LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATIONS PROJECT

FINAL REPORT OF ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT -LOT 2

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TRANSMISSION COMPANY OF NIGERIA
TCN

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LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATIONS PROJECT

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LIST OF ABBREVIATIONS AND ACRONYMS

GENERAL

BDL	Below Detection Limit
BOD	Biochemical Oxygen Demand
DO	Dissolved Oxygen
DS	Dissolved Solids
EC	Electrical Conductivity
EDTA	Ethylenediaminotetra-acetic acid
HC	Hydrocarbon
HSE	Health, Safety and Environment
EHS	Environmental Health and Safety
QHSE	Quality Health Safety and Environment
SS	Suspended solids
TDS	Total Dissolved Solids
TPA	Tons per Annum
TPD	Tons per Day
TSP	Total Suspended Particulate
VOC	Volatile Organic Compounds
PS	Performance Standard
RoW	Right-of-Way
SEP	Stakeholder Engagement Plan
PPE	Personal Protective Equipment

UNITS OF MEASUREMENT

%	Percentage
µg	Microgramme
µm	microMetre
µS	micro Siemen
cfu/ml	Colony forming unit per milliliter
cm	Centimetre
dBA	Decibel
ft	Feet
g	Gramme
g/cm	Gramme per Centimetre
Ha	Hectare
Hz	Hertz
Mw	Mega Watt
MHz	Mega Hertz
Kcal/kg	Kilo calories per kilogramme
Kg	Kilogramme
Km	KiloMetre
KV	Kilovolt
kWh	Kilowatt per hour
m	Metre
m/s	Metre per second
m^3	Metre Cube
meq	Milliequivalent

mg	Milligramme
mg/Kg	Milligramme per kilogramme
mg/l	Milligramme per litre
ml	Millilitre
mm	Millimetre
mmtpa	million metric tonnes per annum
NTU	Nephelometric Turbidity Unit
$^{o}/_{oo}$	Parts per thousand
^{o} N	Degree North
pH	Hydrogen ion concentration
ppb	parts per billion
ppm	parts per million
$T^{o}C$	Temperature in degrees Celsius
V	Volt
mm/s	Millimetre per second
mG	Milli Gause

CHEMICAL ELEMENTS AND COMPOUNDS

Al	Aluminum
C	Carbon
Ca	Calcium
$CaCO_3$	Calcium Carbonate
Cl	Chloride
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Cr	Chromium
Cu	Copper
Fe	Iron
H	Hydrogen
H_2O	water
H_2S	Hydrogen Sulphide
Hg	Mercury
K	Potassium
Mg	Magnesium
Mn	Manganese
N	Nitrogen
Na	Sodium
Na_3PO_4	Sodium phosphate
NaOH	Sodium hydroxide
NH_3	Ammonia
NH_4^+	Ammonium ion
NH_4F	Ammonium flouride
Ni	Nickel
NO_2^-	Nitrite ion
NO_3^-	Nitrate ion
NO_X	Nitrogen Oxides
O_2	Oxygen
P	Phosphorus
Pb	Lead

PO_4^{3-}	Phosphate ion
SiO_3^{2-}	Silicate
SO_2	Sulphur dioxide
SO_4^{2-}	Sulphate ion
V	Vanadium
Zn	Zinc
PCB	Polychlorinated Biphenyl

STRUCTURES AND EQUIPMENT

AAS	Atomic Absorption Spectrophotometre
GPS	Geographical Positioning System

ORGANIZATIONS

APHA	America Public Health Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAO	Food and Agricultural Organization of the United Nations
FEPA	Federal Environmental Protection Agency
FMEnv	Federal Ministry of Environment
ISO	International Standard Organisation
IUCN	International Union for Conservation of Nature
WWF	World Wildlife Fund
WRI	World Resources Institute
NIMET	Nigeria Meteorological Agencies
TCN	Transmission Company of Nigeria
JICA	Japan International Cooperation Agency
SEPA	State Environmental Protection Agency
TBA	Traditional Birth Attendants
USDA	United States Department of Agriculture
SEEMS	Scientific Energy and Environmental Management Systems
WB	World Bank
WHO	World Health Organisation
NIPP	National Integrated Power Project
OGEPA	Ogun State Environmental Protection Agency
NERC	Nigerian Electric Regulatory Commission
NESI	Nigerian Electricity Supply Industry
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGC	Nigeria Gas Company Limited
NGO	Non-Governmental Organization
SEPA	State Environmental Protection Agency
IEC	International Electro Technical Commission
IEEE	Institute of Electrical and Electronics Engineer
IFC	International Finance Corporation
IFI	International Financial Institutions
ILO	International Labour Organization
USEPA	United State Environmental Protection Agency
MFM	Mountain of Fire and Miracles Ministries
RCCG	Redeemed Christian Church of God

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EXECUTIVE SUMMARY

Introduction

The Federal Government of Nigeria through the Transmission Company of Nigeria (TCN) intends to construct new transmission lines totaling about 203km and 5 high voltage substations in Lagos and Ogun States. This project is required to loop up the existing power transmission lines in accordance with the electricity master plan. The Transmission Lines network capacity development component of the master plan is aimed at achieving transmission capacity of 20,000 MW by 2020. The project is being funded through a loan facility by the Japan International Cooperation Agency (JICA). The investment will improve the availability and reliability of electricity supply to Lagos and Ogun States. While the justification for the projects from socio-economic considerations cannot be overemphasized, the cumulative environmental consequences of such projects need to be brought to the fore. In order to ensure environmental protection and safety of the population resulting from the transmission lines and associated substations projects of such magnitudes, an Environmental and Social Impact Assessment (ESIA) which is mandatory in Nigeria as stipulated by Environmental Impact Assessment Act No. 86 of 1992 of the Federal Ministry of Environment (formerly Federal Environmental Protection Agency (FEPA) is required. It is in compliance with the national and international regulations of minimizing impact on the environment in which it operates that Transmission Company of Nigeria (TCN) that is charged with the responsibility for the planning, design, construction and maintenance of the transmission plans to carry out Line Route (LR), Environmental and Social Impact Assessment and Resettlement Action Plan (RAP) studies for the proposed projects. In this view, Transmission Company of Nigeria (TCN) has engaged SEEMS Limited to conduct Environmental and Social Impact Assessment (ESIA)

The proposed projects for the construction of 63.97km, 330/132kV Double Circuit Transmission Line involves:

- Construction of Ogijo (Likosi/Dejuwogbo) to Arigbajo (Ejio) 48.74km 330kV Double Circuit Transmission Line,
- Construction of 2.41km 132kV, 2-Double Circuits Transmission Line from Ogijo (Likosi/Dejuwogbo) to the Existing Ikorodu/Shagamu 132 kV Transmission line,
- Construction of 7.83 km 132kV Double Circuit Transmission Line from Ogijo (Likosi/Dejuwogbo) to Redeem,
- Constuction of 4.99km 330kV Double Circuit Transmission from MFM to the Existing Benin (Omotosho)/Ikeja West 330kV Transmission Line,
- Construction of 330/132kV Substation with 2x300MVA 330132kV and 2 x 100MVA 132/33kV Transformer capacities at Ogijo (Likosi/Dejuwogbo),
- Construction of 2x60MVA, 132/33kV Substation at Redeem,
- Construction of 132/33kV Distribution Substation with 2x150MVA, 330/132kV +and 2x60MVA 132/33kV Transformer capacities at MFM.
- Development of land access (from nearby roads) to TLRoW to facilitate construction and maintenance
- Construction of incoming feeders and outgoing feeders which are connected to the existing transmission system

Project Justification

The Need and Benefits of the Project

The benefits of this project for the people of Lagos and Ogun State in particular, and the economy of Nigeria in general are numerous. The following few are worth mentioning;

- Improved and more reliable electric power supply.
- Enhances productivity and efficiency in both public and private organizations
- It helps to develop and promote small, medium, and large-scale enterprises thereby creating direct and indirect employment opportunities.
- It helps to improve the security of lives and properties.
- General contribution to climate change through overall reduction of the use of personal power generating sets.
- General improvement of the standard of living for the populace.

Project Alternatives

The following project alternatives were considered having regard to the objectives of the project, pertinent environmental and economic factors and community concerns:

(i) Do nothing
(ii) Different Transmission Capacity
(iii) Alternative Technologies
(iv) Alternative Starting/Ending Points

Project Sustainability

The proposed project is expected to be technically and environmentally sustainable because of the following:

- Proven transmission line construction technology and expertise available within the country
- Strict adherence to internationally accepted engineering design and construction standards as well as codes of practice at all stages of the project
- Periodic inspection of facilities in accordance with the operational procedures developed through TCN’s extensive experience;
- Management of the project by fully trained and qualified personnel who are conversant with the TCN’s policy guidelines

In accordance with the sustainability principle of ‘engaging and working with stakeholders’ during projects, project-affected groups and local non-governmental organizations (NGOs) will be consulted about the project’s environmental and social aspects and taking their views into account as necessary. Effective community relations and conducive environment will be maintained in the project area during construction and throughout the life span of the project

Project Description

The project proposed by Transmission Company of Nigeria (TCN), is the construction of new transmission lines totaling of about 63.97-kilometers including 3 substations and transmit spanning across Ogun State. The proposed project is required to loop up the existing power transmission lines and hoping to improve the availability and reliability of electricity supply to Ogun States. It is aimed at increasing the capacity of the transmission network thereby improving the voltage profile in the Ogun state as well as strengthening the grid and improving system reliability, stability and operational efficiency of the national grid network. This project is being funded through a loan facility by the Japan International Cooperation Agency (JICA). It is expected that the investment will bring more reliable power supply, decreasing the number of power outages and reducing the operation of generator sets by households and companies.

It is anticipated that construction of the transmission lines and substations will commence in late 2019 and take approximately 36 months to complete. This does not however show the interdependencies of the activities.

Phase I: Pre-construction

- Feasibility studies
- Line-route studies
- Environmental and Social Impact Assessment (ESIA)
- Resettlement and Compensation
- Front End Engineering Design
- EPC contract award
- Mobilization
- Check survey of EPC contractor
- Impact Mitigation Monitoring
- Transmission line and Substation detail design
- Material production (transformers and accessories, tower members, conductors, insulators, line hardware)
- Material testing
- Material shipment

Phase II: Construction Phase

- Clear and grub site at substations and along transmission lines corridor
- Impact Mitigation Monitoring
- Foundations for tower installation and substation construction
- Tower erection
- Substation construction and installations
- Conductor stringing
- Impact Mitigation Monitoring
- Commissioning and testing
- Reinstating and clean up
- Demobilization
- Impact Mitigation Monitoring
- Ready for handing over

Phase III: Operations and Maintenance Phase

- Power Transmission
- Maintenance of TL
- Maintenance of SS
- Compliance Monitoring

- Period Environmental Audit
- Periodic Systems Audit

Phase IV: Decommissioning/Closure

- Decommissioning Audit
- Dismantling and removal of Structures
- Site restoration

Description of Existing Environment

This chapter presents information on the existing environmental conditions in the project area including the details of the materials and methods of baseline data collections for the different studies carried out for the project ESIA. The main source of information was through the field survey when a strong team of experts obtained site specific data and/or collected samples / specimens for determination as detailed for the respective studies involved. The field survey was carried out December 18-23, 2017 during the dry season. Secondary data from previous studies was obtained to cover the rainy season as stated in Chapter 4. The environment components covered were climate and meteorology, air quality and noise level, geology / geophysics/hydrology, soil and land use, vegetation, water quality, hydrobiology, wildlife, socio-economics and health status. All selected sampling stations were geo-referenced using a handheld Geographical Position System (GPS) set.

Climate and Meteorology

The project area falls within the Semi-Hot Humid Climate of the world. The climate type is characterised by high ambient air temperature in the range of 19.0 – 38.5^{0}C comprising 19.0 – 35.1^{0}C for morning period (09hr) and 24.1 – 38.5^{0}C for the evening period with an annual mean ± s.e. of 26.4±0.15^{0}C and 31.5±0.25^{0}C respectively. Relative humidity was generally higher in the morning (mean 80.4-83.7%) than in the evening (mean=61.3-63.3%). Over the annual cycle, mean difference between morning and evening values was more pronounced in the dry season (13.4%) than in the rainy season. Heat index was almost invariably higher than air temperature. The incidence of normal heat index (<27%) was higher in the morning than in the evening. Like most parts of the country, the wind regime in the project area is dominated by two major wind systems namely, the southerly winds (originating over the Atlantic Ocean) and the north-easterly wind originating from the Sahara Desert.

The diurnal pattern of wind system was characterised by higher wind speed in the afternoon (usually as light breeze) than in the morning (usually as light air). On the whole, wind speed varied over a wide range of 0.16-6.8m/s (0.0-24.5km/hr) i.e. from calm, through light air to moderate breeze. The annual cycle consists of two seasons with regard to rainfall namely: dry season (November - March) and rainy season (April - October) but there is no month without a trace of rainfall. Over the period 1989 – 2010, annual total rainfall varied from 843mm (1998) to 2102mm (2000) with the overall mean ± s.e of 1485±93mm (median=1443 and mode of 1628mm). The rainy season is characterised by two peaks, occurring mostly in July and September. Annual rainfall has steadily increased over the period of 1998 – 2010, an evidence of climate change in the area.

Air Quality

Ambient air was sampled and analysed in-situ at 24 established sampling points for pollutant gases (SO_2, NO_2, CO, O_3, H_2S and NMHC) and particulates (TSP) along the RoW of the proposed Transmission Lines and Substations> Air samples were collected at about 1.5 m above the ground level and measured for the composite gases using RAE multi-gas analyser while particulates were sampled using Air Metric Mini volume sampler and measured gravimetrically. Whereas TSP and pollutant gases were sampled at each station over one-hour averaging period. TSP concentrations ranged from 48 – 295µg/m^3 in the dry season and over 56 – 450 µg/m^3) in the wet season. Thus, generally below Federal Ministry of Environment (FMEnv) maximum allowable limit of 600 µg/m^3. NMHC, SO_2, H_2S and NO_2 were generally below the detection limit of the equipment used (<0.01) during the dry season but slightly higher (P>0.05) during wet season. The concentration of CO occurred over the concentration of 1-4ppm (mode = 1ppm) in the dry season and 1-3ppm in the wet season. On the whole, the concentration of air quality parameters fell within FMEnv standard ranges and did not show significant seasonal variations.

Noise Level, Vibration and Electromagnetic Field (EMF) Measurements

Short and Long-term noise measurement were carried out using a HD 60 and CEL-24x sound level meter with data logger software Which enables the computation of indexes. Vibration measurements were carried using a vibration meter (Extech U.S.A.) while EMF was measured using an Extech (U.S.A) EMF Meter. All measurements were carried out at the stations established for air quality. Noise levels measured ranged from 34.60dBA to 66.50dBA and 52.50 – 76.90 dBA for both dry and wet season respectively. The noise level in the project area was due mainly to human conversation and commercial activities but all the obtained values were within the FMEnv allowable limits. Vibration levels were generally low (range= 0.10-0.50 mm/s). EMF was not detected along the transmission line because it has not been energised while it was in the range of 0.1-0.20mG at Likosi and Ejio Substations

Geology and Geophysical Investigations

Geological and geophysical investigations involving surface lithological observation and Vertical Electrical Sounding (VES) were carried out along the proposed Transmission Lines and Substations. The facilities are all located within the recent alluvium, coastal plain sand, Oshosun, Ilaro and Ewekoro formations. The sand horizon, which constitute the competent layer, occur at depths varying from 0.9 to 42.9 m with intercalation of low competent clayey layers. The competent layers (essentially sand) was not delineated beneath the proposed MFM Substation – existing Ikeja West 330Kv Transmission Line. Metal structures embeded within Transmission Line tower foundation could be under significant threat of corrosion over a long period of time, most especially between 27.15 -29.39 km along the proposed Ejio – Likosi Transmission Line and 0 -0.82 km along the proposed MFM Substation – existing Ikeja West 330Kv Transmission Line. The subsoil beneath the proposed MFM Substation with resistivity values less than 100 ohms-m are good earthing materials while the proposed Likosi and Redeem Substations with resistivity values greater than 100 ohms-m may need to be artificially enhanced. Where the subsoil is clayey and incompetent, transmission line tower foundation should be anchored on friction piles to prevent settlement.

Soil and Land Use Studies

Eighteen (18) soil sampling stations were established along proposed transmission lines and substations. Soil samples were taken at about 0 -5km interval along the route from surface (0-15 cm) and subsurface (15-30 cm) levels using a Dutch Auger. At each station, 10 core samples, spatially distributed for surface and subsurface soil levels were collected in bulked mixed and sub-sampled for laboratory analysis. Soil classification and the analysis of physico-chemical characteristics were based on standard methods (USDA, FAO-UNESCO). The soils in the area are classified into two main types, namely: the deep well -drained upland soils of Alagba series (Oxic Haplustalf or Eutric Nitrosol) and the poorly-drained upland soils of Owode series (Ferric Luvisol). Each of the two soil types is described with regard to physiography, parent, material, vegetation cover and land use. The deep well-drained upland soils of Alagba series covers 78% of the total land area of the project as opposed to 22% coverage by the poorly drained upland soils or Owode series. In general, soils in the area are formed in-situ and lies over shale and limestone which are rich in ferromagnesian minerals. They vary in texture from sandy loam at the surface (0-15 cm) to loamy sand-sandy clay loam in a few locations. Soil reaction vary from slightly acidic to neutral (pH= 5-7) in the surface, and acidic to very acidic (pH= 6-3) at subsurface level. Organic Carbon content was slightly higher at the surface (0.05-0.74%) than at the subsurface level (0.03-0.53%). With a base saturation in the range of 74 – 94%, the sum of soil exchangeable cations (ECEC) was strongly dominated by the basic cations (Ca^{2+}, Mg^{2+}, Na^{+} & K^{+}) and the soils were characterised by moderate fertility. The plant- extractable Cu, Cd and Ni contents of the soil are within the acceptable limit for soils. On the other hand, Pb content was locally elevated at Thames Valley College (probably due to the disposal of used leaded battery) while in Ibokuru, Magboro and Ejio Communities, Zn content was elevated. On the average, the investigated heavy metals occurred in the order of Zn>Cu>Ni>Pb>Cd>Cr usually slightly higher at the surface than at the subsurface level. The transmission line mostly passed through built-up environment mostly shops, shanties and few living houses. The farmlands mostly consisted of cassava (55%), maize (10%), vegetable farms (15%), plantain/banana (10%) and a mosaic of tree crops such as palm tree (10%). The land use in the areas surrounding the proposed project was 63% (agriculture), 22%(fallow) and 15% (built-up).

Protected Area

There are no protected areas within the sphere of influence of the proposed project and up to 10km radius.

Biodiversity

The definition an overview of biodiversity is given as an introduction to the specific aspects of biodiversity studies carried out in respect of the Lot 2 transmission line and substation project. Information is also given on the importance and the intrinsic values of biodiversity in accordance with the Convention of Biodiversity, an international party to which Nigeria is a member. Reference is made to the various bodies of the United Nations Organizations (UNO) that have shown keen interest in biodiversity issues, notably UNEP, UNESCO, FAO, UNDP and IPBES and why biodiversity is an integral part of EIA / ESIA in Nigeria. The two major NGOs who have been on the vanguard of biodiversity in Nigeria are the Nigerian Field Society (NFS) and The Nigerian Conservation Foundation (NCF). The journal of NFS, ***The Nigerian Field***, is a goldmine of information on the biodiversity of Nigeria especially its vertebrate fauna (Amphibians, reptiles, birds and mammals) and terrestrial flora. Reference is made to the ongoing Biodiversity Action Plan (BAP) of the NCF to enhance forest re-vegetation and mitigate the effects of climate change on the Nigerian forest which is fast decreasing. The details of biodiversity in the Lot 2 project area of the transmission line and substations are given under the specific studies on vegetation, wildlife ad hydrobiology (plankton, benthic macro-invertebrate and microbiology).

(i)Vegetation

Natural vegetation provides humans with an array of products and services that are vital for livelihood and balanced development. Some of the various specific ways in which plants and plant products are beneficial to human livelihood and development are enumerated to indicate the relevant of vegetation study in the present project. The strategy for the selection of sampling stations for vegetation studies along the proposed Transmission Lines and Substations was developed during the preceding reconnaissance survey. The vegetation type of the area was identified and photographs taken. Systematic samples were collected at each selected site over a plot measuring 400 m^2 (20 m x 20 m). All plants within the plot (quadrat) were identified while those that could not be identified were collected, pressed and treated for later identification in Ife Herbarium. Studies covered floristic composition, distribution, density, other aspects were morphology, agriculture and economic importance and plant pathology.

The project area falls largely within the lowland rainforest zone of Nigeria, mostly made up of mixtures of trees, shrubs, herbs and grasses. With regards to floristic composition, the entire area was relatively homogenous and comprised a total of 32 plant species belonging to 16 families/sub families. The families with the highest species include Mimosaceae, Compositae, Sterculiaceae, Anacardiaceae, Euphorbiaceae, Ceasalpinaceae. Fifteen trees and shrub species each recorded 50 % occurrence frequency among which *Albizia zygia*, *Mangifera indica* (Mango), *Spondia mombim*, *Cassia siamea and Cola spp* were particularly common Grasses (Poaceae) and palms (Palmae).These are commonest monocotyledon plants. Mean tree and shrub density in proposed the project area was 395/ha while herbaceous biomass was in the range of 15kg/ha. Aquatic macrophytes comprised mainly of *Pistia stratoides* and *Nymhaea lotus* (Water lily) while grasses and sedges occurred mostly in wetland mostly swamps and pools, edges of river. About 75% of the plant species or phanerophytes, whereas 10% are Hemicrytophytes (mainly grasses), 7% Crytophytes (include of geophyle and 6% Therophyle (annual plants). A checklist of 15 common economic plants occurring within the study area is produced. The density of these economic plants in the area is about 80/ha. The economic importance of the plants includes being useful as fuel wood, timber, dyes, vegetables, edible fruits, seed trees, medicinal and religious plants and sponges. Plants in the study area were generally healthy with no obvious signs of stress. The commonest disease pathogen recorded was *Cercospora* spp but the effect varied from light to moderate.

(ii)Terrestrial Wildlife

The study of terrestrial fauna (game animals) in the project area was based on both direct observation method and the indirect observation method. The direct method involved actual sighting of the animals during the reconnaissance visits and field works. On the other hand, the indirect method involved sighting of signs and things (e.g footprints, spoors, calls) left by or indicative of an animal. This is also included the information received from farmers, and local hunters living within the sampling area. An inventory of the wildlife thus recorded is provided. They comprise mostly terrestrial vertebrates notably amphibians, reptiles, Aves(birds) and mammals. A number of mammalian wildlife occurring commonly in most parts of Nigeria were recorded in the study area. Incidentally, they are mainly small to medium size mammals which constitute the bulk of the bush meat trade in the Country. They include mice, rodents, squirrels, grass cutter, and the ungulates (mostly deer and antelopes) as well as wild eats and dogs (Civet cats). However, following the general pattern in the Country, the avian fauna and population was the most noticeable and dominant in the study area. The most occurring of them were the weaver birds (e.g. *Ploessus cuculatus)* and the common garden bulbul *Pyconotus barbatus* were the most common birds in the area. Francolin (*Francolinus bicalcaratus*) was however the only bird of economic importance. Egret, Hawk, Vulture and Pied Crow (*Corvus albus*) were very frequent in residential area especially in-home gardens. On the other hand, the wood pecker (*Dendropicos pyrrhogaster*), Eagles and white-crested hornbills to mostly occur in the low forest area of the project area. The herpathological fauna (the amphibians and reptiles) consisted mostly of the fogs toads(amphibians), lizards and snakes (reptiles) many of which are of economic importance as sources of animal protein, medicinal products, hide,e.t.c. Many of the recorded wildlife animals showed seasonal variation in occurrence and /or in abundance. For instance, the mouse-brown, sun bird (*Anthreptes gabonicus*) and the black and white-tailed Hornbill were more frequent during wet season than in nthe dry season. On the other hand, the snakes, the black cobra (*Naja nigricollis*) and the West African. Green tree mamba (*Dendroaspis viridis*) were more frequent during the dry season than wet season.

(iii) Hydrobiology

The specific studies carried out on the hydrobiology of the project area (Lot 2) include: Phytoplankton flora, zooplankton fauna, microbiology flora, benthic macroinvertebrate fauna, biological primary photosynthetic productivity and sediment physico-chemical characteristics. These studies were based on the surface waterbodies (streams, rivers, pond, wetlands) in the study area and altogether twelve (12) representative habitats were investigated. The floral and faunal studies involved taxonomic composition, occurrence and distribution pattern, abundant community structure of the plant and animal populations involved. Plankton analysis was based on net samples and sedimental samples which were examined microscopically. Photosynthetic primary productivity and respiration rates were determined based on the white and black oxygen bottle method.

The plankton biota comprised a phytoplankton flora of 67 species and a zooplankton fauna of 22 species. The phytoplankton are all algae comprising six Divisions represented qualitatively in the following dominance order: Bacillarophyta (Diatoms) > Charophyta (Green algae) > Cyanophyta (Blue green algae) > Euglenophyta > Chlorophyta > Chrysophyta with 34, 9, 8, 8, 7 and 1 species respectively. The major groups (phyla) of zooplankton were Rotifera, Copepoda, Diptera, Ostracoda and Ciliophora (Protozoa) with 11, 6, 1, 2, 1, 1 species respectively. The most widely occurring phytoplankton were the desmid *Closterium gracile* (45%) and the centric diatom *Stephanodiscus sp* (73%). The desmid *Spirogyra fluviatiles* and the blue green *Oscillatoria sp* were fairly common, each with 27% occurrence frequency. Rotifers dominated the zooplankton fauna both qualitatively and quantitatively. The most occurring species were *Argonothoca sp* and *Hexarthra mira* each with 36% occurrence frequency. Nauplius larvae were fairly common. The number of recorded specie per sample / station was in the range of 0 – 10 (median =1sp). The richest stations being station 3 (10 spp) and station 19 (8spp). Station 3 was also the richest station with regard to phytoplankton species composition. The average gross primary photosynthetic productivity (GP) of 8.07±1.68kcal/m^3 comprised 70% respiration (R) and 30% net productivity. The stations with the highest net productivity were station 10 (71% GP), station 13 (65% GP), stations 11 and 15 (60% GP) and station 18 (57% GP). On the other hand, stations 8 and 9 were each characterised with very low net productivity (only 3% GP).

The grain size composition of the investigated sediment samples comprised averagely 88.1±2.4% sand, 6.1±1.9% silt and 5.8±1.7% clay with a sandy textural class. The sediments ranged from moderately acidic to neutral over a pH range of 5.57 – 7.06 and a slightly mean value of pH = 6.11±0.14 in aqueous solution and pH = 5.79±0.12 in neutral salt (KCl). The exchangeable cations (expressed in cmol/kg) occurred in the dominance order of $Ca^{2+}>Mg^{2+}>K^{+}>H^{+}>Na^{+}>Al^{3+}$ with an overall mean base saturation (BS) of 93%. The mean values of nutrient compounds were as follows, 0.12±0.01%. Total nitrogen, 15.17±3.6eppm available phosphorus and 1.92±0.31% organic matter. Most of the heavy metals occurred within the concentration range of 1.0 – 10.0mg/kg (Ni>Cr>Cd>Co>Zn) while Fe and Pb were within the range of 11.0 – 100mg/kg and Mn > 100mg/kg. Most of the metals were below their geochemical background level except Cd and Pb with relatively higher GBL values.

The benthic macro-invertebrates in the surface waters in the project area consisted of 20 species represented by members of four major animal groups, *viz:* Annelida, Insecta, Mollusca and Malacostraca. One half of the sampling stations were characterised by medium abundance in the range of 501 – 1000org/m^2 while station 3 was the most abundant (1375 org/m^3). *Melanoides tuberculata* was the most abundant species (1500org/m^2) while *Melanopsis sp* was the least abundant (25org/m^2). The occurrence of *Tubifex tubifex* in some stations was an indication of organic pollution in those stations

Water and Sediment Microbiology

The investigated surface and groundwater bodies in the Lot 2 project area as well as the sediment from the surface water sources were sub sampled and analysed for their microbial taxa composition, distribution and abundance using standard microbiological assays and tests. The sample set comprised 9 groundwater sources (borehole and hand dug wells) 12 surface water sources (streams, rivers, pond and lakes) and 12 sediments from the surface waterbodies. A total of nine bacterial species isolates were recorded from the three sets of samples collected from the project area. They belong to three genera *Pseudomonas* (4 spp) *Klebsiella* (4 spp) and *Citrobacter* (1 sp). All the nine isolates were recorded in sediment samples as opposed to only 6 isolates occurring in the surface water and 5 isolates in the groundwater sources. The most widely occurring isolates were *Pseudomonas acruginosa* (100%) and *Klebsiella edwardsii* (89-100%). The abundance of Total Heterotrophic Bacteria (THB) was in the order of surface water >groundwater> sediment with median values of $3.2x10^7$ cfu/ml, $6.4x10^6$ cfu/ml and $8.5x10^5$ cfu/ml respectively. The level of coli MPN was less than 100 cells/100ml in most of the samples. In general, there was no significant difference between the THB population in both surface water and ground water. The fungal flora comprised 27 species isolates consisting of 18 isolates in sediment samples and 21 isolates in surface and ground water samples. The species limited to water samples were *Microsporium audounii, Mucor eretus* and *Penicillium roqueforti.* Quantitatively the dominant genera were *Aspergillus* (4 spp), *Muco*r (4 spp), *Penicillium* (4 spp) and *Rhizopus* (3 spp) while the most widely distributed isolates were *Mucor hiemalis* (92-100%), *Aspergillus* fumigates (27-50%) and *Trichoderma* sp (59-89%). Fungal abundance was generally lower than bacterial abundance probably because the environmental matrices were generally alkaline in nature. The median THF abundance was $4.1x10^7$cfu/ml (surface water), $9.7x10^5$ cfu/ml (groundwater) and $3.0x10^5$ cfu/ml (sediment).

Fishery

The source of information on the fish and fisheries of water bodies in the study area was based largely on the assessment of catches / fish landing by fisherfolks and or interview with them. This has been supplemented with available information from literature especially on Oyan Reservoir.

Fish (both finfish and shell fish) always constitute the most important resource of most aquatic systems especially in major waterbodies. This is based on the fact that fish fauna occupies the terminal position in the ecological chain of any aquatic environment and many fish species are commercially important. Fishes are the source of cheap high-quality protein much needed by human population hence fishing and fish marketing provide job opportunities to a wide variety of people. In addition, it may provide recreational satisfaction to many people.

Ecosystem Services

IFC 2012 recognizes that maintaining ecosystem services are fundamental to sustainable development. Ecosystem services are the benefits people including businesses derive from plant resources (IFC 2012). Ecosystem services are organized into four types namely provisioning services (food, medicine and raw materials), regulating services (Carbon sequestration and storage, Local climate regulation (air quality), Waste water treatment and detoxification, Regulation of water flow, Biological control, Erosion prevention and maintenance of soil fertility and Moderation of extreme events such as storm and shorelines), supporting services (Soil Formation, Nutrient Cycling, Primary Productivity and Habitat Mediation& space) and cultural services (Spiritual and religious values, Knowledge systems and Educational values, Inspiration, Aesthetic Values, Social Relations, Sense of Place, Cultural diversity, Cultural Heritage Values and Recreation and Ecotourism). Impacts on biodiversity often adversely affect the delivery of ecosystem services.

Water Quality

A total of 21 water samples from nine (9) underground and 12 surface water sources were analysed to character the water quality of the project area. Samples were collected, preserved and subsequently analysed for a wide range of physico-chemical water quality parameters using standard methods with adequate quality assurance and quality control (QA/QC) measures. Broadly the parameters analysed were grouped as physical (temperature, colour, turbidity and TDS), general chemical parameters (conductivity, pH, TDS, Alkalinity, Acidity and Hardness), major cations and anions, oxygen parameters, nutrient compounds, and heavy metals.

Both ambient air (AT) and water temperature (WT) were generally high at both surface and subsurface water sampling stations in the area. The Groundwater sources were mostly coloured and turbid with mean apparent colour of 30.69±5.42 Pt.Co and true colour of 25.72±1.94Pt.Co. The salinity parameters of TDS and electrical conductivity indicate that the ground water sources were dilute freshwater. They varied in chemical reaction from very strongly acidic to slightly alkaline over a pH range of 4.75 – 7.47. They were mostly well buffered (mean alkalinity = 55.8±22.9mg/L$CaCO_3$), soft with total hardness almostly all of carbonate component i.e. sole of temporal hardness. The major cations occurred in the dominance order of Na^+>>Mg^{2+}>K^+>Ca^{2+} and anions in the order of HCO_3>Cl^->SO_4^{2-}>NO_3. The levels of oxygen parameters (DO, BOD_5, COD, TOC) were generally at moderate levels. Majority of the heavy metal occurred in the range levels of 0.01 – 0.02mg/L (Fe > Ni > Zn > Cu > Mn > Cd) while Pb, Co and Cr were barely detectable (<0.01mg/L).

Apparent colour, true colour and turbidity were relatively high especially compared to drinking water standards. Based on conductivity and TDS values the surface water sources were more dilute than the Groundwater source. However, the levels of alkalinity, acidity and hardness were comparable in both water sources. Similar the cationic and anionic order of dominance were also same for the two water sources. The heavy metals occurred at three levels = <0.01mgl^{-1} (Pb>Zn>Cr>Cu), 0.01 – 0.019mgl^{-1} Ni>Co>Cd>Mn and ≥0.02mgL^{-1} (Fe). There is no indication of heavy / trace metal water pollution although the levels of BOD in some of the samples is suggestive of fairly organic content / pollution.

Socio Economics and Health Status

There are a number of settlements with permanent residential houses along the proposed transmission lines and the sites for the substations. The majority of people residing in the Project area are Yorubas, constituting about 80% of the total population. Apart from the Yorubas, other tribes and nationalities such as Igedes, Igbo, Eguns and people from Benin Republic also reside in the area. However, majority of people in the Project area speak and understand Yoruba. The traditional governance structure, which hardly varies from one community to another, is at two levels. The first is the traditional governance structure composed of the village chiefs and headed by the village/community head (the "Baale / Oba"). The second is the Community Development Association, comprising an elected chairman and executive members with the role of mobilizing the different sections and interest groups in the community for development purposes. There is also a Youth Council at the bottom rungs of the ladder of authority with traditional roles including constituting a labour force in development projects, security of the community and to enforce law and order. Traditionally, there is a limit to the involvement of women in the political governance of these local settlements. Each of the communities has a patriarchal familial arrangement. Women play a subdued role in the communities, usually placed at the background.

The common marriage type is monogamy, however, the proportion of those with 2 or 3 wives are fairly high (16.3%). Most of the inhabitants are either Muslim or Christian but predominantly Christians. However, the adherents of these two popular religions also practise traditional religion at the same time. Majority of inhabitants of the affected communities are artisans (67%). Other subsidiary occupations are Industry, trading, and farming. Majority are between 35 and 64 years and the population structure are made up of 51% male and 49% female and most of them do not have formal education; with the exception of Ifo where almost 67% attained tertiary level of education, most of the people did not go beyond secondary school. Land ownership is based on inheritance, lease, and purchase. Although the prevalent land tenure system in the communities is through inheritance,

Based on low infrastructural development in the area, the quality of life of the people in most of the project area can be described as poor. Majority of the affected people were found to be poor by virtue of the fact that their income is less than the national average and low standard of living; so virtually all of them should be considered vulnerable. With the exception of Likosi and Sagamu, all other communities in the project area do not have functional health facility which makes estimation of disease burden difficult. The Health Centre in Ejio is not functioning. Malaria is the commonest ailment suffered by members of the communities, as a result of a high prevalence of mosquitoes. Few individuals in Likosi, Ejio and Gan-un communities have borehole/potable water supply. The main sources of water for domestic use in most of the other communities are river and rainwater. Few of the communities (Ejio, Likosi, Sagamu and Gan-un) are connected to national grid; although electricity supply to these communities was also reported to be irregular and unreliable. Majority of the households use kerosene for lighting, while fuel wood is used for cooking. Transportation is majorly by commercial motor vehicles and motorized cycles.

In the engagement with the key stakeholders as part of this ESIA, community leaders expressed their preparedness to support the project based on their benefits they hoped to derive from it based on their previous experiences. Some of them perceived the project to lead to increase in business activities most especially during construction; they hope to benefit from the influx of workers. Some believe that the project will bring employment opportunities to the youth and some hope to be involved by supplying sand and blocks for construction. However, a few, who appear very enlightened, raised issues regarding air pollution, noise and biodiversity displacement. The team allayed their fears on the level of pollutants and promised an environmentally friendly project.

Potential and Associated Impacts

The Project activities will give rise to a range of impacts of varying magnitude and significance. The impacts for the short-term construction phase and the long-term operational phase were considered separately, where appropriate. The assessment methodology used to assess the significance of impacts took into account impact magnitude and sensitivity of receptors and resources affected. Impacts were assessed pre-mitigation and a significance rating determined. Mitigation measures to avoid, reduce, remediate or compensate for potential negative impacts and actions to be taken to enhance benefits were identified. Residual impacts were then assessed taking into account any mitigation and enhancement measures that TCN has agreed to implement.

Cumulative impacts

At this moment the ESIA team is not aware of planned initiatives in the same area, which could create cumulative impacts with this Project. Potential cumulative impacts between the Transmission Lines and Associated Substations Project have been highlighted in this ESIA. In the construction phase both projects will be managed, coordinated and managed by TCN through EPC contractor of which cumulative impacts is guaranteed.

In the operation phase, TCN will be responsible for the operation of Transmission Lines and Substations, so coordination to manage cumulative impacts will be required by TCN.

Mitigation Measures

A key objective of the ESIA was to develop and describe practical, appropriate and cost effective mitigation and management measures that avoid, reduce, control, remedy or compensate for negative impacts and enhance positive benefits. The objectives of mitigation have been established through legal requirements or industry good practice standards and where standards were not available, project-specific standards have been established.

These measures are often established through industry standards and may include:

- changes to the design of the project during the design process (e.g. changing the development approach);
- engineering controls and other physical measures applied (e.g. waste water treatment facilities);
- operational plans and procedures (e.g. waste management plans); and
- the provision of like-for-like replacement, restoration or compensation.

In developing mitigation measures, the first focus is on measures that will prevent or minimise impacts through the design and management of the Project rather than on reinstatement and compensation measures.

The Tables below provide a summary of the potential impacts, mitigation and residual significance during the construction and operation of the Project.

Site Preparation and Construction

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx, PM and CO_2 as GHG)	Affected communities in area of influence and region	Minor	Use good international practice: • Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations • Stationary generators to be located to facilitate dispersion	Minor
	Elevated dusted levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Minor	Use good international practice: • Cover properly loose materials and keep top layers moist • Use binder material for erosion and dust control for long term exposed surfaces • Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt • Spray surfaces prior to excavation • Use covered trucks for the transportation of materials that release dust emissions • Speed limits on-site of 15kph on unhardened roads and surfaces	Minor
Noise, vibration & EMF	Nuisance noise from construction activities	Affected communities in area of influence Construction workers	Moderate	Use good international practice: • Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings • Select ‘low noise’ equipment or methods of work • Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources). • Avoid dropping materials from height, where practicable • Avoid metal-to-metal contact on equipment • Maintain and operate all vehicles and equipment’s in accordance with manufacturers recommendations • Avoid mobile plant clustering near residences and other sensitive land uses • Ensure periods of respite are provided in the case of unavoidable maximum noise level events • Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the CLO. • Noisy activities (activities that can	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				be heard in nearby communities) restricted to day-time working hours	
Geology and Soil	-Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads) -The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi/Dejuwogbo and Redeem are poor earthing media.	Soil on construction site Soil on Likosi/Dejuwogbo and Redeem Substation	Moderate	• Construction of foundations to be undertaken in the dry season. • Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. • Protect excavated soil materials from erosion. • Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. • Use of existing track for transport of man and material to the extent possible. • The subsoil conductivity may need to be artificially enhanced to ensure proper earthing of high voltage substations. The metallic structures should be protected against corrosion. Also, where the subsoil is clayey and incompetent, transmission line tower foundation shall be anchored on friction piles to prevent settlement.	Minor
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminium oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Minor	Use good international practice: • Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. • Install oil/water separators and silt traps before effluent, leaves the site. • Minimise bare ground and stockpiles to avoid silt runoff. • Bunding of areas where hazardous substances are stored (eg fuel, waste areas). • Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains. • Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages. • Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques. • Set-up and apply procedure regarding dealing with contaminated soils. • Development and implementation	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed of correctly. • Spread sheet underneath the tower structure prior to start any painting activity.	
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater-well and bore hole	Moderate	See above measures to mitigate 'Potential contamination of soil' impact	Minor
	Exploitation of water resources (e.g. casting of foundations) sourced from nearby water bodies through tanks	Ogun River, River Wagunu, Streams	Minor	Regular inspection/checks to minimize the impacts on the waterbodies	Minor
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Minor	• See above measures on air quality, noise and vibration, soils and water resources. • Limit lightening on site. • Sensitivity training to staff and anti-poaching policy.	Minor
	Loss of vegetation due to clearance activities	Flora and fauna within the ROW and Substation	Minor	• Site clearance activities to be restricted to the minimum required area.	Minor
Aquatic ecology	Construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands.	Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun	Moderate	TCN shall maintain acquire RoW for clearing and upgrade existing roads	Minor
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the RoW and/or the site for the substation.	People living close to the construction sites.	Minor	Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor
	Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate	Registered Ogun State Ministry of Environment waste contractor shall be engaged to dispose domestic waste and construction waste	Minor
Land Planning and Use	Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major	• Site clearance activities to be restricted to the minimum required area. • Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas • RAP process will mitigate the impact to the minimum level	Moderate

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. In addition dealing with community/ stakeholder perceptions around cumulative impacts linked to the new plant and transmission lines and substations operations. Management of legacy issues on account of environmental pollution from stakeholder concerns around existing transmission lines.	Affected communities in area of influence	Major	Follow mitigation for construction phase air quality, noise and traffic.	Moderate
				Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting	
				Set-up and effectively monitor construction grievance mechanism	
				Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.	
				Engage communities in the monitoring activities to enhance transparency and involvement.	
				Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities.	
				Ongoing reporting to stakeholders on the overall environmental performance of the plant and the steps taken to mitigate any adverse environmental impacts.	
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users	Minor	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.	Minor
	Temporary influx of outside workers in the communities, risking tensions between outside (partly possibly expatriate) labour and local population, due to differences in wealth and culture.	Affected communities in area of influence	Minor	A Local Content Plan should be prepared to facilitate involvement of local labour. See HR policies and procedures below. No hiring of short-term labour to be made at the site gate.	Minor
				Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour. Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor	Provide STD awareness material to all workers. Provide condoms to workers.	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Risk of an increase in prevalence of malaria and other mosquito borne diseases in communities due to creation of mosquito breeding areas on site.	Affected communities in area of influence	Minor	Manage site to eliminate potential mosquito breeding sites including – eliminate surface water ponding and no outside storage of tires. For unavoidable ponding monitor for mosquito larvae and treat with a US-EPA (or similar) approved mosquito larvicide.	Minor
	Risk of erosion into creeks, which are used as source of domestic water for the communities	Affected communities in area of influence	Minor	Erosion prevention measures especially in locations close to creeks and cropped fields by keep construction sites flat, clearing lose soil from the site and covering with geo-textile if needed.	Minor
Resettlement	Households living in the RoW need to be relocated and assets in the RoW will be lost	Affected properties and livelihood	Moderate	Follow principles and procedures of Resettlement Action Plan (RAP), including way forward, micro-plans per affected household.	Minor
Labour and working conditions	Exploitation of workers	Labour force	Minor	• Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • Provide proper work place facilities for water/sanitation/rest rooms. • If case of retrenchment needs first viable alternatives are analysed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. • A worker’s grievance mechanism will be in place.	Minor
	Activities and staff at site may create security risks	All staff working at the construction site	Minor	Make security plan and emergency response and contacts with security forces.	Minor
	Risk of health & safety incidents amongst labour force, including minor incident’s such as cuts and major incidents such as loss of life	Construction labour force	Moderate	Develop project specific health and safety procedures based on TCN standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor

Indicator	**Potential impact**	**Receptor**	**Significance (pre-mitigation)**	**Mitigation or enhancement measures**	**Significance (post-mitigation)**
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Local residents of affected communities and Nigerian nationals	Positive	Prepare a local content plan to enhance ability to locate local hires and Nigerian nationals. Include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the company	Nigerian companies and local SMEs	Positive	Prepare a local content plan to facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Positive
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Minor	Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. Upgrading of existing access roads.	Minor
Cultural heritage	shrines are located within the RoW along the transmission line and need to be relocated.	Affected communities-	Minor	The shrines will be relocated to outside the RoW, where the local communities will continue to use them. The exact location and ceremony for relocation will be managed by the communities	Minor
	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the RoW	Minor	Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor
Indicator	**Potential impact**	**Receptor**	**Significance (pre-mitigation)**	**Mitigation or enhancement measures**	**Significance (post-mitigation)**
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx, PM and CO_2 as GHG)	Affected communities in area of influence and region	Minor	Use good international practice: • Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations • Stationary generators to be located to facilitate dispersion	Minor
	Elevated dusted levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Minor	Use good international practice: • Cover properly loose materials and keep top layers moist • Use binder material for erosion and dust control for long term exposed surfaces • Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt • Spray surfaces prior to excavation • Use covered trucks for the transportation of materials that release dust emissions • Speed limits on-site of 15kph on unhardened roads and surfaces	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Noise, vibration & EMF	Nuisance noise from construction activities	Affected communities in area of influence Construction workers	Moderate	Use good international practice: • Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings • Select 'low noise' equipment or methods of work • Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources). • Avoid dropping materials from height, where practicable • Avoid metal-to-metal contact on equipment • Maintain and operate all vehicles and equipment's in accordance with manufacturers recommendations • Avoid mobile plant clustering near residences and other sensitive land uses • Ensure periods of respite are provided in the case of unavoidable maximum noise level events • Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the CLO. • Noisy activities (activities that can be heard in nearby communities) restricted to day-time working hours	Minor
Geology and Soil	-Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads) -The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi and Redeem are poor earthing media.	Soil on construction site Soil on Likosi and Redeem Substation	Moderate	• Construction of foundations to be undertaken in the dry season. • Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. • Protect excavated soil materials from erosion. • Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. • Use of existing track for transport of man and material to the extent possible. • The subsoil conductivity may need to be artificially enhanced to ensure proper earthing of high voltage substations. The metallic structures should be protected against corrosion. Also, where the subsoil is clayey and incompetent, transmission line tower foundation should be anchored on friction piles to prevent settlement.	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminium oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Minor	Use good international practice: • Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. • Install oil/water separators and silt traps before effluent, leaves the site. • Minimise bare ground and stockpiles to avoid silt runoff. • Bunding of areas where hazardous substances are stored (eg fuel, waste areas). • Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains. • Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages. • Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques. • Set-up and apply procedure regarding dealing with contaminated soils. • Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed of correctly. • Spread sheet underneath the tower structure prior to start any painting activity.	Minor
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater-well and bore hole	Moderate	See above measures to mitigate 'Potential contamination of soil' impact	Minor
	Exploitation of water resources (e.g. casting of foundations) sourced from nearby water bodies through tanks	Ogun River, River Wagunu, Streams	Minor	Regular inspection/checks to minimize the impacts on the waterbodies	Minor
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Minor	• See above measures on air quality, noise and vibration, soils and water resources. • Limit lightening on site. • Sensitivity training to staff and anti-poaching policy.	Minor
	Loss of vegetation due to clearance activities	Flora and fauna within the RoW and Substation	Minor	• Site clearance activities to be restricted to the minimum required area.	Minor
Aquatic ecology	Construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are	Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun	Moderate	TCN shall maintain acquire RoW for clearing and upgrade existing roads	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	represented by the plants in river and vegetation supported by wetlands.				
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the RoW and/or the site for the substation.	People living close to the construction sites.	Minor	Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor
	Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate	Registered Ogun State Ministry of Environment waste contractor shall be engaged to dispose domestic waste and construction waste	Minor
Land Planning and Use	Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major	• Site clearance activities to be restricted to the minimum required area. • Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas • RAP process will mitigate the impact to the minimum level	Moderate
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc) and adverse impact/inconveniences resulting from it. In addition dealing with community/ stakeholder perceptions around cumulative impacts linked to the new plant and transmission lines and substations operations. Management of legacy issues on account of environmental pollution from stakeholder concerns around existing transmission lines.	Affected communities in area of influence	Major	Follow mitigation for construction phase air quality, noise and traffic. Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting Set-up and effectively monitor construction grievance mechanism Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP. Engage communities in the monitoring activities to enhance transparency and involvement. Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Ongoing reporting to stakeholders on the overall environmental performance of the plant and the steps taken to mitigate any adverse environmental impacts.	Moderate

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users	Minor	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.	Minor
	Temporary influx of outside workers in the communities, risking tensions between outside (partly possibly expatriate) labour and local population, due to differences in wealth and culture.	Affected communities in area of influence	Minor	A Local Content Plan should be prepared to facilitate involvement of local labour. See HR policies and procedures below. No hiring of short-term labour to be made at the site gate. Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour. Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Minor
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor	Provide STD awareness material to all workers. Provide condoms to workers.	Minor
	Risk of an increase in prevalence of malaria and other mosquito borne diseases in communities due to creation of mosquito breeding areas on site.	Affected communities in area of influence	Minor	Manage site to eliminate potential mosquito breeding sites including – eliminate surface water ponding and no outside storage of tires. For unavoidable ponding monitor for mosquito larvae and treat with a US-EPA (or similar) approved mosquito larvicide.	Minor
	Risk of erosion into creeks, which are used as source of domestic water for the communities	Affected communities in area of influence	Minor	Erosion prevention measures especially in locations close to creeks and cropped fields by keep construction sites flat, clearing lose soil from the site and covering with geo-textile if needed.	Minor
Resettlement	Households living in the RoW need to be relocated and assets in the RoW will be lost	Affected properties and livelihood	Moderate	Follow principles and procedures of Resettlement Action Plan (RAP), including way forward, micro-plans per affected household.	Minor
Labour and working conditions	Exploitation of workers	Labour force	Minor	• Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour.	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				• Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • Provide proper work place facilities for water/sanitation/rest rooms. • If case of retrenchment needs first viable alternatives are analysed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. • A worker's grievance mechanism will be in place.	
	Activities and staff at site may create security risks	All staff working at the construction site	Minor	Make security plan and emergency response and contacts with security forces.	Minor
	Risk of health & safety incidents amongst labour force, including minor incident's such as cuts and major incidents such as loss of life	Construction labour force	Moderate	Develop project specific health and safety procedures based on TCN standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Local residents of affected communities and Nigerian nationals	Positive	Prepare a local content plan to enhance ability to locate local hires and Nigerian nationals. Include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the company	Nigerian companies and local SMEs	Positive	Prepare a local content plan to facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Positive
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Minor	Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. Upgrading of existing access roads.	Minor
Cultural heritage	shrines are located within the RoW along the transmission line and need to be relocated.	Affected communities-	Minor	The shrines will be relocated to outside the RoW, where the local communities will continue to use them. The exact location and ceremony for relocation will be managed by the communities	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the RoW	Minor	Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor

Operation and Maintenance

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Exposure to emissions from operational vehicles but very limited and other activities	Workers on site, communities in area of influence	Minor	Best practices will mitigate the impact to the minimum level	Minor
	GHG: Fugitive emission from line maintenance and Transmission Lines. Also, accidental significant leaks from aging equipment, and gas losses occur during equipment maintenance and servicing	RoW, Likosi/Dejuwo gbo, Redeem and MFM Substations	Moderate	Impact of SF_6 shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques.	Minor
Noise, vibration & EMF	Noise & EMF from overhead line due to Corona effect and EMF effect	Affected communities along the RoW	Minor	• Noise generation is unavoidable. • Use of conductors conforming to IS standard to minimize corona effect during rainy weather conditions • Avoiding over loading Transmission Lines • Installation of mesh at strategic places	Minor
Geology and Soils	Potential contamination of soil from inadvertent release of hazardous or contaminating material	Soil along RoW of TL and Substation	Minor	Best practices and guidelines shall be used for all operation.	Minor
Water resources	No impact on the surface water and hydrogeology of the area is anticipated	Local groundwater	Minor	Best practices and guidelines shall be used for all operation.	Minor
Terrestrial ecology	Avian collision	Birds in the area of influence	Minor	Visibility of Double circuit will not allow the birds to collide with power line	Minor
	Loss of vegetation due to routine clearance of vegetation	Flora and fauna within the RoW	Minor	Maximum of 7.5m wide within centre line of RoW shall be maintained for Transmission Lines maintenance	Minor
Aquatic ecology	Loss of woody species, comprising trees and shrubs, as they can grow taller above 4m	Flora within the RoW and substation	Minor	Maximum of 7.5m wide within centre line of RoW shall be maintained for Transmission Lines maintenance.	
Visual amenities	Transmission lines and towers will be visible from far and become an extrinsic	Likosi/Dejuwo gbo, MFM Shimawa axis communities	Minor	• The RoW does not affect forests or valuable landscapes. Vegetation will be felled, but if possible smaller trees can be	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	element in the landscape. Cumulative with the other Transmission lines this may result in a loss of the visual amenity.	near RoW		kept. • Towers have an open structure, not hampering the view very much.	
Land planning and use	Stablisation of electricity will lead to increase in land use and pressure on natural environmental area	Substation areas e.g Redeem & MFM	Major	Government shall regulate the acquisition of land in the study area	Minor
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with operation phase issues (like air and dust emissions, traffic, and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. Dealing with community/stakeholder perceptions around cumulative impacts linked to the new plant and existing cement plant operations. Disappointment about electricity supplied to national grid, while locally electricity supply has reduced reliability	Affected communities in the area of influence	Major	Follow mitigation for operation phase air quality, noise and traffic. Inform communities about details of operation activities (e.g., employment opportunities) by by billboards, posters and plant visit Set-up, manage and manage grievance mechanism Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP. Engage communities in the monitoring activities to enhance transparency and involvement. Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Coordinate Stakeholder Engagement of all partners of industrial site, prepare and implement Stakeholder Engagement Plan . Explain effects of electromagnetic fields to communities to limit concerns. Keep fields within limits of International Commission on Non-Ionizing Radiation Protection (ICNIRP). Interference with radio/TC transmission during rain needs to be explained to the communities	Moderate
Community Health, Safety and Security	External safety risks of electrocutions, bush fires, line snapping, tower collapses	Affected communities along the RoW	Moderate	Develop an emergency response plan following TCN and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines and collapsed towers, roles and responsibilities. Coordinate with emergency services of LGAs Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. Communicate to communities in RoW the safety risks of the transmission lines and provide response measures. Put sign boards on towers about electrocution risk.	Minor
Labour and working conditions	Exploitation of workers	Labour force for maintenance work	Minor	• Follow human resources policies and procedures of TCN, following Nigerian Labour Law and ILO	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • A worker's grievance mechanism will be in place.	
	Occupational H&S risks in operation and maintenance	Labour force	Moderate	TCN should follow their Occupational HSE plan following Nigerian and international requirements: train staff, monitor and keep record. Special focus on slip-trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. Use personal protection equipment. Have medical emergency equipment at hand.	Minor
Employment and Economy	Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Nigeria	Positive	Regular maintenance of the project to ensure reliable production of power	Positive
Cultural heritage	Potential interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities in the RoW	Minor	Consult with local communities on festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	Minor

Environmental and Social Management Plan (ESMP)

Environmental and Social Management Plan is a planned, integrated programme aimed at ensuring that unforeseen and unidentified impacts of proposed project are contained and brought to an acceptable minimum. ESMP objectives are usually achieved by the implementation of an HSE policy which typically addresses a number of environmental and social issues, including the following:

- Identification of environmental sensitivities
- Identification of potential significant impacts
- Adoption of project design measures or operational procedures that eliminate or reduce impacts to acceptable levels.
- Establishing emergency and contingency plans
- Monitoring the effectiveness of environmental protection strategies and
- Auditing the success of the overall project strategy.

