surge in the number of infected people with COVID-19 threatens national public health. Emmanuel, (2020) stated that the Nigeria public health system due to its lack of coordination, fragmentation of services, dearth of resources, drug and supplies, inadequate and decaying infrastructure, inequity in resource distribution, access to care will be suppressed if the Coronavirus goes out of hand. The Nigeria Center for Disease Control (NCDC) provides a daily update on the number of COVID-19 infected cases in Nigeria; as at July 1, 2020, there are over 30, 000 cases in Nigeria with Lagos state, the epicentre of Nigeria economy and a state with the highest population in the country, having over 10, 000 infected cases and Ogun State rcording over 1,200 cases. With the limited capacity of the national and state level of health system, the impact of the Coronavirus can override and cripple the health system.

The Nigerian healthcare system is organised into primary, secondary and tertiary healthcare levels. The Local Government Areas (LGAs) are responsible for primary healthcare, the State Governments are responsible for providing secondary care while the Federal Government is responsible for policy development, regulation, overall stewardship and providing tertiary care. Nigeria is one of the developing countries faced with the “double burden” of

persisting high prevalence of communicable diseases and the rising prevalence of non-communicable diseases. Key health indicators such as maternal and infant mortality are worse than the Sub-Saharan African average, with 3.1% HIV prevalence rate. Malaria is Nigeria's most important public health challenge and is responsible for 60% of outpatient visits to health facilities in Nigeria, 30% of childhood deaths and 11% of maternal deaths. Over 90% of Nigerians are at risk of malaria with over 100 million cases per year and about 300,000 deaths (PharmAccess Foundation Report, 2015).

As observed during the baseline study, in Ikenne community there is a healthcare clinic called Ikenne Local Government Healthcare Clinic, specialist hospitals and teaching hospital situated in Babcock University. At Illisan-Remo community, there is a community hospital under the management of the Ogun State hospital management board. The in-depth interview held with the doctor during the baseline study revealed that the morbidity pattern in the community is due to diabetes, malaria, cough, and typhoid. The ratio of healthcare workers/doctors per patients is pegged 1/35. The doctor stated that the main factor affecting the health of the community members is majorly hygiene. There are healthcare services that provide pre, post and ante-natal services.

Plate 4.21: Signposts of healthcare infrastructures available in the study area

Source: EnvAccord field Survey, 2020

Respondents who have access to medical facilities such as pharmaceutical outlets, private clinic and public healthcare units and hospital are approximately 95 per cent while 5 per cent do not have access medical facilities. The baseline data revealed that 27.50 per cent of respondents make use of public hospital available in the study area; 41.58 per cent make use of pharmaceutical outlets to purchase drugs or seek for advice; 23.82 per cent make use of private hospital/clinic and 7.1 per cent make use of traditional medicine such herbs and take advice from local herbal medicine sellers.

The health status of respondents is quite encouraging with the results from the survey data showing that 88.24 per cent have good health, 11.76 per cent of the respondents stated that they have excellent health, are strong and they hardly get sick, none reported being ill in the past 1 year.

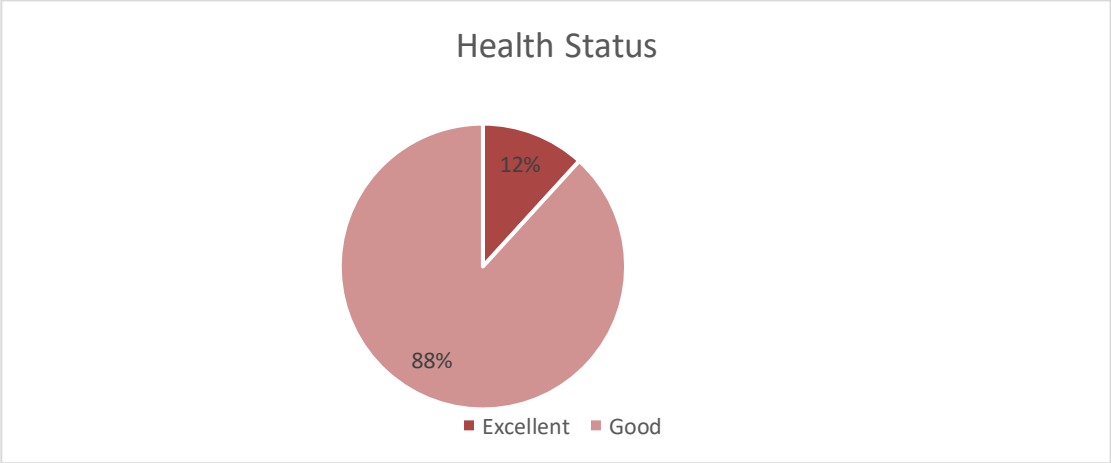

Figure 4.32: Showing distribution of respondent's general health status
Source: EnvAccord Field Survey, 2020

4.4.5.9 Community Concerns and Perception

The survey data revealed that none of the respondents is fully aware of the proposed Project until the survey team explained the Project in detail to members of the communities. During the discussion with the men, youths and women, the Project components amidst the advantages and disadvantages were thoroughly explained to participants. The reaction was positive as the participants believe that there is an impending economic advantage for them in terms of temporary jobs on-site during the site clearing and construction. They harbor the thought of having different people in the community, especially those who would come to work in the Project area and the possibility of an economy boost for the community as workers will consume goods and services available in the community.

4.4.5.10 Gender-based Assessment

Gender equality which according to Reeves and Baden (2000) means women having the same opportunities in life as men, including the ability to participate in the public sphere, have been identified as a core development objective. This is because it enhances productivity, improves development, especially for the next generation, and make institutions more representative. Attempts made to reduce poverty can only be successful if the differences in the status of women and men in key areas like population and families, health, education, work, power and decision making, violence against women, environment and poverty are taken into consideration (Lin, 2011; World Development Report on Gender

and Development, 2012; ILO, 2012). It is on these bases that the United Nation General Assembly in 1979 adopted the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). CEDAW which till date has been ratified by nearly 187 countries of the world takes care of civil rights of women, legal status of women, reproductive roles and rights, and the impact of cultural factors on gender relations and on barriers to the advancement of women (UNDESA, 2012).

Gender equality has been identified as one of the development strategies for reducing poverty. Upon discovering that the women who constitute about 50% of the total population in Nigeria and contribute significantly to national development are the lowest income level earners, constitute the highest percentage of the poor and vulnerable, and are predominantly in the informal sector of the economy (Nigeria Vision 20:2020, 2010), the federal government through the Ministry of Women Affairs and Social Development have attempted programmes to empower the women. Such programs include economic and political empowerment programmes, sensitization program on subject matters girl child education and violence against women (Ntiwuka, 2013).

However, despite the various efforts and programs, women still have less voice, less power, less control over resources and are very much vulnerable to violence at home and in society at large. In most African countries, women cannot acquire land without a husband's authorization. They are not involved in household decisions about spending their personal earned income (Reed, Raj, Miller and Silverman, 2010). In Nigeria, women occupy fewer than 30 per cent of all posts in the public sector out of which only 17 per cent are senior positions (British Council Nigeria, 2012). Notwithstanding the various efforts made globally for women to run for public office, the number of women holding parliamentary seats is not encouraging. In 1995, women accounted for 10 per cent of the members of the lower or single national parliaments and in 2009, 17 per cent (UNDESA, 2010).

Ogun state has not been excluded from such programs that aim to empower women and reduce inequality. On political empowerment in Ogun State, workshops were conducted for women in politics. In 2020, the ministry in Ogun State coordinated one hundred and eight members of the women-in-politics drawn from the twenty Local Governments in the state (Nigeria Women Development, 2002). Vocational skill trainings were provided for the women on leadership, protocol and security. The state has also been a beneficiary of other economic and financial empowerment such as skill acquisition and access to microcredit through the Women Fund for Economic Empowerment (WOFEE) (Sowumi, 2012; Balogun, 2012).

Gender inequality at the national level is still very much reflected in the state because statistics has shown that, despite the efforts, women are still under represented in the state. Women occupy only 27.8 per cent of all ministerial positions in the State, and 5 percent representation as the local government chairman (Reed, Raj, Miller and Silverman, 2010). And only 48.4% of the women could access the credit facilities (Federal Ministry of Women Affair, 2006).

Ogun State also has records of GBV experiences which have been aggravated by the COVID'19 pandemic. The GBV situation in Nigeria reflects the global trend of increased gender-based violence as GBV has been reported to have significantly increased since the lockdown began and Ogun State is one of the three most affected States (UN, 2020). Data on reported incidents of GBV cases in Nigeria based on preliminary information from 24 states shows that in March the total number of GBV incidents reported was 364, and it increased into 794 in April (United Nation Nigeria, 2020). Some of these incidents of violence have tragically resulted in death of victims, the rape of children, and tenant-landlord assault among others. Economic uncertainty, increased substance abuse and changes to daily family live as a result of the pandemic have also increased tensions within households, compounding violent situations.

- *Gender-Based Community Profile*

Ikenne and Ilishan communities are made up of women who are strong pillars for their households and they spend their time between house chores, care of children and economy activity. Similarly, the women in Illishan also reported they are actively engaged and engrossed in economic activities and also homemaking duties. They reported the burden of the workload and how it is unusal for their husbands to support them with household chores. Only 10% of men in Ikenna community support their wives in household chores.

In the two communities, women are known to be hardworking and always ready to take up any form of job; hence, they engage activities such as; tailoring, hairstylist, laborers, proprietor of schools, CEO of various enterprises, corporate workers. Women in Ilishan community are particularly specialized in kolanut trading and they are known for the special skill of preserving the kolanut for up to five years. Their men engage in farming and solely their economic engagement and they rarely assist in household chores the women further reported that most women get insulted by their husband if they attempt to question them for not being supportive.

- *Security and safety of women within the community*

The women in the two communities reported during the FGDs that the communities are safe for women and young girls. They furthered that people in

the communities are accommodating as visitors and non-indigenes are welcome. An instance discussed during the discussion was Illisan community accommodated and hosted Babcock University. The festival periods are identified as a period that is unsafe for women and young girls in the communities. Women and young girls are warned from attending festivals like Oro and Egungun as they are dangerous to the sight of women.

- *Power inequality in the community*

The report of the women on power inequality is consistent with that of British Counsel as reviewed in past literature. Though there are prove of educational and economic empowerment for the women, there is still unequal power representation among the women. Though the women are carried along and aware in public decision making, there is low representation of women in power. They reported that the women representation in power and decision making in the communities is less than 10% and women in Ilishan reported that they have representatives at Women for Equity and Fairness Organization for Nigeria (WEFON), an organization fighting against power inequality in the state at large.

- *Access to land, properties and Assets*

The economic empowerment of the women in the two communities has exposed women to financial resources and independence. They reported they have right and freedom to use their resources as wish, and by their hard work they can acquire assets and properties. The Women reported that women build 60% of the houses and structures in the two communities, they have both statutory and customary right to land ownership and they also have right to inherit land and properties.

- *Gender-Based Violence*

Cases of gender-based violence reported in Ikenne community are domestic and physical violence. Violence against women is at its peak in “tumoro” locality. In Illishan community, they reported cases of domestic violence, physical violence, emotional violence and sexual violence. They further reported that scenes have been created publicly of women been abused and molested. Instances were given on cases that happened few weeks before the survey.

The only available gender-based violence response center is the customary court, stationed in Ilishan community, along healthcare centre for survivors. No other government or non-governmental organization addressing Gender Based Violence in the communities.

- *Awareness and expectation from Project*

In Ikenne community, only few women are fully aware of the Project. Those who were informed during the Focus Group Discussion with women provided support for proposed Project. Some of women stated that they have benefited from the company through palliatives and they are expecting more benefits through employment for women as they have adults who graduate but unable to find suitably paid employment.

The women in Ilishan community reported that they were neither informed nor aware of the Project and its associated benefits. They received information about the project through the Focus Group Discussion. They however showed support and acceptance for the proposed Project.

The major expectations from Ladgroup are; employment, partnership for distribution and resale of products, continuous community engagement and meeting the needs of the communities.

4.5 Stakeholder Engagement, Consultations and Disclosure

This section describes the activities that were carried out to engage and consult with key stakeholders. 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 describes the actions that the Project took to disclose pertinent information to stakeholders. This section also describes the plan that the Project will implement to ensure that stakeholders are continued to be engaged throughout the project life cycle.

4.5.1 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 EIA.

4.5.2 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:

- 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;
- 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.

4.5.3 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 in order 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 (FMEnv)
- Ogun State Ministry of Environment
- Ikenne Local Government Area
- Ogun State Ministry of Agriculture
- Ikenne and Ilishan-Remo communities

The consultations served to provide stakeholders with information about the Project and to gather information important to the EIA. 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 4.22 to 4.26 show the sample photographs of the stakeholder scoping workshop while attendance lists and engagement tools are provided in Appendix 4.2.

Plate 4.22: Remarks by the Federal Ministry of Environment during the Scoping Workshop

Source: EnvAccord, 2020

Plate 4.23: Presentation by the EIA consultant during the Scoping Workshop

Source: EnvAccord, 2020

Plate 4.24: Remarks by representative of Ogun State ministry of environment

Source: EnvAccord, 2020

Plate 4.25: Remark by one of the community leaders present at the Workshop

Source: EnvAccord, 2020

Plate 4.26: Group photograph of participants at the Scoping Workshop
Source: EnvAccord, 2020

Table 4.30 below summarizes the findings of the scoping consultation.

Table 4.30: Initial Scoping Consultation Findings

Stakeholder	Quotes/Comments during Scoping Workshop	How comments were addressed
Federal Ministry of Environment, Abuja Office	• Report should contain a list of equipment to be used at the factory. • Sampling frame for soil samples should be rounded up to 10. • In- situ measurement for climate and meteorology should be included in the report in addition to the historical data. • Food safety impact should be captured in the report. • Climate change mitigation and adoption issues should be incorporated into the report. • Study should also capture the health impact assessment.	• Chapter 3 sub section 3.3 (Project components) contains a list of equipment to be used at the factory • The number of sampling stations for soil has been increased to eleven in the SoW/ToR • In- situ measurement for climate and meteorology has been included in the report in addition to the historical data. • Chapter 3, sub section 3.4.3.2 captures food safety procedure and process applicable to Ladgroup's operations • Impact of climate change is dicussed in Chaper 4, sub section 4.3.9 • Potential biophysical and socio-economic impacts (including health and safety) of the project has been assessed and discussed in the EIA report.
The Federal Controller, Federal Ministry of Environment, Abeokuta Office	• Ensure the FMEnv EIA process if fully followed.	• The EIA study is in compliance with the FMEnv EIA procedural guidelines
Ogun State Ministry of Agriculture	• What are the CSR plans for the communities	• Ladgroup will develop and implement a fit for purpose stakeholder engagement plan (SEP). Part of the SEP will be a detailed framework for its CSR programs
Ogun State Ministry Environment	• Relevant laws of Ogun State on environmental protection should be captured in the EIA report. • Ladgroup should ensure the implementation of the EIA recommendations. • Community buy-in is very important for Project implementation.	• Chapter 1, sub section 1.6.2 of the EIA report contains state Laws applicable lto the EIA study. • Ladgroup will maintain periodic engagement with relevant stakeholders including local communities and government agencies, amongst others.
Ikenne Local Government Area (LGA)	• In the area of regulatory agencies, Ikenne was not captured as the chief host LGA. Federal ministry of Environment was only mentioned as the only regulatory agency. This should be updated	• This has been updated in Chaper 1, sub section 1.6.3 of the EIA report

Stakeholder	Quotes/Comments during Scoping Workshop	How comments were addressed
Ikenne Community	• Emissions from heavy machines and dust which settle in nearby and adjacent communities should be appropriately documented • Ground water quality should be included in the report, to identify any form of pollution	• As part of the baseline data gathering exercise the air and water quality of the project area has beeen assessed and documented in the Chapter 4 sub section 4.3 of the EIA report
Ilishan-Remo Community	• Environmental impact of Ladgroup should be well documented • The EIA consultant should pay attention to the solid and liquid waste to be generated in the factory • toxicity of waste to plant should be included in the report • solid/liquid effluent should be properly treated before discharge to the environment • Issue related to traffic management should be captured in the report	• A waste management plan has been developed as part of the EMP to be implemented for the Project. No effluent will be generated as the production process as the production process is a dry process. • The primary waste associated with the sheabutter processing is the de oiled cake, which is sold out to third-party vendors who use it for animal feed please refer to chapter 3, Table 3.1 • A traffic survey has been conducted as part of the EIA study and documented in chapter 4 of the EIA report.

CHAPTER FIVE:

ASSOCIATED AND POTENTIAL IMPACTS

CHAPTER FIVE

ASSOCIATED AND POTENTIAL IMPACTS

This chapter discusses the potential environmental and socio-economic impacts of the proposed Ladgroup factory expansion Project in Ikenne, Ogun State. It also includes the methodology employed to assess the significance of the impacts. The mitigation measures (in addition to those incorporated into the Project design) required to address the identified significant impacts is presented in the next chapter of this report.

5.1 Impact Assessment Overview

The potential for an environmental impact exists where an environmental aspect has been identified i.e. where a project activity has been determined to have the potential to interact with the biophysical and socio-cultural environment. The significance of each impact is then determined.