This ESIA study has addressed most of the above environmental issues and has revealed that if the proposed impact mitigation measures are implemented the project impacts will be low and acceptable. However, in order to ensure that these mitigation measures are implemented and that the provisions of HSE plan is integrated into subsequent stages of the project, an Environmental and Social Management Plan (ESMP) has been developed over all the phases of the project. The framework for the plan consists of two parts, *viz:* an environmental management system (EMS) and environmental and social monitoring programme.
TCN shall adopt a systematic monitoring schedule that will comprise both effects and compliance monitoring plans for the implementation of the proposed project. The essence of the plan is to apportion roles and responsibility to all the various parties involved in the project implementation. Roles to be taken by TCN shall include the following.

- Staff training
- Emergency contingency plan
- Facilities surveillance
- Project planning and implementation strategy
- Project operation

With regard of ESMP, the monitoring objectives must be clearly defined and for each environmental component monitored for the impact indicators as stated in the Federal Ministry of Environment Procedural Guidelines. Also. the scope and methodology of monitoring must be stated. The details of all these requirements are presented in a tabular form for all the identified project impacts in this chapter (Tables 7.4.1a and 7.4.1b).

Decommissioning Plan

This chapter (chapter 8) provides information on the decommissioning plan for the proposed transmission line and ancillary installations after they must have passed their life expectancy (25 years) and/or are no more viable. The decommissioning will be in accordance with national regulatory requirements and international standards. The process will involve consultation with various stakeholders including members of the host communities, nearby facility owners, regulatory bodies and experts. The plan will commence about five years before the final action to allow for proper disinterment or redeployment of personnel as appropriate. The activities to be carried out shall include the following:

- Dismantling of towers
- Dismantling of all surface equipment including conductors and grounding wires
- Removal and disposal of concrete work
- Removal and disposal of conductors etc.

An appropriate remediation plan shall be put in place depending on impacts as well as prevailing biophysical and social environmental attributes. The procedure shall be in accordance with approved ESMP and international industry standards. All facilities that can be used or recycled will be identified and removed from site. All other facilities will be scrapped and or moved away to other location so that the site can be re-vegetated using native plant species.

Conclusions and Recommendations

The ESIA of the proposed Lagos and Ogun States Transmission lines and Substations Projects has been conducted in accordance with the Nigerian regulatory requirements (FMEnv) and applicable international standards (JICA Guidelines, IFC performance standards and World Bank requirements). The potential associated impacts of the project were identified and evaluated to be mostly of low rating. Adequate mitigation measures have been recommended for the negative impacts considered to be significant / high rating to reduce them to levels as low as reasonably practicable (ALARP). A project-specific Environmental and Social Management Plan (ESMP) for assessing the effectiveness of the mitigation measures against all identified significant impacts has also been recommended. The project could thus be executed successful and will result into substantial economic benefits to both the local communities and the Federal Government of Nigeria through increased electric power transmission and distribution.

ACKNOWLEDGEMENT

Transmission Company of Nigeria (TCN) wishes to acknowledge with thanks, the opportunity granted it by the Federal Government of Nigeria, through its agencies, to conduct this Environmental and Social Impact Assessment of the proposed Lagos and Ogun States Transmission Lines and Associated Substations Project.

This report has been prepared in line with the national and international regulatory requirements and standards. The Project Team enjoyed a cordial working relationship with the Federal Ministry of Environment, Ogun State Government Team, five (5) affected Local Governments and the Elders, Chiefs and Youths of the host communities.

The active participation of Project Team in the ESIA studies right from the inception, supervision, review of the preliminary documents and final draft report is hereby acknowledged.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

1.1.1 The Project

The Transmission Company of Nigeria (TCN) is one of the companies unbundled from the defunct Power Holding Company of Nigeria (PHCN), and the only one wholly owned by the Government. TCN is charged with the responsibility of transmitting electric power from the various power stations to the load centres across the country and beyond, ensuring efficient and cost-effective transmission, system operation, and improved service delivery. TCN is also responsible for the management of assets of the High Voltage Transmission System Operations, generation dispatch functions, as well as the development of the network through the construction of new transmission lines and substations for efficient transmission and system operations.

Nigeria has realized strong economic growth, until 2016 when the economy went into recession. However, stronger growth is projected for the future due the new anti-corruption posture of the Government as well as economic policies targeted at reducing capital flight. Meanwhile, power supply capacity is overwhelmingly insufficient. As a countermeasure of serious power shortage, Transmission Company of Nigeria (TCN) planned a project geared to achieving transmission capacity of 20,000 MW by 2020 in accordance with growth of generation capacity. Presently, the transmission lines to the largest demand centre of Lagos are in a bottleneck situation so the generating capacities being built across the country cannot be fully utilized. Moreover, there are no detour routes for use when equipment failure occurs and the system reliability is low.

The Lagos and Ogun States is targeted at improving power supply to Lagos and Ogun States, in line with the Transmission Lines network capacity development of achieving transmission capacity of 20,000 MW by 2020.This Transmission line project in Lagos and Ogun States ("Lagos and Ogun States Transmission Project" or "the entire project") is to be financed through a loan (Japanese ODA loan) from Japan International Cooperation Agency (JICA). The Transmission Company of Nigeria (TCN) is the implementing agency and owners of the project when completed. This entire project plans reinforcement of transmission capacity, improvement of credibility of electricity supply and reduced electricity loss by installing transmission systems in southwest area Nigeria. It contributes acceleration of economy and development of the communities.

The entire project consists of about 203km high voltage transmission lines and 6 high voltage substations. For the purpose of ESIA and RAP study, the entire project is divided into 3 sections, Lot1, Lot 2 and Lot 3. Transmission Company of Nigeria (TCN) has engaged SEEMS Limited to conduct Environmental and Social Impact Assessment (ESIA) for Lot 2 of the project (hereinafter "the project" or "proposed project") consisting of the following components in Table 1.1.1 as described in the TOR;

Table 1.1.1 Description of Proposed Transmission Line and Substation

Lot	Description of Transmission Line	Size / length
Lot 2	Ogijo (Likosi/Dejuwogbo) Substation	25.00 Hectares
	Redeem (Abule Oba) Substation	9.62 Hectares
	MFM (Makogi) Substation	19.69 Hectares
	Ogijo (Likosi/Dejuwogbo) – Arigbajo (Ejio) D/C Transmission Line	48.74 km
	Ogijo – Existing Ikorodu/Shagamu 132 kV 2x D/C Transmission Line (132kV Quad Line)	2.41 km
	132kV D/C Transmission Line from Ogijo – Redeem (Abule Oba)	7.83 km
	MFM (Makogi) – Existing Benin (Omotosho)/Ikeja West 330kV 2 x D/C Transmission Line	4.99 km

The project is financed through a loan from Japan International Cooperation Agency (JICA), as part of the development of power transmission infrastructure in the South-Western Region of Nigeria.
This type of project must undergo an environmental and social impact assessment as required by the EIA Act No. 86 of 1992. And in conformance with Nigerian legislations, JICA guidelines for environmental and social considerations, the World Bank environmental and social safeguard policies and International best practices, the project is subjected to a complete environmental study, along with RAP and an Environmental and Social Management Plan (ESMP).

1.1.2 The Proponent

Transmission Company of Nigeria (TCN), wholly owned by the Federal Government of Nigeria and having its headquarters at 14, Zambezi Crescent, Maitama, Abuja, is the project proponent. The company was incorporated in November 2005, emerging from the defunct National Electric Power Authority (NEPA) as a product of the merger of the Transmission and Operations sectors on April 1, 2004.

TCN has eight Transmission Regions and a National Control Centre, NCC. Each of these is headed by a General Manager (Transmission), who is responsible for the running and maintenance of transmission and transformation facilities in their areas of operation. The Transmission Regions are Lagos, Osogbo, Kaduna, Bauchi, Benin. Shiroro, Enugu and Port Harcourt and the National Control Centre (NCC) located at Osogbo.

Being one of the 18 unbundled Business Units under the Power Holding Company of Nigeria (PHCN), TCN was issued a transmission license on 1st July 2006 by the Nigerian Electricity Regulatory Commission (NERC) to carry out electricity transmission, system operation and electricity trading which is ring fenced.

The mandate of TCN includes the following

- Management of assets of the High Voltage Transmission System Operations as well as generation dispatch functions.
- Operate as the provider of open access transmission service based on regulated transmission tariff and non-discriminatory system operations and economic dispatch services within a regulatory framework provided by the Nigerian Electricity Regulatory Commission (NERC), the Grid Code and the Market Rules.

- Load forecasting and system expansion planning.
- Acquiring the necessary ancillary service for defined reliability and quality service standards.
- Managing the market settlement system.
- Development of the network through the construction of new transmission lines and substations for efficient Transmission and System operations, hence all stakeholders should observe the Grid Code, Distribution Code and Market rules.

TCN has a Health Safety and Environment (HSE) Department, headed by a General Manager. The department is responsible for environmental and social safeguards of the company's activities and operations. The department also facilitates liaisons with communities as well as government agencies and local government departments to facilitate stakeholder consultations, as well as interfaces with the Federal Ministry of Environment for the approval of the ESIA.

1.1.3 Project Location

The entire project consists of about 203km high voltage transmission lines and 6 high voltage substations located in Lagos and Ogun State. The entire project is divided into three (3) Lots and the proposed project subject to this ESIA. The proposed line route for Lot 2 runs from Ogijo (Likosi/Dejuwogbo) and passes within the vicinity of Redeem (Abule Oba)/Mountain of Fire, and Arigbajo (Ejio) in Ogun State. Figure 1.1.1 shows Ogun state location in the map of Nigeria. Specifically, it will pass through the local government areas listed In Table 1.1.2

Table 1.1.2: Local Government Areas Affected by the Project

S/N	STATE	LGAs
1	Ogun	Ewekoro, Sagamu, Owode/Obafemi & Ifo

Table 1.1.1 shows the description of proposed Transmission Line with a total length of about 63.97 km and substations. Figure1 1.1.2-1.1.4 show the route of Transmission Lines and substations.

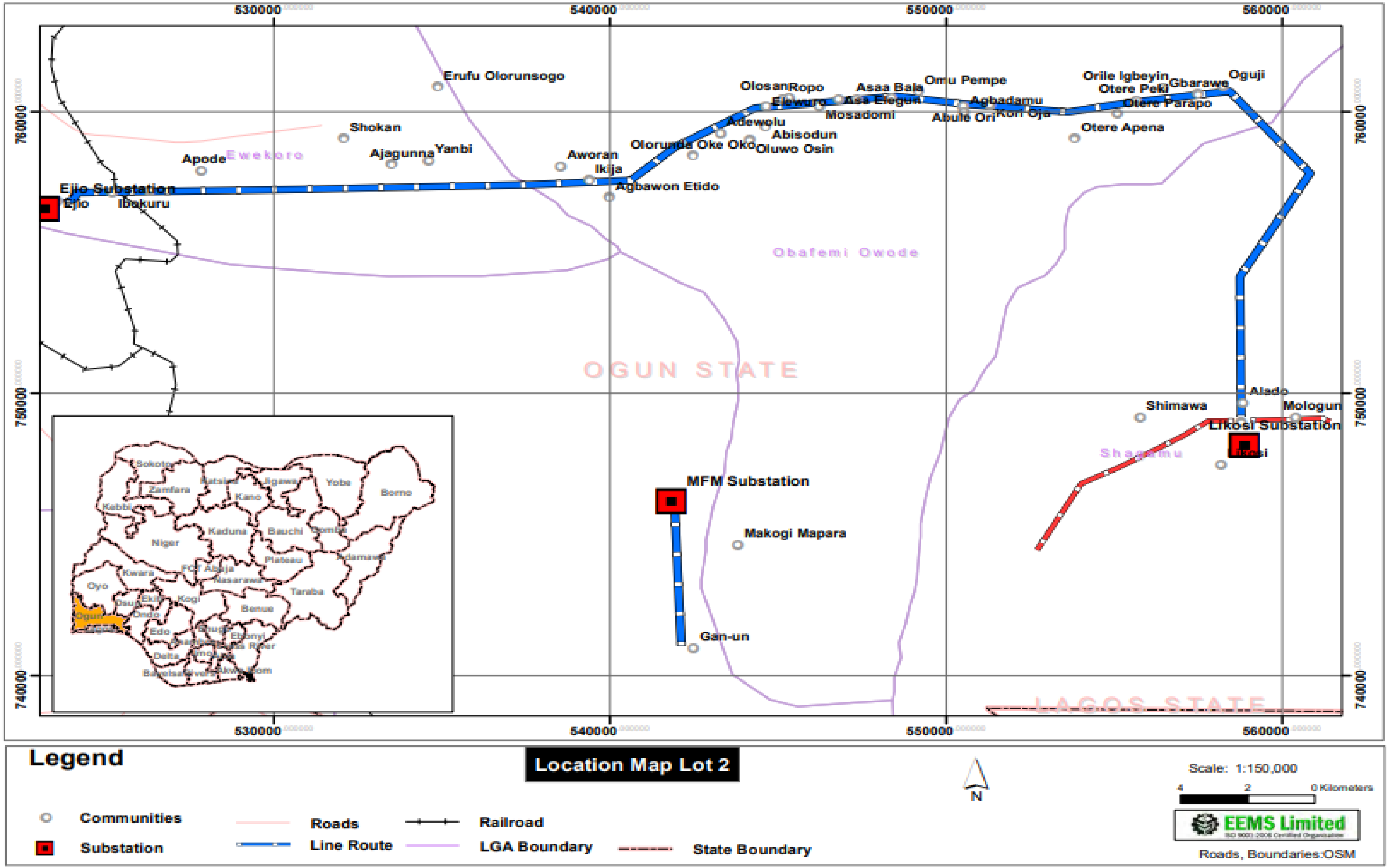


Figure 1.1.1: Location Map for the Proposed Projects in Nigeria –Lot 2

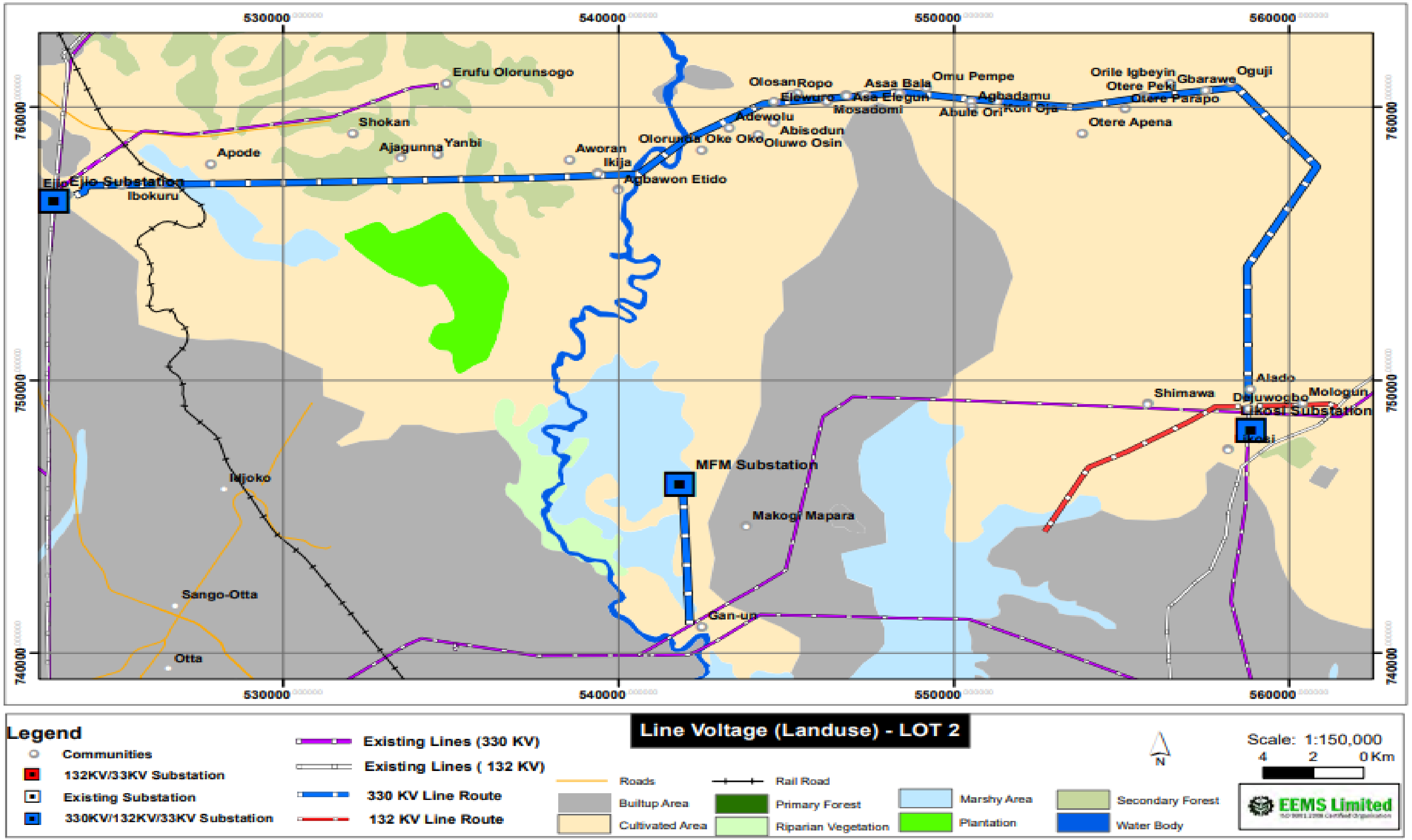


Figure 1.1.2: Location of Existing and Proposed Transmission Lines Components for the Projects- Lot 2

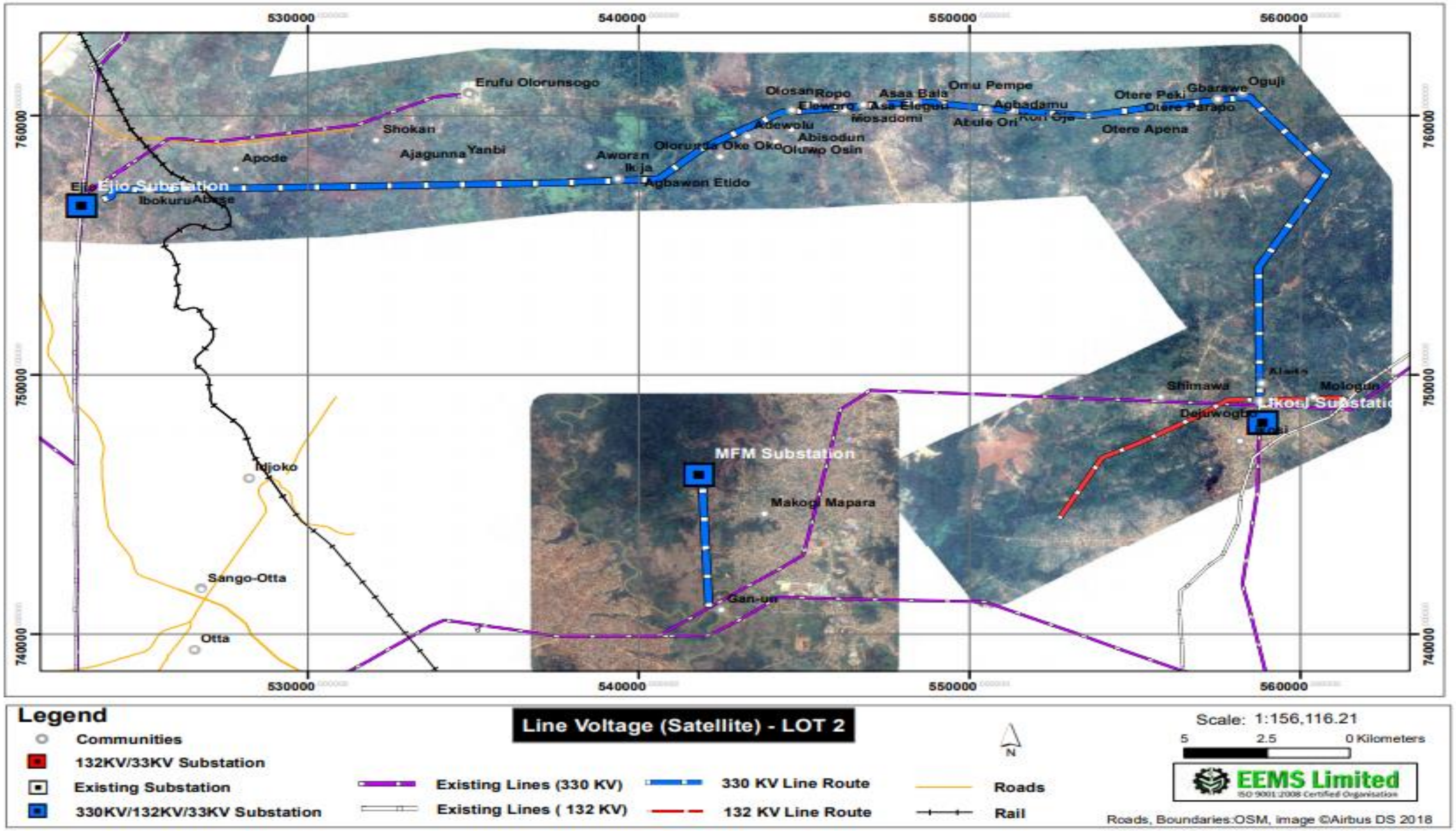


Figure 1.1.3: Satellite Imagery of Existing and Proposed Transmission Lines Components for the Projects- Lot 2

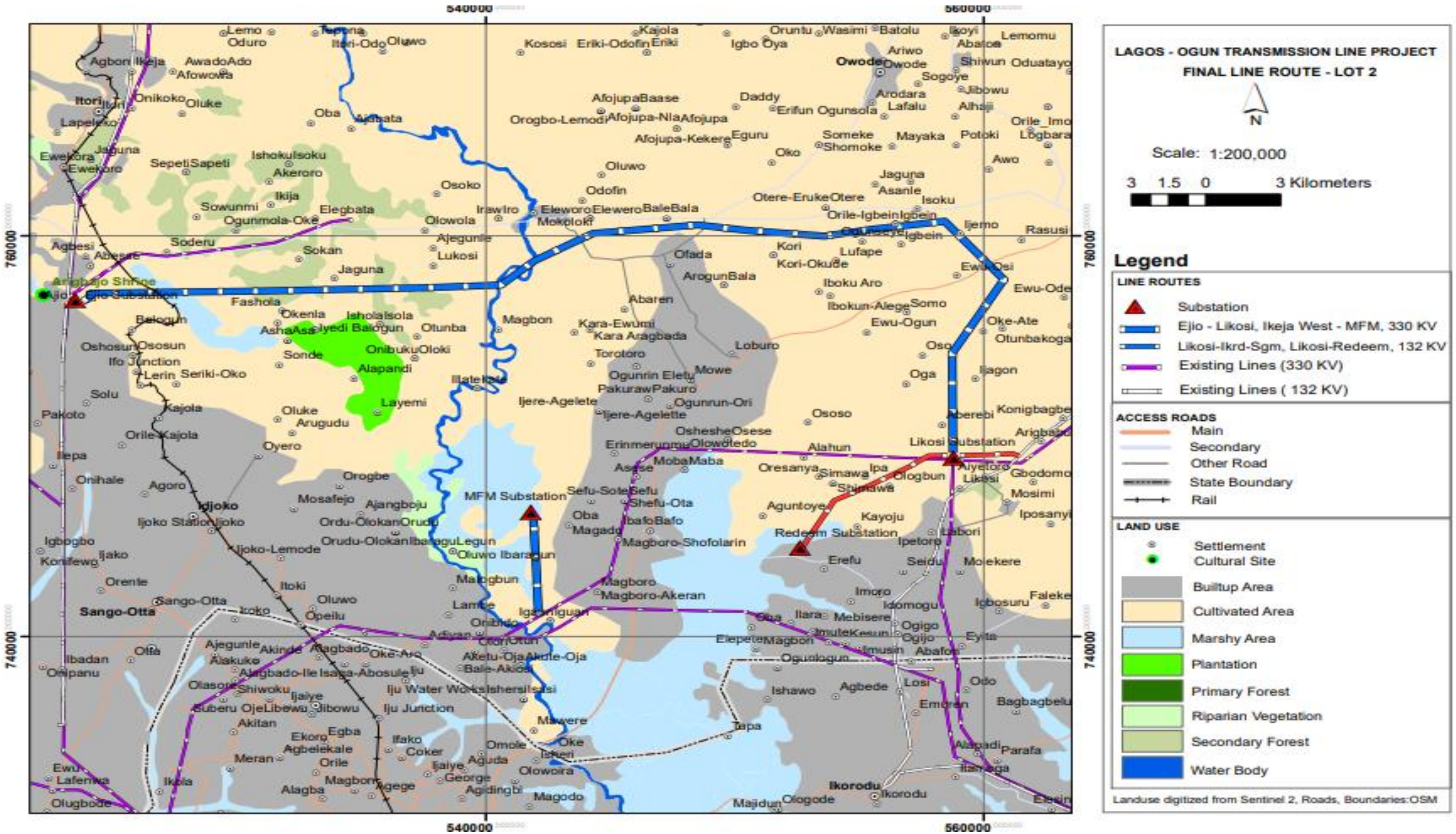


Figure 1.1.4: Location of Proposed Transmission Lines and Associated Substations Projects for Lot 2

1.2 OBJECTIVES OF THE ESIA

The objectives of the ESIA are as follows:

1. Ensure compliance with national environmental regulations and policies, JICA guidelines for environmental and social considerations, World Bank Safeguard Policies, and industry best practice and standards;
2. Generate baseline data to characterize existing environment as well as socio-economic and health conditions and for subsequent monitoring and evaluation of how well the mitigation measures have been implemented during the project life cycle;
3. Identify and analyze alternatives to the proposed projects, including sites, technology, layout, etc;
4. Identify and assess the anticipated environmental and social impacts of the proposed projects – both positive and negative;
5. Propose mitigation measures for negative impacts and enhancement measures for positive impacts to be undertaken during and after the implementation of the proposed projects;
6. Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;
7. Consultation to seek the views of affected persons and stakeholders;
8. Prepare an Environmental and Social Management Plan (ESMP), include budget for implementation

1.3 ESIA SCOPE OF WORK

1.3.1 Scope of Project Component

The scope of project assigned to SEEMS (Lot 2) for the studies- Line Route, Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) are as follows;

- Construction of Ogijo (Likosi/Dejuwogbo) to Arigbajo (Ejio) 48.75km 330kV Double Circuit Transmission Line,
- Construction of 2.4km 132kV, 2-Double Circuits Transmission Line from Ogijo (Likosi/Dejuwogbo) to the Existing Ikorodu/Shagamu 132 kV Transmission line,
- Construction of 7.8 km 132kV Double Circuit Transmission Line from Ogijo (Likosi/Dejuwogbo) to Redeem (Abule Oba),
- Constuction of 4.76km 330kV Double Circuit Transmission from MFM (Makogi) to the Existing Benin (Omotosho)/Ikeja West 330kV Transmission Line,
- Construction of 330/132kV Substation with 2x300MVA 330132kV and 2 x 100MVA 132/33kV Transformer capacities at Ogijo (Likosi/Dejuwogbo),
- Construction of 2x60MVA, 132/33kV Substation at Redeem (Abule Oba),
- Construction of 132/33kV Distribution Substation with 2x150MVA, 330/132kV +and 2x60MVA 132/33kV Transformer capacities at MFM (Makogi).
- Development of land access (from nearby roads) to TLRoW to facilitate construction and maintenance
- Construction of incoming feeders and outgoing feeders which are connected to the existing transmission system

The total length of proposed 330/132kV Double Circuit Transmission Line is 63.97km.

1.3.2 ESIA Scope of Work

The ESIA will inform the Government of Nigeria, TCN as project developer and as project sponsor as well as interested and affected parties and other stakeholders about potential environmental and social impacts associated with the development of the project components. The ESIA should be prepared under meaningful consideration of information gathered from stakeholders, relevant government agencies, and with the active participation of and consultation with all groups of potentially affected people.

The Environmental and Social Impact Assessments (ESIA) will cover at minimum, but will not be limited to the following aspects:

- Description of the entire Project and detailed Project Description.
- Analysis of the National Legal Framework.
- Analysis of applicable international policies, guidelines and standards (Japan International Cooperation Agency (JICA) environmental guidelines as well as International Conventions/Guidelines/Agreements to which Nigeria is a signatory, WB social and environmental safeguards, relevant IFC social and environmental safeguards).
- Baseline Description: environmental and social baseline conditions (identification / census of the economic/person affected to be compensated)
- Assessment of project impacts, disaggregated to construction, operation and decommissioning; disaggregated into temporary and permanent impacts.
- Identification of Project Affected People and of severity of impacts; assessment of adverse as well as of beneficial impacts
- Analysis of alternatives, with an overall description of related impacts
- Assessment of the cumulative potential impacts
- Overview on environmental and social measures for mitigation of adverse impacts and enhancement of beneficial impacts including an outline for monitoring and evaluation procedures
- Institutional arrangements for environmental and social management, including staffing and capacity building plan
- Stakeholder Engagement Provisions, including planning for public information, consultation, participation and disclosure, a transparent and accessible grievance mechanism, monitoring provisions and reference to institutional set ups and responsibilities for the different activities under stakeholder engagement
- Projects Registration with Federal Ministry of Environment (FMEnv) and payment of all required statutory fees for certification.

1.4 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The constitution of Nigeria (1999), as the national legal order, recognizes the importance of improving and protecting the environment and makes provision for it in the following relevant sections:

- Section 20 makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria.

- Section 12 establishes, though impliedly, that international treaties (including environmental treaties) ratified by the National Assembly should be implemented as law in Nigeria.
- Sections 33 and 34 which guarantee fundamental human rights to life and human dignity, respectively, have also been argued to be linked to the need for a healthy and safe environment to give these rights effect.

1.4.1 1.4 POLICY, LEGAL *AND INSTITUTIONAL FRAMEWORK*

A. National Environmental Policy

Launched by Government in November 1989, this document prescribed guidelines for achieving sustainable development in fourteen vital sectors of the nation's economy, namely: Human Population; Land Use and Soil Conservation; Water Resources Management; Forestry, Wildlife and Protected Natural Areas; Marine and Coastal Area Resources; Sanitation and Waste Management; Toxic and Hazardous Substances; Mining and Mineral Resources; Agricultural Chemicals; Energy Production; Air Pollution; Noise in the Working Environment; Settlements; Recreational Spaces, Green Belts, Monuments, and Cultural Property.

It also contains Nigeria's commitment to ensure that the country's natural and built environment is safeguarded for the use of present and future generations. This commitment demands that efficient resource management and minimization of environmental impacts be the core requirements of all development activities. Accordingly, this Policy seeks to promote good environmental practices through environmental awareness and education.

Some specific regulations include:

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

- National Environmental (Sanitation and Wastes Control) Regulations, S.I.28 of 2009,
- National Environmental (Noise Standards and Control) Regulations, S.I.35 of 2009;
- National Environmental (Surface and Groundwater Quality) Regulations, S.I.22 of 2011;
- National Environmental (Electrical/Electronic Sector) Regulations, S.I.23 of 2011;
- National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations, S.I.15 of 2011; and
- National Environmental (Soil Erosion and Flood Control) Regulations, S.I.12 of 2011

The project will have effects on biophysical and human environment, as a result it shall comply with the relevant provisions of this policy.

B. National Energy Policy

The National Energy Policy approved by the Executive Council of the Federation in 2003 and launched in 2005 has the following objectives:

- To ensure the development of the nation's energy resources, with diversified energy resources options, for the achievement of national energy security and an efficient energy delivery system with an optimal energy resource mix.
- To guarantee increased contribution of energy productive activities to national income.
- To guarantee adequate, reliable, and sustainable supply of energy at appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.

The policy dealt with five focal areas;

- Energy Sources: Oil and Gas and Other Conventional (Coal & Tar Sands) Energy Sources such as Nuclear Renewable Energy.
- Energy Utilization: electricity, industry, agriculture, and transport.
- Energy Issues: Environment, Energy Efficiency and Conservation, Research, Development and Training, Energy Manpower Development; Bilateral, Regional and International Cooperation, Energy Databank.
- Energy Financing: Indigenous participation. Financing.
- Planning and Policy Implementation: energy planning, policy implementation, prioritization of strategies into short, medium, and long term, monitoring and evaluation.

The project is about improving energy supply, as a result it shall comply with the relevant provisions of this policy.

C. National Land Policy

The legal basis for land acquisition and resettlement in Nigeria is the Land Use Act of 1978, modified in 1990. According to the act, all land in Nigeria is vested in the Governor of each State, to be held in trust for the use and common benefit of all people.

The administration of urban land is directly under the control and management of the Governor; whereas non – urban land is under the control and management of the Local Government Area.

The Governor had the right to grant statutory rights of occupancy to land. Local Government has the right to grant customary rights of occupancy.

The Land Act gives government the right to revoke statutory and customary rights to land for the overriding public interest. The act gives the government the right to acquire land by revoking both statutory and customary rights of occupancy for the overriding public interest.

In doing so, the act specifies that the state or local government should pay compensation to the current holder or occupier with equal value. The act also requires the state or local government to provide alternative land for affected people who will lose farmlands and alternative residential plots for people who will lose their house.

The need for an integrated approach towards land use planning is highlighted. The coordination of activities of all stakeholders in land use planning is emphasized. In particular, the involvement of land owners, community groups, women, youth and the less privileged in making land use related decisions that affect them is regarded as being critical in the successful implementation of the policy.

The project will involve land take for the line route and the new substation sites. Hence, the process for the land acquisition shall comply with the national land policy.

D. Social Protection Policies

Social protection policy has been on the agenda since 2004, when the National Planning Commission, supported by the international community, drafted a social protection strategy. More recently, the National Social Insurance Trust Fund drafted a social security strategy. The social protection policy approached social protection using a life-cycle and gender lens, recognizing both economic and social risks, including, for example, job discrimination and harmful traditional practices. The policy was organized around four main themes: social assistance, social insurance, child protection and the labour market.

However, only a few of the instruments of this approach were adopted in the national implementation plan, most notably the provision of specific and limited social assistance, social insurance (such as expanding national health insurance to the informal sector) and labour market programmes (such as developing labor-intensive programmes). Moreover, in practice, programmes to date have been focused largely on conditional cash transfers and two health financing mechanisms driven by the federal government with little inter-sectoral or state-federal coordination. A significant number of actors are involved in funding and implementing social protection, including those from government, donors, international non-governmental organizations and civil society. Federal government-led social protection includes three main programmes:

- the conditional cash transfer In Care of the People (COPE) (funded initially through the DRG fund) targeted at households with specific social categories (those with children of school-going age that are female-headed or contain members who are elderly, physically challenged, or are fistula or HIV/ AIDS patients
- the health fee waiver for pregnant women and children under five (financed through the DRG fund)
- the community-based health insurance scheme, which was redesigned in 2011 because the previous scheme had design challenges Other social assistance programmes are implemented in an ad hoc manner by various government ministries, departments, and agencies at state level, and some are funded by international donors. These include conditional cash transfer programmes for girls' education (in three states), child savings accounts, disability grants, health waivers, education support (such as free uniforms) and nutrition support. HIV and AIDS programming at state level also include social protection sub-components (although not as the primary objective), including nutrition, health and education support. Labour market programmes include federal-and state-level youth skills and employment programmes, and Nigeria also has agricultural subsidies/inputs.

The project will have effects on the social aspects of the people around the area, as a result it shall comply with the relevant provisions of this policy.

1.4.2 Legal Framework

National Legislations

(i) The Environmental Impact Assessment (EIA) Act Cap E12 LFN, 2004

The EIA Act 86 makes it mandatory for any person, authority, corporate body private or public, to conduct EIA prior to the commencement of any new major development or expansion that may likely have significant effect on the environment. The Act sets the EIA objectives and the procedures for consideration of EIA of certain public or private projects.

The project is a major development, which is expected to have some impacts on the environment. Hence, full compliance with the EIA Act is required. The EIA guidelines (procedural and sectoral) issued by the FMEnv derived from this Act and the project proponent (TCN) shall conduct its activities for the development of this project in conformance with these guidelines.

(ii) Land Use Act of 1978

The Land Use Act (Cap 202, 1990), now Cap L5 Laws of the Federation of Nigeria 2004, is the key legislation that has direct relevance to this project. Relevant sections of these laws that may relate to this project with respect to land ownership and property rights, resettlement and compensation are summarized in this section.

The Land Use Act is the applicable law regarding ownership, transfer, acquisition and all such dealings on Land. The provisions of the Act vest every parcel of Land, in every State of the Federation, in the Executive Governor of the State. He holds such parcels of land in trust for the people and government of the State.

The Act categorized the land in a State to urban and non-urban or local areas. The administration of the urban land is vested in the Governor, while the latter is vested in the Local Government Councils. At any rate, all land irrespective of the category belongs to the State while individuals only enjoy a right of occupancy as contained in the Certificate of Occupancy, or where the grants are “deemed”.

The concept of ownership of land as known in the western context is varied by the Act. The Governor administers the land for the common good and benefits of all Nigerians. The law makes it lawful for the Governor to grant statutory rights of occupancy for all purposes; grant easements appurtenant to statutory rights of occupancy and to demand rent. The Statutory Rights of Occupancy are for a definite time (the limit is 99 years) and may be granted subject to the terms of any contract made between the state Governor and the Holder.
The Local Government Councils may grant customary rights of Occupancy for agricultural (including grazing and ancillary activities), residential and other purposes. But the limit of such grants is 500 hectares for agricultural purposes and 5,000 for grazing except with the consent of the Governor. The local Government, under the Act is allowed to enter, use and occupy for public purposes any land within its jurisdiction that does not fall within an area compulsorily acquired by the Government of the Federation or of relevant State; or subject to any laws relating to minerals or mineral oils.

The State is required to establish an administrative system for the revocation of the rights of occupancy, and payment of compensation for the affected parties. So, the Land Use Act provides for the establishment of a Land Use and Allocation Committee in each State that determines disputes as to compensation payable for improvements on the land **(Section 2 (2) (c)).**

In addition, each Local Government is required to set up a Land Allocation Advisory Committee, to advise the Local Government on matters related to the management of land. The holder or occupier of such revoked land is to be entitled to the value of the unexhausted development as at the date of revocation. **(Section 6) (5).** Where land subject to customary rights of Occupancy and used for agricultural purposes is revoked under the Land Use Act, the local government can allocate alternative land for the same purposes **(section 6) (6).**

If Local Government refuses or neglects within a reasonable time to pay compensation to a holder or occupier, the Governor may proceed to effect assessment under **section 29** and direct the Local Government to pay the amount of such compensation to the holder or occupier. **(Section 6) (7)**.

Where a right of occupancy is revoked on the ground either that the land is required by the Local, State or Federal Government for public purpose or for the extraction of building materials, the holder and the occupier shall be entitled to compensation for the value at the date of revocation of their unexhausted improvements. Unexhausted improvement has been defined by the Act as:

anything of any quality permanently attached to the land directly resulting from the expenditure of capital or labour by any occupier or any person acting on his behalf and increasing the productive capacity the utility or the amenity thereof and includes buildings plantations of long-lived crops or trees, fencing walls, roads and irrigation or reclamation works, but does not include the result of ordinary cultivation other than growing produce.

Developed Land is also defined in the generous manner under **Section 50(1)** as follows: land where there exists any physical improvement in the nature of road development services, water, electricity, drainage, building, structure or such improvements that may enhance the value of the land for industrial, agricultural or residential purposes.

It follows from the foregoing that compensation is not payable on vacant land on which there exist no physical improvements resulting from the expenditure of capital or labour. The compensation payable is the estimated value of the unexhausted improvements at the date of revocation.

Payment of such compensation to the holder and the occupier as suggested by the Act may appear confusing as it raises the following question: Does it refer to holder in physical occupation of the land or two different parties entitled to compensation perhaps in equal shares? The correct view appears to follow from the general tenor of the Act.

First, the presumption is more likely to be the owner of such unexhausted improvements. Secondly, the provision of **section 6(5)** of the Act, which makes compensation payable to the holder and the occupier according to their respective interests, gives a pre-emptory directive as to who shall be entitled to what.

Also, the Act provides in **section 30** that where there arises any dispute as to the amount of compensation calculated in accordance with the provisions of **section 29**, such disputes shall be referred to the appropriate Land Use and Allocation Committee. It is clear from **section 47 (2)** of the Act that no further appeal will lie from the decision of such a committee. If this is so, then the provision is not only retrospective but also conflicts with the fundamental principle of natural justice, which requires that a person shall not be a judge in his own cause. The Act must, in making this provision, have proceeded on the basis that the committee is a distinct body quite different from the Governor or the Local Government. It is submitted, however, that it will be difficult to persuade the public that this is so since the members of the committee are all appointees of the Governor.

Where a right of occupancy is revoked for public purposes within the state of the Federation; or on the ground of requirement of the land for the extraction of building materials, the quantum of compensation shall be as follows:

- In respect of the land, an amount equal to the rent, if any, paid by the occupier during the year in which the right of occupancy was revoked.

- In respect of the building, installation, or improvements therein, for the amount of the replacement cost of the building, installation or improvements to be assessed on the basis of prescribed method of assessment as determined by the appropriate officer less any depreciation, together with interest at the bank rate for delayed payment of compensation. With regards to reclamation works, the quantum of compensation is such cost as may be substantiated by documentary evidence and proof to the satisfaction of the appropriate officer.
- In respect of crops on land, the quantum of compensation is an amount equal to the value as prescribed and determined by the appropriate officer.

Where the right of occupancy revoked is in respect of a part of a larger portion of land, compensation shall be computed in respect of the whole land for an amount equal in rent, if any, paid by the occupier during the year in which the right of occupancy was revoked less a proportionate amount calculated in relation to the area not affected by the revocation; and any interest payable shall be assessed and computed in the like manner.

Where there is any building installation or improvement or crops on the portion revoked, the quantum of compensation shall follow that outlined in paragraph (ii) above and any interest payable shall be computed in like manner.

This project will require acquisitions of land for the substation sites and RoW for the transmission lines. Hence, will comply with the requirements of this law.

(iii) Electric Power Sector Reform Act No. 6, 2005

The Act established the Nigerian Electricity Regulatory Commission (NERC) as an independent regulatory agency. NERC was inaugurated in October 2005, and is mandated to carry out:

- The monitoring and regulation of the electricity industry
- Issuance of licenses to market participants, and
- Ensure compliance with market rules and operating guidelines.

This Act also deals with acquisition of land and access rights. **Section 77** of the Act empowers the NERC to make a declaration that land is required by a license for purpose of generation or distribution of electricity. **Section 77 (9)** states: “where the President issues a notice under sub-section 6, the Governor shall in accordance with the provisions of **section 28(4)** of the Land Use Act, revoke the existing right of occupancy respecting the land and grant a certificate of occupancy in favour of the concerned licensee in respect of the land identified by the commission in such notice who shall be entitled to claim compensation in accordance with the provisions of the Land Use Act”.

(iv) National Environmental Standards & Regulations Enforcement Agency (NESREA) Act, 2007

Administered by the Ministry of Environment, the National Environment Standards and Regulations Enforcement Agency (NESREA) Act of 2007, repealed the Federal Environmental Protection Agency (FEPA) Act. It is the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources. The following sections are worth noting:

- **National Effluent Limitation Regulation**

The National Effluent Limitation Regulation, S1.8 of 1991 (No 42, Vol. 78, August, 1991) makes it mandatory for industries such as waste generating facilities to install anti-pollution and pollution abatement equipment on site. The Regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the environment. Appropriate penalties for contravention are also prescribed.

- **Pollution Abatement in Industries Generating Wastes Regulations**

The Pollution Abatement Regulation, S1.9 of 1991 (No 42, Vol 78, August, 1991) imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency planning by industries, submission of lists and details of chemicals used by industries to FMEnv, permits for the storage and transportation of harmful or toxic waste and the waste generator's liability.The Regulation also provides strategies for waste reduction, permissible limits of discharge into public drains, protection of workers and safety requirements, environmental audit (or environmental impact assessment for new industries) requirements and penalties for contravention.

- **Management of Hazardous and Solid Wastes Regulations**

The Management of Hazardous and Solid Wastes Regulation, S.1.15 of 1991 (No 102, Vol. 78, August, 1991) defines the requirements for groundwater protection, surface water impoundment, land treatment, waste piles, landfills, and incinerators. It also describes the hazardous substances tracking programme with a comprehensive list of acutely hazardous chemical products and dangerous waste constituents. In addition, the Regulation also contains the requirements and procedures for inspection, enforcement and penalties.

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

(v) The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004

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

- Section 30 (3) requires a building plan to be drawn by a registered architect or town planner.
- Section 39 (7) establishes that an application for land development would be rejected if such development would harm the environment or constitute a nuisance to the community.
- Section 59 makes it an offence to disobey a stop-work order. The punishment under this section, is a fine not exceeding N10, 000 (Ten thousand naira) and in the case of a company, a fine not exceeding N50, 000.
- Section 72 provides for the preservation and planting of trees for environmental conservation.

The project shall be implemented in line with requirements of this Act, including obtaining development permit from Ogun State Governments.

(vi) Harmful Waste (Special Criminal Provisions) ACT CAP H1, LFN 2004
The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

- Section 6 provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
- Section 7 makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where the offence is committed by a company.
- Section 12 defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offending act.

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

(vii) The Endangered Species Act, CAP E9, LFN 2004
This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction as a result of over exploitation. These sections are noteworthy:

- Section 1 prohibits, except under a valid license, the hunting, capture or trade in animal species, either presently or likely, in danger of extinction.
- Section 5 defines the liability of any offender under this Act.
- Section 7 provides for regulations to be made necessary for environmental prevention and control as regards the purposes of this Act.

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

(viii) The Factories Act, 1987 (Factory Act cap 126, LFN, 1990)
The factories Act, as contained in the Laws of the Federation of Nigeria 1990, seeks to legislate, and regulate the conduct of health and safety in the Nigerian workplaces. It was enacted in June1987 with the desire to protect the workers and other professionals against exposure to occupational hazards. The director of factories at the Federal Ministry of Employment, labor and productivity is responsible for the administration of the provisions or requirements of this Act. Section 13 allows an inspector to take emergency measures or request that emergency measures be taken by a person qualified to do so, in cases of pollution or nuisances.
This Act deals with working conditions at work sites, including construction sites, such as the type to be undertaken under the Project. Hence, the occupational health and safety requirements applicable to construction sites, as well as other work sites to be used by the project shall be subjected to the provisions of this Act.

(ix) Labour Act - CAP. L1 L.F.N. 2004
This Act deals with labour issues, including payment of wages, recruitment, discipline, employee welfare, employment of women and child labour. **Sections 54 to 58** which deal with employment of women, prescribed period of absence from work for nursing mothers and allows her half an hour twice a day during her working hours to attend to the baby for a period of up to six months after she resumes work. **Section 55** also exempted women from

night work, except when they are employed as nurses. **Sections 59-64** deal with employment of young people.

(x) Wages Board and Industrial Council Act, 1974

The Act provides for the establishment of a National Wages Board and Area Minimum Wages Committee for States and for Joint Industrial Councils for particular industries. It empowers the Minister to order or direct that an industrial wages board be established to perform, in relation to the workers described in the order and their employers, the functions specified in the provisions of this Act, including minimum wage. The minimum wage is currently NGN 18,000.00 per month, and all workers employed for this project shall not earn less than the minimum wage. Hence, all workers engaged by the project shall be paid a minimum of N18,000 per month.

(xi) Workers' Compensation Act, 1987

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

(xii) EIA Procedural Guidelines

This procedure prescribes the steps to be followed in the EIA process from project conception to commissioning and post commissioning impact mitigation, to ensure that the project is implemented with maximum consideration for environment. This EIA study was conducted in compliance with this guideline.

The EIA Process in Nigeria: The Federal Ministry of Environment (FMEnv) developed guidelines to be used by project proponents in conducting EIA, in compliance with the EIA Act. Accordingly, the EIA process, illustrated in Figure 1.1.5, shall follow the following steps sequentially as outlined in the procedural guideline.

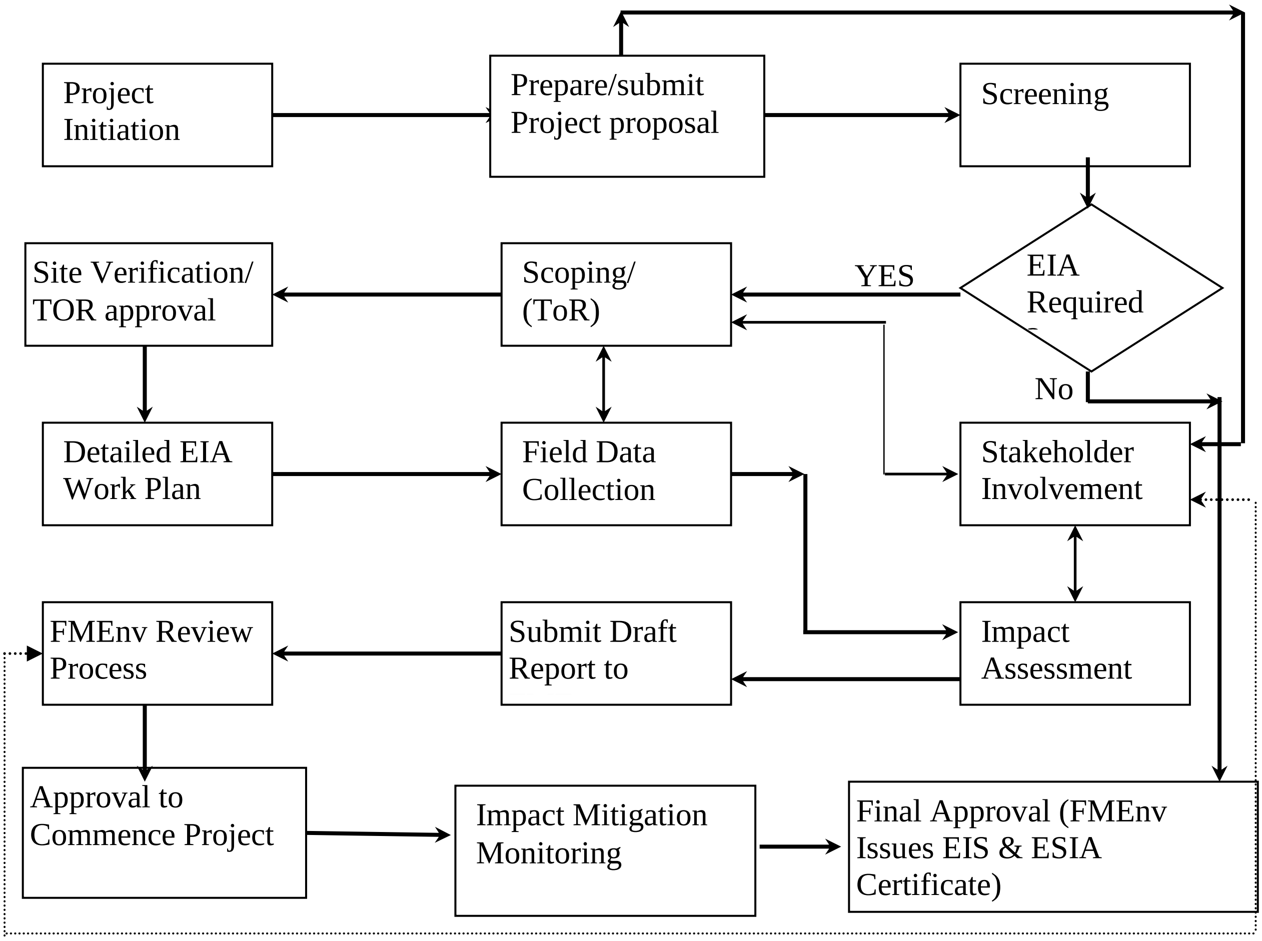


Figure 1.1.5: The EIA Process of FMEnv

(xiii) EIA Sectoral Guidelines (Infrastructures)

This provides general guidelines for EIA of projects in infrastructure sectors of Nigeria, with specific details for sub-sectors. The Electrical transmission sub-sector applies to this project.

(xiv) National Environmental Regulations

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

- National Environmental Protection (Effluent Limitation) Regulations, 1999, makes it mandatory for industries to install anti-pollution and pollution abatement equipment on site. The regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the environment.

- National Environmental Protection (Management of Solid and Hazardous Waste) Regulations, 1999, defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, and landfills. It describes the hazardous substances tracking program with a comprehensive list of acutely hazardous chemical products and dangerous waste constituents. It also states the requirements and procedure for inspection, enforcement and penalty.

- Pollution Abatement in Industries Generating Wastes Regulations, imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency planning by industries, submission of lists and details of chemicals used by industries to FMEnv, permits for the storage and transportation of harmful or toxic waste and the waste generator's liability.

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

E. Ogun State Laws

Ogun State Environmental Management (Miscellaneous) Provision Law, 2004:
This is a group of acts that governs environmental management operations and empowers the Ministry to register all Environmental Management Contractors such as Waste Managers and Waste Vendors as well as Environmental Consultants.

Ogun State Environmental Protection Agency (OGEPA) Law of 1995: This law established Ogun State Environmental Protection Agency as a parastatal under Ministry of Environment with the responsibility to protect the environment in the state.

Ogun State of Urban and Regional Planning Law No 20 of 2005: Established the Ogun State Urban and Regional Planning Board as the agency responsible for development control in the state. The substation sites as well as the RoW in Ogun State needs to approved by the board as part of the process for granting right of occupancy by the Governor. The State Ministry of Urban and Physical Planning also derives its statutory functions from section 3 line 246 of this law as the policy arm of the government related to physical planning in the State.

1.4.3 International Convention

The international conventions, to which Nigeria is a signatory, relevant to this project are as follows:

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

- The Kyoto protocol, Montreal Protocol on Substances that Deplete the Ozone Layer, 1987.
- The African Convention on the Conservation of Nature and Natural Resources, 1968.
- Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)
- Human and Peoples' Rights on the Rights of Women in Africa in 2005
- Civil and Political Rights Covenant
- Economic, Social and Cultural Rights Covenant
- Convention on the Elimination of All Forms of Violence Against Women
- Convention on the Rights of the Child
- ILO Occupational Safety and Health Convention, 1981

ILO Conventions and Core Labour Standards

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

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

TCN as well as its contractors shall comply with these requirements, as well as the following internationally recognized labour rights: the right to a living wage based on a regular working week that does not exceed 48 hours; humane working hours with no forced overtime; a safe and healthy workplace free from harassment; and a recognised employment relationship with labour and social protection.

1.4.4 JICA Guidelines for Environmental and Social Considerations

The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

1.4.5 World Bank Safeguard Policies

The World Bank environmental and social safeguard policies include both Operational Policies (OP) and Bank Procedures (BP). Safeguard policies are designed to protect environment and society against potential negative effects of projects, plans, programs and policies.

1.4.6 IFC Performance Standards for Investment

The Eight Performance Standards established by IFC for the life of an investment include:
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2: Labour and Working Conditions
Performance Standard 3: Resource Efficiency and Pollution Prevention
Performance Standard 4: Community Health, Safety, and Security
Performance Standard 5: Land Acquisition and Involuntary Resettlement
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
Performance Standard 7: Indigenous Peoples
Performance Standard 8: Cultural Heritage

1.4.7 TCN's HSEQ Policy

TCN has a comprehensive Health, Safety and Environment policy as well as a protocol developed for third-party contractors and all parties involved in construction works of grid stations and transmission lines. All parties that will be involved in this project must comply with the HSEQ Policy of TCN.

Particular consideration shall be given to the Safety, Health, Environment, Security (SHE&S) and Regulatory (SHES&R) of all project personnel at all stages of planning, execution and management of the project. The following sections identify how the project shall be planned to achieve SHE&S objectives, through the implementation of procedures relating to SHE&S Planning and Execution. SHE&S is the project's highest priorities and the responsibility of every individual associated with the project. The SHE&S Philosophy are:

- Nobody Gets Hurt during project planning and execution.
- Safety and security are the project's highest priorities.
- Any work performed at a facility must be done in the safest manner possible.
- Safety is an integrated part of SHE&S policies, procedures and requirements and those are required to safely operate and maintain operating facilities.
- Safety is everybody's concern and responsibility.

The Construction SHE&S Management System is to be established prior to construction based on the above philosophy and the requirements of following at minimum:

- OHSAS18001:2007 Occupational Health and Safety Management Systems Requirements;
- ISO9001:2008 Quality management systems: Requirements
- ISO14001:2004 Environmental management systems: Requirements with guidance for use;
- Local Norms, Rules and Regulations for Health, Safety and Environmental Protection;
- Workmen's Compensation Decree/1987;
- Electrical Regulations/1988.

The objectives and strategies for the construction phase of the Project are aligned with the overall Project Objectives and Strategies (POS). Construction Objectives are:

Improve Project Safety, health, security, environmental protection/performance, particularly during construction

- Assure Project Quality
- Reduce Project Life-Cycle Costs
- Reduce Project Schedules
- Properly plan logistics to ensure minimum rework caused by poor engineering/construction coordination
- Properly plan the contracting and procurement activities while supporting field construction requirements to ensure the reduced schedule and cost impacts are realized.
- Enhance Management of Risk
- Involve local communities in the construction process
- Foster an effective relationship with communities.

1.4.8 Gap Analysis against JICA guideline

Regarding legislative and institutional arrangement for EIA, in general there is no difference in categorization, details of EIA study and EIA report, public participation, and information disclosure between the JICA Guidelines and Nigerian laws and regulations as shown in Table 1.4.1

Table 1.4.1: Gap Analysis Between Nigerian Laws and World Bank E & S Policies

Item	Outline of EIA Legislation in Nigeria	Differences/Measures
Category	According to the EIA Decree and EIA Procedural Guidelines 1992, all the proposed projects are classified into three categories considering extent, nature and location of the projects. (a) Category I for which EIA is mandatory; the project is likely to significantly affect the environment (almost same as the category A of JICA Guidelines) (b) Category II for which a partial EIA will be required; the project is likely to not significantly but somewhat affect the environment (almost same as the category B of the JICA Guidelines).and, (c) Category III for which EIA is not required; the project is unlikely to affect the environment (almost same as the category C of the JICA Guidelines) In addition, the proposed projects in Sensitive Areas as shown in 3.1.1.3 2) are also classified as category I.	No difference in general
Screening	Screening should be conducted by FME after site survey.	No difference in general
Scoping and preparation of TOR	Proponent should make environmental scoping and TOR for EIA study and submit to FME.	No difference in general
Environmental Items	Environmental items, on which impacts due to the project to be identified and evaluated are not described in the EIA Decree. However, items of major negative impacts due to power transmission line project are indicated to such items as land acquisition/resettlement and way-leave, landscape, ecological system, noise and vibration are indicated as major negative impacts due to power transmission line project according to EIA Sectoral Guidelines for Transmission Line.	No difference in general
Contents of EIA report	Mentioned in Article 4 of the EIA Decree - An Environmental Impact Assessment shall include at least the following minimum matters: (a) Proposed activities	No difference in general

Item	Outline of EIA Legislation in Nigeria	Differences/Measures
	(b) Potential affected environment including specific information necessary to identify and assess the environmental effects of the proposed activities (c) Practical activities, as appropriate (d) An assessment of the likely or potential environmental impacts on the proposed activity and the alternatives, including the direct or indirect cumulative, short-term and long-term effects (e) An identification and description of measures available to mitigate adverse environmental impacts of proposed activity and assessment of those measures (f) An indication of gaps in knowledge and uncertainly which may be encountered in computing the required information (g) An indication of whether the environment of any other State, Local Government Area or areas outside Nigeria is likely to be affected by the proposed activity or its alternatives (h) A brief and non-technical summary of the information provided under paragraph (a) to (g).	
Environmental Management Plan (EMP) and Environmental Monitoring Plan	Although the term of "environmental management plan" is not found in the EIA Decree, it is used in the EIA Sectoral Guidelines (Transmission Line). Although the term of "environmental monitoring" is not found in the EIA Decree, the term of "follow-up program" is used as follows: (a) Article 16 - the design and implementation of a follow-up program, (b) Article 17 –mandatory study must include a discussion of the need for and the requirements of any follow-up program.	No difference in general
Information disclosure and public participation	Term of "stakeholder" or "public participation" is not found in the EIA Decree. However, subjects relating to public involvement are described from screening process to reviewing draft final report of EIA study for EIA approval in the EIA Decree. In general: Article 7 - FME shall give opportunity to government agencies, members of the public, experts in any relevant discipline and interested groups to make comment. (b) Screening process. (c) Public hearing.(d) Public comments. However, it is not mentioned about public involvement conducted by the proponent itself during scoping phase and EIA study phase.	In the transmission line project (2012) by World Bank stakeholder meetings were held for communities and villages. In the proposed project stakeholder meetings will be held at the scoping phase and at the stage of preparing draft final report of EIA study.
Comparison of alternatives	Mentioned in the EIA Decree. For example: (a) Article 4 - an EIA shall include an assessment of the likely or potential environmental impacts on the proposed activity and the alternatives, including the direct or indirect cumulative, short-term and tong-term effects. (b) Article 17 - every mandatory study of a project by review panel shall include a consideration of alternative means of carrying out the project.	No difference in general

1.4.9 Institutional and Administrative Framework

Responsibilities for the ESIA and its implementation are shared between multiple stakeholders, including concerned ministries, competent authorities, the project implementation unit (PIU), the TCN and the contractors. These include the following;

- The Federal Government of Nigeria (FGN)
- Federal Ministry of Environment
- Transmission Company of Nigeria (TCN)
- JICA Project Implementation Unit (PIU)
- Ikeja Electricity Distribution Company

- Eko Electricity Distribution Company
- Ogun State Ministry of Environment
- Ogun State Environmental Protection Agency ("OGEPA")
- Ogun State Bureau for Lands and Survey
- Ogun State Power Unit, Office of Governor
- Surveyor General Lagos State
- Local Government Authority (LGA):
  - ✓ Ewekoro Local Government Area
  - ✓ Ifo Local Government Area
  - ✓ Sagamu Local Government Area (Sagamu South Local Council Development Area and Sagamu West Local Council Development Area)
  - ✓ Obafemi/Owode Local Government (Mokoloki/Ofada Local Council Development Area)
- The Customary District Councils headed by Obas of each Kingdom affected
- Village Chiefs (Baale) of Affected Communities

The responsibilities and roles of each of the institutions are discussed below.

1.4.9.1 The Federal Government of Nigeria

Section 20 of the constitution of Nigeria makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria. **Sections 33 and 34** which guarantee fundamental human rights to life and human dignity, respectively, can also be linked to the need for a healthy and safe environment to give these rights effect. The executive council of the federation approves all national policies including the National Policy on Environment.

1.4.9.2 Federal Ministry of Environment

The Federal Ministry of Environment is responsible for the overall environmental policy of the Country. It has the responsibility for ESIA implementation and approval, in accordance with the EIA Act. It has developed certain guidelines and regulations to protect the environment and promote sustainable development. It will monitor the implementation of mitigation measures, when the project commences. And they can issue directives to the project on specific actions related to the environment in the project area. The Ministry normally involves the states and sometimes local governments in this responsibility depending on the specific activity.

1.4.9.3 Transmission Company of Nigeria (TCN)

TCN as the implementation agency for the project on behalf Federal Government of Nigeria, established the Project Implementation Unit (PIU) for the end to end delivery of the project. The Project Manager heading the PIU reports to the CEO of TCN through a General Manager. (Project Coordinator) for all donor funding project.

Project Implementation Unit

Is a unit established by TCN with responsibility for the end to end delivery of all JICA funded projects, including planning, feasibility, ESIA and RAP, engineering, procurement and construction (EPC). PIU is headed by a substantive Project Manager.

Furthermore, the PIU shall ensure:

- The ESIA and RAP studies are conducted in line with legal requirements as well as requirements of the lender
- Proper implementation of the ESMP
- Supervise the EPC contractor in conjunction with the Owner Engineers in Project Department to ensure implementation of management measures.
- Provision of information on activities and consultations with the PAPs.
- Maintain an inventory of the assets to be resettled and a detailed valuation of the compensations.
- Ensure proper information and participation of PAPs and affected communities.
- Management of compensation payments.
- Monitoring the resettlement work.
- Implementation of community-approved projects financed through the EPC contractors.
- Production of monitoring reports to appropriate government authorities, TCN and the contractor in charge of the line construction and the Lender.

1.4.9.4 Ogun State Ministry of Environment

The Ministry of Environment was established in July 2003 with the aim of creating better living and conducive environment for the entire people of Ogun State. The Ministry has five (5) departments and two (2) sister Agencies namely, Ogun Environmental Protection Agency (OGEPA) and Ogun State Emergency Management Agency (SEMA).

- Department of Administration & Supplies: is involved in the management, co-ordination and facilitation of the activities of other Departments.
- Department of Environmental Conservation & Resources Management: is responsible for environmental Sanitation, landscaping and beautification, environmental and natural resources conservation, meteorological services, water shed management and water quality monitoring, climate change, etc.
- Department of Planning, Research & Statistics: plan, undertake research and gather data or information which will allow the Ministry to grow and develop.
- Department of Finance & Accounts: responsible for budgeting and other financial management responsibilities.
- Department of Flood & Erosion Control: Management of flood and erosion issues, including planning, designing, and construction and maintenance of control structures.

1.4.9.5 Ogun State Bureau for Lands and Survey

This bureau is responsible for the issuance of right of way (RoW) and certificate of occupancy (C of O) for portions of line route and substation sites that falls within Ogun State. Other functions of the Agency include

- Preparation and issuance of Certificates-of-Occupancy and other certificate evidencing titles.

- Preparation and issuance of Right-of-Occupancy.
- Production and printing of Titled Deed Plan (TDP).
- Street naming and house numbering in Ogun State.
- Provision of Geospatial information infrastructure.
- Textual and graphic data on Ogun State, including land record, aerial photographs, satellite images, engineering drawing, and scanned pictures of building.
- Property search and verification of land record.
- Land application processing and administration.

1.4.9.6 The Ogun State Urban and Regional Planning Board:

This Board is a parastatal of the Ministry of Urban and Physical Planning established the enactment of Ogun State Urban and Regional Planning Law No.20 of 2005. The Board, which have 20 Zonal Town Planning Offices spread across the State is responsible for:

- Controlling all various physical developments be it Residential, Commercial, Industrial, Public, and Institutional uses.
- Monitoring all the development in order to control the growth of Urban Sprawl in Ogun State.

1.4.9.7 Ogun State Ministry of Women Affairs and Social Development: It has the responsibility;

- To promote Gender Equality and provide Empowerment facilities for Socio-economic Development
- To promote the survival, protection, participation and development of children
- To promote family harmony and reduce juvenile delinquency
- To provide care, support, rehabilitation and empowerment for the vulnerable groups (challenged persons, older persons, destitute and the likes)
- To collaborate and network with Non-Governmental Organisations, Professional Institutions and other MDAs on issues affecting women, children/vulnerable ones.

1.4.9.8 Ogun State Ministry of Agriculture

This Ministry is the organ of Government responsible for formulating policies on food and agriculture for the State. The ministry is to enhance self-sufficiency in food production, provide raw materials for agro-based industries, generate employment opportunities and obtain desirable levels of export in order to improve the country's foreign exchange earnings.
Ogun State has 1.2million hectares of arable land which is 74% of the State's total land area. Only 30% of this arable land or 35,000 hectares is under cultivation. The major crops grown or cultivated in the State include: Cassava, Rice, Maize, Oil-Palm, Cocoa, Rubber, Citrus, Cotton, Soya-Bean, Vegetable, Pineapple, Sugar cane, among others. Livestock and fish farming are strong and viable in the State.
The mandate of the ministry includes;

- Formulating and implementing agricultural policies and programmes for Ogun State.
- Regulation of farm practice and certification of farm produce.
- Ensuring food safety and food security.
- Promotion of mechanized agriculture.

- Ensuring availability and provision of quality agricultural inputs
- Coordinating agricultural cooperative societies and commodity groups
- Promoting and managing Irrigation Schemes
- Delivery of agricultural research proven technologies to farmers for adoption through effective Extension Services
- Promoting the development of the Livestock and Fishery industries in the State.

1.4.9.9 Local Government Authority (LGAs)

The project will pass through four LGAs -Ewekoro, Ifo, Sagamu (Sagamu West and Sagamu South LCDAs), Owode/Obafemi (Mokoloki/Ofada LCDA). These LGAs are involved in the ESIA approval process. According to the EIA act, the LGAs will have representatives in the panel that will review the report and advise the Minister to make decisions on the project. The LGAs also have roles in the administration of lands in rural areas and hence, will be involved in the resettlement process as well as sites for the substations.

1.4.9.10 The Customary District Councils

The line route will pass through the Chiefdoms as several villages under them. The Obas (traditional head of chiefdom) and Village Heads (Baales) have important role to play in the project with respect to mobilization of the community members to support the project, grievance redress, peace and security of personnel, equipment and facilities to be installed. Close contact and regular consultation shall be maintained with customary chiefs throughout the life of the project

1.4.9.11 Witness NGO

To enhance transparency and trust from PAPs, it is suggested that a witness NGO, recognized and credible in the project area, be retained, through a public proposal and selection process, by the PIU to provide independent advice and report on RAP implementation and management focusing on consultation activities, compensation and resettlement related activities and grievances management. This NGO could be recognized and credible Human Right Advocacy group or NGO active in environmental management of rural development. This outside look will ensure that proper procedures and stated compensation process are followed, that PAP grievances are well taken care of, and that PAPs are treated with fairness. This mode of supervision was experienced in other projects and gave good results in terms of reduction of grievances in particular

This NGO will revise reports of compensation payment process, meet with PAPs, check implementation of the measures, reconstruction, etc. in the field, and provide comments and recommendations. All PAPs will be informed of the NGO role and function and need to have access to its representatives, in a confidential manner if necessary, to explain and discuss their difficulties of grievances.

1.4.9.12 Contractors

Each contractor shall appoint a qualified environmental manager who, after approval by the PIU will be responsible for daily management on-site and for the respect of management measures from the ESMP and RAP. This manager will report regularly to the environment specialist of the PIU during the entire construction period.

Contractors must hold all necessary licenses and permits before the work begins. It will befall on them to provide the PIU with all the required legal documents, including the signed agreements with owners, authorizations for borrow pits and for temporary storage sites, etc.

1.4.9.13 TCN HSE Department

The HSE department of TCN shall be responsible for ensuring implementation of management measures during operation phase (post-commissioning), including audits, compliance monitoring, preparation of periodic reports required by regulations.

1.5 ESIA TERMS OF REFERENCE

In line with the Nigeria's EIA procedural guidelines (FEPA, 1995), a Terms of Reference (ToR) for the ESIA of the proposed project was developed, for the FMEnv's approval, at the early stages of the study based on an initial assessment of the environmental issues relating to the proposed project. The specific objectives of the ToR were to:

- Define the relevant framework of legal and administrative requirements for EIA of the proposed project;
- Outline the general scope of the ESIA study including the overall data requirements on the proposed project and affected environment; and.
- Define the procedures and protocols for identification and assessment of associated and potential impacts and for selecting appropriate prevention, reduction, and control as well as enhancement measures for such impacts; and eventually developing an effective Environmental and Social Management Plan (ESMP) for the project.
- The ToR has been approved by the FMEnv (Appendix 3).

1.6 STRUCTURE OF THE ESIA REPORT

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

Chapter 1: Introduction

This chapter provides background information about the proposed project and highlights objectives and scope for the impact assessment study as well as the applicable regulatory framework for the proposed project.

Chapter 2: Project justification

This chapter outlines the project justification, including the need and value / benefits of the project and envisioned sustainability.

Chapter 3: Project description

This chapter provides a description of the Project, including location, project components and activities, details of Project inputs and outputs and alternatives considered.

Chapter 4: Description of the environment

This chapter describes the available baseline data on the environment and social resources and receptors within the Project study area. Also included are records of consultations held with the stakeholders notably the elders and youths in the host communities

Chapter 5: Associated and Potential Impacts

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

Chapter 6: Mitigation measures

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

Chapter 7: Environmental and Social Management Plan (ESMP)

This chapter presents the environmental and social management plan (ESMP) that will be adopted throughout the project life cycle.

Chapter 8: Decommissioning plan

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

Chapter 9: Conclusions and Recommendations

References

As much as possible, materials presented in the report are highlights, covering the most important findings and results.

Appendices

For clarity and to make the report easy reading and friendly raw data and other details are presented in Appendices which are duly referred to in the main report.

CHAPTER TWO
PROJECT JUSTIFICATION

2.1 NEED FOR THE PROJECT

Due to significant shortage of power supply capacity compared to demand, load allocation has been implemented nationwide in Nigeria. If all power stations currently being constructed under the National Integrated Power Project (NIPP) become operational, the installed generation capacity will become above 10,000 MW by the end of 2018 and it will be expected to increase greatly. The existing and proposed transmission line system in Nigeria is shown in Figure 2.1.1.

The transmission lines that run from the Niger Delta in the south to the north via the largest demand centre of Lagos are in a bottleneck situation so the generating capacity in the south cannot be fully utilized. Moreover, there are no detour routes for use when equipment accidents occur, and the system reliability is low. Furthermore, as was mentioned above, the capacity of generating equipment is expected to increase greatly in the coming years, however, because transmission capacity is unable to keep up with generating capacity, there is an urgent need to strengthen the transmission infrastructure. As a countermeasure of serious power shortage, Transmission Company of Nigeria (TCN) planned a project geared to achieving transmission capacity of 20,000 MW by 2020 in accordance with growth of generation capacity.

Nigeria has the largest population among African countries. After coming out of recession last year, the economy of the country is expected to grow steadily in in the coming years. However, social infrastructure is far behind the economic development. In particular, electricity supply is extremely in short, being serious impediment to economic development.
Therefore, it is most urgent and essential to secure sufficient and stable supply of electricity as the platform for the economic development.

According to a report "preparatory survey for power transmission project in the Federal Republic of Nigeria" by JICA published in 2016, the implicit peak demand for the national grid is estimated at 11.0GW in 2014 and will increase to 16.4GW in 2020 and 23.6GW in 2025. The report also projected High Case with revised assumptions. Under the High Case projection, the implicit peak demand for the national grid will grow from 11.0GW in 2014 to 17.3GW in 2020 and 26.3GW in 2025. The electricity demand for the grid is projected to grow at annual 7.2% between 2014 and 2025 for the Base Case and 8.5% for the High Case.
Furthermore, according to the Lagos State Electricity Board, the electricity demand in the Lagos Region is presently 1,250MW, however, the average supply capacity is 650MW, resulting in an absolutely short supply. The proposed Lagos and Ogun States Transmission Lines and Substations have been designed to expand supply electricity in the States. There is no adequate transmission line to meet up with demand of households, industries and other infrastructures in Ogun State as proposed and envisaged, hence there is need for the present proposed projects.

2.2 BENEFITS OF THE PROJECT

Energy is the raw material needed to fuel any country's economy growth. *“Energy is the golden thread that connects economic growth, increased social equity and a healthy environment. Sustainable development is not possible without sustainable energy,”* -UN Secretary-General Ban Ki-moon.

The benefits of this project for the people of Lagos and Ogun State in particular, and the economy of Nigeria in general are numerous. The following few are worth mentioning;

- Improved and more reliable electric power supply.
- Enhances productivity and efficiency in both public and private organizations
- It helps to develop and promote small, medium, and large-scale enterprises thereby creating direct and indirect employment opportunities.
- It helps to improve the security of lives and properties.
- General contribution to climate change through overall reduction of the used of personal power generating sets.
- General improvement of the standard of living for the populace.

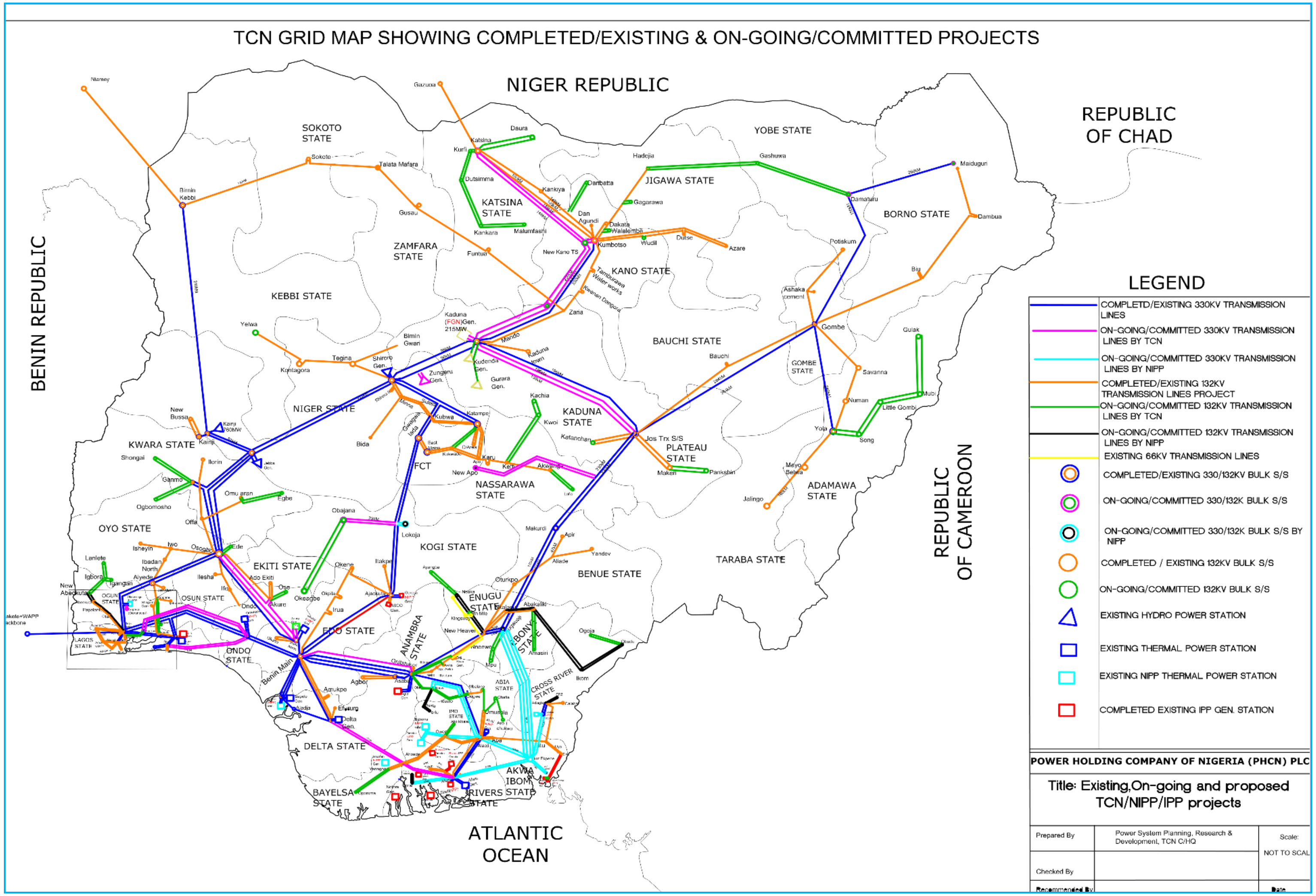


Figure 2.1.1: Existing, On-Going and Completed Transmission and System Operation Infrastructure

Source: TCN, 2016

2.3 ENVISAGED SUSTAINABILITY

Some factors are important to consider to reaching project sustainability. They are related to practical aspects related to economic profitability, technical resources, and all, with an efficient management. With the growth in electricity demand that has occurred over the last decades, adequate and reliable energy supplies are important to economic development. Additional energy resources, including electricity generation and share, as well as infrastructure improvements, are key. Consequently, the investments which will be carried out should be useful primarily economically speaking, for the supply of the local load.

2.3.1 Technical Sustainability

The proposed project shall be technically viable because, it is professionally designed, and the technology employed is readily available. Also, the availability of adequate and qualified manpower for the project execution and operation shall form part of technical sustainability for the proposed project. The proposed route selection has also considered the accessibility for maintenance works after commissioning.

2.3.2 Economic Sustainability

The proposed transmission line project shall be economically sustainable because the proponent is seeking to finance the project through a loan by JICA. Talks has reached advanced stage. Also, there is high demand of the power and the Return on Investment (ROI) is long term but surely high, to ensure effective pay back of the loan in line with loan agreement.

2.3.3 Environmental Sustainability

The line routes and the substation sites has been carefully selected by considering sensitive ecosystems along the proposed PTL route and to avoid built-up areas as much as possible. In addition, practical mitigation measures have been proffered for the identified environmental impacts of the proposed Transmission Lines and Substations project. TCN is fully committed to comply with the relevant applicable national environmental laws, applicable international conventions and world Bank environmental safeguard policies. Furthermore, TCN is also committed to implementing the ESMP developed to further guarantee the environmental sustainability. TCN has full department that handles environmental matters. The HSE department is headed by a General Manager who reports directly to the CEO. Significant number of ESIAs and environmental audits have been conducted in the past by TCN. Hence, they have the technical skills needed to manage the mitigations that are determined for the identified impacts of this project.

2.3.4 Social Sustainability

The project has secured its first social license – the host communities' acceptance of the proposed project their eagerness to see it succeed. The proposed transmission line project shall create job opportunities for unemployed indigenes and Nigerians.
In addition, TCN is committed to effective and continuous stakeholders' engagements and consultations and effective implementation of the RAP.

TCN is committed to comply with applicable national social laws, relevant international conventions and world bank social safeguard policies. Furthermore, TCN has a Social

Specialist as a member of the PIU, but will require training on World Bank involuntary resettlement policy as well as the new environmental and social management framework

2.4 PROJECT ALTERNATIVES

2.4.1 Project Options

a. Do-Nothing' Option

The first project option considered was the 'do-nothing' option. This option would result in in the continuation of the shortage of electricity supply, which has also been inefficient, inadequate, and unreliable. The use of domestic and industrial generators to power homes, offices and industries will escalate. And this will result in increased gaseous emissions with its associated health effects as well as increased greenhouse gas effects. Furthermore, economic growth will be stifled. Therefore, this option was rejected.

b. Delayed Project Option

This would arise if a situation of civil unrest, or public opinion is against the development, or the socio-economic and cultural impacts of the project are not favourable, given available mitigation options. This would mean that all planning and development activities would be stalled until conditions are more favourable.

This option would therefore delay access to more reliable electricity and slow down investments in generation plants, since power evacuation is delayed. The use of domestic and industrial generators to power homes, offices and industries will also be prolonged. And this will result in increased gaseous emissions with its associated health effects as well as increased greenhouse gas effects. Therefore, this option was rejected.

c. Project Implementation Option

The third option considered was the execution of the proposed project as planned. This option was accepted because it will de-bottleneck the grid around the largest demand centre of along Lagos- Ibadan Expressway and provide a more secure and reliable energy supply with all the benefits listed under Section 2.2.

2.4.2 Analyses of Alternatives

2.4.2.1 Design/ Technology Alternatives

(i) Substations

a. Gas-insulated Substation (GIS)

This technology is described in chapter 3 [section 3.10.1 (ii)]. It has the advantage of needing a little space, where land availability poses a challenge but much more expensive than the AIS.

b. Air-insulated Substations (AIS)

This technology is described in chapter 3 [section 3.10.1 (i)]. It has the advantage of being less expensive than the GIS although needing more space. This is the more economical alternative, where land is available.

c. Hybrid

This technology combines the advantages of being less expensive than the GIS with needing less space than the AIS.
The option to be used for the project is the air insulated technology, because the size of land for the substations can contain it with land still available for future expansion.

(ii) Lines

a. Number of Circuits Alternatives

This presents the alternatives of using the single-, double-, or multi-circuit transmission lines.

- The single-circuit (SC) TL combines the immediate advantage of low construction cost with maintenance convenience, although it becomes more expensive on the long run, requiring more land take for corridors. This alternative was rejected entirely.
- The multi-circuits (MC) TL requires the least space for corridor per unit power transmitted than the SC and DC TLs. It is the highest initial capital outlay, although eventually, the most economical. However, in the event of need for maintenance, power outage has farther reaching impacts on consumers than both SC and DC TLs.
- The double-circuits TL minimizes land take per unit power transmitted than the SC, requires more initial cost than the SC but it is more economical, eventually.

b. Towers Types (Tubular / Lattice) Alternatives

There are two basic tower types, namely the tubular and the lattice steel towers. The choice of tower type was based on considerations of available corridor width and cost. The tubular towers are more compact than the lattice type, requiring shorter width but shorter spans and therefore more number of towers. Against this background, therefore, the lattice type will be used for the entire 330kV DC line.

c. Underground versus overhead transmission Alternatives

The underground transmission is very expensive and is often necessary where there is not enough land for the required corridor for the overhead tower infrastructure. It is also aesthetically wholesome and reduces environmental risks and impacts. On the other hand, the overhead transmission alternative is cheaper, easier to construct and maintain and equally sustainable when all identified impacts and risks are eliminated or minimized. Hence surface transmission was selected.

2.5.3 Site and Line Route Alternatives

The general characteristics of the line route considered are:

- short, to minimize cost and the impact on the environment,
- rectilinear, to minimize the angles and the footprint,
- accessible, near roads, to facilitate maintenance,
- surrounding towns and villages, to facilitate electrification, and

- bypassing towns and villages, to minimize the demolition of the built environment and relocation of populations.

The factors to avoid are:

- exclusion zones of airports and airfields
- soils with low load-bearing capacity, thus, far from wetlands and floodplains
- hills and ridges
- protected areas, forest reserves, classified forests, Ramsar sites and other sites, which aim to protect natural areas and species
- Physical cultural resources (PCR), archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites) and aesthetic or other cultural significance.
- Bird migration corridors, feeding, rest areas and nesting grounds.

The Alternative Line Routes and location of substation

Transmission Line

(i) Proposed 330kV Transmission line from Ejio – Likosi/Dejuwogbo (48.74km)

The proposed JICA line route from Ejio to Likosi/Dejuwogbo was followed from AP1 at Ejio Substation up to AP3 across the river at Ejio. Between AP3 and AP4, the line crosses the NGC Gas Pipeline, Proposed railway line under construction and Existing railway line. The line crosses Ogun River between AP5 and AP6 to Okeoko Community through the swampy forest to avoid massive developing residential estates after the river at Ofada and Loburo town. The line crosses Ofada Road between AP9 and AP10 to pass across Omu Apempe, Ori, Otere Apena, Otere Parapo and Oguji to cross Lagos – Ibadan expressway beside Wichtech Roofing Industry thereby avoiding Makun City Residential and Industrial estates. The new option passes behind villages and areas with low developmental rates comprises of mainly farmlands, forests, poultries farms, etc. The length of the proposed best JICA line is 43.285km while the length of the new route is 48.74km

(ii) Proposed 132kV 2 x DC Transmission line from Likosi/Dejuwogbo – Ikorodu/ Sagamu (2.40km)

Due to the proposed re-arrangement and re-configuration of Likosi/Dejuwogbo Substation, the 132kV Transmission Lines are been moved Northward as against the previous arrangement in the JICA report. Due to this re-arrangement, the line was moved away from the previous position proposed by JICA to the proposed position eastward from Likosi/Dejuwogbo substation to join the existing Ikorodu/ Sagamu Transmission line immediately after Thames Valley College. The length of the proposed JICA line is 2.334km while the length of the new route is 2.41km.

(iii) Proposed 132kV Transmission Line from Likosi/Dejuwogbo – Redeem -Abule Oba (7.83km)

Due to the proposed re-arrangement and re-configuration of Likosi/Dejuwogbo Substation, the 132kV Transmission Lines are been moved Northward as against the previous arrangement in the JICA report. Due to this rearrangement, the line was moved away from the previous position proposed by best JICA line to the proposed position westward from Likosi/Dejuwogbo substation at AP1. AP1 and AP2 are new angle points, North of the existing 330kV Ikeja West Transmission Line. The line will cross the existing 330kV Ikeja West Transmission line between AP2 and AP3 and crosses Likosi/Dejuwogbo – Shimawa road between AP 3 and AP4 along the Proposed JICA route. Due to the intersection of the Transmission line with the Redeem Christian Church of God (RCCG) proposed 3km x 3km

Auditorium, a new substation site was proposed thereby changing the length and direction of the line from AP6 to AP7. The length of the transmission line route is 7.83 km.

(ii) Proposed 330kV Transmission Line from Existing Ikeja West - MFM (4.99km)
There is no deviation from JICA option. It passes through swampy forest with fewer developments. The length of the proposed best JICA line is 4.99 km.

The summary of alternative line routes is in Tables 2.5. 1 -2.5.4. Also, the recommended route maps are presented in Figures 2.5. 1 -2.5.4

Substation
Three (3) substations falls within the scope of Lot 2 project namely; Likosi/Dejuwogbo (formerly known as Ogijo) Substation, Redeem Substation and MFM substation. Ejio substation served as the main hub in the entire project where several transmission lines emanated from including Ejio – Likosi/Dejuwogbo Transmission Line.

During visitation to the communities affected by Ogijo substation site, it was learnt that the location of the substation site is not Ogijo but around Likosi/Dejuwogbo area. 25 hectares substation site is situated at Dejuwogbo and Alado communities with approximate 9.0 and 16.0 hectares belonging to Alado and Dejuwogbo respectively. During a stakeholders meeting, it was unanimously agreed that the substation should be named after the community that has the largest share of the land which is Dejuwogbo.

The location of Redeem substation is still under review with the Land committee of Redeemed Christian Church of God (RCCG). Two (2) previous sites allocated for the substations were affected by the Oloparun resettlement site and the 3km x 3km new auditorium of the RCCG. The new substation site has been allocated to Abule Oba Village which is being recommended for the substation.

The 20 hectares substation site situated within the Mountain Top University (MFM substation) at Makogi. The substation site was shifted Northward and carve out of Mountain Top University because of the new Land acquisition in Makogi while the size is still intact.

Table 2.5.1: Alternative Analysis 1 - Section between proposed Ejio – Likosi/Dejuwogbo 330kv Transmission Line Route

		Route 1	**Route 2**	**Route 3**
Description		Straight route with the lowest construction cost.	It avoids crossing an existing Ejio-Olorunsogo 330KV line. It avoids build-up areas and settlement to minimize land acquisition. It avoids Ofada town, OPIC residential/ industrial estate and crosses Lagos-Ibadan expressway into Likosi/Dejuwogbo substation where there are minimal built-up areas.	To reduce impact by land acquisition, it avoids settlements and built-up areas
Distance (km)		36.5	48.74	42.3
Social Aspect	Number of Buildings in Way Leave (Estimated)	189	355 (Majority are under construction)	>400
Natural Aspect	Access Road	Some existing roads are present, but construction of access roads may be necessary in some areas. It goes through the Loburo town.	Some existing roads are present but upgrading of existing access roads may be necessary in some areas.	Some existing roads are present, but construction of access roads may be necessary in some areas.
	Land Use	Commercial areas, congested residential areas, farmland, vegetation, river	Farmlands, vegetation, settlements, river, swampy forest	Farmlands, vegetation, settlements, river
	Impact on Natural Environment	Some vegetation needs to be cleared. No difference from the other route.	Some vegetation needs to be cleared. No difference from the other route.	Some vegetation needs to be cleared. No difference from the other route.
Geographical Conditions (Topography, ground stability, etc)		None in particular	Relatively flat terrain with gentle slopes in few areas.	None in particular
Natural Disaster Risk		None	None	None
Technical Aspect		No difference from the other alternatives	Construction across river and major expressway.	No difference from the other alternatives
Cost		Δ	o	o
Recommended Route			This option is being recommended	

Table 2.5.2: Alternative Analysis 2 - Section between proposed Likosi/Dejuwogbo – existing Ikorodu/ shagamu 132kv 2 x DC Transmission Line route

		Route 1	**Route 2**	**Route 3**
Description		Turning–in /out point is between Ikorodu Substation and Shagamu Substation. There are some shops and houses around the turning –in and –out point.	By moving Turning–in/out point 2.3km to north-east, it is possible to run within the way leave of the existing 330kV line. It also enables to connect straight at the starting and ending points.	About 700m length passes through a developing area after Likosi/Dejuwogbo substation towards Mologun and Gbepa community. The lands at the 2 communities are not developed and it connects Existing Ikorodu/ Shagamu 132kV TL after Thames Valley college.
Distance (km)		1.5	2.3	2.41
Social Aspect	Number of Buildings in Way Leave	7	0	51
Natural Aspect	Access Road	Some existing roads are present, but construction of access roads may be necessary in some areas.	Some existing roads are present, but construction of access roads may be necessary in some areas.	Many existing roads are present around Likosi/Dejuwogbo Substation and along the proposed Transmission line, Construction of access roads may not be necessary.
	Land Use	Vegetation, farmlands, some settlements	Vegetation, farmlands	Developing/ residential areas, farmlands and vegetation
	Impact on Natural Environment	Vegetation in way leave needs to be cleared. Since there is another transmission line in west, vegetation will be segmented.	Since the way leave can be shared with the existing line, impacts on vegetation by clearing or segmenting are lower than Route 1.	Some vegetation needs to be cleared and land acquired.
Geographical Conditions (Topography, ground stability, etc)		None in particular	None in particular	None in particular
Natural Disaster Risk		None	None	None
Technical Aspect		No difference from the other alternative.	No difference from the other alternative.	Construction of special terminal tower
Cost		◎	○	○
Recommended Route				This option is being recommended

Table 2.5.3: Alternative Analysis 3- Section between proposed Likosi/Dejuwogbo – Redeem (Abule Oba) 132kv DC Transmission Line route

		Route 1	Route 2	Route 3
Description		Straight route with the lowest construction cost	It avoids settlements to minimize impacts by land acquisition.	The route was redirected from the Likosi/Dejuwogbo substation to suit the proposed substation design. It crosses existing 330kV Ikeja west TL and follow path taken by Route 1 and terminate at the newly acquired substation site.
Distance (km)		10.1	10.3	7.83
Social Aspect	Number of Buildings in Way Leave	7	6	157
Natural Aspect	Access Road	Some existing roads are present, but construction of access roads may be necessary in some areas.	Some existing roads are present, but construction of access roads may be necessary in some areas.	Many existing roads are present around Likosi/Dejuwogbo Substation and along the proposed Transmission line, upgrading of existing roads may be necessary
	Land Use	Farmlands, vegetation, Settlements	Farmlands, vegetation, Settlements	Farmlands, vegetation, Settlements
	Impact on Natural Environment	Some vegetation needs to be cleared. No difference from the other route.	Some vegetation needs to be cleared. No difference from the other route.	Some vegetation needs to be cleared. No difference from the other route.
Geographical Conditions (Topography, ground stability, etc)		None in particular	None in particular	Undulating terrain, Valleys and gentle slopes
Natural Disaster Risk		None	None	None
Technical Aspect		No difference from the other alternative(s)	No difference from the other alternative(s)	Crossing existing 330kV TL
Cost		◎	○	○
Recommended Route				This option is being recommended

Table 2.5.4: Alternative Analysis 4 - Section between proposed existing Ikeja West – MFM (Makogi) 330kv DC Transmission Line route

		Route 1	Route 2	Route 3
Description		Straight route with the lowest construction cost	The starting point is the existing transmission line tower closest (same as Route 1) but avoiding a built-up area.	To minimize impacts by land acquisition, the starting point is set at the south of MFM substation so that the route can avoid built-up areas completely.
Distance (km)		2.7	3.4	4.99
Social Aspect	Number of Buildings in Way Leave	162	116	50
Natural Aspect	Access Road	Construction of access roads is not necessary due to many existing roads.	Some existing roads are present, but construction of access roads may be necessary in some areas.	Some existing roads are present but upgrading of existing access roads may be necessary in some areas.
	Land Use	Residence	Residence, Vegetation	Residential, Vegetation, farmlands, vacant Land
	Impact on Natural Environment	None to be noted	Vegetation will be cleared and segmented.	Vegetation will be cleared and segmented.
Geographical Conditions (Topography, ground stability, etc)		None in particular	None in particular	Low land
Natural Disaster Risk		None	None	None
Technical Aspect		No difference from the other alternatives	No difference from the other alternatives	No difference from the other alternatives
Cost		◎	○	○
Recommended Route				This option is being recommended

Figure 2.5.1: The recommended Option for Ejio – Likosi/Dejuwogbo 330kV Transmission Line

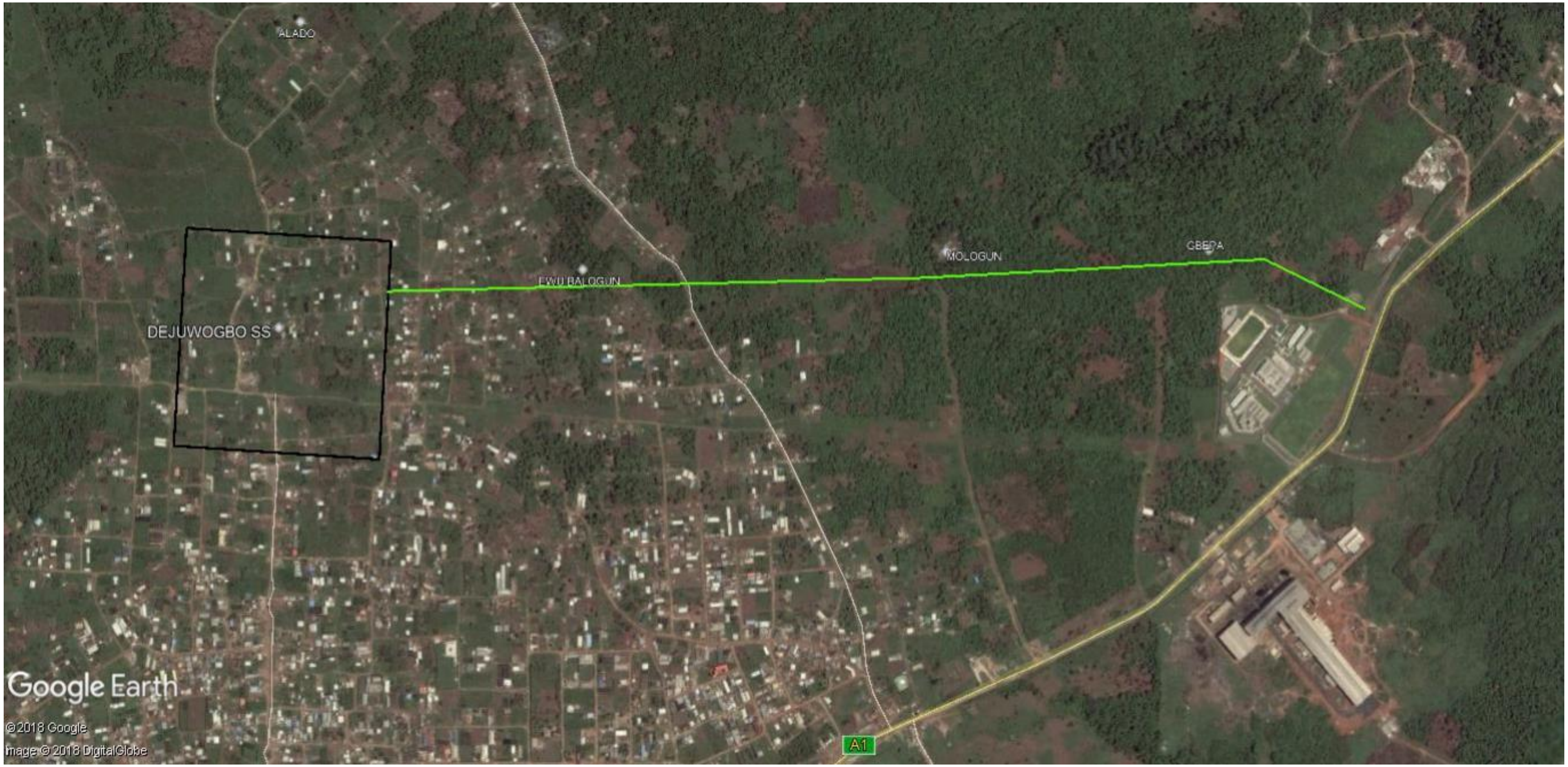


Figure 2.5.2: The recommended Option for Likosi/Dejuwogbo – Ikorodu/ Sagamu 132kV 2 x DC Transmission Line

Figure 2.5.3: The recommended Option for Likosi/Dejuwogbo – Redeem (Abule Oba) 132kV Transmission Line

Figure 2.5.4: The recommended Option for Existing Ikeja West 330kV – MFM (Makogi) Substations

CHAPTER THREE

PROJECT DESCRIPTION

3.1 NATURE OF THE PROJECT

The project proposed by Transmission Company of Nigeria (TCN), is the construction of new transmission lines totaling of about 63.97-kilometers including 3 substations and transmit spanning across Ogun State. The proposed project is required to loop up the existing power transmission lines and hoping to improve the availability and reliability of electricity supply to Ogun States. It is aimed at increasing the capacity of the transmission network thereby improving the voltage profile in the Ogun state as well as strengthening the grid and improving system reliability, stability and operational efficiency of the national grid network. This project is being funded through a loan facility by the Japan International Cooperation Agency (JICA). It is expected that the investment will bring more reliable power supply, decreasing the number of power outages and reducing the operation of generator sets by households and companies.