The methodology used for assessing the potential and associated impacts of the proposed expansion Project consists of five (5) major steps as follows:

Step 1: Identification and description of the proposed Project activities and the understanding of the biophysical and socio-economic environment of the Project's area of influence (AoI).

Step 2: Comprehensive preliminary identification of potential impacts as a result of cause and effect relationship.

Step 3: Comparative assessment of impact importance, identification of impacts that are likely to be significant through application of a basic set of impact significance criteria to the preliminary information available about each impact.

Step 4: Detailed assessment of the identified focus area impacts characterization techniques, quantification of impacts to the extent possible and rigorous qualitative characterization of impacts that cannot be quantified.

Step 5: Final assessment of the severity levels of impacts through application of the results of the quantitative and qualitative characterization of impacts developed in Step 4 to a set of objective impact severity criteria; identification of impacts warranting mitigation and determination of residual impacts.

Figure 5.1 summarizes the impact assessment process adopted for this EIA study.

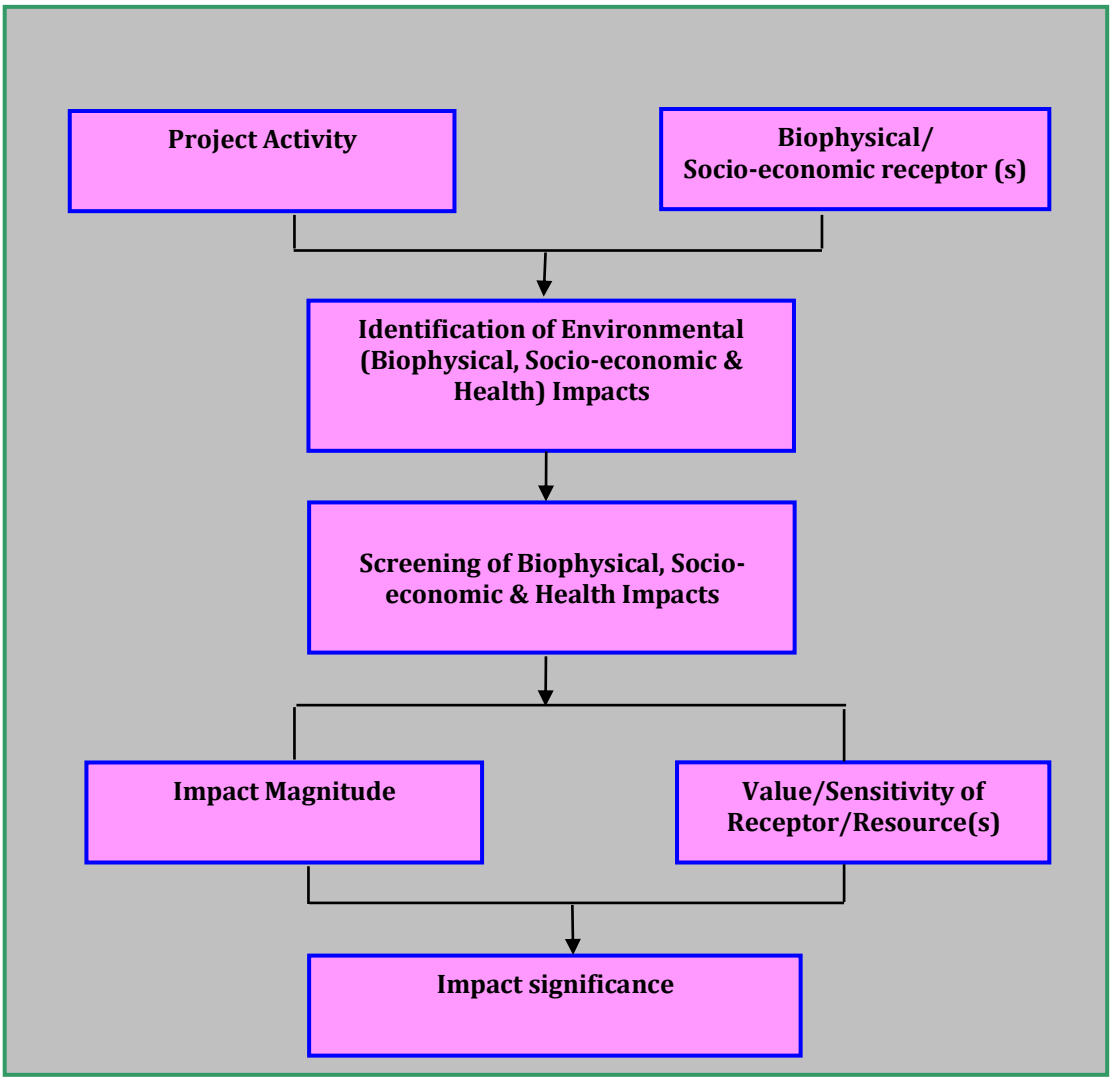

Figure 5.1: Overview of the Impact Assessment Process

The primary objectives of the impact assessment process are to:

- Establish the significance of identified potential impacts that may occur as a result of proposed Project activities.
- Differentiate between those impacts that are insignificant (i.e. can be easily absorbed by natural systems) and those that are significant (i.e. cannot be easily absorbed by natural systems).
- Apply mitigation measures for the identified significant impacts and assess residual impacts, including periodic monitoring of the effectiveness of the proffered mitigation measures throughout the Project life cycle.

In determining the significance of impacts, the factors considered included:

- Magnitude of impacts (which is a function of the combination of the following impact characteristics: **extent**, **duration**, **scale** and **frequency**);
- Value/sensitivity/fragility and importance of identified environmental and social receptors in the Project's AoI;

- Relevant legal/regulatory requirements;
- Public perceptions (based on stakeholder consultation).

The assessment of impact significance is both in qualitative and quantitative terms. Qualitatively, the impact significance is ranked on four (4) widely accepted levels: **Major**, **Moderate**, **Minor** and **Negligible.** These rankings are used for both biophysical and socio-cultural impacts.

The impact assessment discusses in this chapter covers the pre-construction, construction and operation phase while the environmental and social issues including mitigation and management plans related to decommissioning activities are discussed in Chapter 8.

5.2 Impact Prediction Methodology

Various impact prediction guidelines and methodologies have been developed and applied in various EIA activities. Internationally acceptable methods of impact prediction and evaluation include the following:

- Checklist (Canter, 1977)
- **Leopold Interaction Matrix (Leopold *et al.*, 1971)**
- Overlays Mapping (McHarg, 1968);
- Networks; and
- Battelle Environmental Evaluation System (Dee *et al.*, 1972)

The Leopold Interaction Matrix method, when compared to the other approaches is simple, provides the same level of details, requires comparable knowledge of the environment and relies on limited data unlike the other methods that rely on availability of large historical data bank. It also has a wide range of application. Thus, a modified Leopold Interaction Matrix was selected for the purpose of impact screening for this EIA.

5.3 Identification of Environmental and Socio-economic Aspects and Impacts

5.3.1 Definition of Environmental Aspects

The International Organization for Standardization's Environmental Management Systems (EMS), ISO 14001, defines an environmental aspect as: *"An element of an organization's activities, products or services that can interact with the environment"*

To identify environmental aspects of the Project, the proposed Project activities were considered in terms of their direct or indirect potential to:

- Interact with the existing natural environment including its physical and biological elements; and
- Interact with the existing socio-economic and cultural environment.
- Breach relevant policy, legal and administrative frameworks including national legislation, relevant international legislation/conventions, standards and guidelines, and corporate environmental policy and management systems;

Activities assessed covered planned and non-planned events.

5.3.2 Definition of Impacts

ISO 14001 defines an environmental impact as: *"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services"*

An environmental or socio-economic impact may result from any of the identified environmental aspects. For example, Table 5.1 illustrates the links between activity, aspect and impact.

Table 5.1: Links between Activities, Aspects and Impacts

Activity	Aspect	Potential Impact
Use of vehicles (e.g. trucks) for transportation of equipment to site	Exhaust emissions	Decrease in air quality
	Noise	Disturbance to surrounding environment or sensitive receptors
Foundation laying	Excavation of soil	Soil compaction and degradation

5.3.3 Potential Impact Characteristics

The following characteristics were also used to define potential impacts that may be associated with the proposed Project:

i. *Negative:* An impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor.

ii. *Positive:* An impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.

iii. *Direct (Primary):* Impacts that result from the direct interaction between a planned project activity and the receiving bio-physical and socio-cultural environment.

iv. *Indirect:* Impacts that result from other activities that are encouraged to happen as a consequence of the Project.

v. *Temporary:* Temporary impacts are predicted to be of short duration, reversible and intermittent/occasional in nature.

vi. *Short-term:* Short term impacts are predicted to last only for a limited period but will cease on completion of the activity, or as a result of mitigation measures and natural recovery.

vii. *Long-term:* Impacts that will continue for the life of the Project, but cease when the project stops operating.

viii. *Permanent:* Impacts that occur during the development of the Project and cause a permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime.

ix. *On-site:* These are limited to the Project site.

x. *Local:* Impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community.

xi. *Regional:* Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries.

xii. *National:* Impacts that affect nationally important environmental resources; affect an area that is nationally protected; or have macro-economic consequences.

xiii. *Reversible:* An impact from which the environment can return to its natural state.

xiv. *Irreversible:* An impact that the environment cannot return to its original state, e.g. the extinction of an animal or plant species.

xv. *Cumulative/Synergistic:* Potential impacts that may result from incremental changes caused by other past, present or reasonably foreseeable actions together with the Project. This also includes synergy with other projects/infrastructure in the Project area.

xvi. *Residual:* Both environmental and social impacts that will remain after the application of mitigation measures to Project impacts during each of the Project phases (pre-construction, construction, operation).

5.3.4 Screening and Scoping for Potential Impacts

A modified version of the Leopold Interaction-matrix technique was employed to screen and scope for the potential impacts of the proposed Project on the environment. The basis for the screening was derived from the following:

- Knowledge of the Project activities as summarized in Table 5.2.
- Detailed information on the environmental and socio-economic settings of the Project's AoI. The potential environmental and social receptors/resources that could be affected by the proposed Project are summarized in Table 5.3.
- Review of other EIA reports on similar projects/environments.
- Series of experts group discussions, meetings and experience on similar projects.

Table 5.2: Summary of Proposed Project Development Phases and Associated Activities

S/N	Project Phase	Associated Activities
1.	Pre-Construction	Site selection/land take
		Mobilization of personnel, equipment and material to site
		Site clearing and preparation
2.	Construction	Civil work activities including excavation, foundation piling, construction of structures e.g. drainage
		Equipment installation/ Refurbishment of existing mill
		Waste generation (such as construction waste, wood debris etc.) and disposal
		Demobilization of personnel and construction equipment from site
3.	Operation	Milling and refining operations
		Fleet operations
		Equipment maintenance and occasional repairs;
		Utilities consumption
		Waste generation and disposal

Table 5.3: Resource/Receptors and Impacts Indicators Considered

Environmental Receptor	Comment	Impact Indicators
Physical		
Air Quality	Ambient air quality of the Project site and its surrounding environment	Increased concentration of gaseous and particulate pollutants (such as NOx, SOx, CO, VOC, PM_{10}, $PM_{2.5}$, CO_2)
Ambient Noise	Ambient noise level within Project site and the surrounding environment	Increased ambient noise and vibration level, night and day-time disturbance, communication impairment etc.
Soil	Soil environment of the Project site and its surroundings	Changes in physical, chemical and biological properties, loss of soil ecology, erosion etc.
Underground water/aquifers	Underground water resources in the surrounding	Decrease in underground water/aquifer reservoir level, groundwater contamination, and

Environmental Receptor	Comment	Impact Indicators
	environment of the Project site	availability of potable water.
Landscape/topography	Geomorphological land forms and terrain of the Project site and its surrounding environment	Alteration in drainage pattern, changes in landscape.
Biological		
Terrestrial Flora and habitats	Plant species within the Project site and its surrounding environment	Loss of terrestrial flora, introduction of new species.
Terrestrial Fauna including avifauna	Terrestrial fauna and avifauna within the Project site and its surrounding environment	Loss of terrestrial fauna; involuntary migration.
Socio-economic Environment		
Land use	Existing land use of the Project site and its surrounding environment	Loss of existing land value (e.g. farming activities, grazing)
Population	Existing demography of communities within the Project's Area of Influence (AoI)	Increased in local population due to influx of workers; changes in total population, gender ratio, age distribution, socio-economic structure etc.
Visual prominence	Aesthetic quality of the Project on the surrounding visual catchment.	Compatibility of the proposed Project with the character of the locality.
Utilities	Existing utilities (e.g. power supply, water, sewerage services) in the Project's AoI	Changes in existing utilities, damage to public utilities e.g. pipes, cables.
Infrastructure	Existing infrastructure such as road, waste handling facilities within the Project's AoI	Damage to road infrastructure including road traffic; access to health facilities, communication facilities, or waste management facilities
Employment/income	The employment situation in the Project's AoI	Opportunities for local and national employment; changes in income level
Other (Health and Safety)		
Construction workers	Health and safety of construction workers	Accidents, injury, fatality, exposure to nuisance (dust, noise), fire etc.
Workplace health and safety	Health and safety of employees involved in facility operation	Accidents, injury, exposure to nuisance (dust, noise), fire, explosion.
General public	Community health and safety	Exposure to road accident, fire, explosion, etc.

Identified Project activities and environmental and socio-economic receptors were integrated into a matrix with the Project activities on the y- axis and environmental receptors on the x- axis, and the matrix was completed for each of

the project elements. The Leopold's Interaction matrix was subsequently assessed to identify every possible case of activity-receptor interaction. Where it was considered that an activity-receptor interaction was possible, the cell was marked denoting an identified environmental aspect (denoted as dot[•] in Table 5.4).

Table 5.4: 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	Visual Prominence	Construction workers	Workplace health and safety	General Public
Pre-construction																
Site selection/land take								•								
Mobilization of personnel, materials and equipment to site	•	•									•	•			•	•
Site clearing and preparation	•	•	•			•	•	•				•		•	•	
Construction/Installation																
Civil work activities including excavation, foundation works, construction of structures e.g. drainage	•	•	•	•	•					•	•	•	•	•	•	•
Equipment installation/ Refurbishment of existing mill	•	•								•		•		•	•	
Waste generation (such as construction waste, wood debris etc.) and disposal			•	•							•	•	•		•	
Demobilization of construction equipment from site	•	•							•		•	•			•	
Operation																
Milling and refining operations	•	•		•					•	•	•	•			•	
Fleet operations	•	•								•	•	•			•	•
Equipment maintenance and occasional repairs	•	•	•	•							•	•			•	
Utilities consumption	•			•						•						
Waste generation and disposal	•		•	•							•				•	•

• **Is used to establish an interaction between a particular environmental/social receptor and the project activities**

5.3.5 Determination of Impact Significance

Once all environmental aspects were identified, the levels of impacts that may result from the proposed Project activities were assessed. Three (3) stages were utilized to establish significance of impacts as follows:

- **Impact Magnitude** which is a function of the combination of the following impact characteristics: extent, duration, scale and frequency;
- **Value/Sensitivity/Fragility and importance** of the relevant Receptor;
- **Identification of the impact significance,** which is the "product" of a combination of the above two key variables.

The magnitude of an effect is often quantifiable in terms of, for example, the extent of land take, or predicted change in noise levels while the sensitivity, importance or value of the affected resource or receptor is derived from:

- Legislative controls;
- Designated status within the land use planning system;
- The number of individual receptors, such as residents;
- An empirical assessment based on characteristics such as rarity or condition; and
- The ability of the resource or receptor to absorb change.
- Public perception about the criticality or sensitivity of the receptors to the local community.

The determination of significance also includes consideration of performance against environmental quality standards or other relevant pollution control thresholds; and compatibility with environmental policies.

Further details on the criteria used for determining the impacts significance are provided in the sub-sections below:

5.3.5.1 Impact Magnitude

Magnitude is in practice a continuum, and evaluation along the spectrum requires the exercise of professional judgement and experience. Each impact is evaluated on a case-by-case basis, and the rationale for each determination is noted. The magnitude designations employed for potential negative impacts, are: **Negligible; Low; Medium** and **High**.

In the case of a positive impact, it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact, thus no magnitude designation has been assigned.

The magnitude of an impact takes into account the various dimensions of a particular impact in order to make a determination as to where the impact falls on the spectrum from **Negligible** to **High**. These criteria are discussed further in the sub-sections below.

5.3.5.1.1 Determining Magnitude for Biophysical Impacts

For biophysical impacts, the quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided in Table 5.5 and summarized in the following paragraphs:

A **High Magnitude Impact** affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with national or international limits and standards specific to the receptors) or a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.

A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

A **Medium Magnitude Impact** 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 or levels (to be compared with national or international limits and standards specific to the receptors) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it.

A medium magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

A **Low Magnitude Impact** affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (when compared with national or international limits and standards specific to

the receptors) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localized area.

A **Negligible Magnitude Impact**: Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact, and are characterized as having a very low or negligible magnitude.

A number of considerations have been built into these Impact Magnitude Criteria including temporal, spatial, impact reversibility, direct and indirect impacts and relevant legal or policy constraints.