The proposed projects for the construction of 63.97km, 330/132kV Double Circuit Transmission Line involves:

- Construction of Ogijo (Likosi/Dejuwogbo) to Arigbajo (Ejio) 48.74km 330kV Double Circuit Transmission Line,
- Construction of 2.41km 132kV, 2-Double Circuits Transmission Line from Ogijo (Likosi/Dejuwogbo) to the Existing Ikorodu/Shagamu 132 kV Transmission line,
- Construction of 7.83 km 132kV Double Circuit Transmission Line from Ogijo (Likosi/Dejuwogbo) to Redeem (Abule Oba),
- Construction of 4.99km 330kV Double Circuit Transmission from MFM (Makogi) to the Existing Benin (Omotosho)/Ikeja West 330kV Transmission Line,
- Construction of 330/132kV Substation with 2x300MVA 330132kV and 2 x 100MVA 132/33kV Transformer capacities at Ogijo (Likosi/Dejuwogbo),
- Construction of 2x60MVA, 132/33kV Substation at Redeem (Abule Oba),
- Construction of 132/33kV Distribution Substation with 2x150MVA, 330/132kV +and 2x60MVA 132/33kV Transformer capacities at MFM (Makogi).
- Development of land access (from nearby roads) to TLRoW to facilitate construction and maintenance
- Construction of incoming feeders and outgoing feeders which are connected to the existing transmission system

- **Existing facilities at the project site:**

There is existing Transmission Lines around proposed Likosi/Dejuwogbo substation which have tension tower that are carrying the double circuit for Egbin TS and Ikeja-west-Omotosho 330kV transmission lines.

The existing 330kV Transmission Line between Ikeja West S/S and Omotosho S/S is double circuit

3.2 PROJECT PHASES AND ACTIVITIES

It is anticipated that construction of the transmission lines and substations will commence in late 2019 and take approximately 36 months to complete. This does not however show the interdependencies of the activities.

Phase I: Pre-construction

- Feasibility studies
- Line-route studies
- Environmental and Social Impact Assessment (ESIA)
- Resettlement and Compensation
- Front End Engineering Design
- EPC contract award
- Mobilization
- Check survey of EPC contractor
- Impact Mitigation Monitoring
- Transmission line and Substation detail design
- Material production (transformers and accessories, tower members, conductors, insulators, line hardware)
- Material testing
- Material shipment

Phase II: Construction Phase

- Clear and grub site at substations and along transmission lines corridor
- Impact Mitigation Monitoring
- Foundations for tower installation and substation construction
- Tower erection
- Substation construction and installations
- Conductor stringing
- Impact Mitigation Monitoring
- Commissioning and testing
- Reinstating and clean up
- Demobilization
- Impact Mitigation Monitoring
- Ready for handing over

Phase III: Operations and Maintenance Phase

- Power Transmission
- Maintenance of TL
- Maintenance of SS
- Compliance Monitoring
- Period Environmental Audit
- Periodic Systems Audit

Phase IV: Decommissioning/Closure
- Decommissioning Audit
- Dismantling and removal of Structures
- Site restoration

3.3 PRE-CONSTRUCTION ENGINEERING STUDIES AND ROW ACQUISITION PROGRAMME

During Feasibility studies, several site studies have been performed to be used as indicators and basis for engineering works. These studies are considered as preliminary studies and no claim on completeness of these documents can be raised. For detailed engineering, information given herein and described in the reports will be considered during detail design and construction works.
- FEED
- Topographic Survey
- Crossing Study
- Conceptual Design of Transmission Line

3.3.1 Centre - Line and Topographical Survey

Topographical survey has been performed on site. The site is generally flat, with an undulating pattern across the Transmission Lines while Likosi/Dejuwogbo, MFM (Makogi) and Redeem (Abule Oba) substation sites are lowland. According to the results of the topographic survey the TL route and RoW are determined. Road crossings, TL crossing and determination of structures in the TL have been performed according to topographic survey results. All topographical survey works included the establishment of any survey control, needed in addition to the existing survey control.

The complete topographic information for the survey areas use a maximum point interval / grid spacing of 25 m to describe the current local conditions in acceptable accuracy. The locations and elevations of the following minimum scope of data have been determined:
- All topographic surface information and features (high / low points, break lines, streams, river banks, swamps, vegetation, etc.);
- All man-made, civil structures (roads, tracks, buildings, foundations, walls, fences, etc.);
- All existing third party facilities (piping, cabling, process installations, telecom, power lines, utility markers etc.);
- All geotechnical points to be set out / surveyed;
- Temporary access roads, camp sites, fabrication-/storage yards, as required.

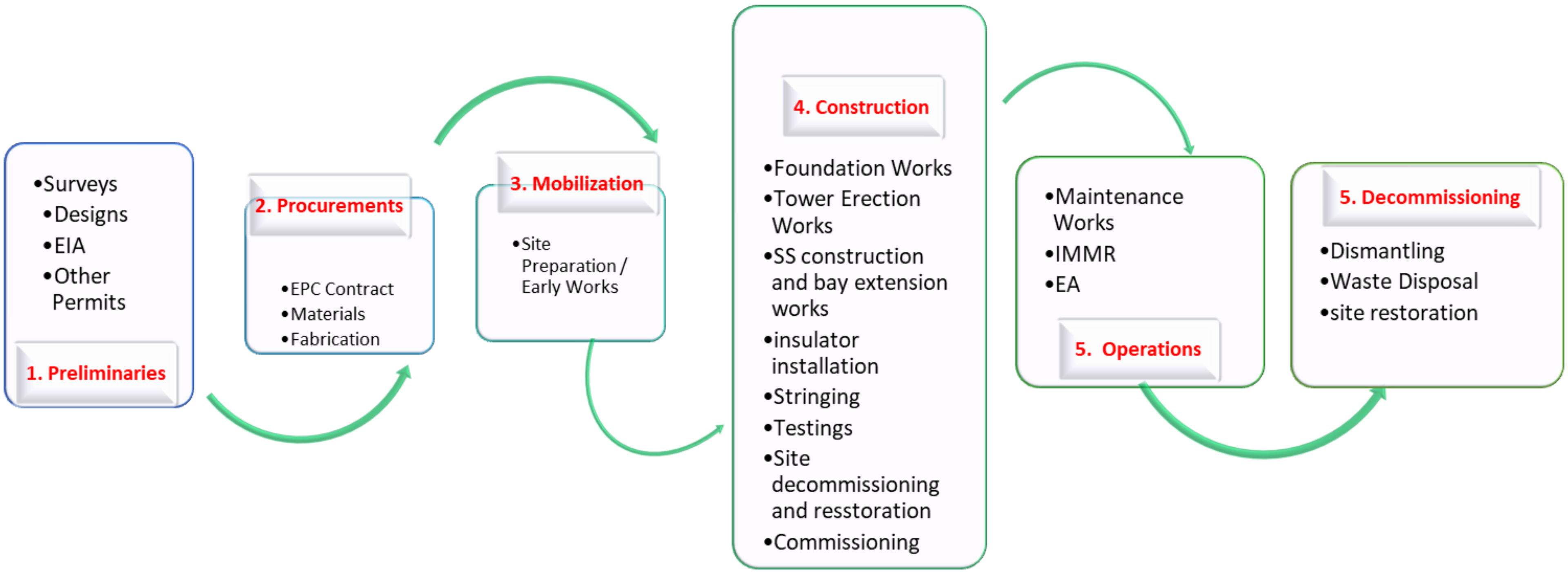


Figure 3.3.1: Proposed Work Flow Chart

A routing team consisting of environmental, a geotechnical engineer, and RoW experts has explored the area of the presently foreseen route. Upon their identification of the area's suitability, navigational positioning marked a preliminary route.

Referring to the evaluation results, the final route has been confirmed on site during a second routing campaign. The centre-line got marked. However, in sections, where the centre-line approximates any constraints, the required minimum clearances have been assured. The route maps have been updated, now showing the confirmed route and being reference for the subsequent route clearance from vegetation.

Upon confirmation of the final TL route the following were performed:

- Clearance of the route from vegetation over a corridor width of 1.5m to 3.0m;
- Establish required survey control along the TL route;
- Set-out and permanently mark the centre-line at an accuracy specified for the TL;
- Survey a longitudinal profile of the centre-line, with specific focus on high / low points, start / end of swamps, road, and water crossings;
- Survey all special points not limited to structures, buildings and obstacles 30m (for 132kV) and 50m (for 330kV) either side of centre-line to meet TCN standards for horizontal clearances;
- Capture additional topographic data at tower locations (15m x 15m), dedicated for towers (and definition of leg extensions);
- Update and finalize the route maps by adding all the above survey data.

3.3.2 Width of RoW

TCN typically use 30m as RoW width for 132Kv lines and 50m for 330kV overhead transmission lines. Factors considered include space to accommodate the lattice tower (wire zone) and safety buffer zone to provide safe limits for electromagnetic radiation as well as tower collapse.

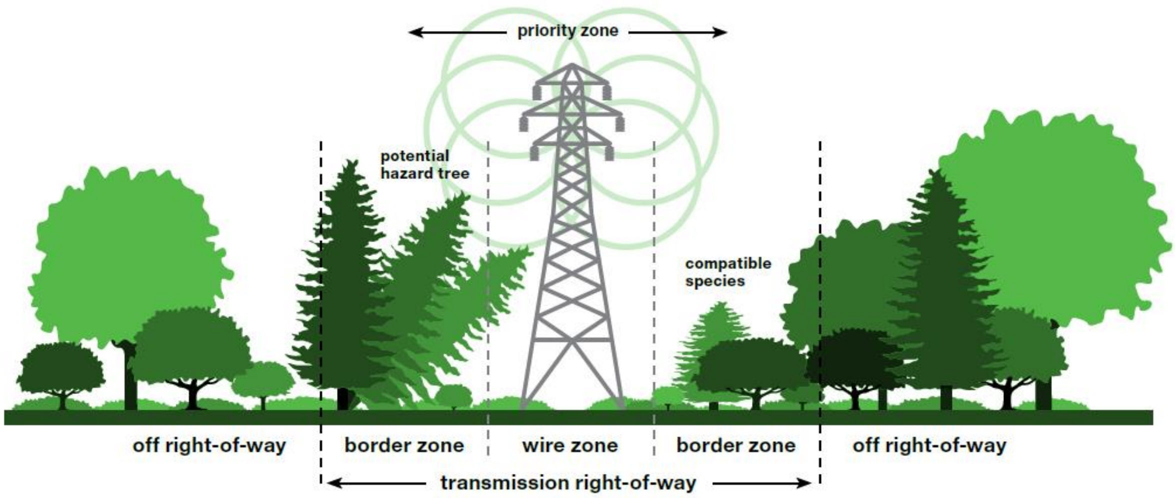


Figure 3.3.2: Transmission Right of Way

3.4 CONSTRUCTION ACTIVITIES

The construction program will have several discrete activities and these are described below. The specific pattern of construction activities will generally follow this sequence although some activities may be carried on concurrently.

3.4.1 Campsites / Logistics Bases

Campsites / logistics bases will be located at Likosi/Dejuwogbo, Redeem (Abule Oba) and MFM (Makogi) substations. Material storage during the construction of the lines will be restricted within the acquired RoW. The campsites / logistics bases at these locations will be required only for storage and fabrication, while workers shall be accommodated in existing hotels around the area.

3.4.2 Access Track Repair / Upgrade / Construction

Access to each structure location will be required for a crane, elevated platform, trucks transporting the materials and construction equipment, materials, and vehicles. Access will also be required to temporary sites needed for storing conductor drums, winching and braking equipment during the overhead earth wire stringing.

Apart from the existing community tracks (where they exist) which none in current condition will accommodate larger equipment necessary for the construction activities, several access tracks for the construction work will be require repair and existing ones upgraded. There are several specific locations where tracks and swamp crossings will require upgrading or access re-evaluated. These upgrades will be identified during detailed design and form part of the construction contractor’s responsibility.

The entire line route corridor has adequate existing roads and tracks that can used to access it. Hence, new tracks will be constructed only where necessary. Any access road to be upgraded will be limited to 5m, while tracks to be constructed under the line is limited to 3m. These will be used during construction and maintained for maintenance purpose. However, final route of access road will be determined in consultation with the landowner, giving consideration to environmental impacts. Where new tracks are required, road plant may be used to construct the track and for final trimming and construction of drains.

There is no specific need for continuous access along the entire route of the transmission line, although continuous access generally provides the simplest and least extensive method of access to individual structures and the proposed easement area. Access tracks will be upgraded progressively as construction works progress. There is no need to construct new access road along Lot 2 proposed Transmission Lines and substations.

Erosion and Sediment Control measures for all works will be implemented, in accordance with the respective regulatory standards. EPC contractors shall prepare an Erosion and Sediment Control Plan (ESCP) in accordance with regulatory standards and submit to FMEnv for approval prior to the commencement of works and maintain same during works. Measures may include installation of silt fences, straw bales, and drains. It is TCN's policy that the tracks be maintained in a condition suitable for the construction work until the completion of the works. The tracks are then maintained to ensure maintenance and inspection works can be undertaken during operation of the transmission line.

3.4.3 Foundation Construction and Erection

The construction of structure foundations generally involves boring or excavating a hole for each leg or pole, installing steel reinforcing and the stub leg, and then pouring concrete. All surplus soils from excavations and boring would be used in filling low lying areas of the access roads, provided that this soil is not polluted. Where the soils are contaminated, this should be reported to Ogun State Ministry for guidance on the most appropriate disposal depending on the nature and extent of contamination.

In poor ground conditions and for the heavier tension towers, more substantial foundations are required involving open excavation, the installation of formwork, pouring of concrete, and subsequent backfilling of the excavation. These foundations take longer to install and will cause more disturbance than the construction of bored tower foundations. In steeper terrain, it may be necessary to create a level bench at some tower sites to provide a working area for construction crew and equipment.

The construction of tower and pole foundations will require a workforce of approximately eight (8) persons, an auger type borer or backhoe excavator and arrangements for supply of premixed concrete, by truck. The construction of foundations for a typical tower or pole might take up to three days, although the time could be a week or more where difficult foundation conditions are encountered. Foundations will be under construction at several sites at any one time.

At each new tower sites, the crane and drill rig will require a flat platform to work on. Although the new tower sites are generally flat, there may be a need for the construction of a level pad. The pad will need to be cut into the slope close to the foundation site and access for concrete trucks will be necessary along the access tracks to each structure.

Erosion and sediment control measures will be implemented, and the level area will be retained and vegetation cover rehabilitated following completion of construction works.

3.4.4 Tower Construction

For this project the lattice tower type shall be used. The conductors are vertically arranged, and the earthing conductors are above conductors. Towers of overhead power lines consist of tower body, earth wire peaks and cross-arms. The transmission voltage, the number of circuits, the height of the towers and other aspects determine the tower design and material, whereby galvanized steel is used. The towers dominate the aesthetic impact of an overhead line, govern the operational reliability. They need to withstand reliably the conductor forces and external loads.

3.4.5 Conductor and Earth Wire Stringing

Following erection of the new structures at either end of the line, stringing of the conductors and earth wires will occur. A process known as "tension stringing" is normally used. This ensures that the conductors remain above ground at all locations in each stringing section. This requires specialized truck mounted equipment. This process will be undertaken gradually along the line as construction progresses.

The process of stringing starts with a light wire, called the draw wire, being fed through "sheaves", or pulleys, supported from the ends of the insulators. Where possible, the draw wire will be run along the ground between structures and through the sheave attached to each structure. The draw wire is then tightened and pulled into the air. Where it is not possible to run the draw wire along the ground, because of terrain difficulties, water bodies, roads or disturbance to vegetation, a nylon draw wire will be fed between two structures using a hurdle and catch cradle arrangement to support the draw wire above ground. The nylon rope will be held at tension above the ground and is "pulled through" the sheaves to draw the normal steel draw wire into the sheaves.

The draw wire will be attached to the end of the conductor and the conductor will be pulled through the sheaves. The conductors will be drawn from the drums and a braking machine applies tension to the conductor as it is pulled out. The tension keeps the conductor from touching the ground, or trees and other obstacles.

At the completion of the "pull", the tension in the conductors will be adjusted to ensure that correct ground clearance is obtained. The conductor will then be fixed in position at each structure and the sheaves recovered and moved along the line to be used again. Stringing requires specialized truck mounted equipment, known as the "winch" and the "brake", to pull out the conductor and to maintain and adjust the tension in the conductors. These two pieces of plant are normally positioned to allow up to 7 km of the transmission line to be strung in a single "pull". For this project the pull distance will be less due to shorter distances between tension structures and the need to minimize outage length. The conductor and earth wire are stored on reels, called "drums", approximately 2 m in diameter. Each drum holds about 3.5 km of conductor so several drums will be stored at each brake site. Plant required at each site includes the winch and/or brake equipment, trucks for delivery of conductor drums, and concrete anchor blocks. Winch and brake sites are normally located adjacent to tensions towers but can also be in the centre of a span. Sites that are relatively level and flat will be required to allow the drums to be maneuvered easily and safely.

The stringing operations will involve approximately 15 to 20 persons, spread over the section being strung. It is expected that each section of line will take several months to string with the actual "pulling out" of the conductors taking only two days. The rest of the time will be spent on preparation and final tensioning in between outage periods.

The stringing and tensioning equipment is normally truck mounted and does not require any specific earthworks or establishment activities. However, the stringing and tensioning activities will involve truck and vehicle access along the section being strung which may result in some surface disturbance. No specific erosion or sedimentation controls will be required however any incidental soil disturbance will be rehabilitated on completion of the construction program.

3.4.6 Substation Construction

The chart for the substations is shown in Figure 3.4.1
Construction activities for the substations will involve the following:

- Construction of the substation access road to Redeem (Abule Oba) substation while existing untarred road at Likosi/Dejuwogbo and MFM (Makogi) substations will be upgraded.
- Removal of vegetation within substation footprint.
- Terracing and levelling of the sites.
- Installation of foundations for infrastructure such as transformers, control room and radio tower: - The project area is made up of different types of soils and varying geological conditions which will require geotechnical studies. Excavations will be conducted to create holes for erecting or installing the pylons. After excavation, foundations will be constructed for supporting the pylons. The excavation and construction of the foundations shall involve the use of hand tools like crow bars, mixers, vibrators, trappers, etc. But in case of rocky areas compressors and drills will be used. The equipment to be used in project construction will require various forms of energy which will include manpower, charged battery or fossil fuel. The manual equipment to be used in the development project include crow bars, spanners and ropes. About 75% of materials for the substation construction is expected to come from offshore locations while 25% will be sourced locally.

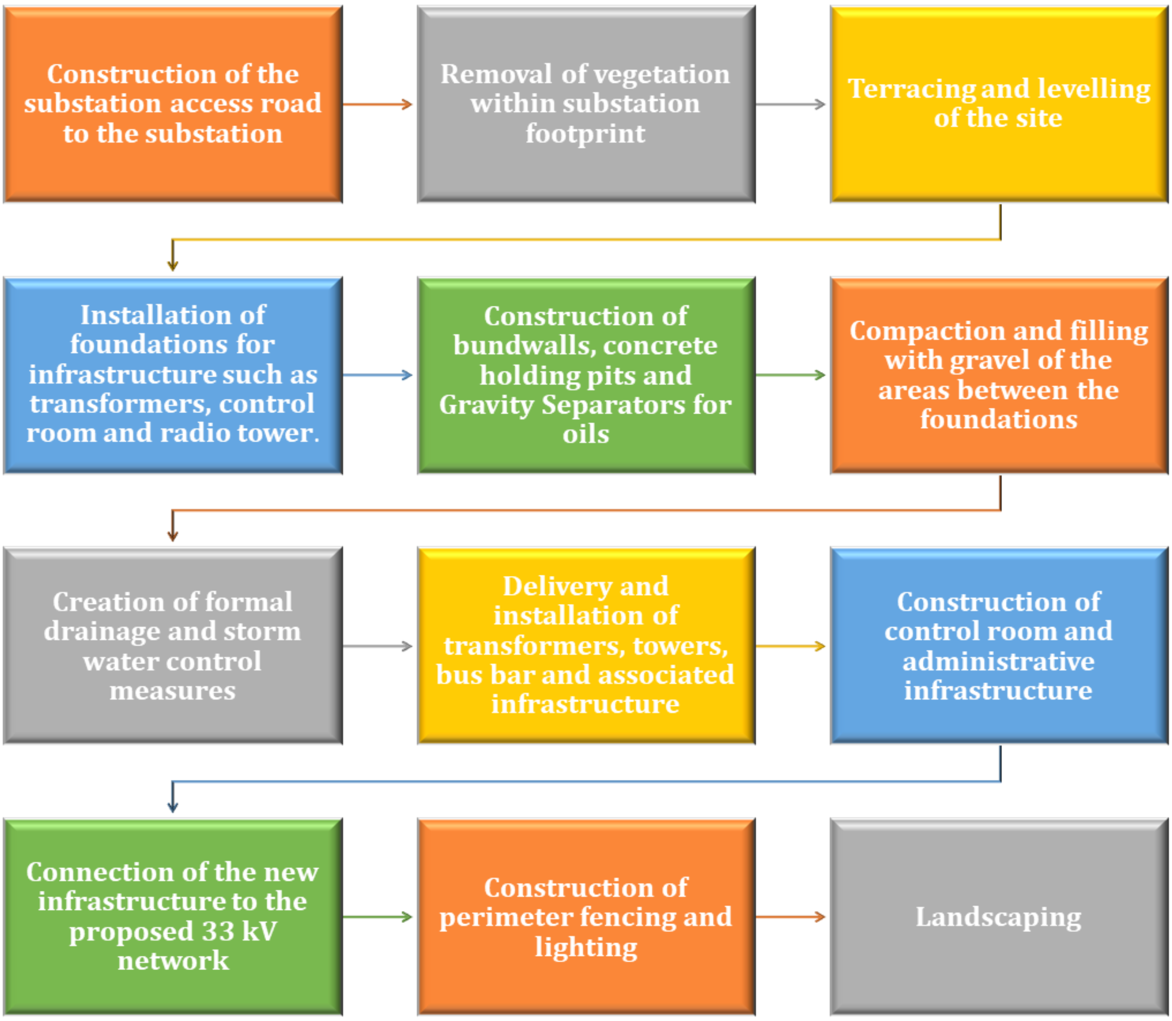


Figure 3.4.1: Construction Activities of the Substations

Fuel based equipment to be used will include mixer, vibrators, compressors, and drills. The construction of the foundations will involve masonry work and related activities. General masonry and related activities to be undertaken will include concrete mixing, construction of foundations, erection of steel tower and curing of fresh concrete surfaces. These activities shall utilize labour from the neighborhood to supplement some machinery works such as that by the concrete mixers. Thus, creating employment for the local population.

- Construction of bunds and oil holding dams (for emergency holding of transformer oil in the event of a spill) and wall safety walls
- Compaction and filling with gravel of the areas between the foundations
- Creation of formal drainage and storm water control measures
- Delivery and installation of transformers, towers, bus bar and associated infrastructure
- Construction of control room and administrative infrastructure
- Connection of the new infrastructure to the proposed 33 kV network
- Construction of perimeter fencing and lighting
- Landscaping: - After successful completion of the project construction work, the project contractor will rehabilitate the project sites that had been subjected to clearing by planting indigenous plant species.

3.4.7 Transportation

Transportation requirements during the construction period will vary per the work required at each tower site. For new structures, the vehicles likely to be used are as follows:

- articulated truck for steel sections and transformers delivery from Lagos (Tin Can or Apapa port where these offshore components of the required materials will be shipped through Ikorodu;
- non-articulated flatbed truck;
- concrete truck;
- track or 4WD mounted drill rig;
- crane;
- bulldozer/grader/excavator/backhoe;
- 4WD vehicles;
- elevated work platform; and
- brake and winch truck

The nomination above for the main earthmoving equipment will vary between the structure sites and will likely be transported to several sites at different times. For example, some foundation sites will require an excavator for the foundation work while others will only need a backhoe. It is not anticipated that earthworks requiring the use of a dozer would be required.

Each site would require an elevated platform or similar for connection of the conductor pulleys. For the stringing operations, two heavier brake and winch trucks and one truck delivering conductor wire, earth wire, and temporary anchor blocks will need access to specific sites along the route.

The EPC contractor shall prepare a Traffic Management Plan (TMP), as a part of the CEMP. TMP is to focus on the construction phase of the project and in addition, must also include (but not be limited to including):

- The management of the delivery of equipment;
- Access to and from structure sites;
- Work methodologies for restringing across roadways;
- Arrangements for temporary road closures;

- Parking; and
- Any security access arrangements.

3.4.8 Workforce and Hours of Operation

3.4.8.1 Workforce

The workforce engaged on the project will vary during the construction program and will be dependent on the specific activities underway. Labour requirements will generally be a maximum of 32 at each route, comprising approximately 10 on access track and foundation work, 10 on structure erection and 12 on stringing work, with several others engaged on miscellaneous other activities. As outlined above, it is anticipated that most activities will be undertaken gradually in accordance with the requirement to keep the existing line in service during peak demand periods.

3.4.8.2 Hours of Operation

Given the need to undertake most of the work in planned system outages, the construction program will include work outside normal construction hours and will include weekend periods as required. All construction activities that are likely to generate noise shall not be undertaken during weekend period.

3.4.8.3 Regulatory Requirements

The contractors shall ensure compliance with the following laws and regulations

- The Factories Act, 1987
- Wages Board and Industrial Council Act, 1974
- Workers' Compensation Act, 1987
- IFC Performance Standard 2: Labour and Working Conditions
- International Labour Organisations (ILO) requirements

These are elaborated in Section 1.4

3.4.9 Clean-Up and Final Inspection

The following steps will be taken to clean up the construction sites and conduct final inspection, preparatory to commissioning:

- On completion of works, the concrete shall be thoroughly cleaned.
- All packing and surplus materials from site and all rubbish and waste shall be removed as well as trees from transmission line right of way and access roads.
- Required burning permits shall be obtained, to comply with government regulations.
- There shall be no disposal of rubbish, waste or any debris in rivers and do not pile such materials in stream beds, river terraces, or any unauthorized place.
- Natural drainage in areas where temporary facilities have been made for construction purposes shall be restored.
- Access roads shall be restored to their original conditions.

Towers shall be inspected to ensure proper installation of all items including signs and accessories, hardware, dampers and spacer dampers, insulators and to ensure that bolts are tightened, no members and bolts are missing, conductors and overhead shield wires are properly sagged with specified clearances maintained, ground leads are removed and towers and foundations are installed within the specified tolerance. Inspection shall be carried out along the transmission line to ensure that rubbish and waste are disposed, fences are mended, holes and over-excavations are filled, drainage is restored, damages to property are made good and the transmission line right-of-way is reinstated.

3.5 OPERATION AND MAINTENANCE OF THE TRANSMISSION LINE

The proposed Transmission Line maintenance will be the responsibility of TCN. The maintenance is described in the following sections.

3.5.1 Structure and Conductor Maintenance

Once the transmission line construction is completed, maintenance patrols will make periodic inspections of the structures, the easement and the conductor and line hardware, taking note of clearance conditions, damage to components or evidence of vandalism.

3.5.2 Easement Maintenance

As outlined in TCN Easement and Access Track Maintenance Policy maintenance of the transmission line easement is necessary to ensure that the safe electrical clearances are not infringed due to growth of vegetation.

Generally, the easement will be inspected in conjunction with the inspections of the structures. If necessary, vegetation control activities will be carried out. Two basic types of control will be employed:

- Hand clearing: In sensitive areas or in areas too steep for mechanical control, hand clearing of re-growth is used. Only a portion of the re-growth is removed to keep the disturbance to a minimum. A team of up to 4 people could be used on this work; and
- Mechanical control: Tractor driven brush cutting equipment capable of clearing small trees are commonly used to maintain access tracks and where heavy re-growth is occurring within the easement. A work team of up to 3 persons could be involved.

In any section of the transmission line the easement does not contain any vegetation, but buildings and other infrastructure instead, it will be important to govern or restrict further development that impinges on the safe electrical clearances required for the 132/330 kV easements.

Nigeria Security and Civil Defence Corps (NSCDC) have legal responsibility for safeguarding national assets such as power lines, railway lines, pipelines and other public utilities. Therefore, it is NSCDC’s responsibility to prevent encroachment on transmission lines. However, TCN being the owner of these lines, shall facilitate and provide logistics support.

3.5.3 Rehabilitation Program

Disturbed areas (e.g., construction pads, winch sites and tracks) that are not required for future use or access will be shaped and seeded in consultation with each landowner. Rehabilitation of work sites will be carried out as work proceeds and as soon as possible after the completion of work on each site. A rehabilitation plan shall be included in the project's ESMP.

Erosion control measures, in accordance with the Blue Book will be implemented at each work site during the work period and following the completion of work at the site, measures to restore the pre-existing ground condition will be implemented and are further discussed in Chapter 5.

Re-vegetation techniques such as loosening of ground compacted by construction equipment, improving soil quality of excavated material spread around structure sites, spreading of fertilizer and grass seeding will be implemented as required. Special re-vegetation techniques will be necessary if acid sulphate soils are encountered. These areas may also require follow up maintenance to ensure that vegetation cover is successful.

In some areas, specialized rehabilitation works will be required or otherwise agreed with the landowners. As such, the ESMP that will need to be developed on a site-by-site basis to reflect the prevailing conditions and the level of rehabilitation required. Farmlands for example may prefer to leave the disturbed area tilled but not sown as they will be returned to vegetable production. Other areas, which may involve tree clearing, will require replanting of trees in areas located outside the easement and the agreement of respective land owners.
These trees will be replaced at a ratio of four to one and planted within the riparian corridor outside the easement. This work will be undertaken in consultation with all affected Local Government Councils.

3.5.4 Project Decommissioning/ Closure

This is the last phase of this project. Decommissioning of the substations and Transmission Lines will be affected when the active life of the substation has expired. The project will involve removing the substation apparatus and reclaiming the land where necessary. Equipment to be removed include:

- The transformers;
- Associated substation equipment; and,
- The substation fence.

The aim is to return the disturbed site to equivalent land capability following the substation decommissioning. The guidelines outlined under FMEnv and NESREA's Environmental Protection Guidelines for Transmission Lines for the reclamation of decommissioned substation sites will be applied in for the substations. These include:

- Assessing soil conditions;
- Protecting the environment during the decommissioning activities; and,
- Ensuring the site is reclaimed to the pre-disturbance land capability and is compatible with current adjacent land use.

Generally, if a decision is made to decommission the lines and SS, the following steps will be taken towards the process in the two study areas:

- Dismantling of the towers and condition
- Dismantling of tower foundations
- Removal of all material from transmission line

- Dismantling and all material and equipment within the substations.
- Restoration of land to its original situation as much as possible

3.6 PROJECT WASTES

A lot of wastes of different kinds are expected and generated during construction, decommissioning/dismantling, operation, and maintenance. Table 3.6.1 shows estimated quantity, sources, disposal method, place of disposal and the responsible party.

3.6.1 Waste Generation

Below is a list of envisaged project wastes and their potential sources:

- Leaves, branches, trunks, grasses from the clearing of the vegetation along RoW and Substation spaces.
- Kitchen wastes from human feeding and activities involving many workforces.
- Scrap metals – from cuttings, fittings, pylon member, nuts, bolts, and welding etc.
- Concrete waste – from foundations and plinths, including housing complex and control room construction.
- Nylons/Plastics – from human activities wrappings, water sachet, food etc.
- Oil spills from heavy duty machinery and equipment, transformers, breakers, and vehicle engines, either during normal runs of old machines or maintenance work.
- Human wastes – from activities of personnel involved in the work or secondary business group.
- Operational activities – nylons, paper materials/office, human waste etc.
- PCB is a toxic substance contained in certain transformer oil, which shall not be used in this project. Nevertheless, to control an accidental spill, provision shall be included in the project design for an API gravity oil separator as well as a bundwall or underground chamber as an integral part of transformer foundation is required to control PCB spillage.
- SF 6 is an inert gas which possesses very high insulation resistance to high voltage and also acts as a very good medium for high voltage arc quenching. It is therefore deployed in high voltage switchgear operations

The expected type and source(s) of waste for the Proposed Transmission Line and Substations project is summarized in Table 3.6.1

Table 3.6.1 Expected Type and Source(s) of Waste for the Proposed Transmission Line and Substations Project

Project Phase	Type of waste	Form of Waste	Source of Waste	Colour Code
Site preparation/ clearing	Degradable	Vegetation, kitchen waste	Camp, TLRoW	Green
Construction	Degradable	Kitchen waste	Camp, TLRoW	Green
	Mixed	Metal scrap, wood, Nylon/plastics, spilled concrete	Camp, TLRoW	Brown /black
	Sewage	Camp sites	Personnel	Black
	Hazardous	Spent oil	Heavy duty vehicles	
Operation and Maintenance	Degradable	Vegetation	TLRoW	Green
	Hazardous	Spent oils	Transformer	Brown/ black
		SF6 gas	Transformer / circuit breakers	Colorless and odourless green house gas

Source: Field Survey, 2017

3.6.2 Waste Disposal

Waste disposal methods will include:

- Composting of biodegradables
- Selling metal, wood, and plastic scraps to buyers
- Reuse of materials e.g., packages, concrete, etc
- Dumping of remaining wastes at approved sites

Sewage from site camps will be vacuum-sucked into septic tanked trucks and taken to the sewage treatment plant within EPC contractor facility. The EPC contractor shall contact these agencies during mobilisation stage to arrange the modalities.

Spent oils generated during transformer fillings, retrofitting and maintenance work will be stored in oil trench and oil sump at the substations and in line with requirements of the Basel Convention.

It is recommended to use mobile toilets at construction sites, and soak-a-way pits at camp sites.

3.6.3 Overview of emissions and wastes

3.6.3.1 Air emissions

Air emissions will be limited to fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles) during the construction phase of the Project.

3.6.3.2 Noise emissions

During the construction phase, noise will be generated by heavy equipment’s and truck traffic.

During the operational phase, the corona of overhead transmission line conductors and high frequency currents of the transmission line may result in the creation of radio noise in the form of buzzing or humming. Typically, a transmission line RoW and conductor bundles are created to ensure radio reception at the outside limits remains normal. However, periods of rain sharply increase the streaming corona on conductors and may affect radio reception in residential areas near transmission lines.

3.6.3.3 Electromagnetic fields (EMF)

The power transmission through the proposed transmission line during operational phase will result in development of electromagnetic fields (EMF). Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of electric current and increase in strength as the current increases. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building materials. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. It is expected that with the clearance requirements give in exposure will stay within the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

3.6.3.4 Solid wastes

Solid wastes will include sludge, food wastes, paper, batteries, glass, plastic, used parts, consumable items such as filters, packing materials, and other materials. A comprehensive waste management system will be in place that allows separation of waste streams to facilitate reuse or recycling. All hazardous materials, such as oily contained rags and filters, and batteries, shall be separated and stored separately.

To reduce waste, where possible the Project will require suppliers to provide consumable items in reusable containers or packaging. All wastes will be disposed of by waste registered contractors by Ogun State Ministry of Environment who have been licensed by the appropriate authority.

3.7 PROJECT SCHEDULE

TCN is strongly committed to the completion of the proposed Lagos and Ogun States Transmission Lines and substations, which have estimated life span of 50 years, and every effort is geared towards actualizing this goal. The proposed project execution schedule is presented in Tables 3.7.1, 3.7.2 and 3.7.3 (Gantt Chart) and indicates construction commencement in Q1 2019 and commissioning scheduled for Q1, 2022.

The implementation schedule for the construction of the transmission lines and substations would follow the under-listed duration. It should be noted that some of the phases and activities will run concurrently to save time.

Table 3.7.1: Implementation schedule for construction of Transmission lines

Transmission Lines		
Phase I	Phase II	Phase III
Pre-construction		
Line Route Studies ESIA RAP	Engineering Procurement and Construction (EPC) Final Acceptance Test (FAT)	Commissioning Project closure
12 months	24 months	3 months

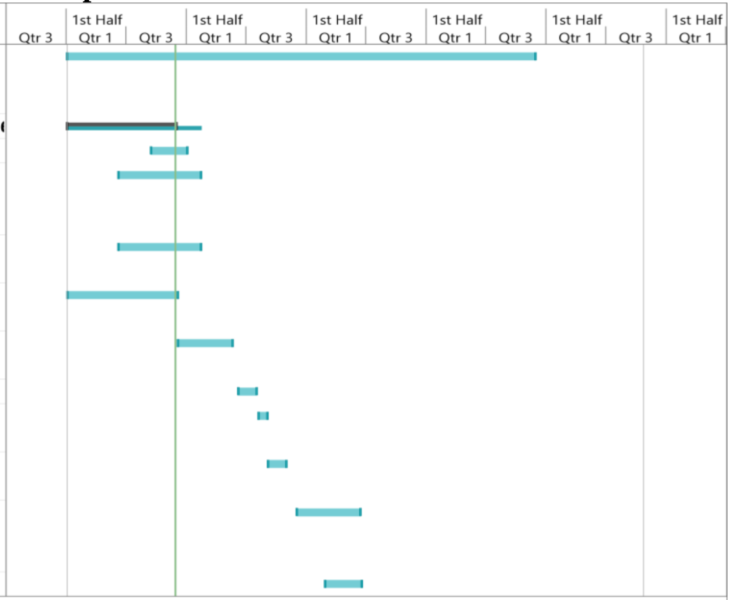
Table 3.7.2 Implementation schedule for construction of Substations

Substations			
Phase I	Phase II	Phase III	Phase IV
Design & Approval	Procurement & Manufacturing	Construction	Communication, Project closure
6 months	12 months	24 months (can run concurrently with part of phase 2)	6 months

Invariably, some percentage variation is allowed in the duration for contingencies. In that case, the average total duration for the entire project execution is put at 36 months. Construction works shall be scheduled at time crops have been harvested.

Table 3.7.3 Proposed Project Implementation Schedule

ID		Task Mode	Task Name	Duration	Start	Finish
1			**Lagos and Ogun States Proposed Transmissions and Substations Projects**	51 mons	Mon 04/01/16	Fri 29/11/19
2			**Feasibility studies**	**12 mons**		**Fri 02/12/1**
3			Line-route studies	4 mons	Thu 15/09/1	
4			Environmental and Social Impact Assessment (EIA)	9 mons	Wed 08/06/16	Tue 14/02/17
5			Resettlement Action Plan (RAP)	9 mons	Wed 08/06/16	Tue 14/02/17
6			Front End Engineering Design	12 mons	Tue 05/01/16	Mon 05/12/16
7			EPC contract award Process	6 mons	Tue 06/12/16	Mon 22/05/17
8			Mobilization	2 mons	Thu 08/06/1	
9			Check survey of EPC contractor	1 mon	Wed 09/08/17	Tue 05/09/17
10			Transmission line and substations detailed design	2 mons	Thu 07/09/17	Wed 01/11/17
11			Material production (tower members, conductor, insulator, line hardware)	7 mons	Mon 04/12/17	Fri 15/06/18
12			Material testing	4 mons		



Project: project schedule for afst.
Date: Tue 29/11/16

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	

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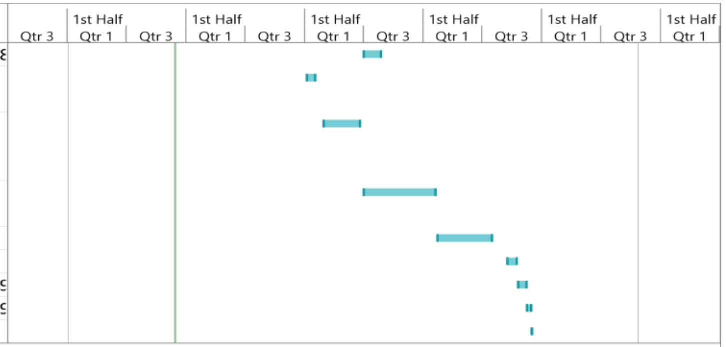
ID		Task Mode	Task Name	Duration	Start	Finish
13			Material shipment	2 mons		Fri 24/08/18
14			Clear and grub site along transmission line corridor	1 mon	Mon 08/01/18	Fri 02/02/18
15			Foundations for tower installation and substation works	4 mons	Thu 01/03/18	Wed 20/06/18
16			Tower erection and substation works	8 mons	Mon 02/07/18	Fri 08/02/19
17			Conductor stringing	6 mons	Fri 15/02/19	
18			Commissioning and testing	1 mon		
19			Reinstating and clean up	1 mon		Fri 15/11/19
20			Demobilization	0.5 mons		Fri 29/11/19
21			Commissioning	1 day		



Project: project schedule for afst.
Date: Tue 29/11/16

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	

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3.8 DESCRIPTIONS OF THE TRANSMISSION LINES

Project Location

The proposed transmission line routes traverse through Ewekoro, Ifo, Sagamu South, Sagamu west and Obafemi-Owode Local Governments Areas. The details of the Transmission Line Routes are as follows;

Proposed Ejio – Likosi/Dejuwogbo 330KV Transmission Line Route

The transmission line is 330kV double circuit between Ejio substation (formerly known as Arigbajo Substation) and Likosi/Dejuwogbo Substation (formerly known as Ogijo substation). The transmission line starts from the proposed substation site at Ejio in Ewekoro LGA and terminates at Likosi/Dejuwogbo in Sagamu Local Government Area. The transmission line runs about 2km Southward parallel with Papalanto – Sagamu road up to Ogun River. After crossing Ogun River, the transmission line deviated North-Eastward towards Papalanto - Sagamu Road so as to avoid a densely developed Ofada/ Loburo community and its environs. The route crosses Lagos – Ibadan highway around Wichtech Company through the forest and southward to Likosi/Dejuwogbo substation. It passes through farmlands, forests, swampy land, undeveloped parcels and several communities. It lies in between latitude (757004mN, 748860mN) and longitude (523425mE, 558844mE). The length of the transmission line route is approximately 48.74km (Figure 3.8.1).

Proposed Likosi/Dejuwogbo – Existing Ikorodu/ Shagamu 132kv 2 x D/C Transmission Line Route

The transmission line route starts from the proposed substation site at Likosi/Dejuwogbo and terminates at Existing Ikorodu/ Sagamu 132kv transmission line beside Thames Valley College in Sagamu Local Government Area and traverse parallel to the existing Ikeja West - Omotosho 330kv TL. It lies in between latitude (748860mN, 748572mN) and longitude (558844mE, 561285mE). The length of the transmission line route is approximately 2.41km (Figure 3.8.1).

Proposed Likosi/Dejuwogbo – Redeem Transmission Line Route

The transmission line is 132kV double circuit from the proposed substation site at Likosi/Dejuwogbo and terminates at the proposed Redeem substation in Sagamu LGA. It passes through existing right of way of existing Ikeja West - Omotosho 330kv TL and branched into part of Shimawa town into the proposed substation site within the premises of RCCG beside the 3m x 3m New Auditorium. (Figure 3.8.1)

Proposed MFM – Existing Benin (Omotosho)/ Ikeja West 330kv 2xD/C Transmission Line Route

The transmission line starts from a point (30m away from existing Tower) at Gan-un village along Existing Ikeja West - Omotosho 330kv TL to the proposed MFM Mountain Top University Substation in Obafemi/Owode LGA. It passes through partly developing swampy area through thick swampy forest to MFM's Mountain Top University substation site at Makogi It passes across an existing NGC Gas Pipeline. It lies in between latitude (746261mN, 741048mN) and longitude (541935mE, 541033mE). The length of the transmission line route is approximately 4.99km (Figure 3.8.1).

The design for construction and installation project components, auxiliaries and ancillaries was based on the practices recommended by a consistent set of local and international codes and standards that had been systematically selected according to their section of relevance to all components of this Transmission Line project.

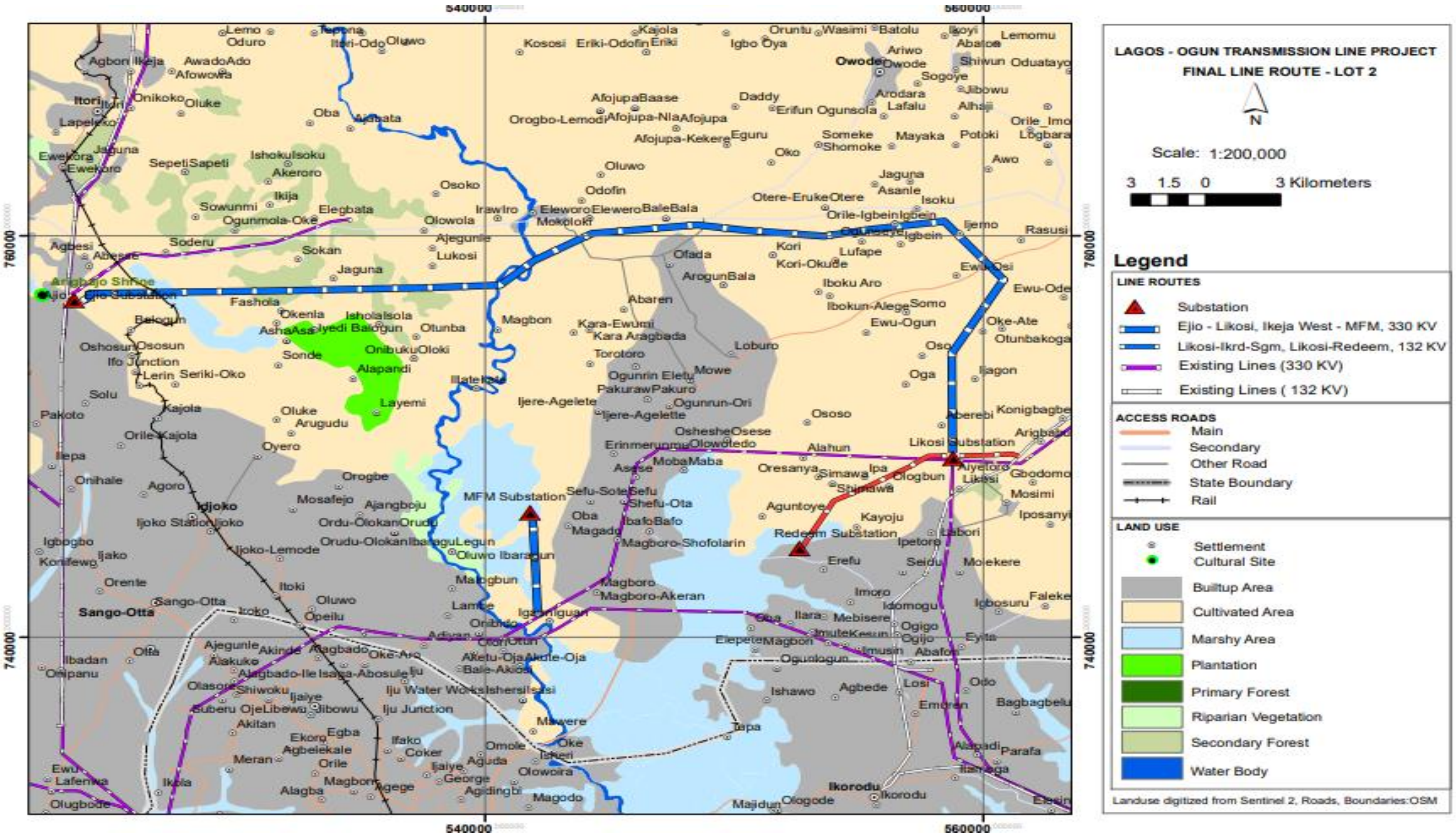

Figure 3.8.1: Location of Proposed Transmission Lines and Associated Substations Projects for Lot 2

3.8.1 Proposed Transmission Lines Engineering Characteristics

i Terminologies

In the process of implementation of the project, the following terminologies shall be used:

a. Structure: It shall be taken to be synonymous with the words “tower”, “transmission structure” or “transmission tower”.

b. Span Length: It shall be taken to mean the horizontal distance between the centre-lines of adjacent towers.

c. Standard Span Length: It shall be the span length assuming level ground, which is considered to be the most economic average span.

d. Standard Tower Height: It shall be the tower height required to provide minimum ground clearance over open land, based on level ground, standard span length and the final unloaded conductor sag at 75^0 C.

e. Wind Span; It shall be on half (1/2) the sum of the lengths of the immediately adjoining spans.

f. Weight Span: It shall be the horizontal distance measured between the lowest points of the sags in the spans immediately adjacent to the structure. This distance is to be the most critical measured at any conductor or ground wire temperature during initial or final sag.

g. Tower Height: It shall be the height of the lowest conductor at the tower above the natural ground at the centre of the structure.

h. Right-of-way width: The distance from the centre-line of the transmission lines to the edge of the right-to-way shall be 15 meters. For a single or double circuit transmission line on its own right-of-way, the total width of the right-of-way shall be 30 meters for the 132kV and 50 meters 330kV.