Table 5.5: Impact Magnitude Criteria for Biophysical Impacts

Category	Ranking	Definition
High	**4**	• Regional to national scale impact resulting in: o Medium term change and/or damage to the natural environment and its ecological processes. o Reduction in regional habitat and species diversity. • Breach of environmental regulations and company policy with exceedance greater than 100% of international, national, industry and/or operator standard for an emission parameter.
Medium	**3**	• Local to regional scale impact resulting in: o Short term change and/or damage to the natural environment and its ecological processes. o Direct loss of habitat crucial for species' (including listed species) continued persistence and viability in the project area (for species unable to disperse). o Introduction of exotic species of fauna in invasive floral species replacing resident 'natural communities' within the project area. o Environmental stress lowering reproductive rates of species within the project area. • Potential breach of environmental regulations and company policy and/or 50%-100% exceedance of international, national, industry and/or operator standard for an emission parameter. • Complaints from the public, authorities and possible local media attention.
Low	**2**	• Local scale impact resulting in: o Short term change and/or damage to the local natural environment and its ecological processes. o Short-term decrease in species diversity in selected biotopes/areas within the project area. o Increased mortality of fauna species due to direct impact from project activities. • 10%-50% exceedance of international, national, industry and/or operator standard for an emission parameter. • Public perception/concern.
Negligible	**1**	• Impact largely not discernible on a local scale being absorbed by the natural environment; areas adjacent to disturbed areas absorb exodus of species able to disperse. • Up to 10% exceedance of international, national, industry and/or operator standard for an emission parameter. • Public perception/concern.
Beneficial	**+**	• Activity has net positive and beneficial effect resulting in environmental improvement for example: o Ecosystem health. o Increase in magnitude or quality of habitat for rare and endangered species of fauna and flora as well as for those species known to naturally occur in the area. o Growth of 'naturally occurring' populations of flora and fauna. • Positive feedback from stakeholders. • Potential financial gains.

5.3.5.1.2 Determining Magnitude for Socioeconomic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact. Table 5.6 presents the impact magnitude criteria for socio-economic impacts.

Table 5.6: Impact Magnitude Criteria for Socio-economic Environmental Impacts

Category	Ranking	Definition
High	**4**	• Major impacts on human health (e.g. serious injury). • Significant impact on the livelihoods of individuals (i.e. access to income source restricted over lengthy period of time). • Serious impact on access to community facilities and utilities (e.g. resettlement of large numbers (10s – 100s) of households). • Breach of economy social policy and/or regulation.
Medium	**3**	• Modest impact on human health and well-being (e.g. noise, light, odor, dust, injuries to individuals). • Moderate impact on individual livelihoods (e.g. restricted access to income source). • Medium impact on access to community facilities and utilities (e.g. access to utilities restricted for long periods (weeks) of time). • Potential breach of company social policy and/or legislation.
Low	**2**	• Limited impact on human health and well-being (e.g. occasional dust, odors, traffic noise). • Some impact on the livelihoods of individuals (e.g. isolated incidents related to ethnic tensions and some restrictions on access to income source). • Some impact on access to community facilities and utilities (e.g. access to cultural centers restricted to a limited extent, i.e. (days).
Negligible	**1**	• Possible nuisance to human health and well-being (e.g. occasional unpleasant odors) • Inconvenience experienced in accessing community facilities and utilities (e.g. electricity supply disruption for short (hours) period of time). • No impact on livelihood, community facilities and human health.
Positive	**+**	• Beneficial improvement to human health. • Benefits to individual livelihoods (e.g. additional employment opportunities). • Improvements to community facilities/utilities. • Increased economy (e.g. local procurement, sourcing of supplies).

5.3.5.2 Determining Receptor Sensitivity

In addition to characterizing the magnitude of impact, the other principal variable necessary to assign significance for a given impact is the value, and sensitivity/fragility of the receptor. This refers to economic, social, and/or environmental/ecological importance of the receptor, including reliance on the receptor by people for sustenance, livelihood, or economic activity, and to the importance of direct impacts to persons associated with the resource.

Impacts that directly affect people or vital natural resources are deemed to be more important than impacts that indirectly affect people or vital resources. The sensitivity of the receptor criterion also refers to potential impacts to Environmentally Sensitive Areas (ESAs) and impacts to species, including loss of

endangered species, effects of introduction of invasive species, and similar environmental/ecological impacts.

There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, soil environment) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered.

Where the receptor is biological (for example, the aquatic environment), its importance (for example, its local, regional, national or international importance) and its sensitivity to the specific type of impact are considered.

Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

The receptors-sensitivity designations employed in this impact assessment process are **Low**, **Medium** and **High** which are universally acceptable.

The sensitivity/fragility/value criteria for physical, biological and socio-economic receptors are defined in Table 5.7.

Table 5.7: Physical, Biological and Socio-economic Receptor-Sensitivity/Fragility/Value Criteria

Category	Ranking	Definition
Physical (for example, air quality)		
High	**3**	All ambient conditions/concentrations exceed guideline limits and are indicative of the resource being impacted or polluted. There is no (or very little) assimilation capacity for increased concentrations/ change in conditions.
Medium	**2**	Some ambient conditions/concentrations exceed guideline limits while others fall within the limits. There is some small assimilation capacity for increased concentrations/ change in conditions. Resource use does affect other users
Low	**1**	All ambient conditions/concentrations are significantly lower than guideline limits and there is capacity for assimilation for additional concentrations/ change in conditions. Resource use does not significantly affect other users.
Biological (for example, terrestrial ecology)		
High	**3**	Specifically protected under Nigerian legislation and/or international conventions; listed as rare, threatened or endangered e.g. IUCN. Considered to be of critical importance to the local use; and totally dependent on for livelihood or means of survival.
Medium	**2**	Not protected or listed but may be a species common globally but rare in Nigeria with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline. Considered to be of moderate importance to the local use; and partially dependent on for livelihood or means of survival.
Low	**1**	Not protected or listed as common / abundant; or not critical to other ecosystem functions. Considered to be of minor importance to the local use; and local communities do not depend on the resources for livelihood.
Socio-economic and health		
High	**3**	Those affected will not be able to adapt to changes and continue to maintain pre-impact status.
Medium	**2**	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.
Low	**1**	Those affected are able to adapt with relative ease and maintain pre-impact status.

5.3.5.3 Significance

The significance of the impact is determined by calculating the "product" of impact magnitude and severity/fragility/value/importance of the relevant receptor(s). Figure 5.2 below illustrates the process for combining the impact magnitude with the receptor sensitivity.

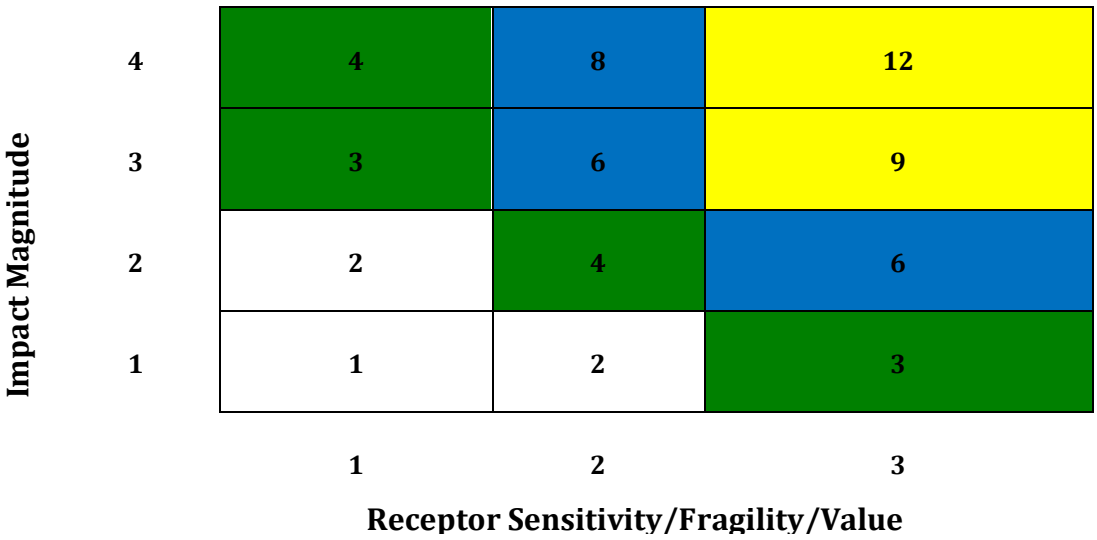

Figure 5.2: Impact Magnitude-Receptor Sensitivity Product Results

Based on its impact magnitude-receptor sensitivity/fragility/value score, each impact was again ranked into four (4) categories or orders of significance as illustrated in Table 5.8.

Table 5.8: Environmental impact significance rankings

Ranking (Impact Magnitude x Sensitivity of Receptor)	Significance
9-12	Major
6-8	Moderate
3 – 5	Minor
1-2	Negligible

Negligible impacts are where a resource or receptor will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.

An impact of minor significance is one where an effect will be experienced, but the impact severity is sufficiently low (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

An impact of moderate significance is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a

legal limit. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP).

An impact of major significant is one where an accepted limit or standards may be exceeded, or high magnitude impact occurs to highly valued/sensitive receptors/resources.

5.3.5.3.1 Determining the Significance of Potentials Impacts of the Project

To assist in calculating the overall significance of each of the identified potential impacts, expert discussions were constituted and employed extensive use of screening matrices and predefined criteria for impact magnitude and sensitivity/fragility/value/importance of resources/receptors. The significance (the 'product' of impact magnitude and sensitivity/fragility/value/importance of resources/receptors) was developed (Table 5.9).

To minimize subjectivity, independent scores were thereafter statistically analyzed and the results of the scores judged as follows:

- if variance, s^2 < 5% of the mean, subjectivity is minimal and the score is good; and
- if s^2 > 5% but < 10% of the mean, the score is fair and scorers were given the opportunity to review their scores.

Table 5.9: 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	Ground water and Aquifers	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities	Infrastructure	Employment/ Income	Visual Prominence	Construction workers	Workplace health and safety	General Public
Pre-construction																
Site selection/land take								2(1)								
Mobilization of personnel, materials and equipment	3(1)	3(1)									2(2)	+			3(2)	2(2)
Site clearing and preparation	2(2)	2(2)	3(1)			3(1)	3(1)	2(1)		2(2)		+		3(2)	3(2)	
Construction/Installation																
Civil work activities including excavation, foundation works, construction of structures e.g. drainage	3(2)	3(2)	3(2)	3(2)	2(2)					2(2)	2(2)	++	2(1)	3(2)	3(2)	3(2)
Equipment installation/ Refurbishment of existing mill	2(2)	3(2)										+		3(2)	3(2)	
Waste generation (such as construction waste, wood debris etc.) and disposal			2(2)	2(2)						2(2)	2(2)	+	2(1)		2(2)	
Demobilization of construction equipment from site	2(2)	2(2)							2(1)		2(2)	+			3(2)	
Operation																
Milling and refining operations	2(2)	2(2)		2(2)					2(2)	2(3)	2(2)	+			3(2)	
Fleet operations	2(2)	2(2)								2(1)	2(2)	+			3(2)	3(2)
Equipment maintenance and occasional repairs;	2(2)	2(2)	2(2)	2(1)								+			2(2)	
Utilities consumption	2(1)			2(2)						2(2)						
Waste generation and disposal			2(2)	2(2)							2(2)				2(2)	3(2)

The value assigned to each cell in the matrix is in the form "x (y)": where "x" denotes the impact magnitude and "y" the sensitivity of receptor

5.4 Impact Discussions

5.4.1 Potential Positive Impacts

The proposed Project will enable Ladgroup to improve the quality of sheanut processed at the factory while adding value to the products. In addition, the proposed Project will provide employment opportunities for various Nigerians (skilled and semi-skilled) from the Project area and beyond. The employment opportunity will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects. For example, 60 workers (at various stages of the project construction) would be engaged. The larger portion of the workers (especially unskilled) would be drawn from the local communities within the Project's AoI. The communities in the Project area also have the opportunities of benefiting from various Corporate Social Responsibility initiatives associated with the Project.

Other potential benefits of the proposed Project include:

- Technology transfer to local personnel during construction and operation;
- Revenue generation to the Government (for example, through taxes);
- Increase in local and regional economy through award of contracts for Project development;
- Direct and indirect employment opportunities (including creation of additional supply chains)

5.4.2 Potential Negative Impacts

The potential negative impacts associated with the proposed Project are discussed in the sub-sections below under the following headings:

- Potential impacts of the proposed factory expansion.
- Potential cumulative impacts of the proposed Project in relation to other development projects in the study area.

It is important to note that the impact significance ratings discussed in the sub-sections below are without mitigation measures except those already built into the Project design. Implementation of additional mitigation measures (presented in the next chapter of this report) are expected to further reduce the impact ratings as low as reasonably practicable.

5.4.2.1 Potential Impacts of the proposed factory expansion

5.4.2.1.1 Pre-Construction Phase

The pre-construction phase of the proposed factory expansion Project entails the following key activities:

- Site selection/land take
- Mobilization of equipment, materials and personnel to site
- Site clearing and preparation

The potential impacts associated with each of these activities are discussed below:

❖ ***Site Selection/Land take***

The proposed expansion Project will involve the construction of new facilities and upgrading/retrofitting existing ones within the existing land. The proposed project site is located along the Shagamu-Benin express road. The land area is about 17 hectares. The land was acquired from the community.

The Project site is currently fenced round and is characterized by scanty vegetation which includes shrubs and grasses. None of the flora or fauna species observed in the Project site is regarded as endangered or threatened species based on the IUCN classification as previously discussed in Chapter 4. Also, the land acquisition for the proposed expansion Project will not lead to any physical and/or economic displacement. Thus, the potential impact on the existing land use of the Project site is **negligible**.

❖ ***Mobilization of Personnel, Materials and Equipment to the site***

Heavy-duty and other pieces of equipment will be moved to the Project site prior to the commencement of construction activities for site preparation, civil work and equipment installation. The potential bio-physical impacts associated with the mobilization activities include decrease in air quality of the project area as a result of emissions from vehicles (such as trucks) that will convey materials and equipment to the site, as well as dust generation. High noise levels from vehicular movement may also be pronounced during the mobilization activities leading to annoyance to the nearby industries. The impacts could be more pronounced if the mobilization activities are carried out in the dry season.

However, considering that the mobilization activities will be intermittent across the project developmental phases and the trucks that will transport construction equipment and materials to the site will not be driven at the same time, the potential impact is short term, reversible, and localized. The impact magnitude is rated to be medium. The sensitivity of the current air environment of the Project Aol is considered low judging by the values of air pollutants such as Carbon monoxide (CO), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Total Suspended Particulates (TSP) recorded in the area when compared with the National Ambient Air Quality Standards and the World Bank Air Quality Guidelines.

Given that the concentrations of ambient air parameters measured within the Project site and its surrounding environment generally complied with the relevant regulatory limits, the capacity for assimilation of vehicular emissions and dust associated with the mobilization activities is considered to be high (i.e. the existing ambient air of the area is of low sensitivity). The impact significance on the ambient air quality of the Project's AoI is thus rated **minor**.

Regarding social infrastructure and community health and safety, mobilization activities during the pre-construction phases of the proposed Project could potentially increase traffic volume in the Project area (and potential for road accident and annoyance from other road users). The potential impact is considered to be negative and localized. The magnitude of the impact is considered low given that the mobilization activities would be short term and intermittent. However, the sensitivity of the receptor is adjudged to be medium. The impact significance of mobilization activities on the existing road infrastructure in the Project's AoI is rated **minor**.

- ***Site Clearing and Preparation***

As part of pre-construction activities for the expansion project, site clearing and preparation would be carried out. Site clearing will be done with the use of earth moving equipment such as tractor and bulldozer. The potential impacts associated with the proposed site clearing activities on the biophysical and socio-economic environment of the Project's AoI are assessed and discussed in the following paragraphs:

Potential Impact on Terrestrial Flora and Fauna

Site preparation will involve the clearing of vegetation on the Project site. The site clearing activities would lead to loss of terrestrial flora (vegetation) and potential negative impacts on terrestrial fauna species. The potential impact on the terrestrial flora is considered to be negative, direct, and site specific. However, the impact magnitude is considered to be medium since the vegetation was scarcely distributed and its removal will not significantly affect the integrity of the plant population in the study area. The sensitivity of the receptor is low; due to the fact that none of the plant species identified within the project site was found to be critically endangered or threatened species based on IUCN 2020 classification. The impact significance is considered **minor**.

Plant are also known to sequester GHGs from the atmosphere as such clearing of the flora species could further increase the impact of climate change. The impact significance is considered **minor**. Since the land area required for construction activities is just 2.43Ha leaving the remaining 14.57Ha as green field.

While the plant species are unable to avoid the point of impact, most fauna species may be able to migrate away from unfavourable areas. Animals are

generally mobile and, in most cases, can move away from a potential threat. The tolerance levels of some animal species are of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact. With regard to the clearing of the Project site for construction purpose, the potential impact on terrestrial fauna species may include loss of individual or localized population of fauna species or disturbance to avifauna species. This is unlikely to lead to a change in conservation status of the species since none of the terrestrial fauna (including avi-fauna) encountered in the Project site belongs to the IUCN classification of threatened animal species which include those classified as critically endangered, endangered, or extinct. The impact magnitude is considered medium because of the land size and the receptor sensitivity is considered low .There is also no faunal breeding area within the site. Therefore, the impact significance of clearing activities on the fauna species within the Project site is thus rated **minor**

Potential Impact on Soil

The soil environment of the Project site would be directly impacted during the site clearing activities. The potential effects include soil degradation which involves the removal, alteration, or damage to soil and associated soil forming processes. The disturbance to the natural ground level, over disturbed areas will negatively affect moisture levels, soil density, soil chemistry, and biological activity. The results of particle size distribution analysis indicate that the soil environment of the Project site is dominated by clay. In terms of soil chemistry, the concentrations of anions recorded in the soil samples were low while heavy metals concentrations were below the prescribed limit for unpolluted soil. The overall impact significance is rated as **minor** given that the impact magnitude is medium due to the size of the site that would be cleared.

Potential Impact on Air Quality

The pollutants which could impair air quality during site clearing activities are particulate matter in form of dust, and NOx, CO, SOx from combustion engines of the earth moving equipment that will be used for clearing. The impact magnitude is considered to be low since the impact will be short term, intermittent, localized and reversible. The site clearing activities would take less than one (1) week. The sensitivity of the air shed of the Project site and its surrounding environment is regarded as low based on the results of air quality measurements conducted in the area during the field data gathering. Thus, the impact significance of site clearing activities on the ambient air quality of the Project area is rated **minor**.

Potential Noise Impact

The site clearing activity is associated with noise emission which could have impact on the nearby facilities and some local residents within the Project's AoI.

However, the impact magnitude is considered to be low since the potential noise impact would be intermittent and the noise level generated during the site clearing activity is not envisaged to result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location offsite beyond the permissible limit. During the baseline field data gathering, no elevated noise levels beyond the World Bank maximum limit of 70dB(A) and FMEnv limit of 90dB(A) were recorded in the Project's AoI. The day-time noise levels recorded within the Project site ranged from 40.5 to 76.3dB (A); Therefore, the overall impact significance is rated **minor**.

5.4.2.1.2 Summary of Potential Negative Impact Associated with Pre-Construction Phase

Table 5.10 below summarizes the potential impacts associated with the pre-construction phase of the proposed Project.

Table 5.10: Summary of Potential Impact of Pre-Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Site selection/ land take	Existing land use of the Project site	• Change in land use	Negligible
Mobilization of personnel, materials and equipment to site	Air Quality	• Decrease in ambient air quality • Increase in ambient noise level	Minor
	Social infrastructure and community health and safety	• Increase in traffic volume including potential for road accident	Minor
Site clearing and preparation	Terrestrial flora and fauna	• Little vegetation loss • Loss of individual or localized population of fauna species or disturbance to avifauna species • Increase in the average temperature of the earth due to climate change	Minor
	Soil	• Loss of top soil • Soil compaction and degradation • Increased erosion potential • Reduction in structural stability and percolative ability of soil	Minor
	Air Quality/Noise	• Decease in ambient air quality • Increase in ambient noise level with associated effects on the nearby sensitive receptors	Minor

5.4.2.1.3 Construction Phase

The construction phase of the proposed project will entail activities such as civil, electrical and mechanical works; equipment installation/ refurbishment of

existing mill. Waste generation is also associated with the construction activities which could be significant if not properly managed.
The potential environmental and social impacts associated with the planned activities are further discussed below:

Potential Impact on Air Quality

The ambient air quality of the Project site and its surrounding environment could be impacted due to emissions such as SO_2, CO, NO_x, VOC generated from internal combustion engine of some of the equipment and machinery that would be used for construction activities. Dust is also likely to be generated during removal of overlying materials as well as windblown dust generated from cleared land and exposed materials stockpiles.

The emissions from the construction equipment could increase the concentrations of ambient air parameters of the Project area there by further increasing the impact of climate change. The potential impact is considered to be short term, intermittent, localized and reversible. However, considering the duration of the construction phase which is estimated to be ten (10) months, the impact magnitude is rated medium. The sensitivity of the air shed of the Project's AoI is adjudged to be low based on the results of in situ measurements undertaken in the area during the baseline data gathering. Thus, the impact significance is **minor**.

Potential Noise Impacts

The planned activities during the construction phase of the Project have the potential to increase the ambient noise levels in the Project's AoI which could pose adverse noise impacts (such as annoyance and disturbance) to the surrounding sensitive receptors, especially the nearby local resident. These activities include civil work, vehicular movement and operation of construction equipment and machinery. During the baseline survey, the day- time noise levels recorded were below regulatory limit. The noise level associated with the construction phase of the Project would be intermittent and is not envisioned to result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location offsite beyond the permissible limit. The potential nearby sensitivity receptors that could be affected are local residents of Ikenne community (located about 400m away from the Project site). The impact significance is rated **moderate**.

Potential Impacts on Soil

During construction, soil environment of the Project site could be directly impacted in terms of removal of topsoil and soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms resulting from compaction during excavation activities, foundation works, and

erection of buildings. Waste streams (such as spent oil, general refuse, food wastes, etc.) associated with the construction activities if not properly handled could also lead to soil contamination with indirect effect on the groundwater resources in the Project's AoI. Considering that the land area occupied by the Project would likely be affected, the impact magnitude is considered to be medium. The sensitivity of the soil environment of the Project site is regarded as low based on the results of laboratory analysis undertaken on soil samples from the Project site and its surrounding environment. The soil samples are characterized by very little organic matters and low anion and cation concentrations. No elevated heavy metal concentrations beyond the recommended values for tropical soil were recorded in the soil. The overall impact significance is rated **moderate.**

Potential Impact on Groundwater

The quality of groundwater resources in the Project's AoI could potentially be impacted as a result of infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction equipment and/or storage tanks as well as improper handling of construction wastes. Baseline data gathering indicates that the results of physico-chemical characteristics of groundwater resources sampled in the Project's AoI generally fall within the FMEnv and the WHO limits. No elevated heavy metal concentrations were recorded. The sensitivity of the receptor is considered low; the impact significance is rated **moderate**.

In terms of water use, the construction phase of the Project is not envisaged to adversely affect the existing underground aquifer in the Project area considering the duration of the construction activities, the estimated volume of water that will be required during construction is 300m^3. Also Considering NiMet 2019 data, Ogun State experiences high rainfall with the total annual rainfall of 1,732.99mm. The impact significance is rated **moderate**.

Potential Social Impacts (Community Health, Safety and Security)

The key negative issues associated with the construction phase of the Project on community health, safety and security are those related to the presence of construction workers on site (influx of workers); impact of heavy vehicles, including damage to roads, safety, and noise and dust generation.

With regard to the presence of construction workers on site, the manner in which the workers conduct themselves can affect the local communities in terms of disruption of existing family structures and social networks. The potential behavior of workers, most especially male construction workers, may lead to increase in levels of crime and drug and alcohol abuse, and an increase in incidence of sex workers and casual sexual relations, which may result in

increase in sexually transmitted disease (such as HIV/AIDS infections) and unwanted pregnancies. Additional pressure may also be placed on existing infrastructure. Considering the number (60) of labour force during construction phase of the Project, the potential risk to local family structures and social networks is regarded as medium. However, given that the majority of the construction workers, especially unskilled labour force would come from the local communities, the impact significance is considered to be **moderate**.

During construction, there will be an increase in vehicle movement to and from the Project site. The movement of project vehicles during the construction phase activities may damage roads, create noise, and safety impacts for other road users in the area, the impact significance is considered to be **moderate**.

Construction Workers Health, Safety, and Welfare

Construction sites are potentially hazardous place. Occupational accidents may occur especially when those involved are unskilled. Such occupational accidents may result in loss of man-hours which may ultimately affect the schedule date of completion of the project development especially if the man-hour losses are high. Potential impacts to construction workers include increased noise level and air emissions from construction activities (resulting from the use of heavy duty equipment and construction vehicles), injuries, respiratory tract disease infections, electrical shocks, accident, and denial of rights. Although the majority of the construction workers will be unskilled, the overall unmitigated impact significance is considered **moderate**.

5.4.2.1.4 Summary of Potential Negative Impact Associated with Construction Phase

Table 5.11 below summarizes the potential negative impacts associated with the construction phase of the proposed Project.

Table 5.11: Summary of Potential Impact Associated with Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Construction/ Installation Activities	Air Quality	• Decrease in ambient air quality • Introduction of GHG into the atmosphere leading to climate change	Minor
		• Increase in ambient noise level with potential impact on the nearby sensitive receptors	Moderate
	Soil	• Soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms • Decrease in soil quality	Moderate

Activity	Receptor	Associated Impact	Significance
	Groundwater	• Groundwater contamination • Groundwater reduction	Moderate
	Socio-economics (community health, safety and security)	• Influx of people, increase in sexual transmitted diseases; pressure on existing infrastructure	Moderate
		• Road damage, traffic and safety impacts	Moderate
	Occupational Health and Safety (health, safety, and welfare of construction workers)	• Injury to construction workers due to construction activities • Poor welfare and working conditions for both skilled and unskilled worker engaged during construction phase	Moderate

5.4.2.1.5 Operation Phase

The major activities during the factory operations include milling and refining operations, fleet operations, loading and unloading of goods, equipment maintenance and occasional repairs, utilities consumption, waste generation and disposal. The potential impacts associated with the factory operations are discussed in the following paragraphs:

Potential Impact on Air Quality

The potential sources of air emission during the factory operation includes, vehicular movement (delivery trucks, diesel powered forklifts etc.), use of 1MW diesel powered generator (which would serve as back up source of power). It is estimated that on a monthly basis, 100 trucks will be required to move raw and finished products in and out of the factory.

The primary criteria pollutants from generators are NOx, CO, and VOC. Other pollutants, CO and VOC, are primarily the result of incomplete combustion, some of which are notable GHGs.

Another potential form of air emission during the operational phase is the fugitive emissions from diesel during transfer from delivery tankers to the storage tanks onsite if the fill pipe is not properly connected. However, with stringent operating system this impact can be avoided. The overall potential impact on air quality during the operational phase can be said to be site specific and reversible, hence the impact significance is considered **moderate.**

Potential Noise Impact

The potential sources of noise emission during the operational phase of the Project include milling and refining operations, vehicular movement and the

onsite power generator. The potential impact will be largely localized. The potential sensitive receptors are the workers onsite and Ikenne community; however, the community is situated about 1km away from the factory. The impact significance is considered to be **minor**.

Potential Impact on Groundwater

Groundwater impacts may include decreased in groundwater volume as a result of the project activities, reduction in groundwater recharge through infiltration as a result of paved surfaces. Liquid wastes (such as sanitary waste, used water from general housekeeping), accidental diesel spills due to disconnection or improper connection of the fill pipe during fuel refilling and leakage of the storage tank as a result of corrosion could impact the groundwater quality, if not properly managed. Based on the result of laboratory analysis conducted on groundwater samples from the Project area, no heavy hydrocarbon pollution was recorded; thus, sensitivity of the groundwater resources is considered to be low. The overall impact significance is considered to be **moderate**.

Potential Impact on Socio-economic

The potential negative impacts on the socio-economic environment during the factory operation are those related to impact on road traffic and impacts on water resources. The potential impact on water resources is considered to be low since the local geology (Abeokuta formation) is known to have a prolific aquifer characterised by an aquiferous sandy layer and there has never been any recorded case of water shortage. The impact significance is rated **minor**.

During the factory operation, on a monthly basis, 100 trucks will move raw and finished goods in and out of the factory. The traffic impact associated with the operational phase will however largely be localized as all the trucks will not move at the same time. A truck park will be constructed as part of the expansion project where trucks will be parked in other to minimize traffic on the road. The impact significance is considered **moderate.**

Occupational Health, Safety and Welfare during Operation

During the factory operations, workers may be exposed to occupational health and safety issues (e.g. electrical hazards and mechanical injuries) including work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions etc. The impact significance is considered **moderate.**

5.4.2.1.6 Summary of Potential Negative Impact Associated with Operation Phase

Table 5.12 below summarizes the potential negative impacts associated with the operation phase of the project.

Table 5.12: Summary of Potential Impact Associated with Operation Phase of the proposed factory expansion project

Activity	Receptor	Associated Impact	Significance
Factory Operation and Maintenance	Air Quality/Noise	• Decrease in ambient air quality including generation of GHG emissions • Introduction of GHG into the atmosphere leading to climate change	Moderate
		• Increase in ambient noise level	Minor
	Groundwater	• Reduction in groundwater recharge through infiltration as a result of paved surface • Accidental oil spillage or leakage from diesel storage tanks during re-filling, or as a result of corrosion	Moderate
	Socio-economic	• Potential impact on ground water resources	Minor
		• Traffic associated with the operational phase	Moderate
	Health, safety and welfare of staff	• Injuries to personnel associated with the factory operations, • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions	Moderate

5.5 Potential Cumulative Impacts

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project (GSI, 2003). The concept of cumulative effects is an important one. It holds that, while impacts may be small individually, the overall impact of all environmental changes affecting the receptors taken together can be significant. When a resource is nearing its tolerance threshold, a small change can push it over.

This section discusses the potential cumulative impacts associated with the proposed Project.

There would be no impact to public services under the proposed project action. The project will not introduce any additional long-term population into the area, and thus, would not result in any additional long-term demand for police or fire services. The construction activities will not require roadway lane closures and detour. Fire, emergency, medical, and police services would be appropriately informed of relevant aspects of the project. No damage to roadways is expected beyond that which would be considered normal wear and tear. In addition, the proposed project would result in negligible impact on public utilities.

5.6 Risk and Hazard Assessment

5.6.1 Overview

Risk assessment is the determination of quantitative or qualitative estimate of risk related to a concrete situation and a recognized threat (also called hazard). The assessment of the risks and hazards associated with the proposed Project involves the following steps:

- Identification of hazards/risks
- Likelihood of occurrence
- Consequence/severity of the hazards

The risk assessment matrix is then developed as presented in Figure 5.3.

0 – 5 = Low Risk 6 – 10 = Moderate Risk 11 – 15 = High Risk 16 – 25 = extremely high unacceptable risk		Severity of the potential injury/damage				
		Insignificant damage to Property, Equipment or Minor Injury **1**	Non-Reportable Injury, minor loss of Process or slight damage to Property **2**	Reportable Injury moderate loss of Process or limited damage to Property **3**	Major Injury, Single Fatality critical loss of Process/damage to Property **4**	Multiple Fatalities Catastrophic Loss of Business **5**
Likelihood of the hazard happening	Almost Certain **5**	5	10	15	20	25
	Will probably occur **4**	4	8	12	16	20
	Possible occur **3**	3	6	9	12	15
	Remote possibility **2**	2	4	6	8	10
	Extremely Unlikely **1**	1	2	3	4	5

Figure 5.3: Risk Assessment Matrix

5.6.2 Project Specific Risks and Hazards

The potential risks and hazards associated with the proposed Project are described below:

<u>Fire and explosion</u>

The major risk associated with the factory operation is fire and explosion. The machineries to be installed are subject to electrical faults like any other electrical installation such as short circuits, ground faults and reverse currents. These faults can result in hot spots that can ignite combustible material in their vicinity. Another major source of fire and explosion at the facility is from the diesel storage tank used for generating power. Even though the tanks used for storage have been designed to meet the required standard there are likelihood of explosions particularly from human or mechanical error. The haxane dump is also a potential hazard if not properly managed with appropriate safety measures.

Any outbreak of uncontrolled fire in the factory can escalate to dangerous dimensions which could lead to multiple fatalities and catastrophic loss of business. The overall significance is **high.** Careful handling is necessary to mitigate fire and explosion risks.

Security Threat and Attack

Security systems are essential for the operation of the factory in order to avoid damage and possibly downtime from theft and vandalism. It is likely that the proposed project may be subject to sabotage or attack and thus result in low production than planned as a result of uprising. Although, the current insurgency in the country is limited to some states in the North East geopolitical zone, the likelihood of terrorist attack at the project site is considered to be of remote possibility. The severity of the attack if happens would be a major injury and critical loss of process and damage to property. However, due to the existing security measures at the existing factory, the risk significance is rated **minor**.

Occupational Hazards

Workers may be exposed to occupational hazards when working at elevation during construction. The construction at the factory and installation of machineries can pose physical hazard to workers using elevated platforms and those located below due to the potential for falling objects. Also, there could be trench collapse, scaffold collapse and electrical hazards to workers. Working within confined space is also a potential hazard. The likelihood of these hazards occurring is considered to be possible while its severity may lead to reportable injury and limited damage to property. The overall significance is rated **moderate**.

Detailed mitigation measures for specific risks and hazards identified here are provided in Section 6.4 of chapter six.

5.7 Summary

In summary, the key potential adverse impacts and risks associated with the proposed project developmental activities have been evaluated in this chapter. The significance of these impacts and risks could be minimized to acceptable levels with the implementation of appropriate mitigation measures. Efficient and cost-effective mitigation measures for the identified negative impacts are presented in the next chapter of this report.

CHAPTER SIX:

MITIGATION MEASURES

CHAPTER SIX

MITIGATION MEASURES

6.1 Introduction

Following the detailed description of the associated and potential impacts of the proposed project in Chapter 5, the recommended mitigation measures for the identified negative impacts are presented in this chapter, as well as the enhancement measures for the potential positive impacts.

6.2 Mitigation Measures Approach

Mitigation refers to measures or interventions necessary to avoid, minimize, reduce or offset adverse impacts. Approach for selecting appropriate mitigation measures followed the framework stated by UNEP (2002):

- Avoid adverse impacts as far as possible by the use of preventive measures;
- Minimize or reduce adverse impacts to "as low as practicable" level;
- Remediate or compensate for adverse impacts which cannot be mitigated or residual impacts which cannot be further reduced.