Tower centreline to tower centreline clearance for parallel transmission lines

The distance between the transmission line centre lines of any voltage to be the larger of Y1 or Y2. Y1 = 50 meters

Where:

Y1 = Distance from centre line of transmission line (A) to Line (B) and

Y2 = (X + 1) + F + G

Where:

Y2 = Distance from centre line of transmission line A to centre line of transmission line based on the criteria that transmission tower of line A falls towards line B or tower of line B falls towards A, whichever is critical.

X = Distance from centre line of line A (or line B) to the end of its lower cross arm (m).

F = Total height of maximum height tower of line (or line A) where maximum height tower is defined as required tower height for a level span length of 1.2

times the design suspension tower wind span (m) or for existing lines, the actual total highest structure.

G = One-half the ground line spread of the maximum height tower of line B (or Line A) (m).

3.8.2 Line Design Inputs

Network Requirements

The network requirements quoted in Table 3.8.1 underpin the designs recommended for the proposed power transmission lines.

Table 3.8.1 Network Requirements

Factor	Value	Source
Network nominal voltages	330/132 kV	TCN Criteria
Normal operating range	±10%	
Equipment highest voltage	362 kV	
Minimum required lightning/surge impulse withstand	1175 kVp	
Short time withstand: • OPGW • Overhead earth wires • Phase conductors	56kA for 270 ms 56kA for 200 ms 56kA for 270 ms	

Physical Environment

Line designs have been based on the following physical environmental conditions as presented in Table 3.8.2.

Table 3.8.2 Rated Physical Environment

Factor	Value	Source
Conductor rating: Maximum ambient temperature	40^0C	TCN
Solar radiation	18.2 – 20.0$Wm^{-2}day^{-1}$	Nimet
Wind speed	(4.1 – 6.74) knots	Nimet
Keraunic level (Ave. annul thunder days)	11	Nimet
Everyday temperature	(28 – 32) ^{0}C	Nimet

Maintenance Provisions

The Transmission Lines are high security lines. As such, future planned outages for maintenance or new load/generator cut-ins will be very difficult to obtain. Aligned with standard industry practice, TCN allows live line maintenance for 330kV transmission lines. The maintenance policy is to use the live bare hand methodology, with a minimum safe approach distance of 2,030mm (for the live line maintenance clearance requirements).

Design Life and Reliability Requirement

TCN is adopting the industry standard design working life of 50 years for transmission lines and their components. Reliability level 3 (LR=3) is selected which is applicable to the 330/132kv transmission lines. These factors correspond to wind return period of 200 years.

Applicable Codes and Standards

All known and agreed internationally accepted code and system regulations have been reflected in the codes and standards deployed in the manufacture and installation of 330/132kV DC transmission lines network components. A typical code and standard include.

System Parameters for the transmission line:

Electrical:

- 50m (for 330Kv) and 30m (for 132kv) ROW
- 400m - 450m (for 330Kv) and 325 – 350m (for 132kv) span between line towers
- 42m -57m (for 330Kv) and 28m - 32m (for 132kv) height for 330kV DC suspension tower (see Figs 3.7 and 3.8)
- 4.5 tonnes (for 330Kv) and 2.8 tonnes (for 132kv) weight suspension towers.
- Normal Voltage 330kVrms (for 330Kv) and 132kVrms (for 132kv)
- Highest Voltage – 362kVrms
- Frequency – 50Hz
- System grounding effectively earthed system
- Basic insulation level 1135Vp switching impulse level 950kVp
- Power frequency withstand voltage (wet) 450kVrms
- Short circuit level for Isec 31.5kA
- Corona extinction voltage 230kVrms
- RIV at 230Vrms (uv at 1MHz) 1000

3.8.3 Structure Plotting

A plot of the proposed locations shall be on the plan and profiles such that the following criteria are satisfied:

A) The wind span and weight spans shall both be within the design limits for the tower for both the conductor and overhead ground wire. The ratio of weight span to wind span for the conductor at maximum temperature unloaded, initial condition shall not be less than 0.5 for suspension structures. The ratio of ruling spans on each side of strain towers shall be within design limits of the tower.

B) For strain towers, the maximum weight span on any side of a tower shall not exceed the span used to calculate the design vertical load on that side of the tower. The weight to wind span ratio on suspension structures shall be such that insulator strings do not swing beyond their design limits. Counterweights may be used to limit side swing. The conductor overhead ground wire and OPGW shall not be tensioned beyond the limits specified in sections 10, 12 and 14. Maintain the minimum clearances. When plotting, add not less than 0.5m to the minimum ground clearances to account for minor errors in profile, etc.

C) Leg extensions shall be used as required to compensate for sloping ground at the structure site. The final span to the substation line entry structures shall be “slack spans”. When crossing over communication lines, distribution lines, or pin insulated power lines, maintain the specified clearances assuming the top wire(s) of the line being crossed over is a straight line extending from support to support. When crossing over major highways, dual carriage ways and railways, adjacent suspension type structures with square cross arms and a complete suspension insulator assembly shall be provided at each corner of the cross arm. Structure spotting using Autocad software shall be done using the optimization routine in order to achieve the lowest total cost taking into account towers and foundation.

D) Minimum Clearances in metres at 750C (conductor temperature) 330kV.
   a) Vertical Distance: Normal ground 8.0 6.7, road crossings 9.0 8.3, buildings, pole structures, walls and cradle guards 5.2, 5.0, limited access motorways and dual carriageways 10.0, 10.0, navigable waterways (at high water level) 15.0 15.0, pipelines (oil, gas, water) 10.0 10.0 communication and power line wires 4.6 3.6 and cradle guard to top of railway track 9.0 8.3.
   b) Horizontal Distances: Nearest steel of transmission tower, to edge of navigable waterways, pipelines, bridges, highway pavement, railway (nearest rail), buildings on right-of-way and at crossings, to structure of line being crossed 50.0, 50.0.

E) Route Selection: The routes shown on the Route Plan represents the preferred routes, taking into account such aspects as soil conditions, access, right-of-way acquisition costs, and avoidance of built-up areas. Distances between paralleling transmission lines shall be as determined herein.

F) Right-of-way Clearing and Access Roads: Clearing transmission line right-of-way shall mean cutting, removing and disposing of all trees, brush, fallen timber and debris from the transmission line right-of-way.

G) Work Involved: The work of this section consists of the clearing of the right-of-way for transmission lines and shall include all measures and materials to clear the right-of-way as specified. Work also includes the preparation of the permanent access roads.

H) Anger Trees: This shall mean any tree outside the right-of-way which, when falling towards the line will pass within 1.5 metres from either the tower steel or the conductor at its vertical position. At the maximum or minimum sag, access road and access to the line right-of-way from existing roads/tracks shall also be shown.

Tower Foundations:
Tower foundation shall mean the tower footing and footing and the supporting soil, which together resist the applied tower loads. Tower footings are the structural element (piles, grillages, pad and chimneys, etc.) that transmit the load to the soil. The soil types and soil engineering parameters shall be adequate and properly taken into account.

For this project, the determination of type and size of a tower foundation, soil details from geotechnical investigations shall be used and complemented with additional investigations where required. All foundations shall make adequate provision for horizontal shear forces at the ground line. The foundation types chosen for the proposed TL project shall be constructed using concrete and reinforcement as major materials. Due to the possibility of the corrosion of foundation materials by underground water, surface water and soil, the following shall be used: The foundation protection thickness shall be enlarged to over 50mm while the top of the foundation shall be minimum 500mm above ground level.

I) High strength concrete shall be used.
J) Antiseptic such as bitumen shall be applied on the area that shall have direct contact with the soil.
K) Specific high-grade cement shall be used in the concrete mixture.

Standard Foundations

Standard foundations for towers shall be concrete pad and chimney. The height of the chimney shall be determined according to expected buoyancy (e.g. floods, tidal water level changes). The use of displacement method for calculating bearing pressure in pad and chimney foundation, reducing the unit weight of concrete in account of excavated earth overburden shall not be accepted.

Special Foundations

In areas of low soil bearing capacity, special foundations will be required for the set-up of TL towers. Special foundations comprise but are not restricted to:
L) Pad and chimney with enlarged pad (soil bearing capacity!)
M) Raft foundations (soil bearing capacity!)
N) Pile foundations,
O) Combined pile and raft foundations

For design of these foundations, special considerations shall be made concerning water levels, buoyancy, concrete quality, etc.

Transmission Lines Design for Actual Conditions:

The design and foundation selection shall be done based on the actual ground conditions at each site, taking into account the differences in design methods applicable to granular and cohesive soils and considering the maximum and minimum ground water elevation at each site, whichever is critical, in the determination of the foundation and protective requirements. Initial identification of the soil type has been based on visual examination of the soils present throughout the length of the RoW. Soils have been identified as either granular or cohesive on the basis of the field identification procedures.

Loading on Foundation: The foundations are designed from the loads worked out from the tower design at the base of the tower and these loads are increased by 10% in case of suspension tower and 20% in case of tension tower. These loads are considered as working loads for the design of the foundation.

3.8.4 Fabrication and Manufacture

Reinforcing Steel

The EPC Contractor shall make bends in reinforcement to shapes shown on the drawings and bar schedules; make bends around mandrels to achieve the specified bending radii; discard bars with cracks or splits; and for concrete filled pile caissons, ensure that the reinforcing steel extends the full length of the pile element.

Structural Steel

All structural steel shall be fabricated in accordance with the tower supply specification applicable to this project.

Installation

Ground levels existing prior to the construction of foundation shall be considered in determining tower heights and individual single leg extensions. The material shall be disposed and the movement of equipment so regulated that disturbance of the original grade is kept to a minimum.

Protective Measures

Foundations shall be provided in seasonally dry riverbeds, or drainage channels, with appropriate erosion protection measures. Foundations shall be provided for steeply sloping ground or erosion sensitive sites with adequate support to prevent loss of backfill.

Excavation

The base of the foundations shall be set within the specified allowable tolerances, to the specified depth. Any over-excavations shall be filled with compacted suitable materials to bring the excavation to the required elevation.

Backfill

Backfill shall be excavated materials. It shall be clean from organic or other deleterious substance. Backfill from any other source shall be subject to the agreement of the engineer. Compact backfill will be done by tamping in 150mm layers, before compaction, for the first 1000 mm above the bottom surface of the excavation. The remainder of the backfill tamp in layers shall not be more than 200mm. After compaction, backfill shall have at least the minimum density used for uplift design of the foundation. Backfill in every location shall be built up to a minimum of 300mm above the surrounding ground surface to allow for settlement. Backfill shall be placed only in dry excavated holes or in holes kept dry by pumping out any water in the hole using a surface pump. Under no circumstances shall backfill be placed in an excavation where water is present.

Concrete

Concrete work shall conform to all requirements of the latest editions of ACI 301. Specifications for structural concrete building, except as modified by the supplemental requirements below:

The use of earth cuts for forms will be permitted, provided adequate cover is maintained for reinforcement. A 40mm x 40mm chamfer shall be provided on external corners and edges of concrete exposed to view. Testing will be carried out as specified in Field Quality Control.
Formwork shall not be disturbed until concrete has hardened adequately. Reference may be made to ACI 347 for recommended times of removal of forms. Welding of reinforcement will not be permitted. For concrete filed pile caissons, reinforcing steel shall extend the full

length of the pile element. Placement of concrete underwater will not be permitted. Finishing of exposed formed surfaces shall be as specified in ACI 301 Chapter 10 for the following:

P) Rough form finish;
Q) Smooth form finish;
R) Finishes of exposed slabs shall be as specified in ACI 301 Chapter II for the following:
S) Broom or belt finish;
T) Trowelled finish.

The top of all concrete foundations shall extend at least 500mm above the ground.

The slope of the top of the foundations shall be away from the tower legs.

Steel Work

Bases of grillages will be set firmly on and in complete contact with undisturbed soil or backfill used to fill over excavations. Grillages shall not be set on organic material.

Piling

Piles shall be driven in such a sequence as to minimize the detrimental effects of vertical and lateral displacement of the ground. When a pile has risen as a result of adjacent piles having been driven, the defect shall be corrected. Driving shall not be carried out close to recently cast concrete which has not attained sufficient strength to withstand the vibration.

Casing of Piles

The inside surfaces of the casing to receive concrete shall be cleaned prior to placement of concrete.

Towers

EPC shall ensure that all concrete foundations or rock anchor grouting have cured for the minimum period specified (at least 21 days) and that all backfill is compacted to its approved level before placing or erecting tower steel on the foundations.

Tower height specified is the height of the bottom conductor above the natural ground at the centre of the structure. Towers shall be assembled in accordance with the approved TCN's guidelines (see 3.8.5 (i-iii) below).

Tower Erection/Accessories

Towers shall be erected based on the approved design and all accessories shall be attached such as anti-climbing devices; cattle, birds and cradle guards; circuit plates (2 nos. for D/C towers), phase plates, danger plates, number plates aerial identification signs, step bolts and ladders, etc. Tower painting shall be ensured as prescribed. Specific requirements for painting, if required for the project, shall be provided by TCN. Stub templates above the base shall be provided as necessary to ensure correct position of the stubs during setting and concreting of foundations.

Tower Configuration/Extensions

The towers shall be self-supporting, latticed double circuit vertical configuration structures with one overhead ground wire and one OFGW for the lines. The 4-circuit towers shall be provided with 2nos OFGW instead of one OFGW and one ground wire. Opposite faces of the towers shall be identical but adjacent faces may be dissimilar. Each tower type is designed so that the tower height is compatible with and connect directly to the bottom of the common body. Individual leg extensions shall be interchangeable in any combinations and shall be compatible with and directly connected to any leg position of the common body or body extension of a particular tower type. The body extension shall be in the steps of 3m, 6m and 9m and leg extensions in the steps of 1.0m and 2m.

3.8.5 Line Insulation and Fittings

Insulators Type Analysis

The following three types of insulators are considered:

- Porcelain discs
- Porcelain Longrod
- Polymeric Longrod

Comparative Costs

Polymeric longrod has not had the same service history as porcelains and therefore its longevity has not been as well established as that of the latter type.

Manufacturers and users of polymeric insulators have indicated that the industry assessment, at this point in time, points to a lifetime of about 25 years.

Porcelain ceramic insulators, on the other hand, have a service history of over 50years.

It is evident from the cost analysis that although the porcelain disc insulator presents higher capital cost, porcelain disc insulators are the most economical insulators.

Line Fittings

The line fittings design will be in accordance with standard fittings assembly. The design will include armour grip suspension units, spacers and dampers. The tension insulators assemblies will include grading rings to reduce the effects of corona.

3.8.6 Structure Suite Selection

Functional Requirements

The objective of this section is to determine the most economical suite of structures that can cover all possible functional requirements of proposed Transmission Lines.
The high-level inputs to this process are as follows:

- wind strength and special wind conditions

- environmental and community engagement inputs
- line route and terrain
- visual impact issues
- special clearance requirements

The process of structure suite selection consisted of:

- Determining the possible combinations of tower types and functional requirements.
- Refining the tower suite to obtain the most optimal use of towers, i.e. taking into consideration cost of developing each different tower type and utilizing towers for multiple applications.
- Determining the actual angles for which the towers will be designed that optimizes their usage over the various angle requirements of the line route.

Structure Type Optimization

In determining a suite of structures for the transmission lines, the following tower types must be included:

- Suspension structures (designed for 0 or less than 5-degree deviation)
- Heavy suspension structures (to cater for 5 or more degree deviations). This option may be used where there are many small angles in the line route.
- In line strain structures (applicable only for line constructability on long transmission lines)
- Strain structures (designed for major line angle /deviations)
- Terminal structures (for terminating the transmission lines prior to entering the substation).

Table 3.8.1 displays all the initial tower type combinations available for the proposed TCN PTL route.

Table 3.8.1 Structure Types Selection for the proposed PTL project

Region Tower Types	Light Suspension	Heavy Suspension	In-line Tower	Strain Tower	Terminal Tower
Low – Medium Wind Area	✓	✓	✓	✓	✓
Strong Wind loads Area	X	X	X	N/A	N/A
Low Profile Tower Area	✓	N/A	N/A	N/A	N/A

Source: TCN

Lost Angle Optimization of Tower Types

The suite of towers identified above comprises a combination of suspension and angle tower types. To determine the angles for which towers should be designed that will be cost effective, a lost angle analysis was carried out. The lost angle analysis reviewed the nominated tower angle and compared its suitability against the actual deviation on the line route.

The difference in angle between the nominated tower angle and the deviation is considered a "lost angle". The average of this "lost angle" is compared with the total cost of the angle towers and the cost to develop and test a new tower.

The analysis considered various angle tower combinations and it shows that the most economical option is to design 4 angle towers that can be used to cover the following range of deviation angles:

- 0-0.4 degrees (0 deg suspension)
- 0.4-5 degrees (5 deg suspension also 0 deg in inline strain)
- 5-15 degrees (heavy suspension based on 45deg angle strain body)
- 15-45 degrees (strain)

Section Length Requirement

The structures are designed with longitudinal strength similar to the transversal direction and are fully capable of dissipating a shock load within the next two or three spans and to prevent the cascade failures. This eliminates any need for stop structures.

3.8.7 Tower Geometry

Phase Conductor Cross Arm Separation and Length

The line is designed for live line maintenance. As such, the power frequency and impulses do not only determine the geometry withstand clearances required, but also by live line maintenance approach and working distances. A minimum safe approach distance of 2,030mm for live bare hand work is required for 330/132kV line.

For low wind periods, the wind pressure used in calculating the swing angles is 0.1 kPa. For high wind periods, the wind pressure was calculated for a 200-year wind return period and converting the 3 second gust to a 5 minutes gust. The 5-minute guest wind will provide a satisfactory operational performance with a probability of exceeding the calculated swing angle of 1%.

Lightning Protection and Earthing

The earth-wire cross-arm length is calculated to provide adequate shielding to prevent a shielding failure occurring in an area with a keraunic level of 10 as indicated in NIMET map of thunder days.

The earth-wire is placed above each top phase conductor at the same vertical distance of the vertical phase to phase separation of the line designed for de-energized maintenance as opposed to the live line design. This is due to the increase in length in phase to phase separation for a live line design. Industry practice has shown that de-energized maintenance distance for earth-wire to phase is adequate to avoid flashover.

3.8.8 Structure and Foundation Requirements

- Basis of Design: The structures have been designed to withstand minimum loading requirements.

- Structural Reliability: As mentioned earlier, the design life of the proposed PTL is 50 years with a reliability level of 3, which correspond to 200 - year wind return period.
- Design Actions
- Wind Loading

The site-specific wind parameters are based on the fact that the majority of the line is orientated west to east and passes through open terrain.

A detailed examination of topographical maps indicated that most the line did not have any issue with increased wind pressure due to local topographical features such as funneling or expansion in valleys, hills, and escarpments.

In addition, the design considers the seasonal change in wind strength.

The structures are designed to withstand the wind combinations as follows:

- Transversal wind;
- Oblique wind 22.5° inclination to transverse axis;
- Oblique wind 45.0° inclination to transverse axis;

Failure Containment Load

The structures are designed to withstand unbalanced longitudinal conductor tension due to failure of adjacent structure by considering the equivalent longitudinal loads resulting from not less than any one third of all phase conductors on the structure being broken with a nominal coincident wind velocity of 0.25 times the ultimate wind pressure.

Maintenance and Construction Loads

To minimize the structural loads on tower and provide suitable stringing methodology the maintenance loads are considered for each complete phase or overhead earth-wire being worked on in turn.
The conditions are based on the worst weather conditions under which maintenance will be carried out. The limiting wind velocity for maintenance work was taken as 10m/s (industry work practice).

3.8.9 Detailed Tower Design

The PLSCADD method for detailed tower designs is performed to the extent required to extract the tower properties necessary for line optimization analysis such as tower geometry, member sizes, and tower weight and tower models for PLSCADD optimum spotting and performance verification checks.

The tower models are designed using PLS-Tower software package and inserted in the PLSCADD line profile for optimal spotting (level 2 modeling). The structural and electrical performance verification was carried out by using level 4 models and finite element analysis (FEA). The FEA method calculates interactions between the tower members and attached conductor loads by including structure flexibility matrices and hence produces more realistic and more economical results compared with the traditional non-interactive model approach.

3.8.10 Material Selection

Towers shall be of steel material using hot rolled angle (90^0) sections and plates. In general, the following grades of steel shall be applicable:

- Mild steel shall be Grade 250 (for plates) and Grade 300 (for angles)
- The recommended high tensile steel shall be Grade 350L0.

Since the responsibility of costly and time-consuming production of steel fabrication drawings are with the contractor and can only start after the steel standard is approved, any change of steel standard is expected to have a limited influence on the project.

3.8.11 Tower Acceptance Testing

All tower types will be required to be full scale prototyped and then load tested prior to full production to demonstrate that the developed designs meet the quality requirements of TCN technical specification.

The load tests are required to verify the force distribution in the tower members and assess the efficiency of secondary bracing elements for each tower design.

All load tests will be in accordance with IEC 60652 with agreed test procedures to simulate design conditions as closely as practicable.

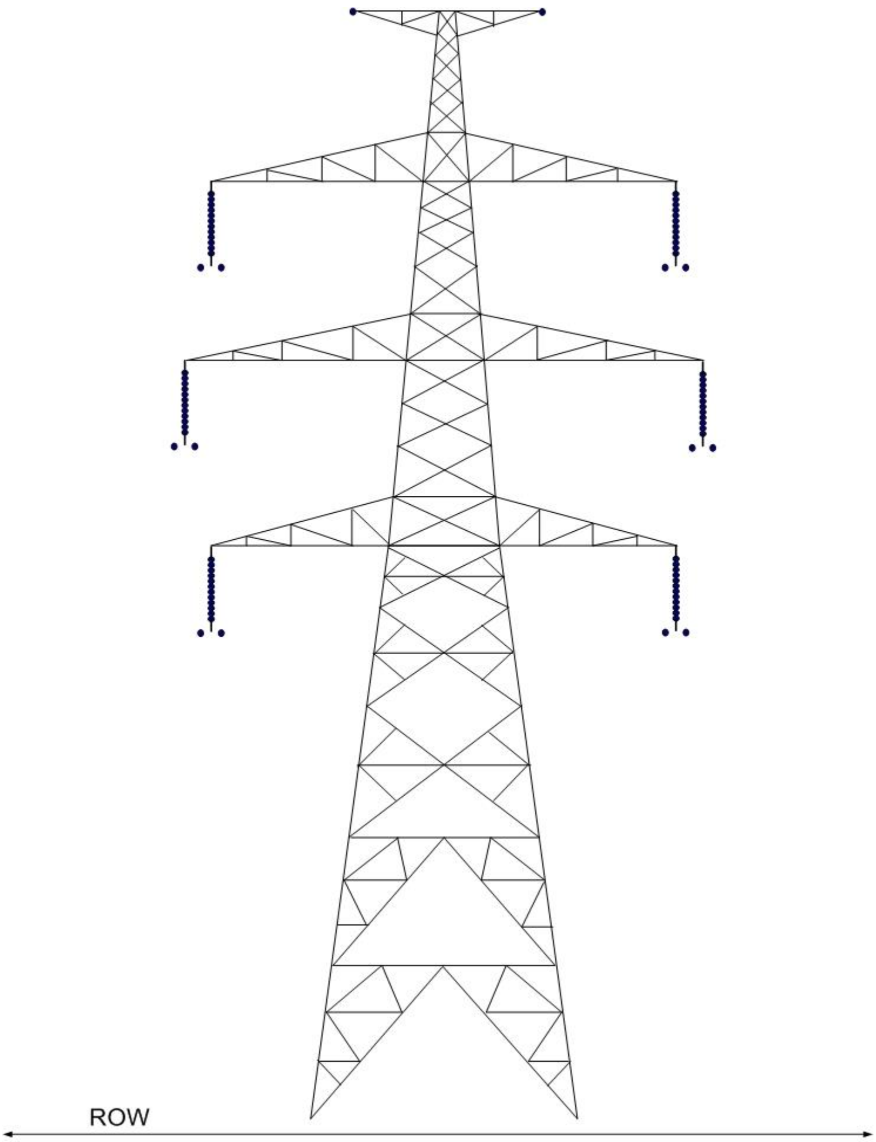

Figure 3.8.2: Typical Double Circuit Lattice Tower

3.8.12 Foundation Selection and Optimization

The following foundation types are considered on the basis of soil types encountered:

- Bored undercut foundation which is formed by augering a hole into soil and extending its base by forming a "bell".
- Type "A" is for dry stable soil
- Type "D" is for wet stable soil.
- Bored socketed foundation, formed by augering a hole into rock; Type "B"
- Mass concrete or spread footings formed by excavation of square holes in soil or rock. The base may be straight sided or undercut depending on soil conditions and construction methods.
- Type "C" is for dry stable soil,
- Type "C1" for dry unstable soil,
- Type "E" is for wet stable soil,
- Type "E1" is for wet unstable soil.

- Type “F” is mass concrete foundation in rock.
- Piled, consisting of driven steel piles; Type “G”.

Further geotechnical investigations shall be carried out at reduced intervals of 2km along the proposed Transmission Lines length in order to achieve the required accuracy of soil parameters.

The cost of the foundations represents a significant part of the overall line cost. Three options are explored to reduce these costs without compromising the safety margin.

A. Minimum common parameters.

   This option is based on less extensive geotechnical investigation and adopts more conservative design parameters. The safety level is high. However, it will result in a higher foundation cost.

B. Full geotechnical testing at each tower location.

   This option will provide very accurate soil parameters at each tower location and prediction of foundation type distribution. However, in order to reduce construction cost the foundation design would be standardized and based on general optimized parameters that cover a reasonable amount of footings (target 90%). Therefore, the option 2 cannot realize the full benefit from the extensive geotechnical investigations.

C. Reasonably frequent geotechnical testing and design based on engineering soil parameters.

The geotechnical investigation will produce values and reasonably accurate distribution of soil parameters that will allow the determination of engineered soil parameters that cover the majority of foundations (target 90%). The engineering parameters will be used for foundation design. Construction personnel will be made aware of the assumed parameters and guidelines will be issued to allow recognition of soils not conforming to the adopted design parameters. The foundation in non-conforming soils will require special design however this is expected to be a small percentage resulting in this option producing the greatest cost/benefit.

The design of each type of footing is based on the following measures, to ensure that the soil conditions meet the assumed design criteria during construction:

- Foundation type testing;
- A geotechnical consultant will review the Contractor’s foundation installation procedures;
- The geotechnical consultant will provide steel pile driving acceptance criteria charts (based on testing records); and
- The geotechnical consultant will train the Contractor’s construction personnel to assess soil parameters. In addition, the geotechnical consultant will provide construction oversight of foundation installation to ensure correct selection by construction personnel.

Material Balance

Material balance recommended for the proposed project.

U) Concrete volume
V) $0.3^{2\cdot}\pi.0.2$ $=0.056m^3$
W) $0.3^{2\cdot}\pi.2.15$ $=0.607m^3$
X) $\underline{0.7^{2\cdot}\pi.}\ (1.0^2+0.3^2+1.0x0.3)$ $=1.018m^3$
Y) $1.0^2\pi.\ 0.05$ $\underline{0.\ 157m^3.}$
Z) $=1.838m^3$
AA) Concrete weight
BB) 1.838.2240= 4117kg = 4.117t
CC) Each volume
DD) $b =2.2.85\ x\ tan20^0 + 2.0=4.07m^3$
EE) $2.85.\ \pi\ (2.035^2 +1.0^2+2.035\ x\ 1.0)$ $=21.40m^3$
FF)
GG) -(0.607 + 1.018) $\underline{=-1.625m^3}$
HH) $=19.775\ m^3$

Earth weight
19.775 x 1600 31.640t
Total weight resisting uplift <u>31.640t</u>
<u>+ 35.757t</u>

3.8.13 Earthing and Protection Systems

Transmission line system protection has both electrical and mechanical aspects. For mechanical protection, Buchholz, high temperature, oil level relays including no-load time changer protection and all will be incorporated. The electrical main protection scheme of the power transformer shall consist of numerical low impedance differential protection, high impedance restricted earth fault for each star connected transformer winding.

On the line, distance protection relays will be incorporated. Other protection devices will include:

- Over current and earth fault protection.
- Surge Arresters protection scheme.
- Reverse Power protection scheme.
- Differential protection scheme.
- Shunt reactor protection.
- Bus bar and breaker failure protection (numerical bus bar protection)
- General earth mat and earthing system.
- Safety and security.
- Fire hydrant system for the transformers.
- Under and over voltage relay system.
- High and under frequency relay’s operation.
- The towers and ground wire are major component of the line earthing, as they are electrically clamped to the towers.
- Lightening protection systems are installed as required to protect the lines and the towers.
- Isolators should be in place and used to knock-off supply finally during maintenance activities.

- All relays are in the relay room close to the control room for resetting when flagged, and recording the fault accordingly.
- The control panel in the substation houses the switches, voltage meters, ammeters, indication lamps, alarm horns, metering system, fault signal equipment, synchroscope and the rest.

3.9 COMMUNICATION/CONTROL SYSTEM

For effective system operations, radio communication between the technical crew in the Substation with the other Substations in the Transmission network, or between the control room officer and other field officers is imperative.

From inception frequency modulated (FM) radios was in vogue, in addition to use of walky-talky within an environment, but recent developments ushered in optical fibre ground wire (OPGW) and SCADA system. This also includes the use of computer and software application for even operational purposes, handsets and all inclusive. All known methods applicable will be employed in the project. There is normally a communication wire at the top of the Transmission line tower linkage to the radio room. Operational control panel showing various feeder areas, taking hourly meter readings, phase voltages and monitoring fault situations and load levels will be employed.

3.10 THE SUBSTATIONS

A substation is part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform as a buffer to provide continuous power to the consumers even if there is a shortfall of power from the source. Electric power may flow through several substations between generating plant and consumer, and its voltage may change in several steps. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

Substations are normally outdoors and are enclosed by a wire fence. However, in residential or high-density areas, the substation may be indoors and even housed inside a building to restrict the humming noise of the large transformers. The elements of a substation are shown in Figure 3.10.1.

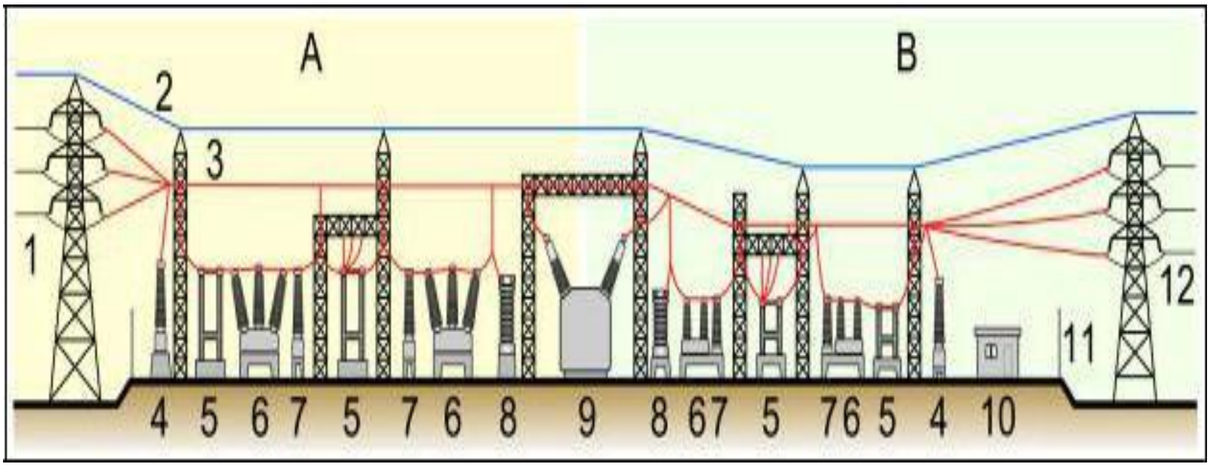

Figure 3.10.1: Elements of a substation

A: Primary power lines' side B: Secondary power lines' side

1. Primary power lines 2. Shield wire 3. Overhead lines 4. Transformer for measurement of electric voltage 5. Disconnect switch 6. Circuit breaker 7. Current transformer 8. Lightning arrester 9. Main transformer 10. Control building 11. Security fence 12. Secondary power lines

For this project, all the substations will use Air Insulated Substations.
The AIS (see Plate 3.10.1) uses air as the primary dielectric from phase to phase, and phase to ground insulation. They have been in use for years before the introduction of Gas Insulated Substation (GIS). Most substations across all regions are AIS, which are in extensive use in areas where space, weather conditions, seismic occurrences, and environmental concerns are not an issue such as rural areas, and favourable offsite terrain. The indoor AIS version is only used in highly polluted areas, and saline conditions, as the air quality is compromised.

Plate 3.10.1: A Typical AIS Substation (with transformers zoomed in)

The following are some points to explain the features of AIS:

- The primary choice for areas with extensive space
- With quality design, the system is viable due to the low construction costs and cost of switchgear
- Less construction time, thereby more suited for expedited installations
- Easy maintenance as all the equipment is within view.
- It is easy to notice and attend to faults.

3.10.1 Configuration of the Substations

Three substations are within the scope of this ESIA for Lot 2 (3 green filed). The substations are located at Likosi/Dejuwogbo, Redeem, MFM. The configuration of each of the substations as well as coordinates of location is in Table 3.10.1 and the layout plan in Figures 3.10.2, 3.10.3 and 3.10.4.

Table 3.10.1 Location and Configuration of Substations

Substation Name	LGA/State	Location (UTM Zone: 31N）	Size of land (ha)	Voltage class	Incoming bay / Outgoing bay for transmission line
Likosi/Dejuwogbo (Ogijo) Substation	Sagamu South LCDA / Ogun State	05558885N 0748567E	25.00	330/132/33kV	Incoming bay from Egbin PS：330kV-double circuit line Incoming bay from Omotosho S/S：330kV-double circuit line Incoming bay from Ejio S/S：330kV-double circuit line Outgoing to Redeem S/S：132kV-double circuit line Outgoing to Existing Ikorodu/Sagamu Transmission Line：132kV-double circuit line
Redeem Substation	Sagamu West LCDA/ Ogun State	05558885N 0748567E	9.62	132/33kV	Incoming bay from Likosi/Dejuwogbo (Ogijo) S/S：132kV-double circuit line
MFM Substation	Mokoloki LCDA/ Ogun State	0542626N 0746296E	19.69	330/132/33kV	Incoming bay from existing Ikeja West: 330kV-double circuit line

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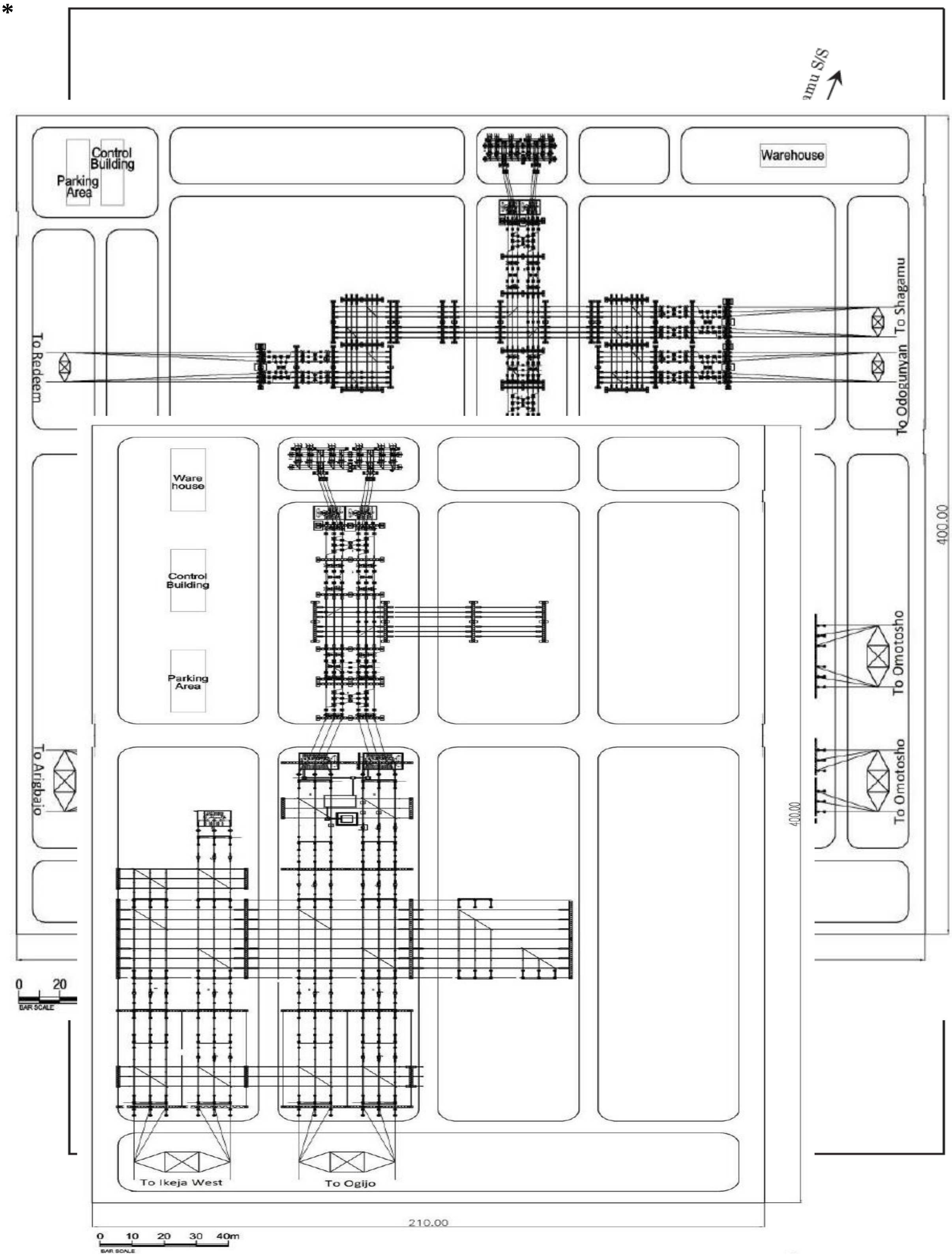


Figure 3.10.2: Draft Layout plan of 330/132/33 KV Ogijo (Likosi/Dejuwogbo) Substation

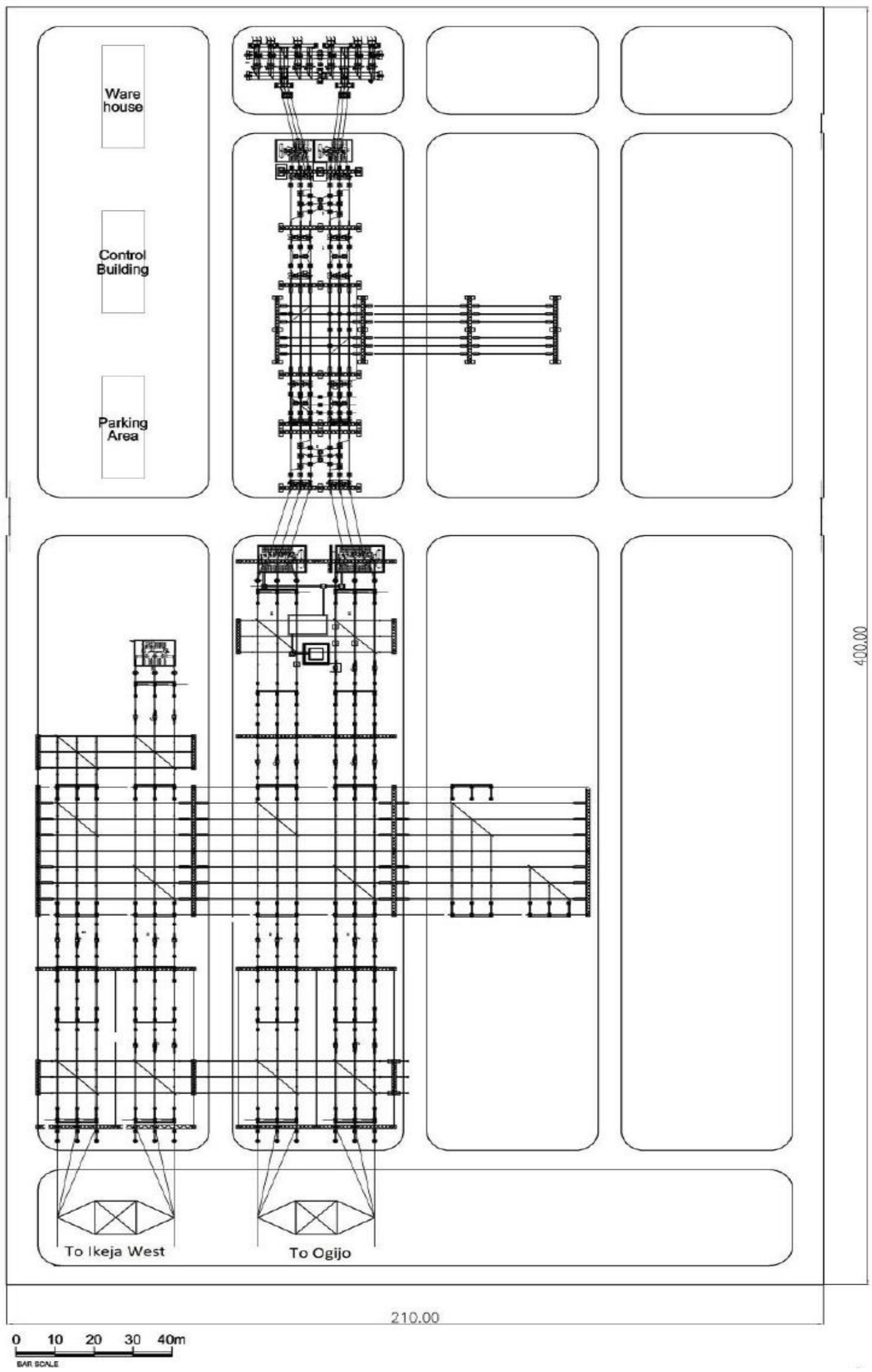


Figure 3.10.3: Draft Layout plan of 330/132/33 kV MFM Substation

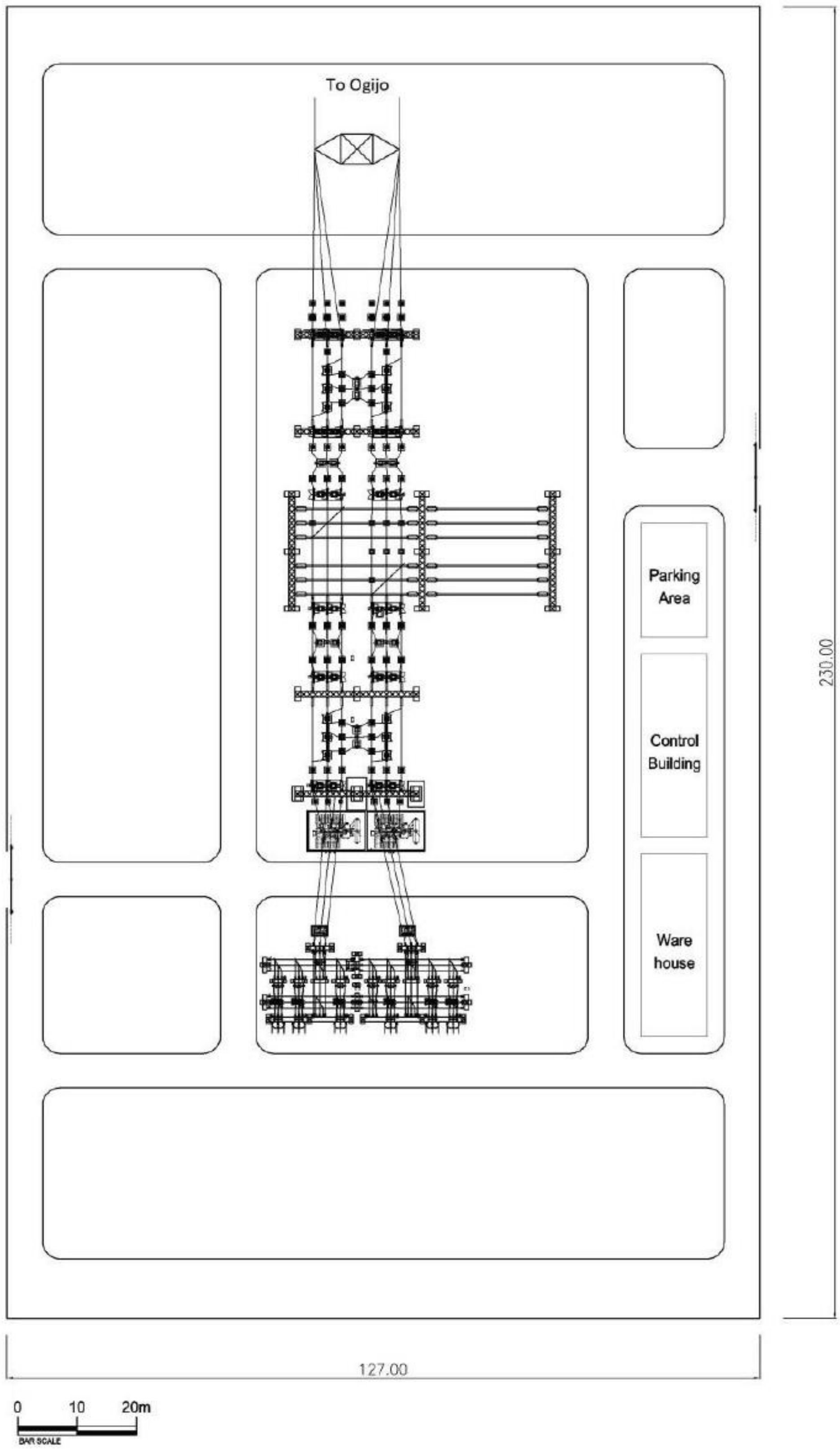


Figure 3.10.4: Draft Layout plan of 132/33 kV Redeem Substation

3.10.2 Functions of the Substations

The proposed substations are designed to function as follows:

- As voltage control mechanism through the transformers to step-up or step-down the system voltage as case might be, thereby lowering transmission losses.
- Correction of power factor in the circuits when the reactive loads are there to protect the generating plants and increase efficiency.
- For load shedding purposes on the distribution network there maintaining system balance.
- For the purposes of safety by switching and isolating the network during maintenance work, using circuit breakers and isolators including load demand sharing.
- Bus bar splitting for power distribution arrangement.

3.10.3 Substation Facilities

The spaces are meant to accommodate the following, in the minimum:

- All transformers of the following sizes and ratings.
  - ✓ Ogijo (Likosi/Dejuwogbo) with 2 x 300MVA 330/132kV + 2 x 100MVA 132/33kV Transformer capacity.
  - ✓ Redeem with 2x60MVA, 132/33kV Transformer capacity.
  - ✓ MFM with 2x150MVA, 330/132kV + 2x60MVA 132/33kV
- All breakers and isolators.
- All auxiliary transformers – Voltage, current, reactor, instrument etc.
- Line Bays as required.
- Cable trenches, oil sumps and drainage channels.
- Control room for system operations with offices, battery rooms, communication section, conveniences, clock rooms, parking slots, cable/junk yard etc.

The substations are highly earthed to take care of excessive current at fault condition. A robust environmental management system has been put in place to meet international standard and local environmental regulations.

In addition, the substations are to be graveled even after laying a nylon cover on the ground as a modern method to:

- Keep the weeds away from growth.
- Allow easy water run-off to drain channels.
- Improve the earthing system.
- Keep the environment clean and clear.

3.11 LAND TAKE REQUIREMENTS FOR TRANSMISSION LINES

This section provides an overview of the land requirements for the construction and operation of the transmission line.

The land of the Right-of-Way under transmission lines will need to be acquired by TCN through Resettlement action Plan (RAP) process. The RAP has been conducted for the acquisition of RoW.

This is based on the following starting points:

- All land in the RoW, under transmission lines and under towers will be acquired and owned by TCN;
- It is not allowed to have buildings or other higher structures under the transmission lines;
- Cropping is not allowed by law in the RoW. However, people often still grow crops under the transmission lines. In case of damage to the crops by Government during maintenance to the lines, there cannot be any claim to TCN;
- The width of the RoW for 330 kV and 132 kV Transmission Lines is 50 m and 30 m according to TCN's practice. TCN's Materials Standards & Specifications for Procurement Works Volume 3A of 5 indicates that ''The minimum width of this strip for 330 kV shall be 50m and for 132 kV shall be 30m, although this may be increased or decreased if substantiated by calculations.

Thus, the calculation for the proposed RoW for the projects are;

- 330kV D/C Transmission Line from Arigbajo (Ejio) – Ogijo (Likosi/Dejuwogbo) with estimated length of 48.74km - 48,750m x 50m = 2,437,000 m^2

- 132kV 2 x D/C Transmission Line from Ogijo (Likosi/Dejuwogbo) – Existing Ikorodu/Shagamu with estimated length of 2.41km – 2,410m x 30m = 72,300 m^2

- 132kV D/C Transmission Line from Ogijo (Likosi/Dejuwogbo) – Redeem with estimated length of 7.83km– 7830m x 30m = 234,900 m^2

- 330kV 2 x D/C Transmission Line from Existing Benin (Omotosho)/ Ikeja West Transmission Line – MFM with estimated length of 4.99km – 4,990 x 95m = 474,050 m^2

CHAPTER FOUR
DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1. General

This chapter presents information on the existing environmental conditions in the Project area and details of the methods of baseline data collection for the different studies carried out for this ESIA. The scope of environmental components and the main indicator parameters used to characterize them are highlighted in Chapter 5. The main source of information was through the field survey when a strong team of experts (scientists, engineers and technologists) obtained site specific data and/or collected samples for determination as detailed below for the respective studies. Information on the existing environment makes it possible to determine the sensitivity of the environment and can be used as a benchmark against which subsequent changes in the environment can be determined and/or evaluated later through monitoring.