In proffering mitigation measures for the various negative impacts identified in the previous chapter, preference was given to avoidance or prevention of adverse impacts and where not feasible, measures which are practicable and cost-effective using best available technology were suggested to reduce and/or minimize the impacts while rehabilitation, restoration or compensation was considered as the last resort.

6.3 Mitigation Measures and Potential Residual Impacts

The recommended mitigation measures for the identified significant negative impacts of the proposed Project are highlighted in Table 6.1, including the potential residual impacts (following the application of the recommended measures). The recommended mitigation measures are considered adequate to address the adverse impacts identified in the Chapter 5 of this report. There are no potential long-term impacts associated with the Project that cannot be mitigated to acceptable levels of residual impact.

6.4 Mitigation Measures for the Identified Project Risks and Hazards Due to Unplanned Events

The mitigation measures for the identified Project risks and hazards (due to unplanned events) are highlighted below:

Fire and explosion

- Firefighting and suppression system including fire extinguishers, fire notices, fire alarms etc. warning signs, etc.) Shall be installed at strategic locations in the factory.
- Only machineries which comply with international and local standards for electrical performance and safety shall be used.
- Good housekeeping shall be maintained at the factory.
- Safe storage of flammable substances e.g. hexane in line with the relevant guidelines shall be ensured.
- Emergency response plan shall be maintained for the factory.

Security Threat and Attack

- No authorized person(s) shall be allowed into the facility without adequate check.
- A 24-hour site security shall be put in place.
- Ladgroup shall maintain regular communication with the Nigerian Police Force and other relevant local security outfits.

Occupational Hazards

- Provision of an adequate work-positioning device system for workers shall be ensured.
- Hoisting and lifting equipment shall be rated and maintained and operators trained in their use.
- Appropriate Personal Protective Equipment (such as helmet, coverall, nose masks, ear muffs etc.) shall be provided to workers.
- Electrical installation shall be carried out by trained personnel in line with the approved procedures.
- International best practices with regards to laboratory operations must be adhered to

6.5 Enhancement Measures for Identified Positive Impacts

6.5.1 Direct Employment and Training

The proposed factory expansion Project will give rise to direct employment opportunities across different skill levels, from unskilled to highly skilled labour. For example, 60 workers (at various stages of the project activities) would be engaged. Training for local people from skilled technicians will also be possible.

The following measures shall be implemented to ensure that direct employment and training opportunities are maximized:

- Ladgroup shall include requirements for local employment in the process for EPC Contractors and ensure its implementation. The process will demand that contractors hire workers from local communities wherever possible, especially for unskilled and semi-skilled positions.

- A Local Content Plan for employment, supplies and contract awards shall be developed and implemented. This will include notifying the local communities of the specific jobs and the skills required for the Project, prior to the commencement of construction.

- Adequate training and skill development programmes shall be provided to the local employees.

During operation phase of the proposed Project, job opportunities will also be created. This will be a mixture of skilled labour (such as electrical and mechanical technicians) and unskilled labour. Periodic capacity building will be offered to the workforce.

The construction and operation of the proposed Project will also create opportunities for the supply of goods and services and in turn, indirect employment will be created in the supply chain. This will be enhanced through the use of locally produced materials and goods for the Project development as much as practicable.

Also, Ladgroup shall build a good relationship with the host community through the provision of community development programmes.

Table 6.1: Mitigation Measures for the Potential Negative Impacts of the proposed Project

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Pre-construction Phase					
Mobilization of personnel, materials and equipment to the Project site	Air quality	Decrease in ambient air quality due to vehicular emissions and dust generation; increase in ambient noise level	Minor	▪ Project vehicles with efficient engine performance and with minimal emissions (through regular servicing and maintenance) shall be selected and used. ▪ A Journey Management Plan shall be developed and implemented. ▪ All construction materials (e.g. sand) with potential to result in dust emissions shall be covered during transport. ▪ The size of vehicles to be used for the mobilization of materials, equipment and personnel to site shall be optimized to reduce the number of journeys required.	Negligible
	Social infrastructure and community health and safety	Increase in traffic volume including potential for road accident	Minor	▪ A Journey Management Plan shall be developed and implemented. ▪ Off-road driving shall be prohibited. ▪ Project vehicles with efficient engine performance (through regular servicing and maintenance) shall be selected and used. ▪ Speed limit of less than 30 km/h shall be adhered to within the Project's AoI. ▪ Driver's competency shall be assessed and where required, additional training shall be provided. ▪ A grievance procedure that will track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Site clearing and preparation	Terrestrial flora and fauna	▪ Loss of vegetation ▪ Loss of individual or localized population of fauna species or disturbance to avifauna species ▪ Increase in the average temperature of the earth due to climate change	Minor	▪ Clearing of vegetation shall be limited to the Project site. ▪ Work areas shall be clearly marked to prevent clearing or disturbance outside areas designated for project development. ▪ Areas that are cleared but not used for operations shall be restored and revegetated with native plant species. ▪ Use of herbicides for vegetation clearing shall be avoided. ▪ As much as practicable, a fauna rescue program shall be implemented to save and capture local fauna from dangerous situation during site clearing.	Negligible
	Soil	Loss of top soil; soil compaction and degradation; increased erosion potential; reduction in structural stability and percolative ability of soil	Minor	▪ Clearing and removal of vegetation shall be limited to the area required for project activities. ▪ Disturbed areas shall be rehabilitated. ▪ Areas of exposed soil and soil stockpiles shall be reduced as much as practicable. ▪ Use of silt traps or similar systems to reduce discharge of silt shall be ensured. ▪ Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.	Negligible
	Air quality/Noise	Decrease in ambient air quality	Minor	▪ Site clearing equipment shall be operated and maintained under optimum fuel efficient conditions. ▪ Areas of exposed soil and soil stockpiles shall be reduced as much as practicable to minimize dust generation.	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				▪ Site clearing equipment/machinery shall be turned off when not in use.	
		Increase in ambient noise level with associated effects on the nearby sensitive receptors	Minor	▪ Noise impacts shall be reduced by enclosing and insulating noise emitting equipment as much as practicable. ▪ Site clearing equipment/machinery shall be turned off when not in use. ▪ Site clearing activities shall be limited to daytime as much as possible. ▪ Site clearing equipment/machinery with lower sound power levels shall be selected and used. ▪ Appropriate PPE (e.g. ear muffs) shall be worn by workers involved in site clearing to reduce exposure to noise impact. ▪ A grievance procedure that will track grievances from nearby communities regarding excessive noise emissions, and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.	Negligible
Construction Phase					
Construction activities and installation of machineries including waste generations	Soil	• Soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms • Decrease in	Moderate	▪ Excavation works shall be conducted in line with appropriate engineering practices ▪ Executions under aggressive weather conditions shall be avoided. ▪ Soil conservation measures shall be implemented such as stockpiling topsoil for the remediation of disturbed areas ▪ Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
		soil quality		▪ Disturbed areas shall be rehabilitated as soon as possible to prevent erosion. ▪ Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint. ▪ Any hydrocarbons, fuels, lubricants and chemicals to be used shall be stored in properly labelled oil storage tanks (surrounded with bund wall), with hoses and gauges kept within the bund. ▪ Waste and storage areas for hazardous substances shall be separated on site and waste storage areas shall be located on hard stand (or in a bund wall, where necessary) to prevent potential contamination. ▪ Spill containment equipment to contain incidental spills/leaks, including drip pans to contain any spills during refuelling activities shall be provided ▪ Spill control and response plans to respond to spills and leaks shall be implemented. ▪ General wastes that cannot be reused shall be periodically evacuated to the government approved dumpsite by a third-party contractor accredited by the Ogun State ministry of Environment.	
	Groundwater	Groundwater contamination	Moderate	▪ Training shall be provided for workers on safe storage and handling practices and rapid spill response and clean-up techniques during induction. ▪ Spill control and response plans to respond to spills and leaks shall be	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				implemented. ▪ Waste receptacles shall be provided within a secured area within the project site for collection of solid waste. ▪ General wastes that cannot be reused shall be periodically disposed of a through a government accredited third party waste contractor	
	Air Quality	Decrease in ambient air quality	Minor	▪ Speed restriction of construction vehicles to a speed of 30 km/h or less shall be ensured; ▪ Regular maintenance and servicing of machines and engines shall be maintained; ▪ Use of clean fuels e.g., unleaded and de-sulphurized fuels, if available, shall be ensured. ▪ Construction equipment shall be turned off when not in use. ▪ The use of appropriate Personal Protective Equipment (PPE) such as nose masks in particular for construction workers shall be maintained. ▪ Measures to reduce dust generation, such as spraying water on soil before excavation shall be adopted, where required. ▪ Regular maintenance and servicing of construction equipment that contribute to air emission shall be implemented. ▪ Only modern and well maintained equipment and machinery for construction activities shall be selected and used.	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				▪ Grievance procedure for complaints shall be developed and implemented.	
		Increase in ambient noise level with potential impact on the nearby sensitive receptors	Moderate	▪ All equipment shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ Activities associated with high levels of noise shall be limited to daylight hours. ▪ Construction equipment with lower sound power levels shall be selected and used. ▪ Acoustic enclosures shall be installed on equipment casing radiating noise. ▪ Ladgroup shall ensure that engines and other noise making equipment are in good working order and well maintained, and that all have original noise suppression equipment (e.g. mufflers) intact and in working order. ▪ Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Negligible
		Introduction of GHG into the atmosphere leading to climate change	Moderate	▪ Use of cleaner energy sources e.g. gas ▪ All equipment shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ Work areas shall be clearly marked to prevent disturbance of vegetation outside areas designated for project development. ▪ Areas that are cleared but not used for operations shall be restored and revegetated with native plant species.	
	Socio-economics	Influx of people, increase in sexual	Moderate	▪ The EPC Contractor shall develop an induction programme, including a Code	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	(community health, safety and security)	transmitted diseases; pressure on existing infrastructure		of Conduct, for all workers (including sub-contractors and their workers) prior to construction activities. ▪ A copy of the Code of Conduct (CoC) shall be presented to all workers and signed by each person. The Code of Conduct will address the following aspects: - respect for the norms and values of local communities; - no hunting or unauthorised taking of products or livestock; - zero tolerance of illegal activities by construction personnel including: prostitution and/or solicitation for sex; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting; - compliance with the Traffic Management Plan and all road regulations; - description of disciplinary measures for infringement of the CoC. ▪ If workers are found to be in contravention of the Code of Conduct, which they will be required to sign at the commencement of their contract, they shall face disciplinary procedures that could result in dismissal. Stock theft shall be noted as a dismissible offence ▪ A grievance procedure (which tracks grievances and responses; and respond in a timely manner with corrective actions identified where appropriate)	

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				shall be developed and implemented. The grievance procedure shall be communicated to the local communities. Key steps of the grievance mechanism include: - Circulation of contact details of 'grievance officer' or other key developer contacts. - Creation of awareness among local communities (including all directly affected and neighbouring residents) regarding the grievance procedure and how it works. - Establishment of a grievance register to be regularly updated, this should include all responses and response times. ▪ Ladgroup shall ensure that the EPC contractor develops a means of monitoring access to the site, prohibiting unauthorized access to the site and ensuring that all visitors report to the site office. ▪ No employment shall take place at the entrance to the site. Only formal channels for employment will be used, and recruitment shall take place only at designated times and locations. ▪ Ladgroup through its EPC Contractor shall develop and implement an HIV/AIDS policy and information document for all workers directly related to the project. The information document will address factual health issues as well as behaviour change	

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				issues around the transmission and infection of HIV/AIDS. ▪ Ladgroup through its EPC Contractor shall in addition to creating awareness education about HIV and AIDS and other sexually transmitted diseases, also ensure the distribution of protective sexual materials to both the contractor's personnel and to active residents in the potentially affected communities. ▪ Stakeholder engagement plan shall be developed and implemented.	
		Road damage, traffic and safety impacts	Moderate	▪ The EPC Contractor shall develop and implement a construction traffic management plan (CTMP). ▪ All access routes within the site shall be identified, clearly demarcated and constructed. ▪ Speed limits (of less than 30 km/h) shall be adhered to in the Project area. ▪ Off-road driving shall be prohibited. ▪ All vehicles used for the project shall be regularly serviced and maintained. ▪ Driver's competency shall be assessed and where required training will be provided. ▪ A grievance procedure that will track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.	Negligible
	Occupational Health and Safety (health,	• Injury to construction workers due to	Moderate	▪ Development and implementation of a robust Health and Safety (H&S) Management Plan by the EPC contractor	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	safety, and welfare of construction workers)	construction activities • Poor welfare and working conditions for both skilled and unskilled worker engaged during construction phase		shall be ensured. The H&S Plan will be developed following all relevant national and international standards. ▪ Construction works shall be limited to the day time as much as possible. ▪ Provision of bill boards at the construction site gates notifying people of the construction activity and timings. ▪ Speed limits within the project site access roads and immediate vicinity shall be limited to 30 km/hr. ▪ Implementation of Health and Safety communication and training programmes to prepare workers to recognise and respond to workplace hazards shall be ensured. Daily toolbox talks prior to commencement of construction activities shall be implemented and regular drills conducted involving the neighbours. ▪ Provision of adequate PPE to workers shall be implemented. All employees will be required to wear the appropriate PPE whilst performing their duties. ▪ Provision of regularly maintained firefighting equipment in easily accessible areas as well as ensuring site personnel are well trained in their use, as well as maintaining them regularly shall be ensured. ▪ Safety training focused on operational procedures, emergency procedures and safe working practices, information on specific hazards, first aid and fire-fighting shall be included in the	

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				induction, prior to the commencement of construction ▪ Training of workforce on communicable diseases and Sexually Transmitted Diseases (STDs) and community interactions in general shall be undertaken. ▪ Ladgroup and the EPC Contractor shall put in place a worker grievance mechanism that will be accessible to all workers, whether permanent or temporary, directly or indirectly employed. The grievance mechanism shall be open to the EPC Contractor and subcontractor workforce, and in the event that their grievance is not adequately resolved by their direct employer, Ladgroup shall have the authority to act to resolve this grievance.	
Operation Phase					

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Facility Operations including routine maintenance	Air Quality/Noise	▪ Decrease in ambient air quality including generation of GHG emissions ▪ Increase in ambient noise level	Minor	▪ The factory machineries shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ Acoustic enclosures shall be installed on equipment casing radiating noise. ▪ Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact. ▪ Periodic maintenance of the factory components shall be carried out. ▪ Speed restriction of construction vehicles to a speed of 30 km/h or less shall be ensured; ▪ Regular maintenance and servicing of vehicles shall be maintained ▪ Use of clean fuels e.g., Gas fired generators as alternative to diesel powered generators	Negligible
	Ground water	•Reduction in groundwater recharge through infiltration as a result of paved surfaces. •Accidental oil spillage or leakage from the diesel storage tanks during re-filling, or as a result of corrosion	Moderate	▪ Unused portions of the facility shall be backfilled and landscaped to serve as a means for recharging the underground aquifer during rainfall. ▪ Ladgroup shall avoid over-fill during refilling of the diesel storage tanks by installing an over fill alarm at the tanks ▪ All pipes shall periodically be tested for leakages. ▪ Absorbent kits shall be provided to clean up minor oil spills ▪ Appropriate training on emergency response procedures shall be provided	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
		•Reduction in groundwater quality		to staff.	
	Socio-economic	•Potential impact on ground water resources	Minor	▪ Unused portions of the facility shall be backfilled and landscaped to serve as a means for recharging the underground aquifer during rainfall. ▪ Ladgroup shall avoid over-fill during refilling of the diesel storage tanks by installing an over fill alarm at the tanks ▪ All pipes shall periodically be tested for leakages. ▪ Absorbent kits shall be provided to clean up minor oil spills ▪ Appropriate training on emergency response procedures shall be provided to staff.	Negligible
		•Traffic associated with the operational phase	Moderate	▪ Journey Management Plan shall be implemented. ▪ Off-road driving shall be prohibited. ▪ Project vehicles with efficient engine performance (through regular servicing and maintenance) shall be selected and used. ▪ Speed limit of less than 30 km/h shall be adhered to within the Project's AoI. ▪ Driver's competency shall be assessed and where required, additional training shall be provided. ▪ A grievance procedure that will track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be implemented	Negligible
	Health, safety	• Injuries to	Moderate	▪ Human resources (HR) policy relevant to	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	and welfare of staff	personnel associated with the factory operations. • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions		scale of the Project shall be updated to the scale and scope of the expansion if need be ▪ The HR policy will include the following key issues, among others: – Provision of clear and understandable information regarding rights under national labour and employment law, and any applicable collective agreements, including those related to hours of work, wages, overtime, compensation, etc. – Provision of employment, compensation/remuneration and working conditions, including working hours, terms of employment, based on equal opportunity and fair treatment, avoiding discrimination on any aspects. – Retrenchment policy including alternatives analysis prior to decision. – Implementation of a grievance mechanism. – Adoption and implementation of a sexual harassment policy. – Adoption of open attitude towards freedom of association. – All workers will be able to join unions of their choice and have the right to collective bargaining. – A worker grievance mechanism that will be made known to all workers ▪ Occupational health and safety policy and procedures including emergency plan shall be updated to the scale and scope of	

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				the expansion if need be. Staff shall be trained on emergency preparedness and responses. ▪ Provision of medical insurance scheme for all employees shall be ensured.	

CHAPTER SEVEN:

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN

7.1 Introduction

This chapter presents the Environmental Management Plan (EMP) for the proposed Ladgroup factory Expansion Project in Ikenne, Ogun State.

EMP is a planned, integrated programme aimed at ensuring that unforeseen and unidentified impacts of a project are contained and brought to an acceptable minimum.

The associated and potential impacts of the proposed Project have been analyzed in Chapter 5 of this report. In order to ensure the environmental and social considerations and mitigation measures of the EIA are implemented, an EMP has been developed. Its purpose is to ensure that those recommended mitigation measures are translated into practical management actions, which can be adequately resourced and integrated into the Project development phases.

The EMP has been developed to meet international and national standards on environmental and social management performance. It covers the pre-construction, construction and operation phase of the proposed Project. It details the mitigation and enhancement measures Ladgroup has committed to implement throughout the life cycle of the Project and includes desired outcomes; performance indicators; monitoring; associated cost; and timing for actions and responsibilities.

Ladgroup shall have principal responsibility for all measures outlined in this EMP, but may delegate responsibility to its contractors, where appropriate and monitor the implementation.

7.2 Objectives of the EMP

The EMP is essential for effective implementation and monitoring of the Project's environmental and social performance. 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 and social performance and helps ensure that environmental risks and liabilities are identified, minimized and managed.

The EMP shall be a living document and shall continue to develop during the

design, construction and operational phases to enable continuous improvement of the Project's environmental performance.

The specific objectives of the EMP are to:

- Promote environmental and social management and communicate the aims and goals of the EMP.
- Ensure that contractors including all workers, subcontractors and others involved in the Project meet legal and regulatory requirements with regard to environmental management. This also includes the partners that shall be involved in the Project.
- Incorporate environmental and social management into Project design and operating procedures.
- Address concerns and issues raised in the EIA's stakeholder engagement process and those that shall likely continue to arise during the Project's lifetime.
- Serve as an action plan for environmental and social management for the Project.
- Provide a framework for implementing Project environmental and social commitments (i.e. mitigation measures identified in the EIA).
- Prepare and maintain records of Project environmental and social performance (i.e. monitoring, audits and non-compliance tracking).

7.3 Environmental and Social Management Organization

Ladgroup is committed to providing resources essential to the implementation and control of the EMP. These include appropriate human resources and specialized skills**,** training, programs and capacity building, communication procedures, documentation control and a procedure for the management of change.

Ladgroup has a HSE unit that is responsible for the management of health, safety and environmental issues including community related issues associated with its operations at the factory. The organizational structure of Ladgroup is shown below in Figure 7.1.

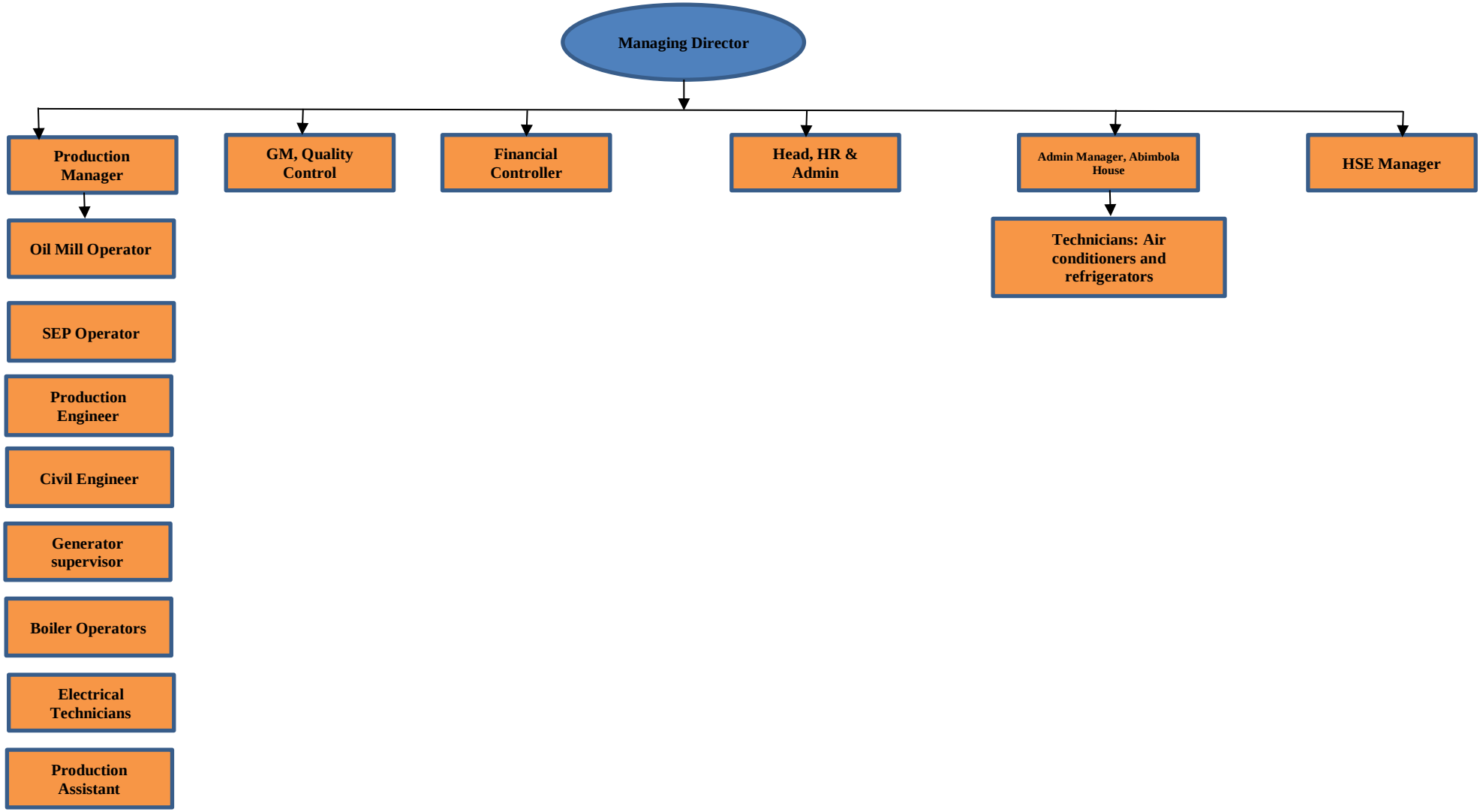

Figure 7.1: Organizational Structure of Ladgroup Nigeria limited

The HSE Manager shall oversee the environmental and social (including health and safety) aspects of the proposed expansion Project. The HSE Manager shall ensure that the Project and subcontractors operate in accordance with the applicable regulatory HSE requirements and plans and also monitor implementation of environmental and social protection measures.

7.3.1 Awareness, Training, and Capacity Building

Ladgroup shall further identify, plan, monitor, and record training needs for personnel (especially new staff associated with the Project) whose work may have a significant adverse impact on the environmental or social conditions. The Project recognizes that it is important that employees at each relevant function and level are aware of the company's environmental policy; potential impacts of their activities; and roles and responsibilities in achieving conformance with the policy and procedures. This will be achieved through a formal training process. Employee training will include awareness and competency with respect to:

- Environmental and social impacts that could potentially arise from their activities (including dust, noise, soil contamination etc.);
- Necessity of conforming to the requirements of the EIA and EMP, in order to avoid or reduce those impacts;
- Roles and responsibilities to achieve the required conformity, including those in respect of change management and emergency response.

Employees responsible for performing site inspections will receive training by drawing on external resources as necessary. Training will be organized as at when required and based on formally identified needs.

Similarly, the Project will require that EPC contractor including each of the subcontractors institute training programs for its personnel. The EPC contractor and sub-contractors training program is responsible for site HSE awareness training for personnel working on the job sites. They are also responsible for identification of any additional training requirements to maintain required competency levels.

The EPC contractor and sub-contractors training program shall be subject to approval by Ladgroup and it shall be audited to ensure that: training programs are adequate; all personnel requiring training have been trained; and competency is verified.

Also, capacity building on the operation and maintenance of the factory in form of both internal and external trainings shall be provided to workers.

7.3.2 Communication

Ladgroup shall maintain a formal procedure for communication with the regulatory authorities and communities. Meetings shall be held, as required, between Ladgroup and the relevant regulatory authorities and community representatives to review environmental performance, areas of concern and emerging issues. Dealings shall be transparent and stakeholders shall have access to personnel and information to address concerns raised.

The Project shall also develop and implement a grievance mechanism whereby community members can raise any issues of concern. Grievances may be verbal or written and are usually either specific claims for damages/injury or complaints or suggestions about the way that the Project is being implemented. When a grievance has been brought to the attention of the Project team, it will be logged and evaluated. The person or group with the grievance is required to present grounds for making a complaint or claiming loss so that a proper and informed evaluation can be made.

Where a complaint or claim is considered to be valid, then steps are required to be undertaken to rectify the issue or agree compensation for the loss. In all cases, the decision made and the reason for the decision shall be communicated to the relevant stakeholders and recorded. Where there remains disagreement on the outcome then an arbitration procedure may be required to be overseen by a third party (e.g. Government official). Local community stakeholders shall be informed on how to implement the grievance procedures.

7.3.3 Documentation

Ladgroup shall control HSE documentation, including management plans; associated procedures; and checklists, forms and reports, through a formal procedure. All records shall be kept on site and will be backed up at several offsite locations (including secure cloud storage facilities as may be required). Records shall be kept in both hard copy and soft copy formats. And all records shall be archived for future purpose.

In addition, the document control procedure shall describe the processes that the Project shall employ for official communication of both hardcopy and electronic document deliverables. Also, it will describe the requirement for electronic filing and posting and for assignment of document tracking and control numbers.

The EPC contractor and subcontractors shall be required to develop a system for maintaining and controlling their own HSE documentation and describe these systems in their respective HSE plans.

7.3.4 Operational Control Procedures

Each potentially significant impact identified in the EIA will have an operational control associated with it that specifies appropriate procedures, work instructions, best management practices, roles, responsibilities, authorities, monitoring, measurement and record keeping for avoiding or reducing impacts. Operational controls are monitored for compliance and effectiveness on a regular basis through a monitoring and auditing procedure described in the EMP.

Operational control procedures shall be reviewed and, where appropriate, amended to include instructions for planning and minimizing impacts, or to at least reference relevant documents that address impact avoidance and mitigation.

7.3.5 Emergency Preparedness and Response

Ladgroup shall review and update its existing Emergency Preparedness and Response Plan to ensure that it is appropriate to the scale and scope of the existing and proposed factory. The emergency response plan shall be updated in accordance with the requirements of the IFC Performance Standard 1 and the FMEnv requirements.

7.3.6 Facilities Surveillance

This is a salient system maintenance requirement for the environmental sustainability of the Project. Ladgroup shall carry out constant equipment and facilities surveillance to detect on time, the malfunctioning or deterioration of equipment and/or facilities. The surveillance shall aim at taking prompt corrective/repair measures on detected faults.

7.3.7 Managing Changes to Project Activities

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The Project shall implement a formal procedure to manage changes in the Project that will apply to all related activities.

The objective of the procedure is to ensure that the impact of changes on the health and safety of personnel, the environment, factory and equipment are identified and assessed prior to changes being implemented.

The management of change procedure will ensure that:

- Proposed changes have a sound technical, safety, environmental, social and commercial justification;
- Changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;

- Hazards resulting from changes that alter the conditions assessed in the EIA have been identified and assessed and the impact(s) of changes do not adversely affect the management of health, safety or the environment;
- Changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes;
- The appropriate Ladgroup personnel accepts the responsibility for the change

7.3.8 Additional Management Plans

Additional management plans shall be developed and maintained to support the implementation of this EMP. The timing of the development of the plans may be staged, ensuring that the appropriate focus and level of detail is provided for construction and operational activities. Where required, the documents will be finalized by Ladgroup in consultation with the Federal Ministry of Environment, the Ogun State ministry of Environment and other relevant stakeholders. The plans will be developed in line with the requirements of the relevant local and national regulations as well as the international standards such as the IFC Performance Standards on Environmental and Social Sustainability, the World Bank EHS guidelines and AfDB safeguard policies.

The additional management plans and the overview of what they would entail are summarized in Table 7.1 below.

Table 7.1: Overview of Additional Management Plans for the proposed Project

S/N	Management Plan	Overview
1.	Stakeholder Engagement Plan	This plan serves to provide a framework to facilitate and manage effective and meaningful engagement with key stakeholders throughout the project life cycle. The SEP shall be periodically reviewed and updated. Its key objectives are to: o Provide adequate and timely information to identified stakeholders; o Provide sufficient opportunity to stakeholders to voice their opinions and concerns, and to consider these concerns in project decision making; and o Define a consistent, comprehensive, coordinated and culturally appropriate approach to stakeholder engagement throughout the development of the Project. In addition, the SEP is designed to: o Identify and include additional stakeholders that were not previously identified during engagement activities; o Document previous engagement activities that have occurred; o Devise a plan for engagement activities going forward taking into account activities that have occurred; and o Provide a grievance mechanism for receiving and managing stakeholders' concerns.

S/N	Management Plan	Overview
		The SEP shall be a 'live' document, which will be updated and adjusted as the Project progresses and project planning evolves. It shall provide a framework to facilitate and manage effective and meaningful engagement with key stakeholders.
2.	Local and Employment Management Plan (LEMP)/Workers Management Plan	This plan is to promote equal employment opportunities at all different phases of the Project. This plan shall set out how the Project shall prioritize local employment and promote local economic development through a policy of local employment and local procurement of goods and services. Tender contracts shall require evidence of local content. The objectives of the Plan are to, amongst others; ○ Develop fair recruitment and selection process for local employment; ○ Enhance and grow diversity in the workplace; and ○ Create a workplace that is free of bullying, harassment, victimization and discrimination.
3.	Journey (Traffic Management Plan	The purpose of this plan is to provide steps to manage potential traffic impacts associated with the project, especially during pre-construction and construction phase. The key components to be covered in traffic (journey) management plan include: ○ Description of management controls to mitigate potential traffic and transport impacts of the facility. ○ Procedures for monitoring and auditing of traffic and transport impacts of the facility. ○ Procedures for the management of complaints and non-compliances.
4.	Occupational Health and Safety (OHS) Plan – for construction phase	An Occupational Health and Safety Plan demonstrate an organization's commitment to health and safety in the workplace by providing a clearly written statement of intent and plan of action for the prevention of accidents and occupational illness and injury. A comprehensive OHS plan and procedures shall be developed by the EPC contractor prior to mobilization to site and be periodically reviewed.
5.	Construction Waste Management Plan (WMP)	The WMP shall contain procedures by which wastes generated during the construction phase of the proposed expansion Project shall be handled (reuse, recycle, or disposed of in an approved dumpsite) This shall be dictated by the nature of the waste.
6.	Site Closure and Restoration Plan	The design of the facility shall take due recognition of the need to decommission the factory and the ancillary facilities at the end of their operational life. The site closure plan shall take due note of the current national and international legislative requirements as well as Ladgroup's Guidelines and Standards for Abandonment.

7.4 Checking and Corrective Action

Checking includes inspections and monitoring as well as audit activities to confirm proper implementation of checking systems as well as effectiveness of mitigations. Corrective actions include response to out-of-control situations, non-compliances,

and non-conformances. Actions also include those intended to improve performance.

7.4.1 Inspection

HSE inspections shall be conducted weekly on a specific basis and formally at least once every three months. The results of the inspection activities shall be periodically reported to the management.

7.4.2 Monitoring

Environmental Monitoring Plan is the systematic schedule for collection of environmental data through a series of repetitive measurements. UNEP (1996) describes three known types of environmental monitoring within the conceptual EIA framework as follows:

- *Baseline Monitoring*: Refers to the measurements of environmental parameters during the pre-project period;

- *Effects Monitoring*: Involves the measurements of environmental parameters during project construction and implementation so as to detect changes in these parameters which can be attributed to the project;

- *Compliance Monitoring:* Is the periodic or continuous measurement of environmental parameters of discharges to ensure that regulatory requirements and standards are met. Compliance monitoring can either be *Mitigation Monitoring* which relates to the prescribed mitigation measures put in place by the pre-project EIA to the existing operational structure of the project, or *Regulatory Compliance Monitoring,* which compares the regulatory monitoring requirements to the existing operational, occupational and environmental parameters.

Ladgroup shall adopt a systematic monitoring schedule that shall comprise both effects and compliance monitoring plans for the implementation of the Project. Baseline requirements are already embodied in Chapter 4 of this report and are such not covered in this chapter. Monitoring program shall be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts for the proposed Project.

The 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 impacts identified in this EIA are effectively mitigated in the construction and operations stages of the Project.
Specifically, the objectives of instituting a monitoring programme for this Project are to:

- Ensure that regulatory standards/limits for parameters of concerns are not exceeded;
- Monitor changes in existing physical, chemical and biological characteristics of the ancillary environment of the Project area. Early warning of environmental damage is thus provided so that urgent action may be taken if needed, to reduce in earnest the unwanted impact.
- Determine whether any detected changes in environmental components are caused by the Project or by other factors.
- Determine the effectiveness of the mitigation measures as well as check mitigation measures are correctly implemented.
- Highlight areas of concern undetected during the EIA study and provide a basis for recommending additional mitigation measures.