For this baseline description, the study area is defined as the Transmission Line route /RoW, associated substations and the environment immediately surrounding them (Figure 4.1.1). Site specific environmental data were collected for the dry season while secondary data were obtained for wet season in the study area. A waiver for one season data gathering and supplementation by secondary data was approved by the Federal Ministry of Environment (see appendix 3). In this context, desktop and fieldwork studies were designed to acquire additional data to fill these gaps.

4.2. Scope of Study

Field studies and data collection for characterization of the baseline conditions of the proposed project environment covered, in line with the approved TOR by the FMEnv.

- Climate and meteorology
- Air quality, noise level, vibration level and Electromagnetic field (EMF)
- Geology/Geophysical investigation/hydrogeology
- Water Resources (Surface and ground water)
- Soil and sediment
- vegetation & fauna wildlife
- Hydrobiology, fisheries and
- Socio economics/health impact, demography and community characteristics

4.2.1. Spatial Boundary

Being the linear project, the specific required width for 330/132Kv Transmission Line Right of Way (RoW) i.e 50 m/30 m, was maintained for soil, geophysical survey and vegetation sampling while other parameters were covered within 700 m buffer zone of RoW along each section of proposed Transmission Lines based on the uniformity in characteristics of the environment. For substations, 5km radius was adopted for sampling.

4.2.2. Baseline Data Acquisition Method

The acquisition of data basically involved field data gathering, measurements and the collection of representative samples used to establish the environmental conditions of the study area. The Quality Assurance/quality Control (QA/QC) procedures covered all aspects of the study, including sample collection, handling, laboratory analyses, data coding and manipulation, statistical analyses, presentation and communication of results. Chain of custody procedures including sample handling, transportation, logging and cross-checking in the laboratory were also implemented. All analyses were carried out in FMEnv accredited laboratory (Obafemi Awolowo University, Ile-Ife Central Laboratory). The methods of analyses used in this study were those specified in Federal Ministry of Environment Guidelines and other internationally accepted analytical procedures, in order to ensure the reliability and integrity of the data obtained.

4.2.3. Desktop Studies

Data from literature review were obtained mainly from the existing reports of environmental studies in the study area and / or contiguous environment

- Impact Mitigation Monitoring Report of Lakatabu Expansion Project at Lafarge WAPCO, Ewekoro Plant, 2011/2012.
- Environmental Impact Assessment of Olorunsogo Power Plant Phase II, Olorunsogo, NIPP, Ogun State, 2012
- Environmental Management Plan (EMP) for the Alternative Fuel of Lafarge Plant Kiln firing at Study area, Ogun State, 2016

A full list of references used for this study is provided in the Reference section.

4.2.4. Field Sampling/Measurement

In order to effectively characterize the ecology and meteorology of study area and determine seasonal variations of specific environmentally related parameters, a one season field survey was carried out on December 18- 23, 2017. The specific objectives but not limited to the following:

- ambient air quality, noise level, vibration level and EMF of the study area;
- physico-chemical and microbiological characteristics of the soil within the study area;
- physico-chemical and biological characterization of water and sediment samples within the study area;
- hydrobiology and fisheries resources of the study area;
- wildlife abundance and diversity of the study area and environs;
- vegetation characteristics of the area; and
- establish the socio-economic and health status of the host and impacted communities.

Table 4.2.1 presents an inventory of the biophysical and socioeconomics/health details collected during field studies, while the map (Figure 4.1) shows the spatial locations of the sampled points.

Table 4.2.1: Inventory of Biophysical and Human Environment Samples

S/N	Environmental Component	Parameter/Details	No of samples collected
1	Surface Water	Physical parameters/general chemical parameters, Oxygen parameters and nutrient compounds Heavy metals/trace elements and microbiology	12
2	Ground water	Physical parameters/general chemical parameters, Oxygen parameters and nutrient compounds Heavy metals/ trace elements and microbiology	9
3	Soil/Sediment	Physico-chemical characterization; Heavy metals determination; Organics and microbiology	18
4	Ambient air quality/ Meteorology	TSP, H_2S CO, NMHC, NO_2, SO_2, Temperature, Relative humidity and pressure	24
5	Noise and Vibration Level	LAeq dBA & Velocity mm/s	24
6	EMF	EMF mG	24
7	Geophysical Investigation	Vertical Electrical Sounding (VES), formation	18
8	Hydrobiology	Phytoplankton flora, zooplankton fauna and benthic macro invertebrates	12
9	Flora	Species composition, density and habitat conditions	15
10	Fauna	Amphibians, Reptiles, birds, and mammals	18
11	Human environment	Socio-economic, Infrastructure, Community health	Selected 39 communities (Affected Household)

Source: SEEMS, 2017

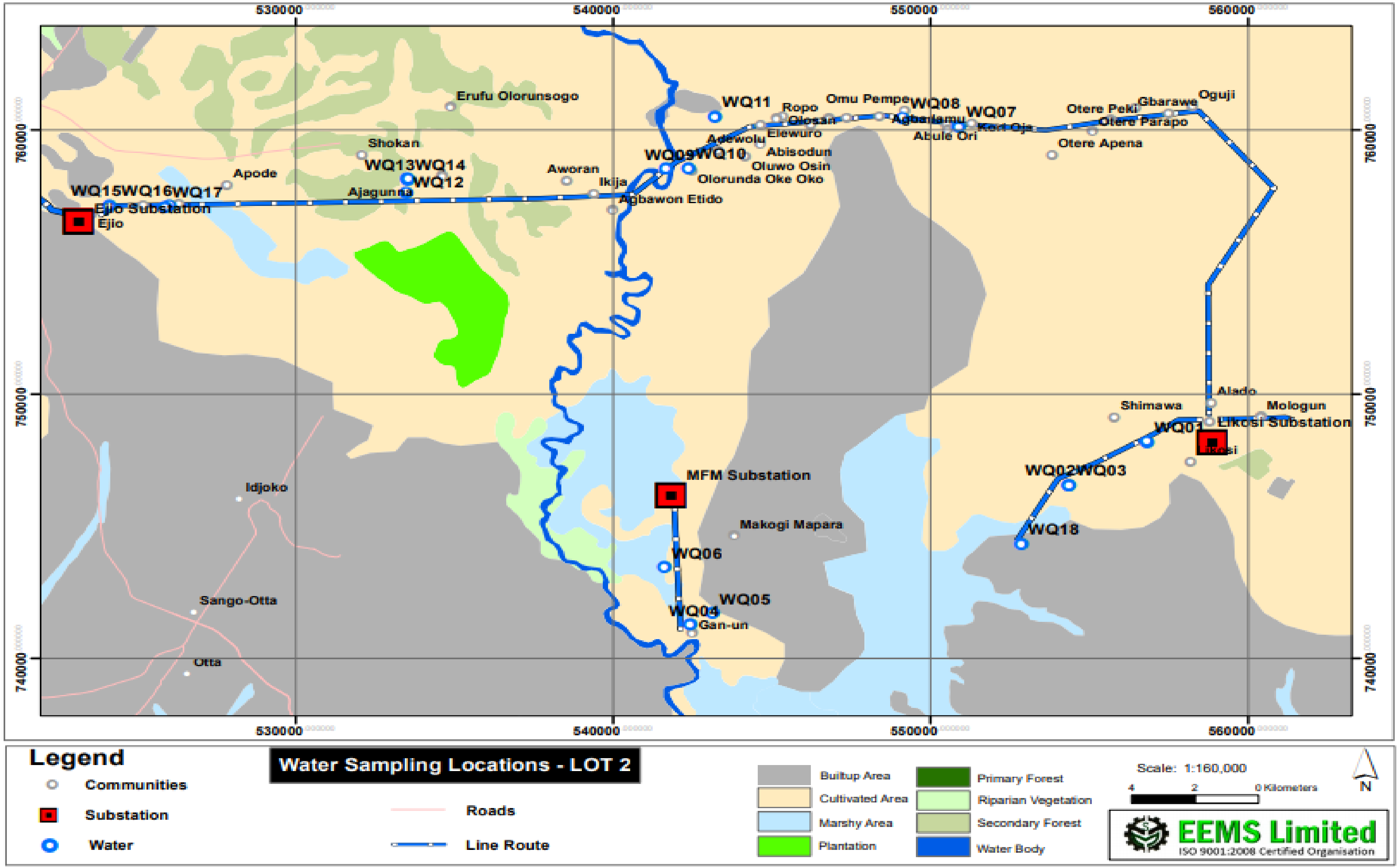


Figure 4.2.1a: Water Sampling Location for the study area –Lot 2

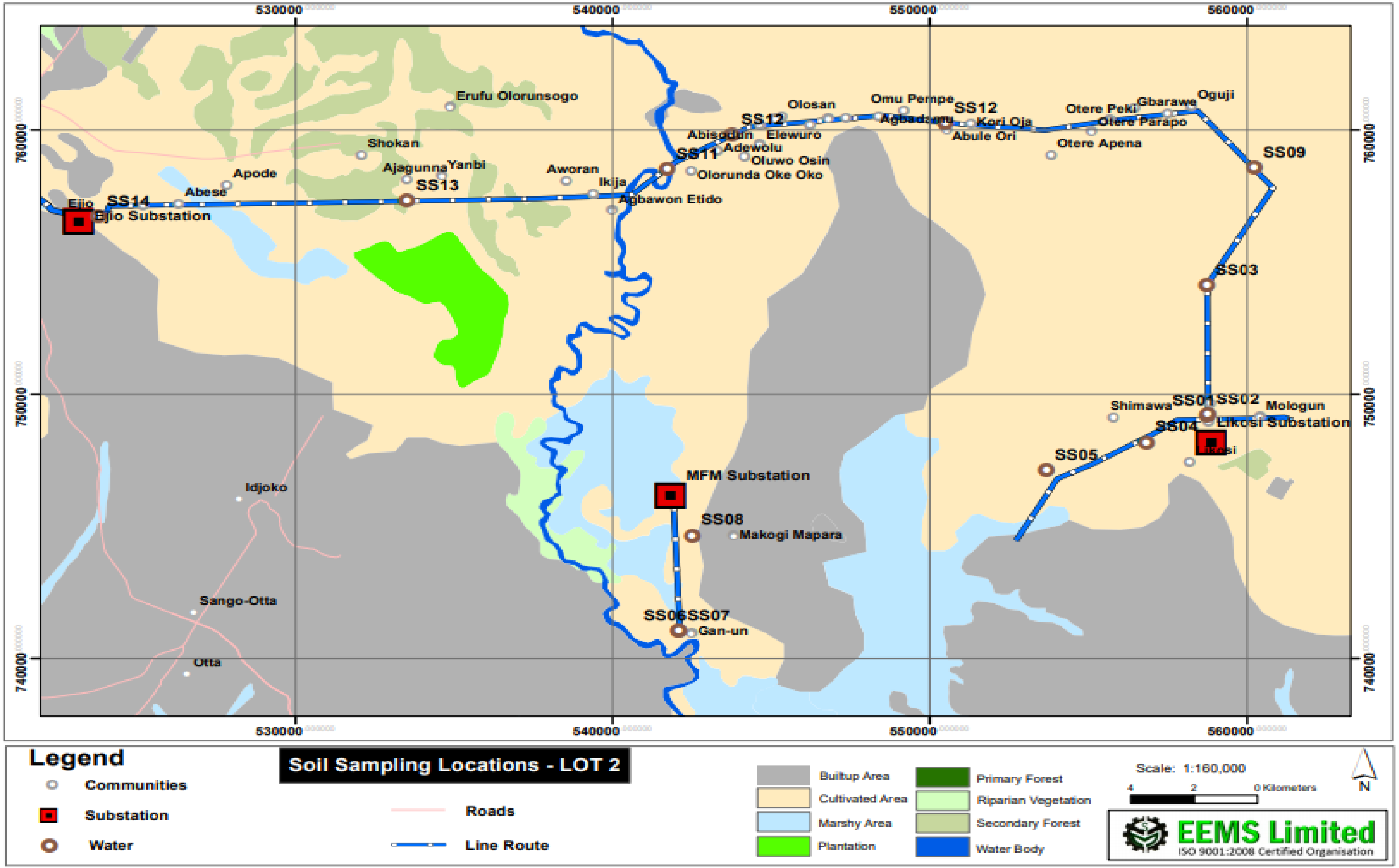


Figure 4.2.1b: Soil Sampling Location for the study area –Lot 2

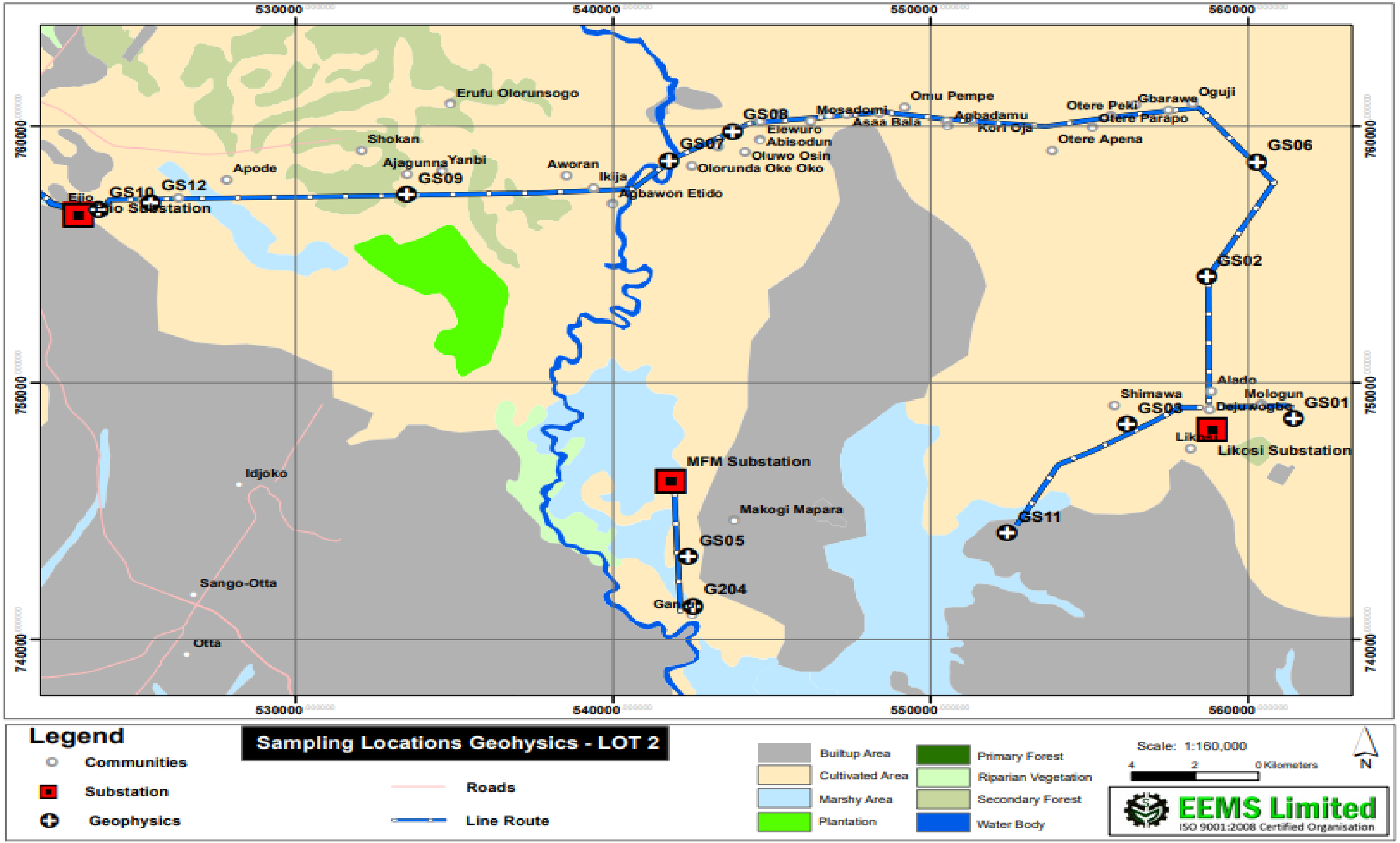


Figure 4.2.1c: Geophysics Sampling Location for the study area –Lot 2

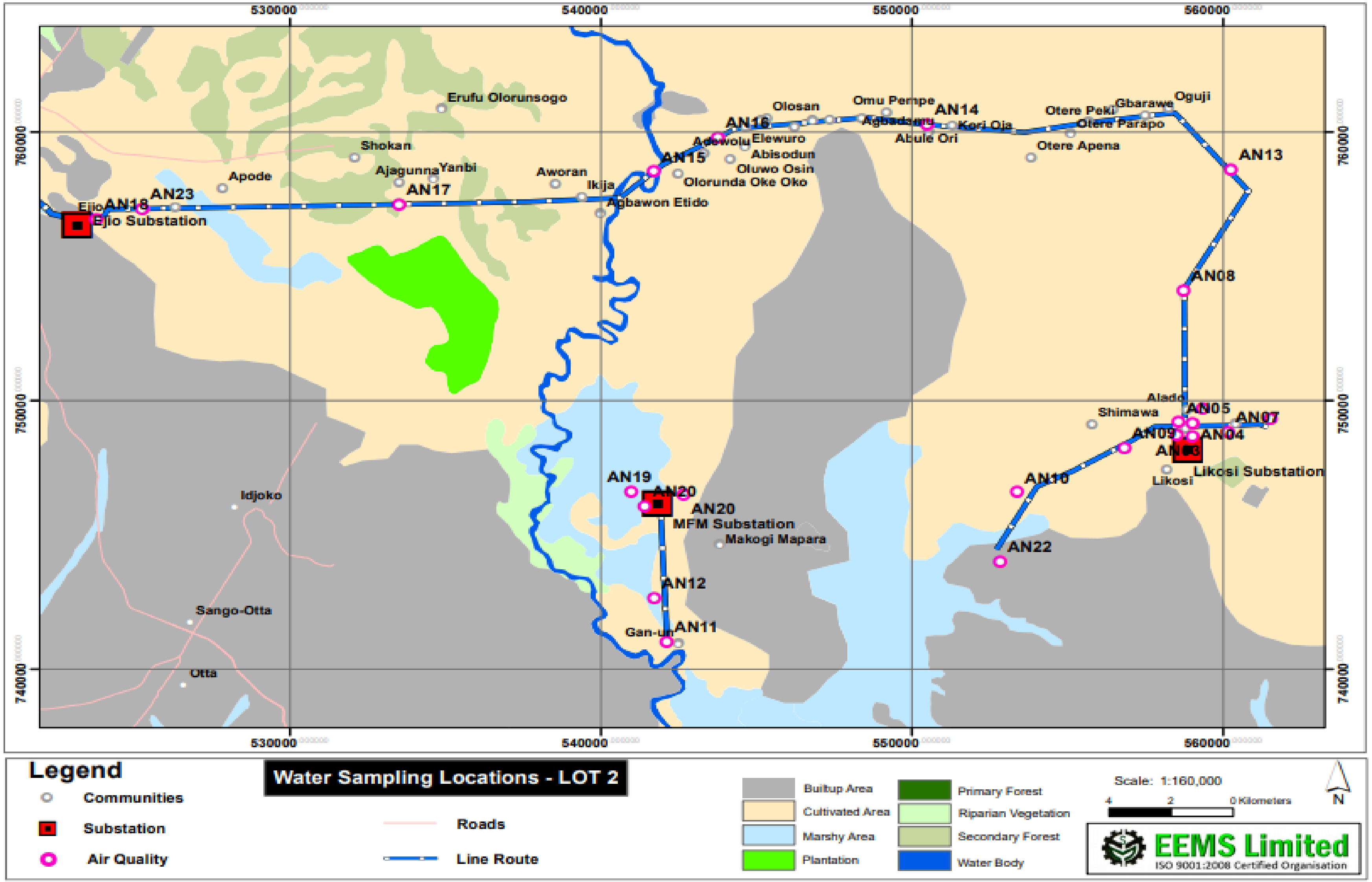


Figure 4.2.1d: Air Quality/Noise/Vibration/EMF Sampling Location for the study area –Lot 2

4.3. Climate and Meteorology

4.3.1. Methodology

The field data on the meteorological parameters of the project area was obtained through the use of a weather Tracker Kestrel 4500 model/ Portable Potlog weather station for the following components: Temperature, Relative Humidity, Pressure, Wind direction and Speed. Also, secondary data was obtained from Nigerian Meteorological Agency (NIMET) for the Abeokuta station and SEEMS' mini weather station at Ewekoro because there is no long-term established meteorological station within or immediately around the proposed project area. Specifically, for the present study a request was made to the Nigerian Meteorological Agency (NIMET) for detailed meteorological data on Abeokuta Station over the past one decade (2005-2014). The NIMET data was used as supplementary data to the field data.

Based on the Climate classification of West Africa (Papadakis, 1965), the Abeokuta, Ewekoro area, Study area, like most parts of the cocoa belt area of southwest Nigeria (Udo, 1968) falls within the Semi-Hot Humid Climate. This climate type is characterized by high temperature and humidity most part of the year.

For the present study, detailed data were collected on a wide range of meteorological parameters, namely: Temperature, Humidity, Heat Index, Wind Speed and Rainfall. Highlights of these respective parameters are given below.

4.3.2. Rainfall

The annual weather calendar in the study area can be divided broadly into two seasons with regards to rainfall regime, namely; dry season (from November to March) and the rainy season (April-October). However, there is no month in which there is no trace of rainfall (Table 4.3.1). During the dry season, monthly rainfall is less than 100mm (10cm or 4 inches) of rain while the number of rainy days is less than 10 days. The rainy season is characterized by two peaks, a major peak occurring mostly in July (sometimes in June or May) and the minor peak occurring mostly in September (but sometimes in October). Over the 22 years period of 1989-2010, annual total rainfall varied from 843mm (1998) to 2102mm (2000) with the overall mean ± S.e of 1485± 93mm (median = 1443mm; mode =1628mm). It is interesting to note that annual total rainfall has steadily increased over the period (1989-2014) as summarized in Table 4.3.1.14. Similarly, it is worthy of note that the highest daily amount of rainfall tended to increase over the years (Table 4.3.3). Such increases are probable evidence of the effect of climate change in the study area, which is in line with the worldwide trend of increasing rainfall in the coastal areas of the world. Before 2000 (1989-199) minor peak in rainfall was mostly in October but since 2000 (2000-2010) minor peak has been mostly in September, i.e occurring a month earlier than the usual time. On the average, major peak (mean± S.e =347± 50mm, median= 319mm) is about one and a half times higher than the minor peak (mean=217=39mm, median = 194mm).Both minor and major peaks have also been increasing over the years. This is an evidence of climate change in the study area. (Table 4.3.3).

Table 4.3.1: Long Term Variation in major and minor rainfall peaks at Study area

	Major peak of Rain (mm)		Minor peak of Rain(mm)	
Period	**mean±s.d**	**median**	**mean±s.d**	**median**
1989-1993	276±38	267	166±53	154
1994-1998	303±104	301	159±57	132
1999-2003	395±71	370	245±169	253
2004-2014	394±99	345	272±84	273
Total	**347±58**	**319**	**217±69**	**194**

Source: NIMET,2017

Table 4.3.2: Long term variation in total rainfall (mm) at Study area

Period	min	max	median	means.e
1989-1993	981	1387	1203	1161 713
1994-1998	843	1703	1305	1258 163
1999-2003	1296	2102	1541	1572 169
2004-2010	1285	2781	1642	1817 177

Source: NIMET,2017

Table 4.3.3: Variation in the occurrence of highest single rain event per year

Near	Highest single rain amount	Day
2004	75	15/5/2004
2005	64.5	2/4/2005
2007	85.4	15/9/2007
2008	123.0	11/9/2008
2009	175.8	11/6/2009
2010	350.0	16/8/2010

Source: NIMET,2017

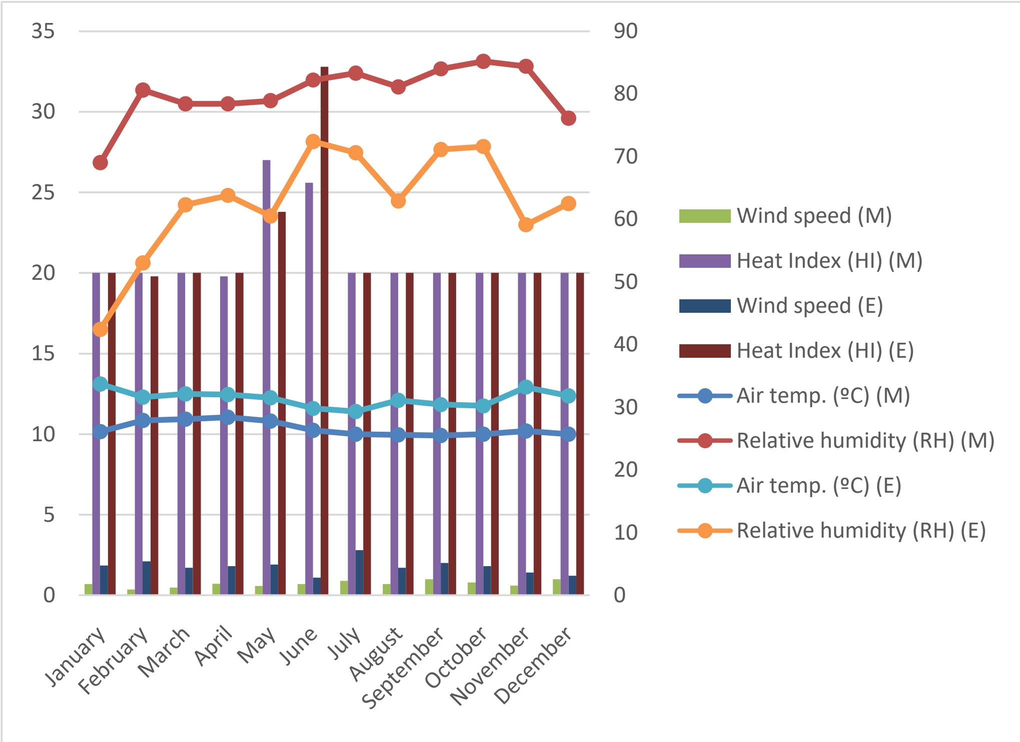


Figure 4.3.1a: Average Monthly Weather conditions in the Study Area

Source: SEEMS,2015

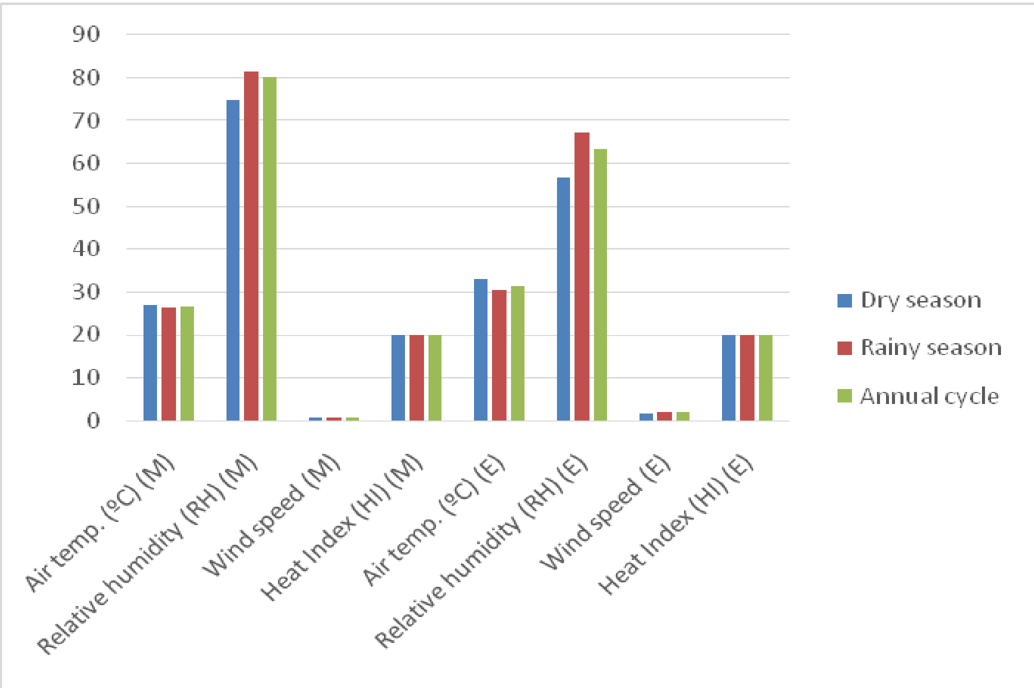


Figure 4.3.1b: Average Seasonal Weather conditions in the Study Area

Source: SEEMS, 2015

4.3.3. Temperature

The data on ambient air temperature at the study area taken twice daily (in the morning at 9hr and in the evening at 15hr) for two years (2010-2011) were analyzed. Over the period, air temperature varied over extreme values of 19.0-38.5 ºC comprising 19.0-35.1 ºC for morning

(9hr) and 24.1-38.5 ^{o}C for evening period respectively (Table 4.3.4). On the whole, annual mean value for morning period was 26.4± 0.15 ^{o}C and 31.5± 0.25 ^{o}C for evening period, giving an overall mean range of about 5 ^{o}C, which is short and typical of the equatorial region to which the area falls.

Temperature values for both morning and evening periods of each day were characterized by two minima occurring in September (at a peak of rainfall) and in December (at the unset of the Harmattan winds). Similarly, two peaks were recorded, occurring in November (at the unset of dry season) and April, before the unset of rainy Season (Table 4.3.6). The extent of daily (diurnal) and seasonal patterns of variation in temperature is shown in Table 4.3.5. In general, and as expected, mean temperature was higher in the evening than in the morning. The mean difference between morning and evening values was higher in the dry season (mean = 6.1 ^{o}C, median = 6.5 ^{o}C) than in the rainy season (mean =4.2 ^{o}C, median=4.3 ^{o}C) while annual difference was in between the two seasonal values (mean= 4.9 ^{o}C, median = 5.4 ^{o}C)

Table 4.3.4: Descriptive Statistics of daily values of ambient Temperature (•C) at Study area

Year	Time	N	Min	Max	Range	Median	Mean	SEM	Skewness	Kurtosis
2011	9hr	180	22.6	35.1	12.5	26.7	26.6	0.15	1.28	2.7
	15hr	140	24.1	38.5	14.1	31.6	31.5	0.25	-0.27	-0.44
2010	9hr	205	19	34.7	15.7	26.3	26.2	0.14	-0.76	3.35
	15hr	161	25.5	37	11.5	31.5	31.5	0.21	-0.25	-0.79

Source: SEEMS, 2015   SEM- Standard error of the mean

Table 4.3.5: Descriptive Statistics of monthly variation in Temperature (^{o}C) at Study area

Statistics	Jan		Feb		Mar		Apr		May		Jun	
N	M	E	M	E	M	E	M	E	M	E	M	E
Min	22.6	31.9	25	29.5	25.7	28.1	25.2	26.7	25.7	28.4	23.4	26.3
Median	26.2	33.9	27.7	33.5	27.9	32.1	28.4	33.2	28	31.5	26.4	29.4
Mean	26.1	33.7	27.9	31.6	28.1	32.1	28.4	32	27.8	31.5	26.3	29.8
S.d	1.8	1.2	1.7	8.6	2.2	2.3	1.6	2.3	1.2	1.7	1.1	2.4
Max	27.5	35.5	31.4	38.5	35.1	35.1	30.8	33.9	29	33.8	27.9	35.5
	Jul		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
N	M	E	M	E	M	E	M	E	M	E	M	E
Min	23.6	27.0	24.2	27.4	23.3	26.8	23.5	26.2	24.9	30.3	24.1	29.7
Median	25.8	28.8	25.4	32.2	25.9	30.8	25.5	29.9	26.2	33.4	25.6	33.7
Mean	25.7	29.3	25.6	31.1	25.5	30.4	25.7	30.2	26.2	33.2	25.7	31.8
S.d	0.9	9.5	1.2	2.7	1.2	3.1	1.2	2.5	8.0	1.9	1.0	2.9
Max	27.2	31.8	29.2	34.6	27.6	35.2	28.2	33.7	38	35.8	27.5	34.1

M= Morning (9hr); E= Evening (15hr)
Source: SEEMS, 2015

Table 4.3.6: Descriptive Statistics of seasonal variation in Temperature at Study area

Statistics	Dry season		Rainy Season		Annual Cycle	
	M	E	M	E	M	E
N	59		104		134	
Min	22.6	28.1	23.3	25.8	22.6	28.1
Median	27.1	33.6	26.2	30.5	26.4	31.8
Mean	27.0	33.1	26.2	30.4	26.6	31.5
s.d.	2.0	6.2	2.8	2.5	2.5	2.7
Max	31.5	35.5	35.2	35.5	31.2	38.5

4.3.4. Relative Humidity (RH)

The descriptive statistics of diurnal pattern of variation in relative humidity (RH) over two years are presented in Table 4.3.7. Over the annual cycle, relative humidity was higher in the morning (mean=80.4-83.7%) than in the evening (mean=61.3-63.3%). The mean difference between morning and evening values (5.6-28.5% at 95% confidence interval) was very highly significant ($P < 0.001$). Over the 12 months of the year, the lowest mean value was recorded in January, comprising 69.5% in the morning and 42.4% in the evening period respectively. On the other hand, peaks values were recorded in October comprising 85.25 % and 71.65% for morning and evening period respectively (Table 4.3.8). For both seasons of the year, mean value for morning period was significantly higher ($P < 0.01$) than for the evening. However, the mean difference between morning and evening values was more pronounced in the dry season (about 18%) than in the rainy season (about 13.4%) as can be noted in Table 4.3.9.

Table 4.3.7: Descriptive statistics of % relative Humidity at Study area

Year	Time of day	n	Min	Max	Mean	SEM	Median	Skewness	Kutosis
2010									
	Morning	180	29.8	92.5	80.4	0.68	82.2	-3.1	11.5
	Afternoon	144	18.7	90.5	63.3	1.14	63.4	-0.44	0.26
2011	Morning	205	30	87.8	83.7	3.9	80.9	13.9	193.1
	Afternoon	161	23.9	85.4	61.2	1	62	-0.57	0.45

Source: SEEMS, 2015

Table 4.3.8: Descriptive statistics of Monthly variation in % relative humidity at Study area

Statistics	Jan		Feb		Mar		Apr		May		Jun	
N	M	E	M	E	M	E	M	E	M	E	M	E
Min	60.8	22.9	73.3	18.7	50.3	43.4	73.9	57.8	66.1	54.0	77.4	55.2
Median	81.4	44.6	80.9	57.3	79.6	61.1	78.7	61.6	79.7	60.0	84.0	75.1
Mean	69.0	42.4	80.6	53.0	78.4	62.3	78.4	63.8	78.9	60.5	82.2	72.4
S.d	28.5	10.3	2.3	16.8	8.2	9.8	3.6	5.8	5.0	17.7	19.0	7.9
Max	87.3	51.3	84.5	69.7	85.2	82.3	82.7	72.0	87.7	79.5	88.3	81.7
	Jul		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
N	M	E	M	E	M	E	M	E	M	E	M	E
Min	75.5	57.8	48.8	50.3	78.7	53.7	68.9	56.9	79.6	50.9	36.8	36.8
Mean	83.3	70.6	81.1	62.9	84.0	71.1	85.2	71.6	84.4	59.1	76.1	62.5
S.d	3.3	8.7	10.2	12.7	3.1	9.9	5.7	10.7	2.6	9.1	16.6	18.8
Median	83.8	71.9	83.6	56.6	83.5	70.8	86.5	72.0	85.6	57.0	84.2	59.5
Max	88.6	80.4	89.4	80.0	88.5	78.5	92.5	90.5	86.7	71.4	88.5	88.5

Source: SEEMS, 2015 *M= Morning (9hr); E= Evening (15hr)*

Table 4.3.9: Descriptive Statistics of seasonal variation in % Relative Humidity at Study area

Statistics	Dry Season		Rainy Season		Annual Cycle	
	M	E	M	E	M	E
Min	36.8	18.7	48.8	50.3	36.8	18.7
Median	81.3	51.3	82.7	68.9	82.2	62.9
Mean	74.7	56.7	81.5	67.1	80.1	63.5
S.d	19.7	16.7	9.4	11.9	11.2	14.8
Max	31.5	35.5	35.2	35.5	31.2	38.5

Source: SEEMS,2015

4.3.5. Heat Index (HI)

Heat Index or Humidex is an index that combines air temperature and humidity to determine the human-perceived equivalent temperature or how hot it feels. Thus, HI is the felt air or apparent temperature. The effect of HI on human body is summarized in Table 4.3.10. The two years of databank on HI at the study area varied over a wide range of 3.1-56.0 ^{o}C comprising 3.1-49.0˚C(mean =30˚C) for morning and 4.0-56^{o}C for evening period respectively. In general, heat index was almost invariably higher than air temperature. The Incidence of Heat index with normal effect (<27%) was generally (and significantly) higher in the morning period (9hr) than in the evening period (15hr). The highest normal occurrence over the month was recorded in January (during the Harmattan). On the other hand, the incidence of heat Index with danger effect on human (41-54 ^{o}C) rose gradually from January to a peek in March and then declined through the rainy season (Table 4.3.11). For both dry season and rainy season, the incidence of normal heat index was higher in the morning than in the evening. On the other hand, the incidence of extreme caution to extreme danger heat index range values was higher in the evening than in the morning (Table 4.3.12).

Table 4.3.10: Heat Index Classification and the effect on human body

	Heat Index (•C)	Effect	Description of body effect
1	<27	Normal	No Effect
2	27-31	Caution	Fatigue possible, Heat cramp possible with prolong exposure
3	32-40	Extreme caution	Heat cramp and exhaustion probable, Heat stroke possible with prolong exposure
4	41-54	Danger	Heat camp and exhaustion likely Heat stroke probable on long exposure
5	<54	Extreme Danger	Heat stroke Imminent

Table 4.3.11: Occurrence Frequency (%) of heat Index levels in Study area

HI	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**	
•C	M	E	M	E	M	E	M	E	M	E	M	E
<27	63	0	29	0	5	0	6	0	6	0	16	0
27-31	29	12	59	8	45	5	62	8	47	19	56	12
32-40	8	69	12	50	50	28	31	25	41	50	28	76
41-54	0	19	0	33	0	67	0	67	41	50	28	76
>54	0	0	0	8	0	0	0	0	0	0	0	0
	Jul		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
	M	E	M	E	M	E	M	E	M	E	M	E
<27	25	0	55	0	6	0	27	0	11	0	21	0
27-31	71	38	35	29	88	13	64	19	68	0	71	19
32-40	4	56	10	71	6	81	9	81	21	100	8	81
41-54	0	6	0	0	0	6	0	0	0	0	0	0
>54	0	0	0	0	0	0	0	0	0	0	0	0

Source: SEEMS,2015 HI= Heat Index, M= Morning (9hr); E= Evening (15hr)

Table: 4.3.12: Occurrence (%) of Heat Index levels in Study area

	Dry Season		**Rainy Season**		**Annual Cycle**	
Heat Index	M	E	M	E	M	E
<27	29	0	21	0	24	0
27-31	49	9	60	22	56	16
32-40	22	63	18	60	19	61
41-54	0	27	1	18	1	22
>54	0	1	0	0	0	1

Source: SEEMS,2015 M= Morning (9hr); E= Evening (15hr)

4.3.6. Wind speed

As applicable to most parts of Nigeria, the wind regime in the study area is dominated by two major wind systems, namely; the Southerly winds (S, SW, SE, SSW) and the Northerly winds (mainly NE). The former winds originate over the Atlantic Ocean and being warm and humid bring about rainfall as they blow over adjacent land mass, from the coastal area inward. The latter winds originate from the Sahara desert and being dry and dust-laden causes the Harmattan. The boundary Zone between the two major winds system is commonly referred to as the Inter-tropical Convergence Zone (ICZ) or simply, the Front. Over the annual cycle, the front moves gradually from the coast inland and back causing two peaks of rainfall in the south and one peak in the northern part of the country. Based on available detailed wind speed data on the study area, wind speed varies greatly in the area especially with regard to the time of day and season. Whereas monthly mean values did not show distinct pattern of variation (Table 4.3.13) diurnal and seasonal variations were distinct (Table 4.3.14 and 4.3.15).

The diurnal pattern was characterized by higher wind speed in the afternoon (usually occurring as light breeze) than in the morning (usually as light air). On the whole, the rainy season was characterized by higher wind speed than the dry season. The whole average wind speed in the evening (15hr) was about 2.5 times higher than the average wind speed in the morning. Wind speed varied over a wide range of 0.10- 6.8m/s (i.e 0.0 -2 4.5k/hr), spanning from calm, through light air to moderate breeze.

Wind speed in the morning comprised 24% calm, 69% light air and 7% light breeze. On the other hand, wind speed in the evening comprised 0.5% calm, 47% light air, 41% light breeze, 11% gentle breeze, and 0.5% moderate breeze (Table 4.3.15).

Table 4.3.13: Descriptive Statistics of Wind speed (m/s) at Study area

Statistics	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**	
m/s	M	E	M	E	M	E	M	E	M	E	M	E
Min	0.4	0.6	0.0	0.4	0.0	0.0	0.0	0.5	0.0	0.7	0.0	0.4
Median	0.6	1.2	0.15	2.4	0.55	1.7	0.5	1.7	0.4	1.7	0.6	1.1
Mean	0.7	1.85	0.35	2.1	0.48	1.7	0.71	1.8	0.58	1.9	0.7	1.1
Max	1.3	3.7	1.1	3.7	1.6	3.1	1.7	4.3	2.7	3.7	1.9	2.4
	Jul		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
m/s	M	E	M	E	M	E	M	E	M	E	M	E
Min	0.0	0.6	0.0	0.9	0.0	1.1	0.0	0.0	0.0	1.1	0.5	0.6
Median	0.7	2.3	0.7	1.9	0.7	1.3	0.8	1.7	0.6	1.2	0.9	1.0
Mean	0.9	2.8	0.7	1.7	1.0	2.0	0.8	1.8	0.6	1.4	1.0	1.2
Max	2.6	6.8	1.4	2.3	4.8	4.1	1.4	3.5	0.9	1.9	2.3	2.3

Source: SEEMS,2015 M= Morning (9hr); E= Evening (15hr)

Table 4.3.14: Descriptive statistics of Seasonal variation in wind speed (m/s)

Statistics	Dry Season		Rainy Season		Annual Cycle	
	M	E	M	E	M	E
Min	0.0	0.0	0.0	0.0	0.0	0.0
Mean	0.6	1.6	0.74	1.85	0.70	1.76
Median	0.6	1.3	0.7	1.65	0.6	1.55
S.d	0.53	1.0	0.74	1.2	0.64	1.14
Mode	0.0	0.7	0.0	0.6	0.0	0.6
Max	2.3	3.7	4.8	6. 8	4.8	6.8

Source: SEEMS,2015

Table 4.3.15: Frequency (%) of occurrence of wind types in the Study Area

	Dry Season		Rainy Season		Annul Cycle	
	M	E	M	E	M	E
	25	2	22	0	24	0.5
	70	51	69	43	69	47
	5	36	9	43	49	47
	0	11	0	11	0	11
	0	0	0	3	0	0.5
Windspeed						
	Beaufort Scale		Description		m/s	
	0		Calm		<0.3	
	1		Light Air		0.3-1.5	

	2	Light Breeze	1.5-3.3
	3	Gentle Breeze	3.3-5-5
	4	Moderate breeze	5.5-8.0

Source: SEEMS,2015

4.4. Ambient Air Quality

4.4.1. Methodology

Protocol of Measurement and Sampling Duration

Ambient air was sampled and analysed *in situ* for the common atmospheric pollutants along the RoW of the proposed Transmission Lines and substations using portable gas and particulate sampler at established sampling points. Sampling locations and coordinates are presented in Table 4.4.1a.

a. Particulates

For total suspended particulates (TSP), sampling was undertaken using a Metric mini volume air sampler fitted with steady state flow regulator, timer and flow meter. Ambient air was drawn through a pre-weighed filter paper (Whatman 41 Cellulose filter paper) at constant flow rates ranging from 5 litres per minute (see plate 4.4.1). The samples were collected at heights of about 1.5m above ground level. The concentration of TSP in μg/m^3 collected per volume of ambient air sampled was obtained by dividing the difference between the filter paper weight after and before sampling, W_i and W_f respectively, by the total volume of air sampled (V_{air}). This is simply the product of the flow rate (in litres per minute) and the sampling time in minutes.

In this study, the filters used for TSP were pre-weighed in the laboratory after they were conditioned for 24 hours in a desiccator having Silica Gel as the drying agent prior to sampling as well as after sampling. All filters were weighed using a microbalance of 1.0 μg sensitivity. The filter paper holders were positioned facedown to ensure that they do not intercept particulate matter removed from the atmosphere by both dry and wet deposition. Also, *in-situ* determination technique was deployed using real-time PPM 1055 handheld particulate sampler.

For TSP calculation, the concentration of particulate matter of a specific aerodynamic diameter was, for every sampling, computed using the relations:

$$PM\left(\mu g/m^3\right) = \frac{\left(W_f - W_i\right)(mg) * 10^6}{V_{air}(litres)}$$

Where,

PM= Particulate Matter (TSP)
w_i = initial weight of the filter.
w_f = final weight of the filter.

b. Pollutant Gases

The concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Non-Methane Hydrocarbon (NMHC) and Hydrogen Sulphide (H_2S) in the ambient air were measured using RAE multi gas analyser. The air samples were collected at heights of 1.5m above ground level.

Table 4.4.1a: Sampling Station Coordinates for Air Quality, Noise, Vibration and EMF Measurements

S/N	Location	Coordinate, UTM (WGS 84) Zone 31N	
		Northing (m)	Easting (m)
1	Likosi Sub 1	748706	558515
2	Likosi Sub 2	748677	559029
3	Likos1 Sub 3	749169	559025
4	Likosi Sub 4	749196	558558
5.	Lik-Sag TL 1	749340	561532
6.	Lik-Sag TL 2	748827	560164
7.	Lik-Redeem TL 1	748210	556856
8.	Redeem Sub	749120	554111
9.	Lik-Ejio TL 1 (Control Point)	749695	559345
10.	Lik-Redeem TL 2- Ologbun	748221	556826
11.	Lik-Redeem TL 3- Sosho Ogbara	746593	553379
12.	Lik- Ejio TL 4-Oriola	757327	533450
13.	MFM Sub 1	746637	540975
14	MFM Sub 2	746487	542656
15.	MFM Sub 3	746086	541410
16.	Ikj – MFM TL Pipeline	742646	541718
17.	Ikj-MFM TL Iganun	741020	542120
18.	Lik- Ejio TL 2-Wichtech	758599	560262
19.	Lik- Ejio TL 3- Ori	760273	550492
20.	Lik- Ejio TL 5-Ifesowapo	758522	541694
21.	Lik- Ejio TL 6 Adewolu	759804	543758
22.	Lik- Ejio TL 7 Jaguna	757313	533504
23.	Lik- Ejio TL 8 Ibokuru	757161	525258
24.	Lik- Ejio TL 9 Ejio	756753	523781

c. Sampling Duration

In general, the monitoring of TSP was carried out for each station at 1-hour sampling period. The monitoring of pollutant gases (notably CO, SO_2, NO_2, NMHC and H_2S) was each based on two approaches as follows:

(1) Field Survey-Short-term (1hr) averaging sampling time. The methodologies are shown in Table 4.4.1.a

(2) Previous Studies- Environmental Management Plan (EMP) for the Alternative Fuel of Kiln firing at Ewekoro (Lafarge, 2016)

Table 4.4.1a shows the methodology and sampling periods for the different air quality indicators parameters.

Table 4.4.1a: Air Sampling Duration and Equipment Used for Air Quality Determination

	Parameter	Equipment Used	Period
1	TSP	Air metric Sampler (Weighing)/ Real -time with PPM 1055 handheld Particulate Sampler	1-hour averaging sampling
2	NO_2, SO_2, H_2S, CO & NMHC	RAE Multi-Gas Analyser	1-hour averaging sampling

The sampling stations were geo-referenced using a Geographical Positioning System (GPS) handset and presented in Table 4.4.1b and Figure 4.4.1

Plate 4.4.1: Air quality set-up at MFM Substation

4.4.2. Results and Discussion

The summary of the ambient air quality measurements in the study area is presented in Table 4.4.1 while the values are compared with some regulatory standard values (including the FMEnv standard) in Table 4.4.2.