7.4.3 Auditing (Internal and External)

Beyond the routine inspection and monitoring activities, audits shall be carried out internally by Ladgroup to ensure compliance with regulatory requirements as well as its own HSE standards and policies. Audits to be conducted shall also cover the EPC contractor and subcontractor self-reported monitoring and inspection activities. The audit shall be periodic as required, with at least one audit undertaken at the beginning of each construction period and every 3 years during operational phase of the factory. The audits shall be performed by qualified staff and the results shall be reported to Ladgroup. All identified gaps shall be addressed.

The audit shall include a review of compliance with the requirements of the EIA and EMP and include, at a minimum, the following:

- Completeness of HSE documentation, including planning documents and inspection records;
- Conformance with monitoring requirements;
- Efficacy of activities to address any non-conformance with monitoring requirements.

There shall be a cycle of audits into specific areas of the Project such as waste management. The frequency of audits shall be risk based and shall vary with the stage of the Project and shall depend on the results of previous audits.
In addition, an external auditing of the factory shall be embarked on every three (3) years as required by the local regulatory authorities (FMEnv, NESREA etc.).

7.4.4 Corrective Action

Investigating a near miss or actual incident after it occurs can be used to obtain valuable lessons and information that can be used to prevent similar or more serious occurrences in the future. Ladgroup shall implement a formal non-

compliance and corrective action tracking procedure (including the return of experience and look back approach) for investigating the causes of, and identifying corrective actions to, accidents or environmental or social non-compliances. This shall ensure coordinated action between Ladgroup and its subcontractors.

7.4.5 Reporting

Ladgroup shall keep the regulatory authorities informed of the Project performance with respect to HSE matters through reports that shall be made available to the regulators when required. Ladgroup shall provide appropriate documentation of HSE related activities, including internal inspection records, training records, and reports to the relevant authorities. The EPC contractor and subcontractors are also required to provide HSE performance reporting to Ladgroup on a regular basis through weekly and monthly reports.

7.4.6 Record Management Procedures

The HSE Manager shall be responsible for the management of environmental records including the resources and training to maintain the following:

- monitoring data (water quality, noise, etc.);
- inspection reports (internal and external);
- maintenance activity details;
- checklists;
- induction and training details;
- complaints/comments register;
- audit reports and follow up (internal and external);
- EPC contractor and subcontractor monitoring;
- waste management records (quantity, disposal location etc.);
- minutes of meetings on HSE related matters with regards to the project;
- monitoring environmental planning obligations;
- correspondence with regulatory authorities and other relevant stakeholders.

Tables 7.2 to 7.5 provide a summary of the environmental management measures (plan) for the various phases of the proposed Project.

Table 7.2: Environmental and Social Management Measures for the Pre-Construction Phase

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Mobilization of Personnel, Materials and equipment to site								
Decrease in ambient air quality due to vehicular emissions and dust generation; increase in ambient noise level	Mobilization of personnel, materials and equipment to the Project site	▪ Minimize deterioration of current ambient air quality ▪ Minimize noise emission	▪ Project vehicles with efficient engine performance and with minimal emissions (through regular servicing and maintenance) shall be selected and used. ▪ The size of vehicles to be used for mobilization of materials, equipment and personnel to site shall be optimized to reduce the number of journeys required. ▪ A Journey Management Plan shall be developed and implemented. ▪ All materials with potential to result in dust emissions shall be covered during transport.	Adherence to measures Benchmarks stated in the Journey Management Plan	Records of journey management plan implementation	Weekly during mobilization	EPC Contractor, Ladgroup HSE unit	87,500
Increase in vehicular movement and traffic around the project and potential road accident	Vehicular movement	▪ Minimize any increase in road traffic ▪ Avoid traffic accident	▪ A Journey Management Plan shall be developed and implemented. ▪ Off-road driving shall be prohibited. ▪ Project vehicles with efficient engine performance (through regular servicing and maintenance) shall be selected and used. ▪ Speed limit of less than 30 km/h shall be	Adherence to measures	Formal and informal feedback from locals Compilation of statistics on numbers of accidents in conjunction with local authorities Grievance Log	Weekly during the mobilization phase	EPC Contractor, Ladgroup HSE unit	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			adhered to within the Project's AoI. ▪ Driver's competency shall be assessed and where required; additional training shall be provided. ▪ A grievance procedure that shall track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.					
Site clearing and preparation								
Loss of top soil; soil compaction and degradation; increased erosion potential; reduction in structural stability and percolative ability of soil	Site clearing and preparation	Minimize soil loss, reduce erosion and decrease and risk of contamination	▪ Clearing and removal of vegetation shall be limited to the area required for project activities. ▪ Disturbed areas shall be rehabilitated. ▪ Areas of exposed soil and soil stockpiles shall be reduced as much as practicable. ▪ Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint. ▪ Spill containment equipment to contain incidental spills/leaks,	Adherence to measures Re-vegetated land	Monitoring the quantity of excavated soil generated and reused for backfilling. Areas of rehabilitated land	Weekly during site clearing	EPC Contractor, Ladgroup HSE unit	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			including drip pans to contain any spills during refuelling activities shall be provided					
Vegetation loss; disturbance/ displacement of avifauna associated with noise from site clearing equipment; direct impacts on vegetation and soil-dwelling organisms, indirect impacts on other animals.	Site clearing and preparation	Minimize loss of flora and fauna species	▪ Clearing of vegetation shall be limited to the Project site. ▪ Work areas shall be clearly marked to prevent clearing or disturbance outside areas designated for project development. ▪ Areas that are cleared but not used for operations shall be restored and revegetated with native plant species. ▪ Use of herbicides for vegetation clearing shall be avoided. ▪ Awareness on environmental protection regarding terrestrial fauna and flora species shall be provided to workers.	▪ Requirements of IFC Performance Standard 6 on Biodiversity and Sustainable Management of Living Natural Resources ▪ Re-vegetated land	▪ Site surveys and photographic records of the cleared site,	Weekly during site clearing	EPC Contractor, Ladgroup HSE unit	175,000
Decrease in ambient air quality Increase in ambient noise level with associated effects on the nearby sensitive receptors	Site clearing and preparation	Minimize deterioration of the ambient air quality Minimize noise emission	▪ Site clearing equipment shall be operated and maintained under optimum fuel-efficient conditions. ▪ Areas of exposed soil and soil stockpiles shall be reduced as much as	Adherence to measures	Maintenance records; fuel consumption records Grievance log	Weekly during site clearing	EPC Contractor, Ladgroup HSE unit	87,500

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			practicable to minimize dust generation. ▪ Site clearing equipment/machinery shall be turned off when not in use. ▪ Noise impacts shall be reduced by enclosing and insulating noise emitting processes on equipment as much as practicable. ▪ Site clearing activities shall be limited to the daytime as much as possible. ▪ Site clearing equipment/machinery with lower sound power levels shall be selected and used. ▪ Appropriate PPE (e.g. ear muffs) shall be worn by workers involved in site clearing to reduce exposure to noise impact. ▪ A grievance procedure that shall track grievances from nearby communities regarding excessive noise emissions, and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.					

Table 7.3: Environmental and Social Management Measures for the Construction Phase

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Construction and Installation								
▪ Reduction in structural stability and percolative ability of soil resulting from compaction during excavation activities, laying foundations, erection of buildings	Construction activities and installation of factory components including waste generations	Minimize soil loss, reduce erosion and decrease, risk of siltation of water resources and risk of contamination	▪ Excavation works shall not be executed under aggressive weather conditions. ▪ Soil conservation measures shall be implemented such as stockpiling topsoil or gravel for the remediation of disturbed areas ▪ Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion. ▪ Disturbed areas shall be rehabilitated as soon as possible to prevent erosion. ▪ Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint. ▪ Any hydrocarbons, fuels, lubricants and chemicals to be used shall be stored in properly labelled oil storage tanks (surrounded with bund wall), with hoses and gauges kept within the bund. Waste and storage	Adherence to measures	Monitoring the quantity of excavated soil generated and reused for backfilling Soil quality monitoring (parameters to be analyzed include: pH, conductivity, cations, anions, hydrocarbons, heavy metals, microbial organisms	Weekly throughout construction Monthly through construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			areas for hazardous substances shall be separated on site and waste storage areas shall be located on hard standing (or in a bund wall, where necessary) to prevent potential contamination. ▪ Spill containment equipment to contain incidental spills/leaks, including drip pans to contain any spills during refuelling activities shall be provided.					
Groundwater contamination;	▪ Civil works and other related activities such as excavation that affects the groundwater aquifer	Minimize any impact on groundwater aquifer	▪ Training shall be provided for workers on safe storage and handling practices and rapid spill response and clean-up techniques during induction. ▪ Spill containment equipment to contain incidental spills/leaks, including drip pans to contain any spills during refuelling activities shall be provided ▪ Any hydrocarbons, fuels, lubricants and chemicals to be used shall be stored in oil storage tanks (in a bund wall) with hoses and gauges kept within the bund. ▪ Waste and storage areas for hazardous substances shall be	Nigerian Water Quality Standard for Drinking water World Health Organization (WHO) limits for potable water.	Groundwater monitoring at the nearby communities Parameters to be monitored include: ground water level, pH, TDS, turbidity, electrical conductivity, DO, COD, BOD, TSS, alkalinity, acidity, heavy metals, cations, anions, hydrocarbon,	Monthly during construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			separated on site and waste storage areas shall be located on hard stand (or in a bund wall) to prevent potential contamination. ▪ Waste receptacles shall be provided within a secured area within the project site for collection of solid waste. ▪ General wastes that cannot be reused shall be periodically evacuated from the site and disposed of at a government accredited dumpsite					
Emissions (like SO_2, CO, NO_x, VOC) from construction equipment such as excavation and levelling equipment, lifting cranes, welding, cutting, painting etc. Increase in dust form cleared land and windblown stockpiles	Earthworks exhaust emissions due to operation of construction machinery and equipment servicing during construction.	▪ Minimize deterioration of current ambient air quality by minimizing dust and gaseous emissions ▪ Ensure that adopted air pollution and noise control and management are effective.	▪ Spraying water on soil before excavation and periodic road wetting to reduce nuisance dust levels. ▪ Speed restriction of construction vehicles to a speed of 30 km/h or less; ▪ Regular maintenance and servicing of machines and engines; ▪ Use of clean fuels e.g., unleaded and de-sulphurized fuels, if available ▪ Ensure that vehicles sizes are optimised to reduce the number of journeys required and most suitable delivery routes are identified	National Ambient Air Quality Standards (NAAQS) WHO Ambient Air Quality Guidelines	Air quality in-situ sampling and measurement methods. Air monitoring parameters shall include SPM, NOx, CO, CO_2 and SO_2,	Monthly throughout construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			▪ Grievance procedure for dust complaints; ▪ The use of appropriate Personal Protective Equipment (PPE) such as dust masks in particular for construction workers. ▪ Ladgroup shall as much as possible ensure that EPC contractor operate only modern and well-maintained equipment and machinery for construction activities					
Noise emission with associated effects on sensitive receptors	Sources of impact for noise and vibration are from civil works and other related construction activities	▪ Minimize impact to sensitive receptors ▪ Ensure that noise levels produced by operation of engines, machines do not exceed the applicable to Nigerian standards ▪ Ensure that adopted noise controls and management are effective	▪ All equipment shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ Activities associated with high levels of noise shall be limited to daylight hours. ▪ Construction equipment with lower sound power levels shall be selected and used. ▪ Acoustic enclosures shall be installed on equipment casing radiating noise. ▪ Ladgroup shall ensure that engines and other noise making equipment are in good working order and well maintained, and that all have original noise suppression equipment	Noise at sensitive receptors does not exceed FMEnv. Limit World Bank Noise Level Guidelines	Noise monitoring/ measurement. Noise monitoring locations shall cover the Project site and the immediate surroundings	Monthly throughout construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			(e.g. mufflers) intact and in working order. ▪ Project personnel shall use appropriate Personal Protective Equipment (PPE) to reduce exposure to noise impact					
Disruption of family structure and social networks; increase in level of crime and drug and alcohol abuse, increase in incidence of sex workers and casual sexual relations, which may result in STIs and unwanted pregnancies	Influx of construction workers	Minimize impacts on local demographic due to influx	▪ The EPC Contractor shall develop an induction programme, including a Code of Conduct, for all workers (including contractors and their workers) prior to construction activities. ▪ A copy of the Code of Conduct to be presented to all workers and signed by each person. The Code of Conduct shall address the following aspects: - respect for the norms and values of local communities; - no hunting or unauthorised taking of products or livestock; - zero tolerance of illegal activities by construction personnel including: unlicensed prostitution and/or solicitation; illegal sale or purchase of	Adherence to measures IFC PS 4 on Community Health, Safety and Security	Formal and informal feedback from locals Grievance log	Monthly	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	350,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting; - compliance with the Traffic Management Plan and all road regulations; - description of disciplinary measures for infringement of the CoC. ▪ If workers are found to be in contravention of the Code of Conduct, which they shall be required to sign at the commencement of their contract, they shall face disciplinary procedures that could result in dismissal. Stock theft shall be noted as a dismissible offence ▪ A grievance procedure (which tracks grievances and responses; and respond in a timely manner with corrective actions identified where appropriate) shall be developed and implemented. The grievance procedure shall be communicated to the local communities. Key steps of the					

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			grievance mechanism include: - Circulation of contact details of 'grievance officer' or other key developer contacts. - Creation of awareness among local communities (including all directly affected and neighbouring residents) regarding the grievance procedure and how it works. - Establishment of a grievance register to be regularly updated, this should include all responses and response times. ▪ Ladgroup shall ensure that the EPC Contractor develops a means of monitoring access to the site, prohibiting unauthorized access to the site and ensuring that all visitors report to the site office. ▪ No employment shall take place at the entrance to the site. Only formal channels for employment shall be used, and recruitment					

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			shall take place only at designated times and locations. ▪ Ladgroup through its EPC Contractor shall develop and implement an HIV/AIDS policy and information document for all workers directly related to the project. The information document shall address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS. ▪ Stakeholder engagement plan shall be developed and implemented.					
Road traffic including accidents	Civil Works Activities	▪ Minimize any increase in road traffic ▪ Avoid traffic accident	▪ The EPC Contractor shall develop a construction traffic management plan (CTMP). ▪ All access routes within the site shall be identified, clearly demarcated and constructed. ▪ Speed limits (of less than 30 km/h) shall be adhered to on the Project site. ▪ Off-road driving shall be prohibited. ▪ All vehicles used for the project should be regularly serviced and maintained.	Adherence to measures	Formal and informal feedback from locals Compilation of statistics on numbers of accidents in conjunction with local authorities	Monthly throughout construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			▪ Ensure that driver competency is assessed and where required driver training is provided.					
Risk of injury and health related issues, rights denial etc.	Civil works and other related activities	Minimize the likelihood of incidents or accidents occurring at site.	▪ Development and implementation of a robust H&S Management Plan by the EPC Contractor. The H&S Plan shall be developed following all relevant national and international standards, including IFC PSs. ▪ Construction works shall be limited to the day time as much as possible. ▪ Provision of bill boards at the construction site gates notifying people of the construction activity and timings. ▪ Speed limits within the project site access roads and immediate vicinity shall be limited to 30 km/hr. ▪ Implementation of Health and Safety communication and training programmes to prepare workers to recognize and respond to workplace hazards. Daily toolbox talks prior to commencement of construction activities shall be implemented and regular drills	Institute of Safety Professionals, Factories Act 1990), IFC PS 2 on Labour and Working Conditions; World Bank EHS Guidelines	Project's HSE Plan	Weekly throughout construction	EPC Contractor, Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	525,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			conducted involving the neighbours. ▪ Provision of adequate personal protective equipment (PPE) to workers. All employees shall be required to wear the appropriate PPE whilst performing their duties. ▪ Provision of regularly maintained firefighting equipment and in easily accessible areas as well as ensuring site personnel are well trained in their use, as well as maintaining them regularly. ▪ Safety training focused on operational procedures, emergency procedures and safe working practices, information on specific hazards, first aid and fire-fighting shall be included in the induction, prior to the commencement of construction ▪ Training of workforce on communicable diseases and Sexually Transmitted Diseases (STDs) and community interactions in general. ▪ Ladgroup and the EPC Contractor shall put in place a worker grievance mechanism that shall be					

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			accessible to all workers, whether permanent or temporary, directly or indirectly employed. The grievance mechanism shall be open to the EPC Contractor and subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer; Ladgroup shall then have the authority to act to resolve this grievance.					

Table 7.4: Environmental Management Measures for the Operation Phase

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Factory operations including routine maintenance								
Decrease in ambient air quality due to vehicular emissions and dust generation; increase in ambient noise level	milling and refining operations	▪ Minimize noise emission ▪ Improved air quality	▪ The factory machineries shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ Acoustic enclosures shall be installed on equipment casing radiating noise. ▪ Project personnel shall use appropriate PPE (e.g. ear muffs) to	Air quality and Noise at sensitive receptors does not exceed FMEnv. Limit World Bank Air quality and Noise Level Guidelines	Air quality and Noise monitoring/ measurement. Air quality and Noise monitoring locations shall cover the Project site and the immediate surroundings.	Quarterly	Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			reduce exposure to noise impact. ▪ Periodic maintenance of the factory components shall be carried out. ▪ Speed restriction of operational vehicles to a speed of 30 km/h or less shall be ensured; ▪ Use of clean fuels e.g., unleaded and de-sulphurized fuels, if available, shall be ensured.					
Potential contamination from oil spills from generators/operational vehicles Contamination of the soil from oil leakage from the storage tanks	Routine maintenance, accidental spill Diesel storage tanks Vehicular activities	Minimize risk of soil contamination.	▪ Implement effective waste management policy. ▪ Absorbent kits shall be provided to clean up small leakages ▪ Adopt proper safety measures when handling those spent oil from the generators or trucks to prevent their leakage and infiltration into the soil.	Heavy metals and hydrocarbon standard limits in soil	Soil sampling monitoring and laboratory measurement.	Quarterly	Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	175,000
Groundwater may be impacted as a result of diesel spillage from diesel storage tanks Reduction in groundwater recharge through	Refueling of diesel storage tanks Servicing of the generators Surface runoff as a result of paved surfaces	Minimize any impact on the aquifers	▪ Ladgroup shall design and implement appropriate drainage system that shall connect to the existing drainage outside the facility.	Water quality and quantity management	Groundwater water sampling and laboratory analysis. The monitoring parameters shall include heavy metals and hydrocarbons among others.	Quarterly	Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for	175,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
infiltration as a result of paved surfaces			▪ Ladgroup shall ensure that cathodic protection system is functional to further prevent corrosion of the storage tanks ▪ Ladgroup shall ensure that an over-fill alarm is correctly installed and functions optimally ▪ Ladgroup shall ensure that all pipes are tested for leakages immediately after installation or after carrying out maintenance work ▪ Ladgroup shall carry out pressure and leak test before using the tanks and conduct the same test every five years until the tank is twenty years old, thereafter the tank should be tested for every two years ▪ Ladgroup shall ensure that backfilling and landscaping of some portion of the facility to retain a means to recharge the underground				implementation monitoring)	

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			aquifer during rainfall. ▪ Ladgroup shall ensure that absorbent kits are provided to clean up occasional oil spills ▪ Ladgroup shall ensure that relevant operational staff receive training on the correct handling and emergency response procedures.					
Health, safety and welfare of staff	General operation activities and routine maintenance	Minimize the likelihood of incidents occurring in the work place. In addition, protecting health of Employees from occupational hazards and related disease.	▪ Human resources (HR) policy relevant to scale of the Project shall be updated to the scale and scope of the expansion if need be. ▪ The HR policy shall include the following key issues, among others: – Provision of clear and understandable information regarding rights under national labour and employment law, and any applicable	Institute of Safety Professionals, Factories Act 1990), IFC PS 2 on Labour and Working Conditions, World Bank EHS Guidelines Emergency Response Plan	Incident and accident records Grievance Log	Quarterly	Ladgroup HSE unit FMEnv, Ogun State Ministry of Environment and other relevant government authorities (for implementation monitoring)	350,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			collective agreements, including those related to hours of work, wages, overtime, compensation, etc. – Provision of employment, compensation/ remuneration and working conditions, including working hours, terms of employment, based on equal opportunity and fair treatment, avoiding discrimination on any aspects. – Retrenchment policy including alternatives analysis prior to decision. – Implementation of a grievance mechanism. – Adoption and implementation of a sexual harassment policy.					

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			– Adoption of open attitude towards freedom of association. – All workers shall be able to join unions of their choice and have the right to collective bargaining. – A worker grievance mechanism that shall be made known to all workers ▪ Develop and implement occupational health and safety policy and procedures including emergency plan. Staff shall be trained on emergency preparedness and responses. ▪ Maintain all work equipment consistent with manufacturer's recommendations ▪ Provision of medical insurance scheme for all employees shall be ensured.					

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Traffic associated with the operational phase	Vehicular movement	▪ Minimize any increase in road traffic ▪ Avoid traffic accident	▪ A Journey Management Plan shall be developed and implemented. ▪ Off-road driving shall be prohibited. ▪ Project vehicles with efficient engine performance (through regular servicing and maintenance) shall be selected and used. ▪ Speed limit of less than 30 km/h shall be adhered to within the Project's AoI. ▪ Driver's competency shall be assessed and where required, additional training shall be provided. ▪ A grievance procedure that shall track grievances (for any road accident) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented.	Adherence to measures	Formal and informal feedback from locals Compilation of statistics on numbers of accidents in conjunction with local authorities Grievance Log	Weekly during the operation phase	EPC Contractor, Ladgroup HSE unit	175,000

CHAPTER EIGHT:

REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

CHAPTER EIGHT

REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

8.1 Introduction

This chapter discusses the activities associated with the decommissioning of the proposed factory expansion Project, including the potential impacts associated with the decommissioning activities as well as the environmental and social measures to address the issues. In addition, an overview of the decommissioning plan for the Project at the end of its operating life is provided.

8.2 Decommissioning Activities

Decommissioning refers to the process of removing and managing all operating assets of a project after completion of its life cycle. The proposed expansion Project is being developed for a projected 25-year operational life time. However, with regular maintenance, it is anticipated that the useful life of the Project could extend well beyond the designed life span.

The decommissioning activities will typically include the following:

- Dismantling and removal of equipment and structures;
- Removal of any surface installations;
- Waste generation and management;
- Rehabilitation of any impacted environmental component (e.g. soil).

Consistent with industry standards, the planning for decommissioning shall begin from the design stage of the factory and shall continue throughout the lifetime of the facility.

8.3 Management of Decommissioning Activities

In the event of decommissioning, Ladgroup shall ensure that the Project site is left in a safe and environmentally acceptable condition. A standard decommissioning, abandonment and closure programme shall be involved. The task will include:

- Restoration of the Project environment to baseline conditions (as much as practicable) in line with legislative and regulatory requirements;
- Assessing the residual impact, if any, the Project has on the environment;
- Monitoring the abandoned Project environment as necessary.

Ladgroup will only begin decommissioning activities after due consultation with the relevant stakeholders including the regulatory authorities. The decommissioning activities shall be carried out in line with the relevant provisions of the National Guidelines for Decommissioning of Facilities in Nigeria (2017) issued by the FMEnv.

Typically, the following steps shall be undertaken for decommissioning:

- An updated plan which takes into account the most cost-effective and best practicable methods, legal requirements and industry practices at that time for the factory decommissioning shall be developed. The plan shall be submitted to the FMEnv. and other relevant government agencies for approval, at least one (1) year prior to scheduled abandonment and decommissioning. The plan shall include, but not limited to the following:
  - Description of the site and components to be decommissioned.
  - Description of the decommissioning scope, objectives, end state and strategy;
  - Activities to be performed during the decommissioning;
  - Schedule of decommissioning activities;
  - Estimate of the decommissioning cost;
  - Estimated inventory of waste streams to be generated during the decommissioning and handling techniques;
  - Decommissioning team (qualifications, roles and responsibilities)
- To ensure that due consideration is given to all options a detailed evaluation of facilities decommissioning options shall be carried out. The options will include facility mothballing, partial facility decommissioning or complete site decommissioning. The evaluation will consider environmental issues in conjunction with technical, safety and cost implications to establish the best practicable environment friendly options for the Project decommissioning.
- A risk assessment shall be conducted to ensure that nothing, which could be constituted as a hazard for other users of the site or for the environment in general, will be left at the site. The Project site shall be left in a safe and environmentally acceptable condition.
- Hazard identification and analysis shall be conducted to determine special safety concerns to be addressed.
- An appropriate Health, Safety and Environment (HSE) plan shall be implemented to ensure that the decommissioning activities are carried out in an environmentally sound manner and in conformity with relevant laws and regulations guiding such operations.
- Third party notifications shall be carried out before any demolition and shall be conducted in a phased sequence.

- Consultation shall be made with relevant stakeholders including Ikenne LGA and Ogun State Government to determine whether if any of the factory components could be useful if left in place. In such instance, the transfer of the responsibility of maintaining such facility shall be considered and documented to avoid any conflicts between interested parties.
- Socio-economic considerations of facility decommissioning shall be carried out. These will include assessment of potential effects associated with termination of employment (at the end of operational phase) and the measures to minimize the effects by:
    - Ensuring that employees are fully informed about the decommissioning and how it will affect them before the project finally closes.
    - Building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase of the factory.
    - Providing training to build local skills tailored to project decommissioning and post-decommissioning activities (e.g. equipment dismantling, rehabilitation activities, monitoring, etc.).
    - Providing training to transfer project-learned skills to alternative and secondary industries tailored to respond to market economy.
- An effective waste management plan shall be implemented for the decommissioning activities. The decommissioning options for redundant structures and equipment will include: the complete dismantling of structures and equipment and the return of all components to the equipment manufacturer for recycling, where possible. A detailed record of all suitable recycling materials shall be maintained.

The environmental and social management measures for the identified potential impacts of the decommissioning activities are presented in Table 8.1.

8.4 Abandonment plan

Prior to site abandonment, Ladgroup shall establish a standard procedure for incorporating the following practices:

- Identification of the factory components to be abandoned and/or removed;
- The proposed methods for abandonment or re-use of the equipment/material applicable;
- Processes put in place to mitigate potential environmental impacts associated with the abandonment process; and

- Appropriate site rehabilitation programs (including re-vegetation of the site with native plant species) to return the Project environment to its original status (as much as practicable).

The decommissioning, abandonment and/or closure programme shall generally be managed by a team of competent personnel, including the HSE personnel of Ladgroup and witnessed by relevant regulatory authorities such as the FMEnv and the Ogun State ministry of environment. A close out report shall be prepared and archived for future reference.

Table 8.1: Environmental and Social Management Measures for Decommissioning

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Soil contamination due to waste generation; soil compaction	Demolition activities	Minimize risk of soil contamination	▪ An approved decommissioning plan by the regulatory authorities shall be implemented. ▪ LADGROUP shall ensure that dismantled materials are taken offsite for appropriate recycling and reuse. ▪ LADGROUP shall ensure that all major electrical items are removed from site and recycled appropriately. ▪ All impacted soil area shall be re-vegetated with native plant species	Site Closure and Restoration Plan	Soil quality monitoring (parameters to be monitored include pH, TOC, heavy metals and hydrocarbons)	Twice during decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of environment and other relevant government authorities (for implementation monitoring)	200,000
Air quality impairment by gaseous and particulate pollutants; Increase in dust level.	Source of impacts for air quality includes demolition of building and associated facilities; and vehicle movement.	▪ Minimize emission impacts on sensitive receptors	▪ An approved decommissioning plan by the regulatory bodies shall be implemented. ▪ LADGROUP shall ensure regular cleaning of equipment to avoid excessive build- up of dirt and mud shall be ensured. ▪ Project vehicles with efficient engine performance and with minimal emissions shall be selected and used. This can be achieved through regular servicing and maintenance.	National Ambient Air Quality Standards (NAAQS) WHO Ambient Air Quality Guidelines	Dust mitigation programme as part of Site Closure and Restoration Plan	Monthly during decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of Environment and other relevant government authorities (for implementation monitoring)	200,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			▪ All materials with potential to result in dust emissions shall be covered during transport ▪ Onsite vehicle speed on earthen roads and surfaces shall be limited to about 15km/h so as to reduce dust generation.					
Discomforting noise from equipment and related activities with attendant health effects.	Source of impacts for noise include demolition of buildings and associated facilities; vehicle movement.	▪ Reduce noise nuisance at receptor.	▪ An approved decommissioning plan by the regulatory bodies shall be implemented prior to demolition activities. ▪ LADGROUP shall ensure that equipment with sound power levels are selected and used. ▪ Acoustic enclosures shall be installed on equipment casing radiating noise. ▪ LADGROUP shall ensure that engines and other noise making equipment are in good working order and well maintained, and that all have original noise suppression equipment (e.g. mufflers) intact and in working order. ▪ Project personnel shall use appropriate PPE.	Noise level at sensitive receptors not to exceed Nigerian and WHO limits for noise exposure	Noise monitoring at sensitive receptors (including the nearest residential houses) during decommission. Measurements of noise levels will be conducted using an integrated sound meter.	Monthly during decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of environment and other relevant government authorities (for implementation monitoring)	200,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Groundwater contamination from spills	Waste generated during decommissioning activities	▪ Minimize impact on groundwater quality	▪ Training shall be provided for workers on safe storage and handling practices and rapid spill response and clean-up techniques during induction. ▪ Spill control and response plans to respond to spills and leaks shall be implemented. ▪ Any hydrocarbons, fuels, lubricants and chemicals to be used shall be stored in properly labelled oil storage tanks (surrounded with bund wall), with hoses and gauges kept within the bund. Waste and storage areas for hazardous substances shall be separated on site and waste storage areas shall be located on hard stand (or in a bund wall, as may be required) to prevent potential contamination. ▪ Waste receptacles shall be provided within a secured area within the project site for collection of solid waste. ▪ General wastes that cannot be reused shall be periodically	Nigerian Water Quality Standard for Drinking water World Health Organization (WHO) limits for potable water.	Groundwater monitoring. Parameters to be monitored include: ground water static level, pH, TDS, turbidity, electrical conductivity, DO, COD, BOD, TSS, alkalinity, acidity, heavy metals, cations, anions, hydrocarbon, microbial	Twice during decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of Environment and other relevant government authorities (for implementation monitoring)	200,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
			evacuated from site for disposal at government approved dumpsite.					
Traffic due to transportation of dismantled equipment and materials from site including wastes	Removal of factory's associated components; transportation of dismantled equipment and materials from site including wastes	▪ Avoid road traffic ▪ Minimize increase in road traffic	▪ Journey management plan shall be developed and implemented. ▪ LADGROUP shall engage with the relevant local authorities in order to repair any damage to the road as a result of the project activities. ▪ A grievance procedure that will track grievances and responses (for any damage or accidents) and respond in a timely manner with corrective actions identified as appropriate shall be developed and implemented. ▪ Drivers shall adhere to speed limits of less than 30 km/h in the project area. ▪ Drivers' competency shall be assessed and where required training shall be provided.	Adherence to measures	Formal and informal feedback from locals Compilation of statistics on numbers of accidents in conjunction with local authorities	Monthly throughout decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of Environment and other relevant government authorities (for implementation monitoring)	400,000

Potential Impact	Source of Impacts	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility	Estimated Cost for implementation (in Naira)
Exposure to injuries, electrical shock, falling from height; slip, trip and fall, suffocation from working in confined spaces	Removal of the factory associated components; Demolition of buildings and associated facilities	▪ Minimize the likelihood of incidents or accidents occurring at site	▪ Occupational Health and Safety Management System (OHSMS) of LADGROUP shall be adopted and implemented. ▪ Appropriate PPE (e.g. coverall, safety shoes, helmets, nose masks, eye goggle, hand gloves, etc.) shall be provided and its use shall be made mandatory ▪ Provision of medical insurance scheme	Institute of Safety Professionals, Factories Act 1990), IFC PS 2 on Labour and Working Conditions; World Bank EHS Guidelines	Incident and accident records Grievance log	Weekly throughout decommissioning	LADGROUP Health and Safety Unit with subcontractors FMEnv, Ogun State ministry of Environment and other relevant government authorities (for implementation monitoring)	700,000

CHAPTER NINE:

CONCLUSION AND RECOMMENDATIONS

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9.1 Conclusion

The EIA of the proposed Ladgroup factory expansion Project in Ikenne LGA, Ogun State has been undertaken in accordance with the EIA Act CAP E12 LFN 2004 as well as the relevant international guidelines.

The study involved a number of key steps including: desktop review, scoping, stakeholder engagement, field data gathering, laboratory analysis of field samples, potential impact identification and evaluation, development of mitigation measures and environmental management plan, and reporting.

The essence of the EIA process is aimed at ensuring informed decision-making and environmental accountability, and to assist in achieving environmentally sound operation throughout the Project life cycle.

Consistent with the regulatory standards, the assessment of the environmental status and the socio-economic aspects of the proposed Project's area of influence has been carefully carried out using universally accepted methodology. Evaluation of associated and potential impacts of the Project identified both positive and negative interactions with the receiving biophysical and socio-economic environment.

The positive impacts associated with the Project include, amongst others:

- Direct and indirect employment opportunities
- Acquisition of new skills through technology transfer
- Revenue generation to Government through taxes
- Improved standard of living in the Project area

There are no human uses of the Project site that will be permanently displaced and no relocation of community residents is required. There are no culturally significant sites or heritage resources within the Project area that would be negatively impacted.

The potential negative effects identified were mostly of minor to moderate significance. The significance levels of the identified negative impacts can generally be reduced by implementing the recommended mitigation measures.

Based on the nature and extent of the proposed Project and the findings of the EIA, it is believed that the potential negative impacts associated with the

proposed Project can be mitigated to as low as practicable. Also, an Environmental Management Plan (EMP) has been established to assess the efficiency and effectiveness of the recommended mitigation measures and ensure long-term monitoring of the Project.

9.2 Recommendations

Ladgroup shall ensure that the proposed factory expansion Project is developed and operated in an environmentally sustainable manner, in compliance with National and International Standards by properly managing the processes/activities that may bring about disturbances to the environment through the implementation of the recommended mitigation measures and the EMP. Continuous monitoring of environmental and social performance of the Project shall also be maintained, including periodic consultation with the relevant stakeholders.