Table 4.4.1: Air Quality Characteristics of the Study Area

ID	Sampling Station	TSP	SO_2	NO_2	CO	H_2S	NMHC
		$\mu g.m^{-3}$	ppm				
AN1	Likosi Sub 1	90.00	<0.01	<0.01	1.00	<0.10	<0.01
AN2	Likosi Sub 2	91.00	<0.01	<0.01	1.00	0.10	<0.01
AN3	Likos1 Sub 3	89.10	<0.01	<0.01	1.00	<0.10	<0.01
AN4	Likosi Sub 4	90.00	<0.01	<0.01	2.00	<0.10	<0.01
AN5	Lik-Sag TL 1	248.0	<0.01	<0.01	1.00	<0.10	<0.01
AN6	Lik-Sag TL 2	48.0	<0.01	<0.01	4.00	<0.10	<0.01
AN7	Lik-Redeem TL 1	248.0	<0.01	<0.01	2.00	<0.10	<0.01
AN8	Redeem Sub	111.20	<0.01	<0.01	1.00	<0.10	<0.01
AN9	Lik-Ejio TL 1	100.0	<0.01	<0.01	<1.00	<0.10	<0.01
AN10	Lik-Redeem TL 2- Ologbun	65.00	<0.01	<0.01	1.00	<0.10	<0.01
AN11	Lik-Redeem TL 3- Sosho Ogbara	72.00	<0.01	<0.01	1.00	0.010	<0.01
AN12	Lik- Ejio TL 4-Dagunja	98.00	<0.01	<0.01	<1.00	<0.10	<0.01
AN13	MFM Sub 1	84.00	<0.01	<0.01	2.00	0.10	<0.01
AN14	MFM Sub 2	84.00	<0.01	<0.01	1.00	0.10	<0.01
AN15	MFM Sub 3	66.00	<0.01	<0.01	1.00	<0.10	<0.01
AN16	MFM Sub 4	295.0	<0.01	<0.01	1.00	<0.10	<0.01
AN17	Ikj-MFM TL Iganun	86.00	<0.01	<0.01	2.00	<0.10	<0.01
AN18	Lik- Ejio TL 2-Wichtech	82.00	<0.01	<0.01	3.00	<0.10	<0.01
AN19	Lik- Ejio TL 3- Ori	70.00	<0.01	<0.01	1.00	<0.10	<0.01
AN20	Lik- Ejio TL 5-Ifesowapo	132.0	<0.01	<0.01	1.00	<0.10	<0.01
AN21	Lik- Ejio TL 6 Adewolu	133.0	<0.01	<0.01	1.00	<0.10	<0.01
AN22	Lik- Ejio TL 7 Jaguna	179.0	<0.01	<0.01	<1.00	<0.10	<0.01
AN23	Lik- Ejio TL 8 Ibokuru	118.0	<0.01	<0.01	<1.00	<0.10	<0.01
AN24	Lik- Ejio TL 9 Ejio	109.0	<0.01	<0.01	1.00	<0.10	<0.01
	Range of EMP Wet Season Baseline data	**56-450**	**0.01**	**0.04-0.06**	**1-3**	**<0.01**	**<0.10**

Source: Dry season Field Survey, 2017; EMP for the Alternative Fuel of Kiln firing at Ewekoro (Lafarge, 2016)

Table 4.4.2: Regulatory Standards for Ambient Air Quality

S/N	Contaminant	Averaging Period	Maximum Concentration (µg/m³)	
			WHO	FMEnv[a]
1.	CO	1 – Hr 8 – Hr 24 – Hr		 22,800 11,400
2.	NO_X	1 – Hr 24 – Hr	200 -	 75 – 113 (0.04-0.06ppm)
3	SO_2	1 – Hr 24 – Hr	125	260 26
4	O_3	24 – Hr	100-120	
5.	$PM_{2.5}$	24 – Hr	25	
6.	PM_{10}	24 – Hr		
7	Non –Methane HC -NMHC			160
8.	TSP	1 – Hr 24 – Hr		600 250

[a]Source: WHO- World Health Organisation; FMEnv (1991); [b]Source: World Bank (1998)

a. Total Suspended Particulate (TSP)

TSP concentrations obtained ranged from 48 to 295 µg/m³ during dry season while wet season values in the previous EMP report ranged from 56 to 450 µg/m³. The highest TSP value was recorded at MFM axis during dry season survey and Ewekoro from previous EMP report for wet season. All measured values along the transmission line and substations were below FMEnv maximum allowable levels of 600 $\mu g.m^{-3}$ and previous EMP study around the project area (Table 4.4.2).

b. Sulphur Dioxide (SO_2)

The levels of SO_2 were less than 0.01ppm during dry season survey. Anthropogenic contribution to SO_2 load was apparently insignificant along proposed Transmission Lines and Substations.

c. Nitrogen dioxide (NO_2)

NO_2 concentration was not detected during the period of survey at all sampling locations except during wet season at Ewekoro where it was relatively low (0.01ppm). The values obtained in wet season previous study were within the FMEnv limits of 0.04-0.06 ppm (Table 4.4.1). There was no significant seasonal variation at the various stations

d. Carbon Monoxide (CO)

Carbon monoxide has a very short atmospheric life span. As expected therefore, low concentrations were obtained at most of the sampling stations, except at Ikorodu-Sagamu road with elevated concentrations of 4 ppm.

e. Hydrogen Sulphide (H_2S)

The levels of H_2S were generally insignificant except at four (4) locations at MFM and Likosi axis. The predominant source of ambient H_2S is the anaerobic degradation of wastes at the axis. Although there are no standards set for H_2S, the low levels obtained should not attract any precautionary measures.

f. Non-Methane Hydrocarbon (NMHC)

The values measured and obtained for NMHC were below detection limit of 0.01ppm at all sampling locations. The results indicate that there is insignificant fugitive emissions of hydrocarbon along the proposed Transmission Lines and Substations.

4.5. Noise Level, Vibration and Electromagnetic Field (EMF) Levels

4.5.1. Methodology

a. Noise Level

The noise measurements were carried out using a HD 600 and CEL-24X sound level meter with data logger from Extech Instruments, USA and Casella Instruments, UK for continuous measurements (short and long-term). The decibel meter is equipped with data logger software which enables the computation of indexes. The equipment was calibrated before and after usage. Noise levels were measured in the same location as air quality measurements. Short-term measurements were carried out at all sampling locations. Measurements were made at a height of approximately 1.5 m above the ground level.

b. Vibration Level

Vibration survey was carried out using vibration meter from Extech, U.S.A. Vibration levels were measured in the same location as noise level and air quality measurements.

c. Electromagnetic Field

The electric field is produced by stationary charges, and the magnetic field by moving charges (currents); these two are often described as the sources of the field. EM field was measured using EMF meter made by Extech, USA. The same locations were used for the measurement as noise and vibration.

d. Monitoring Objective and Scope

The main objectives of the baseline noise, vibration, EMF assessment were to determine the levels along RoW of the proposed Transmission Lines and Substations.

e. Site Selection and Distribution

The same rational and procedure for site selection reported for Air Quality (See Table 4.2.3.1b) was used for noise, vibration and EMF monitoring.

4.5.2. Noise Level

Noise levels along proposed Transmission Lines and Substations ranged from 34.60 dBA to 66.50 dBA during dry season field work. The highest noise level was obtained at Iganun town due to human conversation and commercial activities. However, the values obtained are within the Federal Ministry of Environment allowable limit.

4.5.3. Vibration Level

Vibration levels obtained during the survey ranged from 0.10mm/s to 0.50 mm/s for ground vibration. There is no national standard for the vibration level besides World Health Organisation (W.H.O) standard. Therefore, all the measured values were below W.H.O. standards.

4.5.4. Electromagnetic Field

The values recorded at Likosi and Ejio Substation ranged from 0.1-0.20 mG. No value was recorded at other sampling locations along the proposed Transmission Lines and substations because electrical ancillaries and Transmission Lines have not been energised.

Table 4.5.1: Noise Level, Vibration Level and EMF Level at Different Locations

ID	Location	Noise Level (LAeq dBA)	Vibration (mm/s)	EMF (mG)
AN1	Likosi Sub 1	39.6	0.50	0.20
AN2	Likosi Sub 2	40.9	0.20	<0.10
AN3	Likos1 Sub 3	42.3	0.50	<0.10
AN4	Likosi Sub 4	40.8	0.10	<0.10
AN5	Lik-Sag TL 1	51.0	0.40	<0.10
AN6	Lik-Sag TL 2	51.8	0.20	<0.10
AN7	Lik-Redeem TL 1	55.3	0.10	<0.10
AN8	Redeem Sub	32.6	0.10	<0.10
AN9	Lik-Ejio TL 1	40.4	0.20	<0.10
AN10	Lik-Redeem TL 2-Ologbun	38.9	0.10	0.10
AN11	Lik-Redeem TL 3-Sosho Ogbara	37.4	0.20	<0.10
AN12	Lik- Ejio TL 4-Dagunja	35.2	0.20	<0.10
AN13	MFM Sub 1	36.4	0.10	<0.10
AN14	MFM Sub 2	41.8	0.10	<0.10
AN15	MFM Sub 3	39.8	0.20	<0.10
AN16	MFM Sub 4	40.6	0.10	<0.10
AN17	Ikj-MFM TL Iganun	66.5	0.10	<0.10
AN18	Lik- Ejio TL 2-Wichtech	39.5	0.20	<0.10
AN19	Lik- Ejio TL 3- Ori	34.6	0.20	<0.10
AN20	Lik- Ejio TL 5-Ifesowapo	41.7	0.10	<0.10
AN21	Lik- Ejio TL 6 Adewolu	35.8	0.20	<0.10
AN22	Lik- Ejio TL 7 Jaguna	43.9	0.10	<0.10
AN23	Lik- Ejio TL	36.9	0.30	<0.10
	Standards	**FMEnv (Work place): 85**		

		W.H.O.: Residential-55, Industrial-70	**5mm/s**	**Min- 6.50**

Source: Dry season Field Survey, 2017;

4.6. Geological and Geophysical Investigations

4.6.1. Methodology

a. Topography

The topography of the area is an undulating/complex terrain due to the natural endowment and artificial activities along the proposed Transmission Lines and Substations project. Below is the range of topography for each of the proposed route:

Ejio - Likosi = 11m – 105m
Likosi – Ikorodu/Sagamu = 91m – 100m
Likosi – Redeem = 24m – 100m
MFM – Ikeja West = 6m – 13m
Likosi Substation = 10m-100m
Redeem Substation = 5m-60m
MFM Substation = 2m-6m

b. Geological/Hydrogeological Investigation

The literature on the geology and hydrogeology of the study area were reviewed. Direct observation of superficial deposits and formations in areas around the sampled localities was made.

c. Geophysical Investigation

The geophysical investigation involved the electrical resistivity method. A low frequency electric current (I) was passed into the ground through a pair of current electrodes while the resulting potential difference (ΔV) was measured across another pair of potential electrodes located within the current electrode pair.

The VES technique involved the Schlumberger array. The half inter-electrode spacing (AB/2) was varied from 1 m to 150 m with a maximum spread length of 300 m.

The apparent resistivity values were calculated from the equation:

$$\rho_a = \pi R L^2 / 2l$$

where ρ_a = the apparent resistivity

R = the ground resistance (note $R=\Delta V/I$)

ΔV = the potential difference

I = the energizing current)

L (AB/2) = half the current-current electrode spacing

l = half the potential-potential electrode spacing and

π = a constant (22/7).

Nine (9) VES stations were occupied along the proposed Likosi – Ejio, two (2) VES stations along the proposed Likosi – Existing Ikorodu/Shagamu, three (3) VES stations along the proposed Likosi – Redeem and three (3) VES stations along the proposed MFM – existing Ikeja West transmission lines as shown in Figure 4.6.1 (see plate 4.6.1). The description and geographical co-ordinates of the VES stations are shown in Table 4.6.1.

Plate 4.6.1: Geophysical Consultant on Site

Table 4.6.1: VES Stations and the GPS Geographic Co-ordinates (WGS 84, Zone 31).

Sampling Points (VES)	Proposed Transmission Line	Town/Village	Geographic Co-ordinates Easting (m)	Northings (m)
1	Likosi Substation	Likosi	558779	748656
2	Likosi Substation	Likosi	558763	748741
3	Likosi Substation	Likosi	558752	748808
4	Likosi – Existing Ikorodu/Shagamu	Mosimi	561235	748642
5	Likoso – Ejio	Oriola	558737	754147
6	Likosi – Redeem	Ologbun	556825	748204
7	Likosi – Redeem	Soso ogbara	554040	746885
8	MFM – Existing Ikeja West	Igaun	542453	741256
9	MFM Substation	MFM	542647	746246
10	MFM Substation	MFM	542659	746323
11	MFM – Existing Ikeja West	Magboro	542562	743081
12	Likosi – Ejio	Whichtech	560281	758598
13	Likosi – Ejio	Ori	550495	760276
14	Likosi – Ejio	Oke Oko	541696	758501

15	Likosi – Ejio	Adewolu	543751	759799
16	Likosi – Ejio	Jaguna	533499	757317
17	Likosi – Ejio	Ibokuru	525306	757140
18	Likosi – Ejio	Ejio	523334	757117

Source: SEEMS, 2017

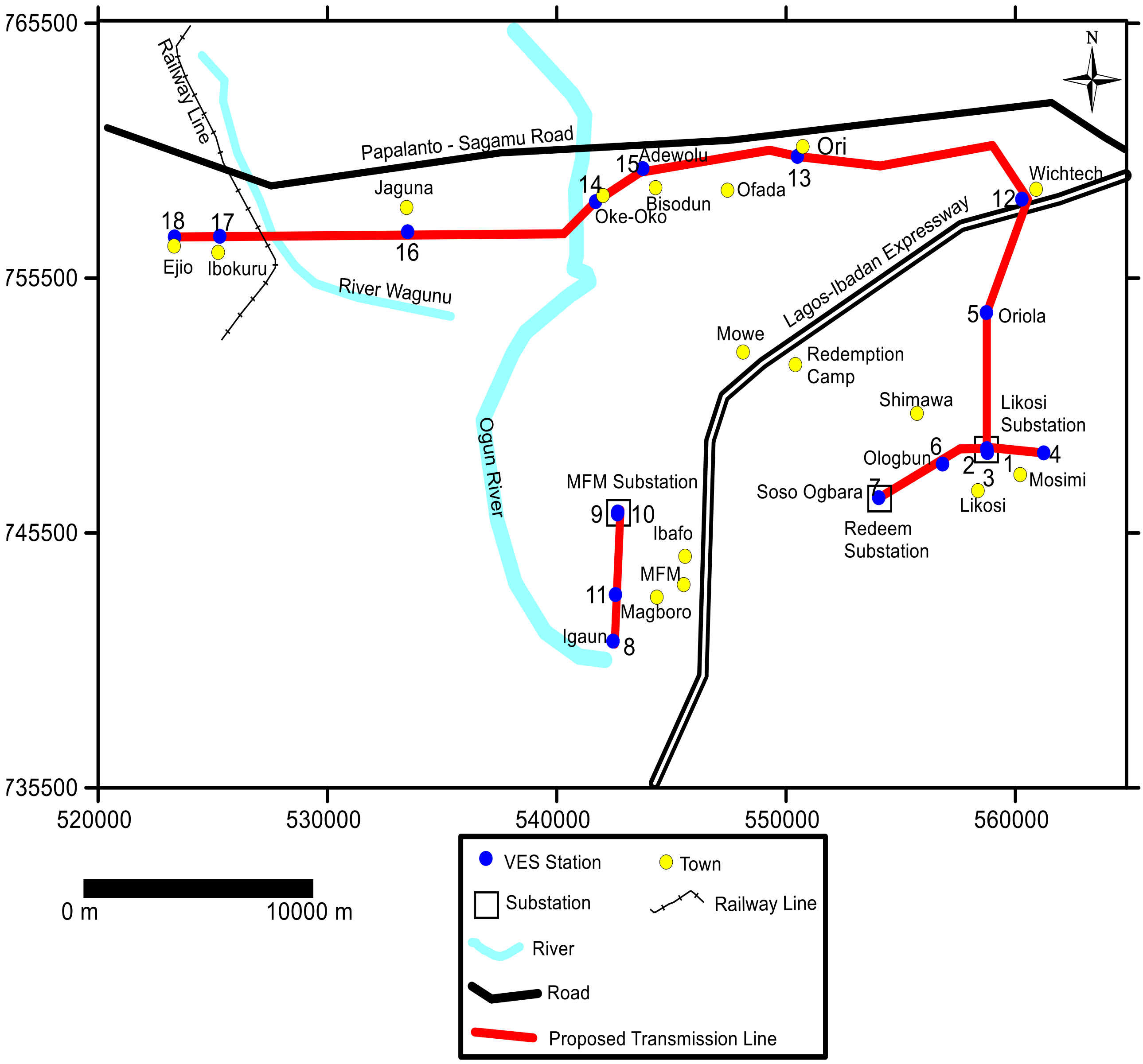


Figure 4.6.1: Base Map of the Proposed Transmission Lines and Substations Projects showing the Vertical Electrical

Source: SEEMS, 2017

The VES data are presented as depth sounding curves obtained by plotting the apparent resistivity values against the electrode spacing on bi-log graph papers (See the Appendix 4).

The quantitative interpretation of the VES curves involved the partial curve matching technique and computer assisted 1-D forward modeling with the WinResist software. The VES interpretation results are presented in Table 4.6.2. The interpretation results were used to generate the geoelectric sections.

Table 4.6.2: VES Interpretation Results

VES No.	DEPTH (m) $d_1/d_2/d_3/\ldots\ldots/d_{n-1}$	RESISTIVITY (ohm-m) $\rho_1/\rho_2/\rho_3/\ldots\ldots/\rho_n$
1	1.0/2.1/5.9/17.1/30.1	431/314/315/1985/56/∞
2	4.5/19.6	430/1324/229
3	1.0/2.9/31.8	212/1622/553/1929
4	1.4/24.9	177/333/∞
5	2.6/7.2	293/7/∞
6	1.1/22.4	162/520/∞
7	1.7/6.4/22.6	472/504/9/∞
8	1.8/8.7/47.2	324/217/29/3
9	0.5/4.5/14.7	52/6/61/14/∞
10	0.8/3.9/15.7	14/4/25/17
11	0.6/1.9/9.6	17/5/77/7
12	1.8/15.2	210/2320/922
13	0.6/1.2/3.2/12.7	119/31/253/100/276
14	1.9/21.1	69/7/144
15	0.7/42.3	933/138/469
16	1.2/3/8/22.4	845/703/25/41/33
17	1.2/2.5/27.3	174/331/5/43
18	0.9/5.1	117/501/914

4.6.2. Geology of the Project Area

The proposed transmission lines and associated substations are located within the five geological Formations. These include the Recent Alluvium, Coastal plain sand, Oshosun, Ilaro and Ewekoro Formation (Figure 4.6.2). The Coastal plain sand underlies the proposed Likosi – Redeem and Likosi – existing Ikorodu/Shagamu Transmission Lines. The Recent Alluvium formation underlies the proposed MFM – existing Ikeja West Transmission Line, while the proposed Likosi – Ejio transmission Line cut across Coastal plain sand, Ilaro, Oshosun, Ewekoro and Recent Alluvium formations (Figure 4.6.2). The alluvium recent sediment is composed of unconsolidated sands with intercalations of peat and lenses of soft/plastic silty clay and shale.

The Coastal Plain Sands underlies the coastal alluvium directly. It is composed of sands with shale/clay intercalations. The sands are fine-medium-coarse grained, poorly sorted, sub-angular to well-rounded and bears lignite streaks and wood fragments in places (Offodile, 2002).

The Oshosun Formation composed of the greenish-grey or beige clay, light greyish, white to purple clay and unconsolidated clayey shale with an interbed of sandstone. Borehole observations suggest its thickness to be around 30 to 35m.The formation is predominantly marine environment of deposition. The top is unconsolidated and a friable mixture of sandstone and clay which serves as the unconfined aquifer bed. The thin beds of limestone or marl are locally present in the formation.

The Ilaro Formation is directly overlying the Oshosun Formation and it consists of predominantly coarse sands of estuarine, deltaic and continental environments, which display a rapid lateral facies change (Slansky, 1962; Jones and Hockey, 1964). The sands are massive, white (sometimes yellowish) and poorly sorted and mineralogically composed of pure quartz grains. The formation is known for its aquiferous potentials with an average thickness of 36 to 60 m.

The Ewekoro Formation is composed of limestone that is exposed in Ewekoro quarry. The limestone contains clay/shale lenses and or is underlain by clay/shale. Apart from the quarry exposures there are very rare outcrops, except those intercepted in several boreholes. It is associated with a shallow marine environment due to an abundance of coralline algae, gastropods, pelecypods, echinoids fragments and other skeletal debris.

There is no recorded presence of subsidence precipitating voids and cavities arising from chemical dissolution of the limestone in the study area. In the highly fractured shale, some of the fractured planes have been filled with chalky material. There are also no surface manifestations of any major geological structures such as faults.

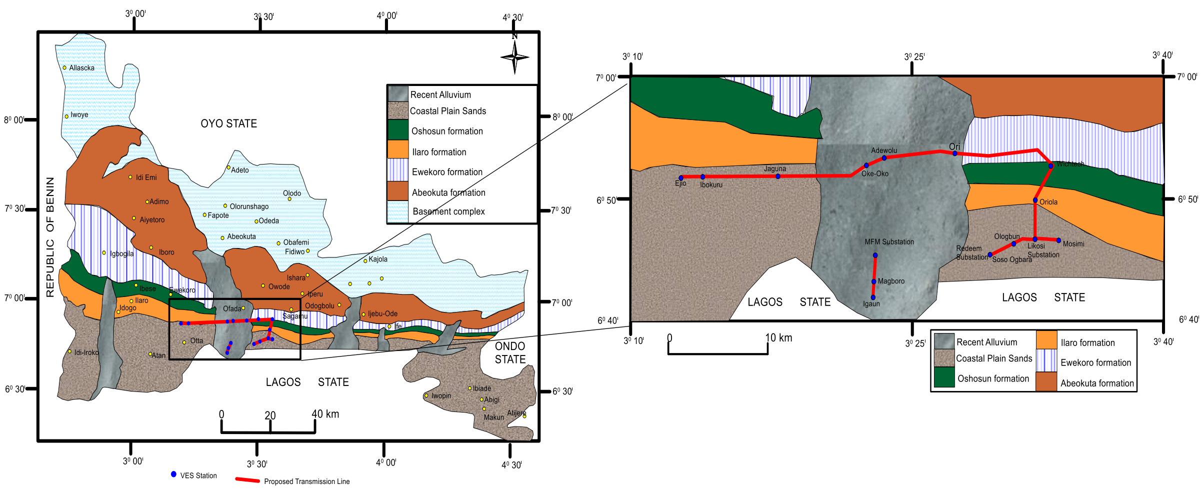


Figure 4.6.2: The Geological Map of Ogun State (GSN, 1974) Showing the Proposed Transmission Line and VES Stations

Source: SEEMS, 2017

4.6.3. Hydrogeological Characteristics

Clay/reddish clayey sands of the Oshosun Formation and the Ewekoro Limestone generally have poor groundwater potential due to low permeability arising from their argillaceous nature. The clayey nature of the formations gives the groundwater its turbid characteristics. However, some lenses of sand and clayey sand are reportedly confined by the clay. Artesian flows have been obtained from some of these restricted aquifers (Offodile, 2002). Partly weathered/Fractured limestone columns, manifesting as low resistivity layers, are known to yield copious groundwater.

The sands within the alluvial deposit and the Coastal Plain Sands constitute major aquifer units. The medium-coarse grained sands are porous and permeable with tendency for high groundwater storage and yielding capacity. The low permeability clays and sandy clays constitute the aquiclude units. The Ilaro formation is known for its aquiferous potentials with an average thickness of 36 to 60 m massive sands.

4.6.4. Recharges and Discharges

The major source of aquifer recharge in the project area is surface precipitation (rainfall). The moderately high annual average rainfall over the area ensures adequate groundwater recharge. Other sources include lateral water movement from streams and rivers and basal groundwater flow. Discharge sources include groundwater abstraction from boreholes, tube wells and hand dug wells located within the project area and evapo-transpiration.

4.6.5. Geophysical (Geoelectric) Characteristics

The VES curves, within the limits of the electrode spread, are the H, A, K, Q, QH, KH, HK QHK and HAKH types.

Figures 4.6.3a – 4.6.3d display the geoelectric sections along the proposed transmission lines. The subsurface sequence and the geoelectric characteristics are the following:

a. Likosi – Ejio Proposed Transmission Line and the Substation (Figure 4.6.3a)

1st Layer: Topsoil: Clay/Sandy Clay/Clayey Sand/Sand.

Resistivity: 31 - 1622 ohm-m; Thickness: 0.9 – 2.9 m

2nd Layer: Clay/Sandy clay

Resistivity: 2.8 – 16 ohm-m; Thickness: 4.5 – 24.9 m (undefined beneath VES16)

3rd Layer: Sand

Resistivity: 43 - ∞ ohm-m; Rockhead at: 0.9 – 42.3 m (undefined beneath VES16).

b. Likosi – Existing Ikorodu/Shagamu Proposed Transmission Line and the Substation (Figure 4.6.3b)

1st Layer: Topsoil: Sandy Clay/Sand.

Resistivity: 177 - 1622 ohm-m; Thickness: 1.4 – 2.9 m

2nd Layer: Clayey sand

Resistivity: 333 ohm-m; Thickness: 23.5 m

3rd Layer: Sand

Resistivity: 553 - ∞ ohm-m; Rockhead at: 2.9 – 24.9 m

c. Likosi – Redeem Proposed Transmission Line and the Substations (Figure 4.6.3c)

1st Layer: Topsoil: Sandy clay/Sand.

Resistivity: 162 - 1622 ohm-m; Thickness: 1.1 – 2.9 m

2nd Layer: Clay

Resistivity: 9 ohm-m; Thickness: 16.3 m

3rd Layer: Sand

Resistivity: 504 - ∞ ohm-m; Rockhead at: 1.1 – 22.6 m

MFM – Existing Ikeja West Proposed Transmission Line and the Substation (Figure 4.6.3d)

1st Layer: Topsoil: Clay/Sandy Clay/Clayey Sand.

Resistivity: 17 - 324 ohm-m; Thickness: 0.5 – 1.8 m

2nd Layer: Clay

Resistivity: 5 – 6 ohm-m; Thickness: 1.3 – 4.5 m

3rd Layer: Sandy clay/Clayey sand

Resistivity: 61 – 217 ohm-m; Thickness: 7.8 – 10.2 m

4th Layer: Clay

Resistivity: 7 - 29 ohm-m; Rockhead at: Undefined

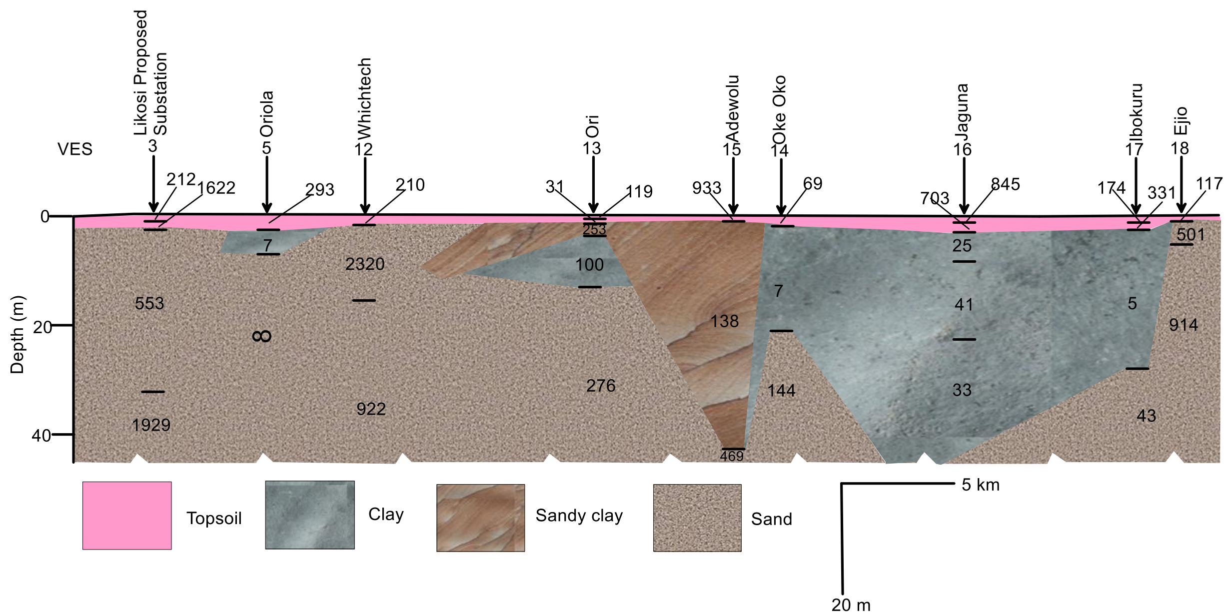


Figure 4.6.3a: Geoelectric Section along the Proposed Likosi – Ejio Transmission Line

Source: SEEMS, 2017

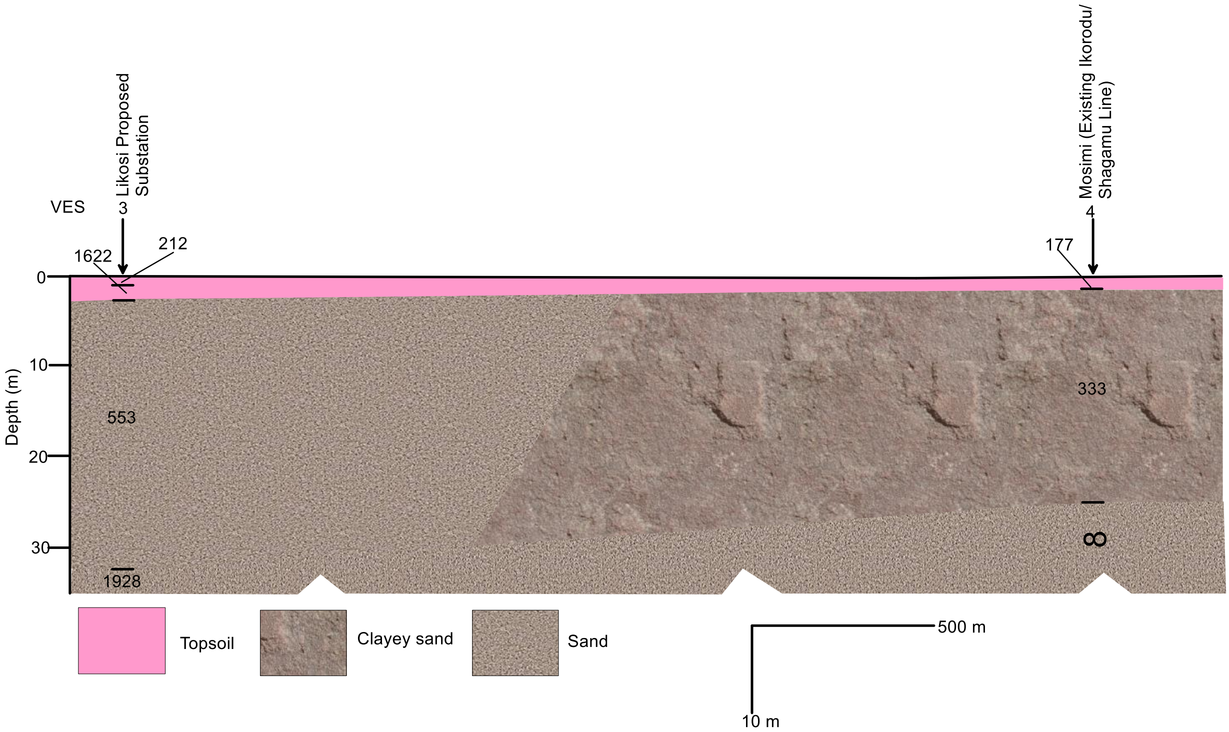


Figure 4.6.3b: Geoelectric Section along the Proposed Likosi – Existing Ikorodu/Shagamu Transmission Line

Source: SEEMS, 2017

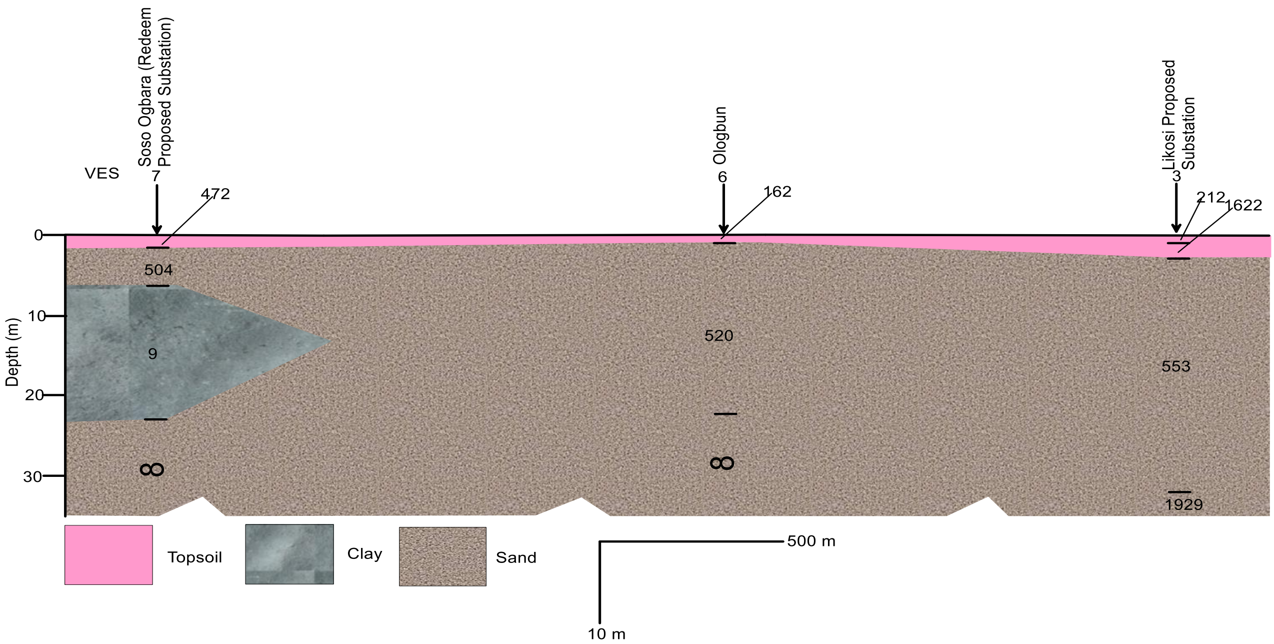


Figure 4.6.3c: Geoelectric Section along the Proposed Likosi – Redeem Transmission Line

Source: SEEMS, 2017

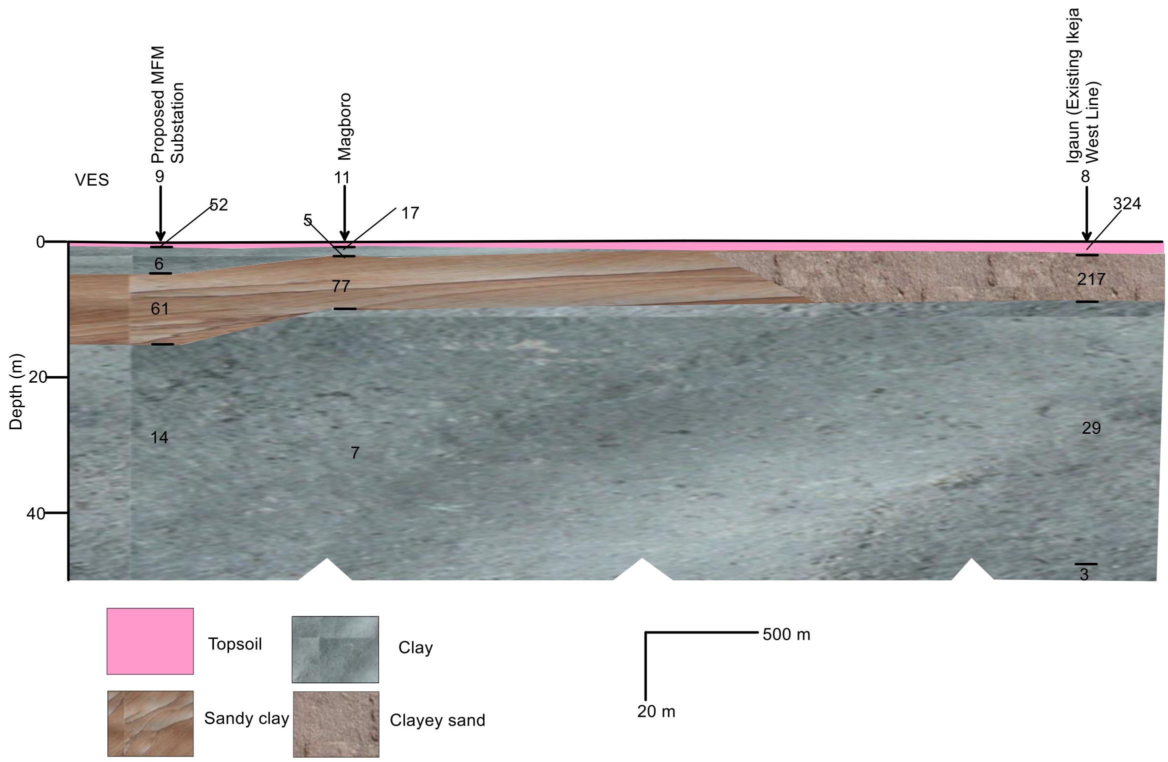


Figure 4.6.3d: Geoelectric Section along the Proposed MFM – Existing Ikeja West Transmission Line

Source: SEEMS, 2017

4.6.6. Soil Resistivity and Corrosivity Evaluation

Low electrical resistivities arising from reduced aeration, increased electrolyte saturation or high concentration of dissolved salts in soils are indicative of good conducting path. Such low resistivity media are known to precipitate severe corrosion.

Based on Baeckmann and Schwenk (1975); Agunloye (1984) and the British Standard BS – 1377, soil resistivity can be classified in terms of the degree of soils corrosivity as shown in Table 4.6.3.

Table 4.6.3: Classification of Soil Resistivity in terms of its Corrosivity

SOIL RESISTIVITY (ohm-m)	SOIL CORROSIVITY
Up to 10	Very Strongly Corrosive (VSC)
10 – 30	Very Corrosive (VC)
30 – 60	Moderately Corrosive (MC)
60 – 180	Slightly Corrosive (SC)
180 and above	Practically Non-Corrosive (PNC)

Source: Baeckmann and Schwenk (1975); Agunloye (1984) and the British Standard BS – 1377

The subsoil resistivity within the depth range of 0 – 2 m within which the base of the transmission line towers could be founded varies from 8 to 764 ohm-m along the proposed transmission lines and the substations (Figures 4.6.4a-4.6.4c). Based on Table 3 above, soils with layer resistivity values within this range are very strongly corrosive to practically non-corrosive. Along the proposed Likosi – Ejio transmission line and the substation (Figure 4.6.4a), the subsoil within 0 – 2 m is moderately corrosive between 0 to 5.3 km, slightly corrosive between 5.31 – 27.15 km and 37.96 – 46.13 km, very strongly corrosive between 27.15 – 29.39 km and practically non-corrosive between 29.39 – 37.96 km and 46.13 – 48.17 km. Along the proposed Likosi – Existing Ikorodu/Shagamu and Likosi – Redeem transmission lines and the substations (Figure 4.6.4b), the subsoil within 0 – 2 m is practically non-corrosive. Along the proposed MFM – existing Ikeja West transmission line and the substation (Figure 4.6.4c), the subsoil within 0 – 2 m is very strongly corrosive between 0 – 0.82 km and practically non-corrosive between 0.82 – 4.17 km.

Metal structures embedded within transmission line tower foundation could be under significant threat of corrosion, most especially between 27.15 – 29.39 km along the proposed Likosi– Ejio transmission line and 0 – 0.82 km along the proposed MFM – existing Ikeja West transmission.

4.6.7. Subsoil Engineering Characteristics

The sand constitutes the competent bedrock in the subsurface sequence delineated beneath the proposed transmission lines and substations. The low permeability clayey Formation constitutes the incompetent overburden. The sand horizon, which constitutes the competent layer, occurs at depths varying from 0.9 to 42.9 m (see Figures 4.6.3a-4.6.3c) with intercalation of low competent clayey layers. The competent layer (sand) was not delineated beneath the proposed MFM – existing Ikeja West transmission line (Figure 4.6.3d), this may be due to space constrain in VES spreading. There is high risk of settlement of transmission line tower foundation within the clayey segment unless the foundations (platforms) of the towers are anchored on friction piles.

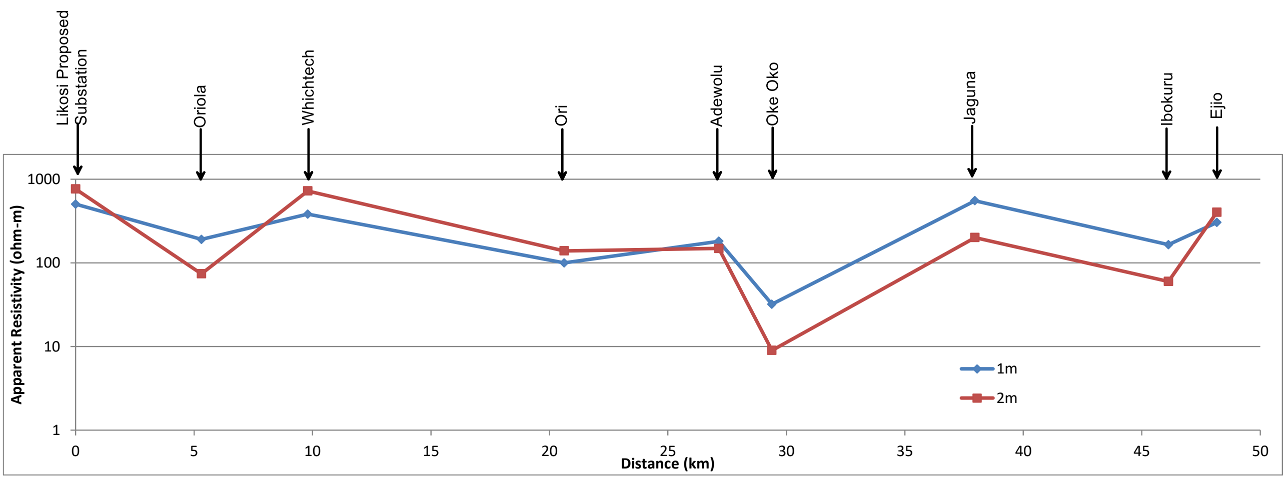


Figure 4.6.4a: Subsoil Resistivity along the Proposed Likosi – Ejio Transmission Line

Source: SEEMS, 2017

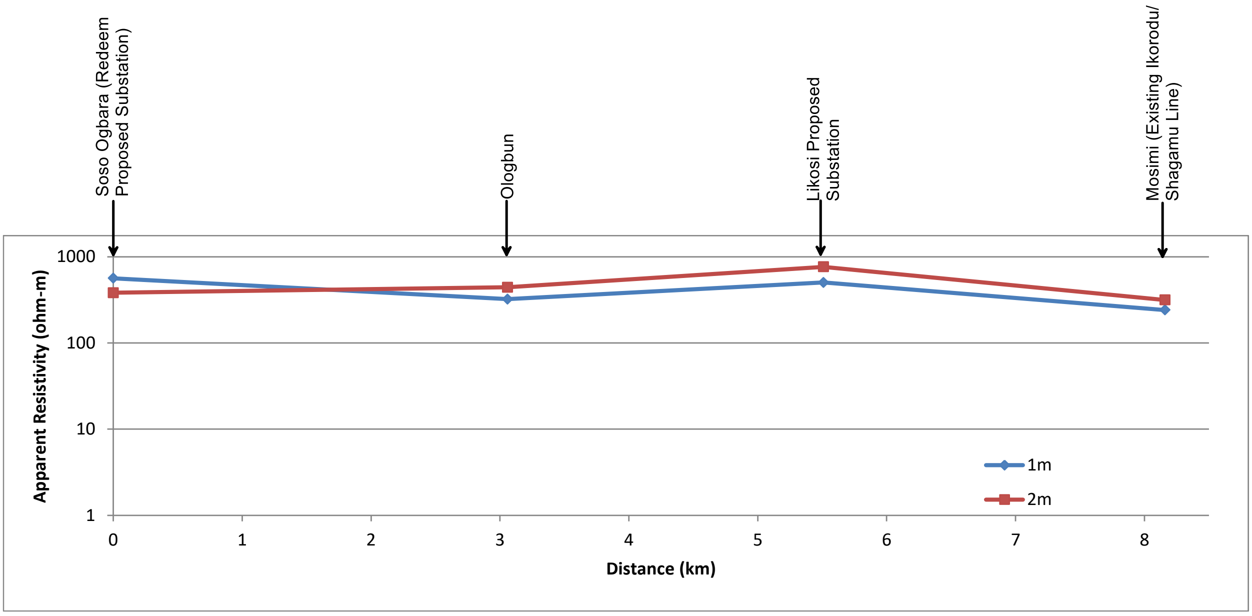


Figure 4.6.4b: Subsoil Resistivity along the Proposed Likosi – Existing Ikorodu/Shagamu and Likosi – Redeem Transmission Lines

Source: SEEMS, 2017

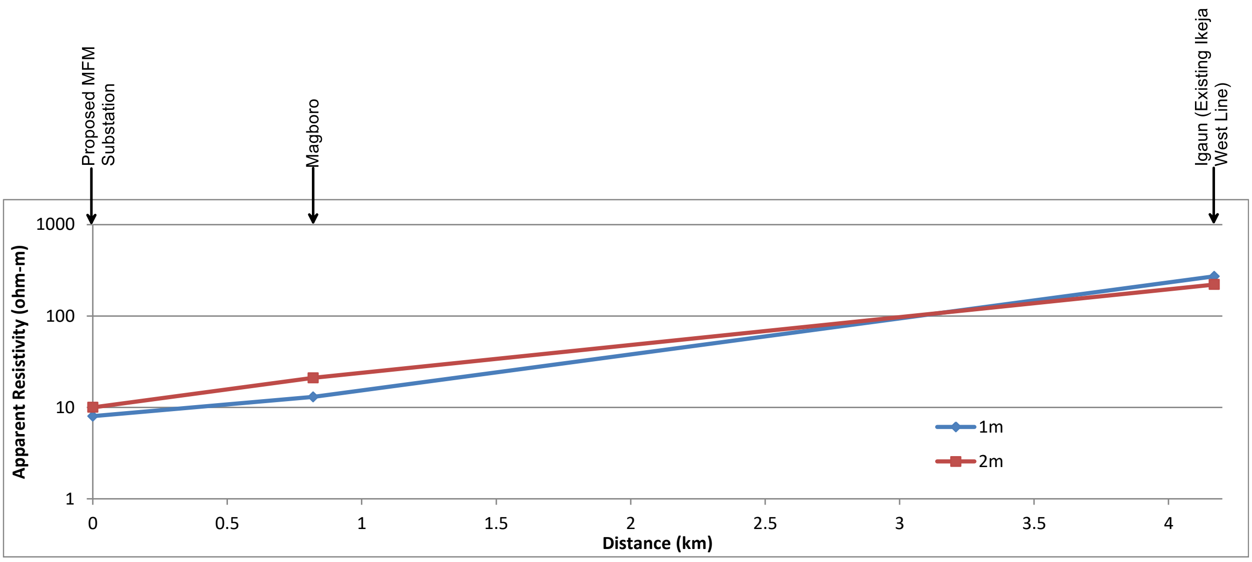


Figure 4.6.4c: Subsoil Resistivity along the Proposed MFM – Existing Ikeja West Transmission Lines

Source: SEEMS, 2017

4.7. Water Quality

Twenty-one (21) sampling stations were selected for the water quality study (Table 4.7.1). They comprised nine (9) samples from the Groundwater sources (boreholes/hand-dug wells) and twelve (12) locations on the surface waterbodies around (majorly streams/channels and rivers). The grid co-ordinates and description of the selected sampling stations were measured using a portable Geographical Positioning System (GPS) set (Table 4.7.1). At each sampling station information on prevailing weather condition and water use activities was recorded. Ambient air temperature and water temperature were measured using a mercury in glass bulb thermometer. The waterbody was sampled and immediately its pH, conductivity, TDS measured using a multi-parameters meter (PCE-PHD1 previously standardized). Surface water bodies were sampled directly from the surface using a 5L capacity plastic sampling bottle, while Groundwater sources were sampled from their supply taps. Separate samples were collected for some parameters or group of parameters, notably: dissolved oxygen, (DO) Biochemical oxygen demand (BOD_5), heavy metals, organic and nutrient compounds. Sample for DO determination was fixed immediately after collection (using Winkler's reagents) for later determination at the field base station. All samples were adequately labelled and preserved appropriately. Table 4.7.1 also, presents the description of the sampled waterbodies, their grid coordinates, date and time of sampling of all the selected stations.

4.7.1. Groundwater sources

The ambient air temperature during the period of the fieldwork ranged from 25.9 to 35.4 ^oC with a mean value of 30.1 ± 0.5 ^oC. The groundwater ambient air temperature depends on the depth of the source. The groundwater temperature ranged from 27.8 to 31.0 ^oC with a mean value of 28.9 ± 0.3 ^oC. They were mostly coloured and turbid. Their apparent colour, true colour and turbidity ranged from 23.11 to 73.78 Pt-Co, from 21.81 to 40.44 Pt-Co and fro 57.60 to 64.82 Pt-Co with mean values of 30.69±5.42 Pt-Co, 25.72±1.94 Pt-Co, 58.99±0.75 Pt-Co respectively (Table 4.7.2). The pH ranged from very strongly acidic (4.75) to slightly alkaline (7.47) and on the average being moderately acidic (5.71 ± 0.29). The conductivity and TDS ranged from 37.6 to 516.0 µS/cm and from 24.8 to 344.0 mg/L with mean values of 155.9±53.9 µS/cm and 104.1±35.9 mg/L respectively indicating they are of freshwater origin with their conductivity values < 1000 µS/cm and TDS values < 500 mg/L.

Acidity and alkalinity ranged from 4.0 to 12.0 mg/L$CaCO_3$ and from 8.0 to 186.0 mg/L$CaCO_3$ with mean values of 7.3±1.0 mg/L$CaCO_3$ and 55.8±22.9 mg/L$CaCO_3$ respectively (Table 4.7.2). On the average, the waterbodies could be regarded as well buffered waterbodies with the mean alkalinity value (55.8±22.9 mg/L$CaCO_3$) greater than 20 mg/L$CaCO_3$. However, stations 1, 2, 6 and 20 could be regarded as poorly buffered water sources with their alkalinity values < 20 mg/L$CaCO_3$. The hardness was mostly carbonate (temporary) hardness with the total hardness values range = 1.23 - 48.97 mg/L$CaCO_3$ and mean = 6.91±5.26 mg/L$CaCO_3$ indicating they are all soft Groundwater sources.

Based on their mean values the ionic hierarchy of dominance of the cations and anions from the water samples were:

Cations: $Na^+ > Mg^{2+} > K^+ > Ca^{2+}$

Anions: $HCO_3^- > Cl^- > SO_4^{2-} > NO_3^-$ (Table 4.7.2).

The oxygen parameters and nutrient compounds (DO, DO%Sat., COD, BOD_5, TOC and OM) ranged from 1.4 to 6.4 mg/L; 18.3 to 82.4 %; 1.13 to 19.86 mg/L; 0.4 to 3.0 mg/L; 0.43 to 7.45 mg/L and 0.73 to 12.83 mg/L) and mean values of 4.4±0.5 mg/L; 57.7±6.7 %; 8.57±1.91 mg/L; 1.4±0.3 mg/L; 3.22±0.72 mg/L and 5.54±1.23 mg/L respectively as presented in Table 4.7.2. Based on the dissolved oxygen mean values the groundwater sources in the area could be regarded as moderately aerated (DO mean value = 4.4±0.5 mg/L) and moderately saturated (DO%Sat. mean value = 57.7±6.7 %). The relatively low mean values of nutrient compounds COD, TOC and OM are evidence of little or no organic pollution of the groundwater sources in the area.

The heavy metals/trace elements in the samples occurred over a wide range 0.000 mg/L (Pb) – 0.220 mg/L (Fe). Based on their average values they can be categorized *viz:*

- < 0.010 mg/L = Pb > Co > Cr
- 0.010 - 0.017 mg/L = Ni > Zn > Cu > Mn > Cd
- > 0.018 mg/L = Fe

Comparing the mean values of the physico-chemical characteristics of the Groundwater samples from the area with Drinking water Standards as presented in Table 4.7.2 showed most of the parameters were within the prescribed limits for drinking water except for apparent colour, true colour, turbidity and cadmium (Cd) which were relatively high.

Groundwater is usually colourless. Colour in groundwater may indicate the presence of natural substances in the water such as:

- dissolved organic matter such as humic substances, tannin, lignin, or coal
- inorganic materials such as iron, manganese, copper, or zinc
- infiltration of surface water containing dissolved organic matter as well as suspended matter or industrial wastes/effluent

Colour in groundwater may also be due to natural geology of the area or may indicate possible contamination (Nova Scotia Environment, 2008).

Sources of cadmium in the environment include anthropogenic activities such as: presence/uses in batteries, colourant/pigments in plastics/ceramics/glasses, fabric printing, photography, cigarettes/tobacco, fertilizers, fungicides, germicides rodenticides etc. (Podsiki, 2008).

Table 4.7.1: Grid Location and site description with sampling date and time of the Water Quality/Hydrobiology Sampling Stations

SN	Station	Water Type/Source	Site Description	Location/Grid Coordinate			Sampling Date
				Northing (N)	Easting (E)	+Altitude (m)	
1	Station 1	Groundwater/Borehole	Road adjacent to Remson Royal Schools around Likosi Sub-Station	0558497	0748469	96 ± 4	18/12/2017
2	Station 2	Groundwater/Borehole	Shagamu Steel Rolling Company Borehole	0561234	0748541	74 ± 4	19/12/2017
3	Station 3	Surface water/Stream	Stream at Oriola Village, Via Ijagon at the back of proposed Golden Crown Estate by Bustom Homes and Properties Ltd.	0558889	0754209	45 ± 6	19/12/2017
4	Station 4	Groundwater/Borehole	Borehole at the last building before the valley at Ologbun	0556809	0748206	94 ± 4	19/12/2017
5	Station 5	Surface water/Stream	Stream at the entrance of Shosho-Ogbara village	0554174	0747125	26 ± 3	19/12/2017
6	Station 6	Groundwater/Borehole	Borehole at Shosho-Ogbara village	0554157	0747145	22 ± 4	19/12/2017
7	Station 7	Groundwater/Borehole	Borehole at Gan-Un Community, Magboro	0542420	0741270	24 ± 6	20/12/2017
8	Station 8	Surface water/River	Rver at the bridge on the road to Gan-Un Community, Magboro	0543116	0741709	11 ± 5	20/12/2017
9	Station 9	Surface water/Stream	Stream at proposed MFM Sub-Station in Makogi Community	0542512	0746593	12 ± 4	20/12/2017
10	Station 10	Surface water/Stream	Stream at the channel along the proposed Green Spring Estate Project Magboro.	0541800	0743233	9 ± 4	20/12/2017
11	Station 11	Surface water/Stream	River at Ori village (River Kori)	0550877	0760129	31 ± 6	21/12/2017
12	Station 12	Surface water/Stream	Stream down the fish pond at Omu-Apempe Community	0549122	0760463	28 ± 5	21/12/2017
13	Station 13	Surface water/River	Ogun River at Ifesowapo, Oke-Oko Community	0541662	0758525	13 ± 4	21/12/2017
14	Station 14	Groundwater/Hand-dug well	Hand-dug well at Ifesowapo, Oke-Oko Community	0542368	0758540	21 ± 4	21/12/2017
15	Station 15	Surface water/River	River at Adewolu Community	0543193	0760502	20 ± 7	21/12/2017
16	Station 16	Surface water/Stream	Stream at Jaguna village towards the Transmission Line crossing	0533482	0757639	27 ± 5	21/12/2017
17	Station 17	Groundwater/Hand-dug well	Hand-dug well at Jaguna village	0533523	0758126	40 ± 7	21/12/2017
18	Station 18	Surface water/Stream	Stream at Abese Community	0524119	0757129	53 ± 4	22/12/2017
19	Station 19	Surface water/Stream	Stream at Ibokuru Community	0526004	0757159	29 ± 6	22/12/2017
20	Station 20	Groundwater/Hand-dug well	Hand-dug well at Ibokuru Community	0525880	0757080	40 ± 5	22/12/2017
21	Station 21	Groundwater/Hand-dug well	Hand-dug well at Ejio Community (with water pumping machine)	0523145	0757042	106 ± 5	22/12/2017

Source: SEEMS, 2017; N = North, E = East, m = meters, + = above mean sea level (amsl).

Table 4.7.2: Physico-chemical characteristics of Groundwater sources from the area

S/N	Parameter	Unit	Station									Range	Mean±S.E.	Regulatory Limit (D.W.Stds)
			1	2	4	6	7	14	17	20	21			
	Physical parameters/general chemical parameters													
1	Air Temperature	ºC	30.1	31.6	28.9	27	29	32.5	32	29	31	27.9 – 32.5	30.1±0.6	Ambient$^+$
2	Water Temperature	ºC	28.3	28	28.9	31	27.8	28.9	29.5	28.5	29.2	27.8 – 31.0	28.9±0.3	Ambient$^+$
3	Apparent Colour	Pt-Co	23.49	23.11	24.05	24.60	27.77	73.78	25.16	26.65	27.58	23.11 - 73.78	30.69±5.42	15 (TCU)$^+$
4	True Colour	Pt-Co	27.03	26.09	23.49	21.81	25.35	40.44	23.11	22.00	22.18	21.81 - 40.44	25.72±1.94	15 (TCU)$^+$
5	Turbidity	NTU	59.03	57.72	58.02	57.60	58.58	64.82	58.32	59.21	57.66	57.60 - 64.82	58.99±0.75	5.0$^+$
6	Total Dissolved Solids (TDS)	mg/L	53.8	24.8	224	43.3	61.6	62.7	344	35.1	87.3	24.8 – 344.0	104.1±35.9	1000*
7	Conductivity	µS/cm	80.7	37.6	335	64.7	92.9	94.4	516	51.8	130.2	37.6 – 516.0	155.9±53.9	1500*
8	pH		4.94	4.75	7.47	5.03	5.67	5.56	6.67	5.34	5.93	4.74 – 7.47	5.71±0.29	6.5 – 8.5$^+$
9	Acidity	mg/L$CaCO_3$	4.0	4.0	8.0	10.0	8.0	10.0	4.0	6.0	12.0	4.0 – 12.0	7.3±1.0	NS
10	Alkalinity	mg/L$CaCO_3$	8.0	12.0	186.0	14.0	20.0	30.0	162.0	16.0	54.0	8.0 – 186.0	55.8±22.9	200*
11	Total Hardness	mg/L$CaCO_3$	1.56	2.08	48.97	1.85	2.08	1.41	1.51	1.47	1.23	1.23 - 48.97	6.91±5.26	150$^+$
12	Non-Carbonate Hardness	mg/L$CaCO_3$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 - 0.00	0.00±0.00	150$^+$
	Anions and cations													
13	Calcium (Ca^{2+})	mg/L	0.28	0.39	0.68	0.23	0.39	0.09	0.11	0.26	0.18	0.09 - 0.68	0.29±0.06	NR**
14	Magnesium (Mg^{2+})	mg/L	0.21	0.27	11.53	0.31	0.27	0.29	0.3	0.2	0.19	0.19 - 11.53	1.51±1.25	NR**
15	Sodium (Na^+)	mg/L	3.75	3.90	7.06	3.30	2.81	2.18	1.86	1.22	1.06	1.06 - 7.06	3.02±0.61	200$^+$
16	Potassium (K^+)	mg/L	0.30	0.28	2.34	0.73	1.14	0.62	0.35	0.38	0.63	0.28 - 2.34	0.75±0.22	NS
17	Chloride (Cl^-)	mg/L	5.14	3.94	2.15	5.14	0.35	8.13	18.91	3.94	6.34	0.35 - 18.91	6.01±1.78	250$^+$
18	Sulphate (SO_4^{2-})	mg/L	1.21	1.28	0.93	0.79	1.27	1.21	1.06	1.04	1.22	0.79 - 1.28	1.11±0.06	100$^+$
19	Bicarbonate (HCO_3^-)	mg/L	9.6	14.4	223.2	16.8	24.0	36.0	194.4	19.2	64.8	9.6 - 223.2	66.9±27.5	100*
20	Nitrate (NO_3^-)	mg/L	0.07	0.06	0.07	0.08	0.10	0.09	0.09	0.07	0.07	0.06 - 0.10	0.08±0.004	50$^+$
	Oxygen parameters and nutrient compounds													
21	Dissolved Oxygen (DO)	mg/L	6.0	5.6	4.4	4.0	6.4	1.4	4.8	2.8	4.4	1.4 – 6.4	4.4±0.5	-
22	Dissolved Oxygen (DO % Sat.)	%	77.8	72.3	57.5	53.9	82.4	18.3	63.3	36.4	57.8	18.3 – 82.4	57.7±6.7	-
23	Chemical Oxygen Demand (COD)	mg/L	10.21	8.51	2.27	12.48	9.65	3.97	1.13	19.86	9.08	1.13 - 19.86	8.57±1.91	-
24	Biochemical Oxygen Demand (BOD_5)	mg/L	1.6	3.0	1.0	0.4	2.6	1.0	1.2	0.6	1.0	0.4 – 3.0	1.4±0.3	-
25	Total Organic Carbon (TOC)	mg/L	3.83	3.19	0.85	4.68	3.62	1.49	0.43	7.45	3.40	0.43 - 7.45	3.22±0.72	5.0$^+$
26	Organic Matter (OM)	mg/L	6.60	5.50	1.47	8.07	6.23	2.57	0.73	12.83	5.87	0.73 - 12.83	5.54±1.23	-
	Heavy metals/trace elements													
27	Cadmium (Cd)	mg/L	0.013	0.009	0.014	0.013	0.008	0.013	0.007	0.010	0.009	0.007 - 0.014	0.011±0.001	0.005**

S/N	Parameter	Unit	Station									Range	Mean±S.E.	Regulatory Limit (D.W.Stds)
			1	2	4	6	7	14	17	20	21			
28	Cobalt (Co)	mg/L	0.004	0.001	0.002	0.004	0.016	0.013	0.011	0.004	0.002	0.001 - 0.016	0.006±0.002	0.04*
29	Chromium (Cr)	mg/L	0.004	0.001	0.002	0.006	0.004	0.004	0.001	0.007	0.004	0.001 - 0.007	0.004±0.001	0.05^{+}
30	Copper (Cu)	mg/L	0.030	0.010	0.030	0.050	0.003	0.003	0.003	0.002	0.003	0.002 - 0.050	0.015±0.006	1.0^{+}
31	Iron (Fe)	mg/L	0.220	0.100	0.140	0.130	0.002	0.001	0.004	0.002	0.001	0.001 - 0.220	0.067±0.028	0.3^{+}
32	Manganese (Mn)	mg/L	0.010	0.001	0.010	0.060	0.006	0.010	0.005	0.002	0.003	0.001 - 0.060	0.012±0.006	0.2^{+}
33	Nickel (Ni)	mg/L	0.015	0.022	0.028	0.030	0.016	0.014	0.009	0.009	0.011	0.009 - 0.030	0.017±0.003	0.2^{+}
34	Lead (Pb)	mg/L	0.005	0.018	0.006	0.000	0.015	0.005	0.011	0.007	0.003	0.000 - 0.018	0.008±0.002	0.01**
35	Zinc (Zn)	mg/L	0.060	0.010	0.020	0.030	0.008	0.003	0.005	0.003	0.002	0.002 -0.060	0.016±0.006	3.0^{+}

Source: SEEMS, 2017

*S.E. = Standard error of the mean; NS = Not stated; NR = none required; $^{+}$ = NIS, 2007 (Maximum permitted); * = WHO, 2011; ** = Health Canada, 2012; Sat. = Saturation; D.W.Stds. = Drinking water Standards*

4.7.2. Surface water sources

All the investigated surface waterbodies were shallow with depth generally less than 1m and were mostly transparent to the bottom except for Stations 10, 12, 13 and 16. Ambient air temperatures during the period of study ranged from 25.9 to 35.4 ^{o}C with a mean value of 30.1 ± 0.5 ^{o}C while surface water temperature ranged from 25.8 to 32.0 ^{o}C with a mean value of 28.0 ± 0.5 ^{o}C (Table 4.7.3). Apparent colour, true colour and turbidity were relatively high especially compared to drinking water standards. Conductivity/TDS (range = 42.4 – 264.0 µS/cm EC and 29.9 – 178.0 mg/L TDS) are indicative that the waterbodies are of freshwater origin, EC values < 1000 µS/cm and TDS values < 500 mg/L.

The pH values ranged from moderately acidic (5.87) to neutral (7.02) and slightly acidic (6.40 ± 0.12) on the average. Acidity and alkalinity ranged from 2.0 to 22.2 mg/L$CaCO_3$ and from 6.0 to 106.0 mg/L$CaCO_3$ with mean values of 8.33±1.39 mg/L$CaCO_3$ and 35.5±9.28 mg/L$CaCO_3$ respectively (Table 4.7.3). On the average, the waterbodies could be regarded as well buffered since mean alkalinity value (35.5±9.28 mg/L$CaCO_3$) is greater than 20 mg/L$CaCO_3$. However, stations 3, 5, 11, 12, 18 and 19 could be regarded as poorly buffered as their alkalinity values were less than 20 mg/L$CaCO_3$. The hardness was mostly carbonate (temporary) hardness with the total hardness values range = 1.01 - 7.41 mg/L$CaCO_3$ and mean = 2.48±0.57 mg/L$CaCO_3$ indicating they are all soft waterbodies.

Based on their mean values, ionic hierarchy of dominance of the cations and anions from the water samples were:

Cations: $Na^{+} > K^{+} > Ca^{2+} > Mg^{2+}$

Anions: $HCO_3^{-} > Cl^{-} > SO_4^{2-} > NO_3^{-}$ (Table 4.7.3).

The oxygen parameters and nutrient compounds (DO, DO%Sat., COD, BOD_5, TOC and OM) ranged from 0.4 to 6.4 mg/L; 5.2 to 79.9 %; 1.13 to 20.42 mg/L; 0.4 to 128.0 mg/L; 0.43 to 7.66 mg/L and 0.73 to 13.19 mg/L) and mean values of 3.4±0.6 mg/L; 44.4±7.4 %; 11.91±1.71 mg/L; 21.1±10.8 mg/L; 4.47±0.64 mg/L and 7.69±1.11 mg/L as presented in Table 4.7.3. According to the classification of Key (1956), most of the surface water samples from the area could be classified as being badly polluted (DO %Saturation < 50 %). On the other hand, Stations 10, 11 and 13 could be regarded as being fair in quality (DO %Saturation = 75% - 90%) while Stations 18 and 19 could be termed as being of doubtful quality (DO %Saturation = 50% - 75%). From the average BOD_5 value = 21.1±10.8 mg/L, the surface water samples from the area could be regarded as badly polluted (i.e. mean BOD_5 value > 5.0 mg/L). However, from the classification of Key (1956), the waterbodies can be categorised as:

- Very clean = BOD_5 < 1.0 mg/L = None
- Clean = BOD_5 1.0 - 1.9 mg/L = Stations 3, 12 and 19
- Fairly clean = BOD_5 2.0 – 2.9 mg/L = Station 11
- Doubtful = BOD_5 3.0 – 4.9 mg/L = Stations 13 and 18
- Bad = BOD_5 ≥ 5.0 mg/L = Stations 5, 8, 9, 10, 15 and 16.

This is an indication of obvious biological/organic pollution in most of the surface water sources in the area as highlighted above.

The heavy metals/trace elements from the surface water sources in the area occurred over a wide range from 0.001 mg/L (Cr, Cu, Fe and Zn) to 0.610 mg/L (Fe). Based on their average values they can be categorized *viz:*

- < 0.010 mg/L = Pb > Zn > Cr > Cu
- 0.010 - 0.019 mg/L = Ni > Co > Cd > Mn
- > 0.020 mg/L = Fe.

The heavy metals/trace elements occurred in trace concentrations from the water samples in the area which is an indication of little or no inorganic pollution of the surface water resources from the area.

Table 4.7.3: Physico-chemical characteristics of surface water sources from the area

S/N	Parameter	Unit	Station												Range	Mean±S.E.
			3	5	8	9	10	11	12	13	15	16	18	19		
	Physical parameters/general chemical parameters															
1	Depth	m	0.16	0.28	0.12	0.11	0.41	0.6	0.68	0.91	0.22	0.31	0.19	0.21	0.11 – 0.91	0.37±0.07
2	Transparency	m	0.16	0.28	0.12	0.11	0.23	0.6	0.42	0.25	0.22	0.15	0.19	0.21	0.11 – 0.60	0.25±0.04
3	Air Temperature	ºC	30.0	28.0	30.0	32.0	35.4	25.9	27.2	32.5	32.0	33.9	27.0	27.8	25.0 – 34.4	30.1±0.9
4	Water Temperature	ºC	27.0	27.1	28.0	28.4	31.0	25.8	26.0	32.0	26.7	29.0	27.0	27.5	25.8 – 32.0	28.0±0.5
5	Apparent Colour	Pt-Co	31.31	35.41	39.32	54.78	50.31	37.83	22.37	60.00	35.59	71.55	34.85	28.14	22.37 - 71.55	41.79±4.16
6	True Colour	Pt-Co	25.35	26.84	29.45	34.85	28.52	27.58	19.95	32.06	27.77	44.91	34.66	27.96	19.95 - 44.91	29.99±1.79
7	Turbidity	NTU	56.59	59.00	59.35	60.81	61.43	60.19	59.62	59.68	58.85	64.64	59.38	58.02	56.59 - 64.64	59.79±0.57
8	Total Dissolved Solids (TDS)	mg/L	29.9	33.3	178.0	120.6	102.1	32.3	38.4	98.7	36.3	73.8	31.4	34.3	29.9 – 178.0	67.4±13.8
9	Conductivity	µS/cm	43.9	49.2	264.0	183.6	153.1	42.4	56.9	147.6	53.3	109.5	46.3	50.6	42.4 – 264.0	100.0±20.9
10	pH		5.91	5.87	6.79	6.84	6.60	6.00	6.10	7.02	5.90	6.32	6.81	6.65	5.87 – 7.02	6.40±0.12
11	Acidity	mg/L$CaCO_3$	6.0	6.0	8.0	10.0	2.0	8.0	6.0	6.0	22.0	8.0	10.0	8.0	2.0 - 22.2	8.33±1.39
12	Alkalinity	mg/L$CaCO_3$	8.0	12.0	106.0	64.0	66.0	10.0	16.0	64.0	20.0	38.0	6.0	16.0	6.0 – 106.0	35.5±9.28
13	Total Hardness	mg/L$CaCO_3$	7.41	5.85	1.93	1.45	1.74	2.17	1.93	1.80	1.01	1.14	1.67	1.66	1.01 - 7.41	2.48±0.57
14	Non-Carbonate Hardness	mg/L$CaCO_3$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 - 0.00	0.00±0.00
	Anions and cations															
15	Calcium (Ca^{2+})	mg/L	1.52	1.19	0.28	0.27	0.32	0.41	0.33	0.21	0.11	0.08	0.21	0.32	0.08 - 1.52	0.44±0.13
16	Magnesium (Mg^{2+})	mg/L	0.88	0.70	0.30	0.19	0.23	0.28	0.27	0.31	0.18	0.23	0.28	0.21	0.18 - 0.88	0.34±0.06
17	Sodium (Na^{+})	mg/L	3.31	4.23	3.27	2.36	4.11	1.86	2.12	2.37	3.22	2.74	1.90	1.14	1.14 - 4.23	2.72±0.27
18	Potassium (K^{+})	mg/L	0.20	0.59	0.90	0.58	0.63	0.28	0.33	0.36	0.53	0.43	0.29	0.27	0.20 - 0.90	0.45±0.056
19	Chloride (Cl^{-})	mg/L	4.54	0.35	17.12	14.12	9.33	4.54	8.73	2.15	5.14	8.73	5.74	5.14	0.35 - 17.12	7.14±1.38
20	Sulphate (SO_4^{2-})	mg/L	1.04	0.81	1.33	1.27	1.61	1.47	1.38	1.16	1.08	1.23	1.27	1.18	0. 81 - 1.61	1.24±0.06
21	Bicarbonate (HCO_3^{-})	mg/L	9.6	14.4	127.2	76.8	79.2	12.0	19.2	76.8	24.0	45.6	7.2	19.2	7.2 - 127.2	42.6±11.1
22	Nitrate (NO_3^{-})	mg/L	0.09	0.07	0.12	0.11	0.13	0.11	0.1	0.11	0.10	0.09	0.07	0.07	0.07 - 0.13	0.09±0.01
	Oxygen parameters and nutrient compounds															
23	Dissolved Oxygen (DO)	mg/L	3.0	1.8	0.4	3.2	5.6	6.4	3.6	5.8	2.2	0.6	4.2	4.4	0.4 – 6.4	3.4±0.6
24	Dissolved Oxygen (DO % Sat.)	%	38.2	22.9	5.2	41.6	75.5	79.9	45.1	79.2	27.8	7.9	53.4	56.3	5.2 – 79.9	44.4±7.4
25	Chemical Oxygen Demand (COD)	mg/L	19.86	2.84	15.89	11.35	11.35	9.08	13.62	20.43	16.45	1.13	11.35	9.65	1.13 - 20.42	11.91±1.71
26	Biochemical Oxygen Demand (BOD_5)	mg/L	1.8	8.0	128.0	56.0	8.0	2.2	0.6	4.6	8.0	32.0	3.6	0.4	0.4 – 128.0	21.1±10.8
27	Total Organic Carbon (TOC)	mg/L	7.45	1.06	5.96	4.26	4.26	3.40	5.11	7.66	6.17	0.43	4.26	3.62	0.43 - 7.66	4.47±0.64
28	Organic Matter (OM)	mg/L	12.83	1.83	10.26	7.33	7.33	5.87	8.80	13.20	10.63	0.73	7.33	6.23	0.73 - 13.19	7.69±1.11
	Heavy metals/trace elements															
29	Cadmium (Cd)	mg/L	0.013	0.010	0.010	0.006	0.004	0.012	0.013	0.015	0.009	0.010	0.011	0.009	0.004 - 0.015	0.011±0.001
30	Cobalt (Co)	mg/L	0.002	0.004	0.009	0.019	0.021	0.016	0.019	0.023	0.014	0.018	0.010	0.017	0.002 - 0.023	0.014±0.002

S/N	Parameter	Unit	Station												Range	Mean±S.E.
			3	5	8	9	10	11	12	13	15	16	18	19		
31	Chromium (Cr)	mg/L	0.002	0.004	0.013	0.006	0.013	0.008	0.004	0.002	0.002	0.005	0.006	0.001	0.001 - 0.013	0.006±0.001
32	Copper (Cu)	mg/L	0.010	0.020	0.002	0.001	0.003	0.001	0.002	0.001	0.006	0.002	0.003	0.005	0.001 - 0.020	0.005±0.002
33	Iron (Fe)	mg/L	0.610	0.380	0.001	0.005	0.003	0.002	0.003	0.005	0.002	0.003	0.002	0.001	0.001 - 0.610	0.085±0.057
34	Manganese (Mn)	mg/L	0.030	0.030	0.010	0.003	0.006	0.008	0.004	0.006	0.008	0.003	0.005	0.003	0.003 - 0.030	0.010±0.003
35	Nickel (Ni)	mg/L	0.018	0.023	0.023	0.018	0.014	0.015	0.021	0.013	0.020	0.019	0.013	0.017	0.013 – 0.023	0.018±0.001
36	Lead (Pb)	mg/L	0.003	0.003	0.013	0.018	0.009	0.010	0.008	0.003	0.011	0.008	0.008	0.009	0.003 - 0.018	0.009±0.001
37	Zinc (Zn)	mg/L	0.030	0.010	0.001	0.005	0.003	0.011	0.010	0.008	0.005	0.007	0.003	0.005	0.001 - 0.030	0.008±0.002

Source: SEEMS, 2017

4.8. Soil Quality

4.8.1. Methodology

Soil samples were taken at about 5 km or less interval along the route. The survey map of the proposed transmission route was explored and used in conjunction with both the road and political maps of Ogun State. The sampling stations were pre-selected using the co-ordinates on the obtained map. The co-ordinates were keyed into GPS receivers which were then used to pin point the exact locations along the route (Table 4.8.1). Soil samples were collected with a Dutch auger and described. At each observation point, 10 core soil samples spatially distributed around the point were taken using the auger where feasible. The core samples were bulked, mixed and sub-sampled for laboratory analysis. Four composite samples from 0 – 15 cm, and 15–50 cm soil depths were taken at every observation point. The environment at each observation point was also described in terms of vegetation and land use. All the soil samples collected were packed and preserved for onward transmission to the laboratory where they were analysed.

4.8.2. Soil Profile and Classification

The proposed transmission line is routed over an area majorly underlain by sedimentary rocks of cretaceous to recent geological times. This portion belongs to the Ewekoro formation which consists of limestone overlain by shale. The remaining portion is overlain by sandstone formation.

4.8.3. The deep well-drained upland soils of Alagba series

USDA Soil Taxonomic System: Oxic Haplustalf
FAO-UNESCO Classification System: Eutric Nitosol by the.
Physiographic unit (Locations of the soils: Found on the flat to slightly undulating topography. Slopes are generally 2-3%
Soil Parent material: Alluvium and it is underlain by shale and limestone at a depth of about 2 m.
Vegetation/Landuse: The soil is deep and well-drained with no mottles or concretions at depths. The vegetation is derived savannah consisting mainly shrubs and sprinkle of trees. It is used for extensive agricultural cultivation of arable crops.
Interpreted characteristics of the soils: Soils of Alagba series are deep red in colour ranging from yellowish red (5YR) in the top horizon to red (10 YR). These soils are free of gravels and are almost devoid of concretions and nodules. Mottles are also not present. Texturally they vary from clayey sand at the top to sandy clay at lower depths. They occur in the upland areas just before the final descent to the flood plains. This soil covers about 78% of the total land area of the project.

4.8.4. The poorly-drained upland soils of Owode series

USDA Soil Taxonomic System: Oxic Haplustalf
FAO-UNESCO Classification System: Ferric Luvisol.
Physiographic unit (Locations of the soils: The soils are located on the upland and are differentiated from the Alagba soil by the presence of mottles and concretions at about 1m depth.

Vegetation/Landuse: The soil is poorly to moderately well drained. The vegetation is mainly derived savannah consisting of shrubs and short trees; and swamps in low lying areas. It is used extensively for arable agriculture with the exception of the built- up areas.

Interpreted characteristics of the soils: The soils of Owode series are yellowish in the top horizons giving way to red and mottles of yellow, greyish white and red at lower depths. Concretions and nodules are usually present. The soil is clayey to very clayey sand in the top few centimetres and gradually become heavier with increasing depth. It is well-suited for arable agriculture since the nodules and concretions would not interfere with their roots. The soil covers about 22% of the proposed transmission route.

Plate 4.8.1: Soil Sampling by SEEMS' Consultant

4.8.5. General Soil Description

The soil is formed in situ and lies over shale and limestone and is rich in ferromagnesium minerals. The soils textures vary from sandy loam at the surface to loamy sand to sandy clay loam even clay in a few locations. Some of the soil physical and chemical characteristics are presented in Table 4.8.1. The soil pH at the surface (0-15 cm) as determined in $CaCl_2$ ranged from slightly acidic (pH 5) to neutral (pH of 7) and from 3.8 to 6 in the sub-surface (15-50 cm) layer. The more acidic soils were in the areas underlain by sandstone while the ones with neutral to slightly basic reactions are located in the areas underlain by shale and limestone. The soil organic carbon at the surface (0-15 cm) layer was low and ranged from 0.05% to 0.74%, while it varied at the subsoil (15-50 cm) layer from 0.03% to 0.53%. The soils' have medium cation exchangeable capacity as measured by sum of cations method (ECEC). This ranged from a mean of 2.3 cmol (+) kg^{-1} 6.47 cmol (+) kg^{-1} soil at the subsurface. The soils exchange sites are however dominated by basic cations as shown by the soils' value of base saturation which is an expression of the fraction of soil's exchange site that is occupied by basic cations. The soils' base saturation ranged from 74% to 94%. The soils have moderate fertility status with the more fertile soils located on the Ewekoro axis underlain by shale and limestone.

4.8.6. Heavy Metals Contents

Plant extractable heavy metals contents of a soil represent the fraction of the soil heavy metals that could be made available for plant uptake. Table 4.8.2 shows the extractable heavy metals contents of the soils along the transmission line. This is generally within the WHO acceptable limits in agricultural soils for all the heavy metals studies according to Kabata-Pendias and Pendias, (1984). The plant-extractable Cu, Cd and Ni contents of the soils are within the acceptable limits for soils. There was however an elevated content of Pb in the soil around the Thames Valley College which could be due to expended leaded batteries. There were also elevated concentrations of Zn in soils of Ibokuru, Magboro and Ejio communities the sources of which needed more investigations.

Table 4.8.1: Physico-chemical properties of the soil along the Proposed Transmission Line and Substations Project (mg kg^{-1})

Depth	pHH2O	pHCaCl2	Sand	Silt	Clay	OrgC	NO3	PO4	Ca	Mg	K	Na	Acid	CEC	BS
Likosi Location 1 (UTM 31N 05558885N 0748567E)															
0-15	6.21	4.79	68	21	11	0.05	0.163	71.16	4.63	1.41	0.00	0.16	0.28	6.47	93.26
15-50	5.84	5.31	26	46	28	0.13	0.095	4.69	2.43	0.61	0.46	0.21	0.31	4.03	87.11
Likosi Location 2 (UTM 31N 0558530N 0748778E)															
0-15	7.14	7	65	12	23	0.09	0.044	0.23	2.52	0.68	0.32	0.12	0.09	3.73	94.32
15-50	6.05	5.65	52	46	2	0.87	0.101	4.37	1.91	1.12	0.12	0.12	0.29	3.55	88.40
Likosi Location 3 (UTM 31N 05587645N 0749066E)															
0-15	6.21	5.75	54	41	5				1.87	1.07	0.46	0.16	0.32	3.88	87.70
15-50	5.43	5.36	58	36	6	0.15	0.092	10.80	3.02	0.97	0.12	0.12	0.35	4.58	89.70
Thames Valley College (UTM 31N 0561208N 0748648E)															
0-15	5.3	4.61	63	10	27	0.07	0.079	0.89	1.52	1.09	0.29	0.17	0.33	3.41	85.21
15-50	4.73	4.16	41	8	51	0.15	0.085	0.88	1.15	0.70	0.12	0.17	0.25	2.39	82.26
Ologbun (UTM 31N 0556836N 0748197E)															
0-15	6.02	5.97	74	12	14	0.48	0.176	63.80	3.88	1.38	0.46	0.21	0.24	6.17	92.73
15-50	6.43	5.82	32	46	22	0.30	0.097	8.44	2.43	1.56	0.46	0.21	0.33	4.99	89.20
Shosho Ogbara (UTM 31N 05558885N 0748567E)															
0-15	5.62	4.97	85	8	7	0.07	0.078	4.55	3.15	1.34	0.33	0.14	0.22	5.18	93.07
15-50	5.48	4.45	81	10	9	0.12	0.039	0.78	1.73	0.61	0.46	0.21	0.23	3.24	86.46
Oriola-Ijagbon (UTM 31N 05541345N 0748567E)															
0-15	4.93	4.19	81	10	9	0.11	0.048	0.45	2.99	1.40	0.27	0.17	0.35	5.18	89.88
15-50	5.6	4.2	79	12	9	0.58	0.053	0.33	1.41	2.72	0.35	0.33	0.31	5.11	87.48
Wichtech (UTM 31N 0560240N 0758598E)															
0-15	4.9	4.47	75	10	15	0.22	0.071	7.95	3.02	0.99	0.12	0.16	0.28	4.56	90.43
15-50	5.01	4.63	72	16	12	0.17	0.073	0.74	2.51	1.16	0.46	0.17	0.32	4.62	89.32
Ori (UTM 31N 0550496N 0760275E)															
0-15	5.86	5.56	68	21	11	0.09	0.149	7.01	1.80	1.00	0.35	0.17	0.37	3.69	85.27
15-50	5.12	5	58	18	24	0.51	0.144	3.75	3.37	1.31	0.92	0.14	0.38	6.13	91.53
Oke-Oko (UTM 31N 0541721N 0758526E)															
0-15	5.2	4.59	55	28	17	0.05	0.076	0.43	2.53	0.73	0.12	0.17	0.34	3.89	86.78
15-50	5.47	5.01	77	14	9	0.12	0.054	0.42	1.30	0.36	0.35	0.12	0.34	2.47	81.30

Adewolu (UTM 31N 0543771N 0759816E)															
0-15	6.59	5.76	24	51	25	0.27	0.086	7.10	2.05	0.73	1.04	0.14	0.34	4.30	88.85
15-50	6.39	5.29	28	41	31	0.08	0.063	2.37	2.68	1.86	0.23	0.19	0.38	5.34	89.30
Jaguna (UTM 31N 0533528N 0757318E)															
0-15	6.7	6.01	72	9	9	0.05	0.125	0.51	1.13	0.74	0.26	0.12	0.32	2.57	82.82
15-50	6.5	5.26	71	18	11	0.19	0.102	0.39	1.00	0.60	0.12	0.17	0.41	2.30	74.65
Ibokuru (UTM 31N 0525306N 0757140E)															
0-15	6.76	6.37	48	27	25	0.13	0.069	0.66	1.90	0.96	0.23	0.12	0.28	3.50	88.52
15-50	5.87	5.32	46	12	42	0.08	0.056	0.34	1.63	1.15	0.35	0.19	0.32	3.63	85.93
Ejio (UTM 31N 0523333N 0757111E)															
0-15	6.7	6.6	67	14	19	0.27	0.116	0.56	4.27	1.45	0.33	0.19	0.12	6.36	95.11
15-50	6.43	6.03	51	18	31	0.40	0.128	0.34	2.02	0.92	0.35	0.14	0.08	3.50	93.74
MFM Location 1 (UTM 31N 0542626N 0746296E)															
0-15	4.85	4.03	37	36	27	0.07	0.070	5.00	1.31	0.57	0.23	0.77	0.36	3.23	65.17
15-50	4.94	3.61	57	30	13	0.11	0.089	0.87	1.45	0.67	0.12	0.10	0.34	2.68	83.43
MFM Location 2 (UTM 31N 0542633N 0746174E)															
0-15	4.57	3.78	56	19	25	0.74	0.011	4.95	2.67	2.08	0.81	0.42	0.36	6.34	87.73
15-50	4.58	3.84	44	34	22	0.17	0.095	6.47	2.92	1.36	0.58	0.50	0.33	5.69	85.34
Magboro (UTM 31N 0541952N 0743058E)															
0-15	5.05	4.14	76	17	7	0.06	0.090	1.38	2.49	1.97	0.35	0.31	0.41	5.52	86.91
15-50	5.85	4.19	54	18	28	0.15	0.165	12.72	2.08	0.82	0.23	0.45	0.43	4.01	77.99
Ganum (UTM 31N 0542416N 0741227E)															
0-15	5.85	5.47	72	5	23	0.05	0.042	0.64	1.59	0.82	0.31	0.12	0.34	3.18	85.50
15-50	5.01	3.55	57	14	29	0.10	0.036	0.21	1.80	0.85	0.28	0.19	0.23	3.35	87.44

Table 4.8.2: Heavy metals contents of soil (mg kg^{-1})

Depth		Cu	Zn	Cr	Cd	Pb	Ni
Likosi Location 1 (UTM 31N 05558885N 0748567E)							
0-15		0.05	0.518	0.005	0.009	0.014	0.026
15-50		0.207	1.261	0.001	0.001	0.001	0.024
Likosi Location 2 (UTM 31N 0558530N 0748778E)							
0-15		0.152	1.529	0.005	0.007	0.255	0.004
15-50		0.231	1.147	0.001	0.001	0.001	0.023
Likosi Location 3 (UTM 31N 05587645N 0749066E)							
0-15							
15-50		0.193	1.642	0.006	0.011	0.026	0.011
Thames Valley College (UTM 31N 0561208N 0748648E)							
0-15		0.214	0.906	0.006	0.012	0.532	0.008
15-50		0.185	0.441	0.004	0.01	0.223	0.009
Ologbun (UTM 31N 0556836N 0748197E)							
0-15		0.12	0.425	0.004	0.009	0.011	0.023
15-50		0.133	1.682	0.001	0.015	0.012	0.034
Shosho Ogbara (UTM 31N 05558885N 0748567E)							
0-15		0.094	0.794	0.005	0.008	0.008	0.008
15-50		0.057	0.565	0.001	0.009	0.016	0.001
Oriola-Ijagbon (UTM 31N 05541345N 0748567E)							
0-15		0.097	0.947	0.01	0.008	0.018	0.01
15-50		0.05	0.819	0.01	0.008	0.011	0.016
Wichtech (UTM 31N 0560240N 0758598E)							
0-15		0.271	0.459	0.001	0.012	0.399	0.008
15-50		0.102	0.51	0.001	0.011	0.199	0.023
Ori (UTM 31N 0550496N 0760275E)							
0-15		0.239	0.599	0.001	0.008	0.01	0.028
15-50		0.101	0.877	0.005	0.009	0.01	0.019
Oke-Oko (UTM 31N 0541721N 0758526E)							
0-15		0.35	1.077	0.005	0.01	0.215	0.008
15-50		0.166	0.589	0.008	0.009	0.03	0.004
Adewolu (UTM 31N 0543771N 0759816E)							
0-15		0.224	0.753	0.005	0.008	0.011	0.018
15-50		0.143	0.855	0.001	0.001	0.011	0.022
Jaguna (UTM 31N 0533528N 0757318E)							
0-15		0.102	0.435	0.01	0.011	0.065	0.01
15-50		0.1	0.268	0.001	0.013	0.022	0.001
Ibokuru (UTM 31N 0525306N 0757140E)							
0-15		0.101	0.807	0.005	0.014	0.087	0.019
15-50		0.095	0.594	0.001	0.012	0.016	0.015
Ejio (UTM 31N 0523333N 0757111E)							
0-15		0.022	0.525	0.001	0.009	0.001	0.005
15-50		0.051	0.387	0.004	0.009	0.189	0.003

MFM Location 1 (UTM 31N 0542626N 0746296E)							
0-15		0.061	0.676	0.014	0.011	0.008	0.014
15-50		0.299	0.694	0.001	0.013	0.59	0.01
MFM Location 2 (UTM 31N 0542633N 0746174E)							
0-15		0.15	0.501	0.005	0.001	0.001	0.016
15-50		0.271	0.691	0.005	0.001	0.01	0.018
Magboro (UTM 31N 0541952N 0743058E)							
0-15		0.103	1.571	0.007	0.009	0.016	0.025
15-50		0.226	0.809	0.005	0.008	0.008	0.036
Ganum (UTM 31N 0542416N 0741227E)							
0-15		0.236	0.621	0.009	0.013	0.507	0.005
15-50		0.168	0.435	0.001	0.011	0.372	0.007

4.9. Protected Area

There is no protected area within the sphere of influence of the proposed project and up to 10km radius.

4.10. Biodiversity

4.10.1. Overview

Biological diversity (Biodiversity) has been defined as the variability among living organisms from all sources including *inter alia*, terrestrial, marine, other aquatic ecosystems (freshwater and brackish water) and ecological complexes of which they are part: this include diversity within species and between species of ecosystems. The Convention on Biodiversity is a legally binding agreement opened for signature at the Earth Summit in Rio de Janeiro (Brazil) in 1992. Over 145 countries, including Nigeria are now parties to the convention. The objectives of the convention are the conservation of biological diversity (biodiversity); the sustainable use of biodiversity’s components and the equitable sharing of benefits derived from genetic resources. The Convention is one of the international legal framework guiding the execution of EIA/ESIA in Nigeria today. To that effect, the convention recognizes the importance of biodiversity for maintaining life sustaining system of the biosphere and acknowledge that the conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing World population. It has a wide range of intrinsic values including ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values.

Today, biodiversity has become an issue of worldwide interest and an integral part of all environmental studies. It is therefore not surprising that virtually all the agencies of the United Nations Organization (UNO) as well as many international Non-Governmental Organizations (NGO) have continued to show interest in biodiversity. The latest development in this global interest in biodiversity is the establishment of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) formed by many agencies of the United Nations UNEP, UNESCO, FAO and UNDP. The Government of Federal Republic of Nigeria is a signatory to the Biodiversity Convention, IPBES as well as many other related Conventions. Indeed, development activities, ways of life and means of livelihood in the country are strictly guided by these Conventions, in addition to many national and state legal and administrative framework.

In support of the Federal Ministry of Environment (FMEnv) which is the federal regulatory body on issues of environment in Nigeria, there are many established NGOs/ societies in the country with strong interest in Biodiversities. Foremost among these NGOs in the country are the Nigerian Field Society (NFS) and the Nigerian Conservation Foundation (NCF). The Nigerian Field Society, established in 1930 (now 87 years old) is the oldest NGO on the environment in West Africa, and its journal (The Nigerian Field) which has published since 1931, is a goldmine on the Nigerian biodiversity (flora, fauna and ecosystems). The Nigerian Conservation Foundation (NCF) established over 40 years ago (located along Lagos – Epe Expressway, Lagos) has co-operated with many international/national bodies and donors (notably the WWF, IUCN, WRI) on the conservation and development of biodiversity in the country. The foundation has worked closely with Government Institutions on development and /or management of the seven established National Parks as well as the numerous forest games reserves, protected areas, zoological gardens and arboretum all over the country. The foundation (NCF) has developed a Biodiversity Action Plan (BAP) for forest regeneration and the mitigation of the identified effects of Climate Change on the Nigerian forest cover which is very fast decreasing. The nearest forest reserve to the present project area is the Omo forest (Ogun State) and contiguous to it is the Shasha forest.

In the present study, the biodiversity of Lot 2 study area has been adequately covered in the following specific studies;

- <u>Terrestrial Vegetation (Flora):</u>
  Vegetation cover and physiognomy, taxonomic composition of trees, shrubs, herbs, economic plants and crops

- <u>Wildlife (Fauna):</u>
  Amphibians, Reptiles, birds, and mammals (taxonomic composition, etc)

- <u>Phytoplankton Flora (Water)</u>
  Taxonomic composition, occurrence and distribution, abundance, community structure and biodiversity indices

- <u>Zooplankton Fauna (Water)</u>
  Taxonomic composition, occurrence and distribution, abundance, community structure and biodiversity indices

- <u>Macro-Invertebrates (Sediment)</u>
  Taxonomic composition, occurrence and distribution, abundance, community structure and biodiversity indices

- <u>Microbiology (Water and Sediment)</u>
  Taxonomic composition, occurrence and distribution, abundance of heterotrophic bacteria and fungi (mould and yeasts).

4.10.2. Terrestrial Vegetation (Flora)

4.10.2.1. Methodology

Sampling was carried out during the dry season (18^{th} – 23^{rd} December, 2017). Prior to sampling a reconnaissance visit was undertaken to all parts of the proposed line routes, with a total length of about 63.97 km namely:

- Construction of Ogijo (Likosi/Dejuwogbo) to Arigbajo (Ejio) 48.75km 330kV Double Circuit Transmission Line,
- Construction of 2.4km 132kV, 2-Double Circuits Transmission Line from Ogijo (Likosi/Dejuwogbo) to the Existing Ikorodu/Shagamu 132 kV Transmission line,
- Construction of 7.8 km 132kV Double Circuit Transmission Line from Ogijo (Likosi/Dejuwogbo) to Redeem (Abule Oba),
- Constuction of 4.76km 330kV Double Circuit Transmission from MFM (Makogi) to the Existing Benin (Omotosho)/Ikeja West 330kV Transmission Line,
- Construction of 330/132kV Substation with 2x300MVA 330132kV and 2 x 100MVA 132/33kV Transformer capacities at Ogijo (Likosi/Dejuwogbo),
- Construction of 2x60MVA, 132/33kV Substation at Redeem (Abule Oba),
- Construction of 132/33kV Distribution Substation with 2x150MVA, 330/132kV +and 2x60MVA 132/33kV Transformer capacities at MFM (Makogi).

A reconnaissance tour of the entire routes (63.97 km) and the immediate surroundings of the Transmission Lines Rows (50 metres wide for (i) and (iv)) and 30 metres wide for (ii) and (iii) was to carefully examine the sites characteristics so as to assist in designing the best strategy for field investigations. Based on the reconnaissance visit, the vegetation types of the study area were identified and photographs taken. For effective spatial coverage of the area, footpaths and transects were used for the sampling. All observations and sampling points were geo-referenced using hand held Geographical Positioning System (GPS) receivers while photographs of the major vegetation types were taken.

Species composition and density and habitat conditions were studied in detail using the Quadrat and Belt Transect Methods. Sampling was carried out along transects at each site. The lengths of the transects varied depending on the real extent of the vegetation being studied. Systematic samples were collected at each identified location (already marked out on the map) where plot measuring 20 m x 25 m (that is 400 m^2) was used for sampling at every sampling point. The name and co-ordinates of each sampling point were recorded. All plants within each quadrat were systematically evaluated identified to species level and the number of individuals of each species enumerated. Specimens of plant species that could not be readily identified on the field were collected and pressed in a plant press and taken to IFE Herbarium (Obafemi Awolowo University) for proper identification.

The number of strata in the vegetation was noted and the dominant and common species recorded. The height of the plants was measured with measuring tape and Haga altimeter. Where counting of individuals was not possible in situations where there are creeping plants, cover was measured according to Greig-smith (1983).

Land-use investigations were carried out along four cardinal points with the tracks serving as the baseline. The major crop species, farming system, habitat and non-farming activities along each of the cardinal points were documented. Plants that were of economic importance were identified and counted.

4.10.2.2.Habitat type

The main block of the Nigerian forest formation along these routes is called lowland rainforest. The high human activities along the proposed transmission lines have greatly transformed the complex structure and species richness of these routes. The entire area under study along the transmission lines and Associated Substation Facilities listed (i) – (iv) above (63.5 km), on the basis of structure and species composition has been classified as degraded lowland rain forest, made up of mixtures of trees, shrubs, herbs and grasses. The species nomenclature is in accordance with Hutchinson and Dalziel of Flora of West Tropical Africa (Hutchinson and Dalziel, 1954-1972). On the basis of density, proportion of plant species and their distribution, the major types of vegetation (fallowland of different ages, farmlands of various crops) were revealed. Plates 4.10.1- 4.10.11 show the typical vegetation types encountered in the entire project area.

The land use pattern estimation for the affected area within RoW is presented in Table 4.10.1

Table 4.10.1: Land use pattern estimation for the affected area within Right of Way

Land use type	Affected area within RoW (m^2)			
	Ejio –Likosi (Dejuwogbo)	Likosi- Redeem (Abule Oba)	Likosi – Existing Ikorodu/Sagamu	Ikeja West – MFM (Makogi)
Primary Forest	148,628	5,266	Nil	Nil
Secondary Forest	917,637	101,461	Nil	111,866.30
Marshy area	174,033	29,227	Nil	94,950.60
Riparian vegetation	6,715	Nil	Nil	Nil
Waterbody	24,763	Nil	Nil	Nil
Cultivated area	728,363	25,202	54,062	Nil
Fallow field	141,211	30,581	Nil	97,933.60
Built-up area	239,212	39,763	18,155	168,381.80
Plantations	53,203	Nil	Nil	Nil
Other	3,235	1,000	83	917.7

Source: SEEMS, 2017

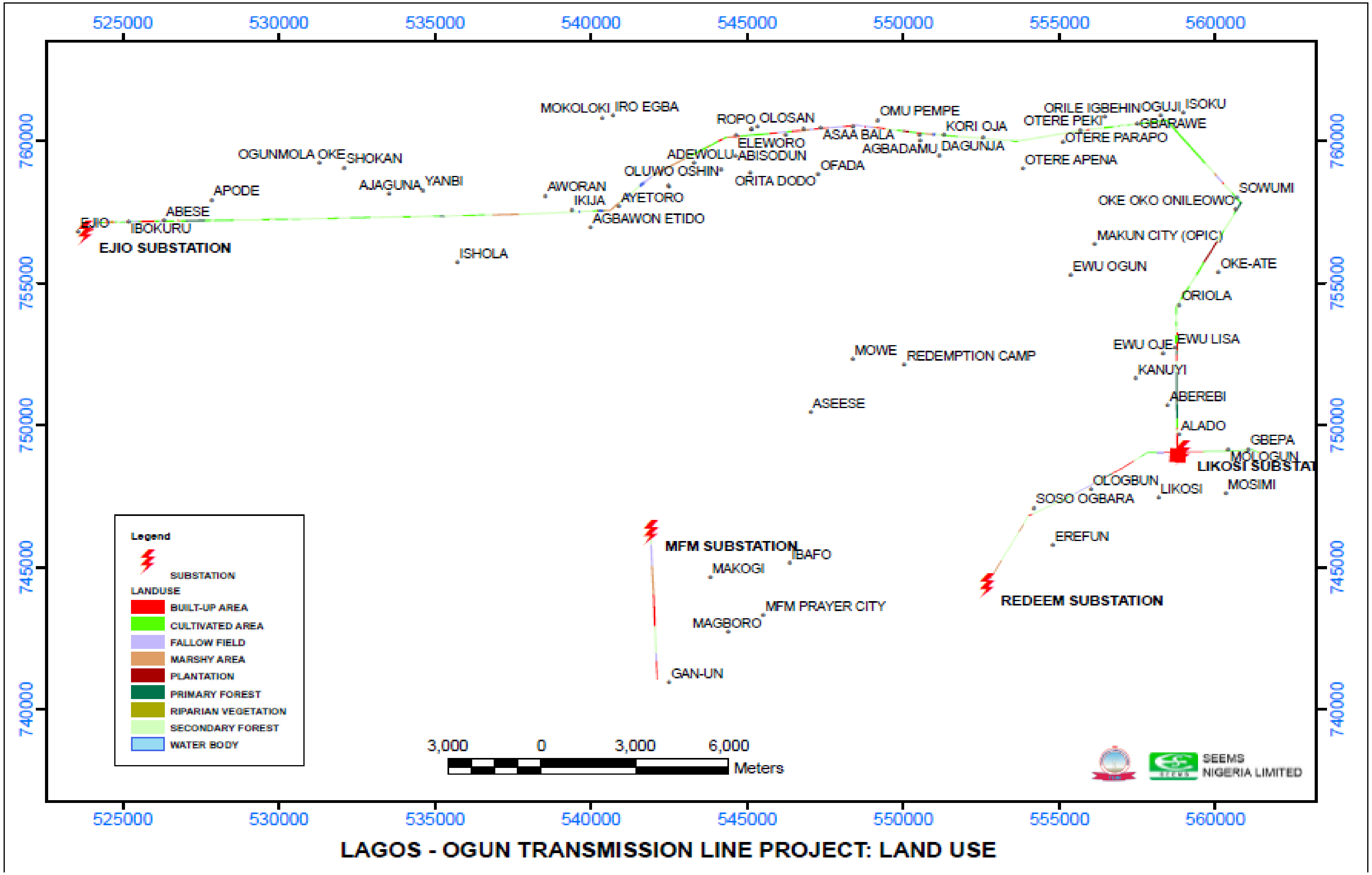


Figure 4.10.1: Land Use Map for Lot 2 Proposed Transmission Lines

4.10.2.3.Species Composition

The floristic composition of the vegetation of the proposed transmission lines and Associated Substation Facilities is diverse in species even over a relatively homogenous area. A total of 32 plant species belonging to16 families/sub-families and comprising trees/shrubs, herbs and grasses were recorded within the proposed project area. Climbers, epiphytes, saprophytes and parasite are also found along this route. The epiphytic component includes; a large number of lower cryptograms and ferns and flowering epiphytes were conspicuous. The families/sub-families that had the highest frequency of occurrence of plant species include Mimosaceae, Compositae, Sterculiaceae, Anacardiaceae, Euphorbiaceae, Ceasalpinaceae. Plant species with frequencies of occurrence of 50% and above (abundant) within this vegetational zone of the proposed project site:

Trees/shrubs*: Albizia zygia, Alchornea cordifolia, Mangifera indica, Morinda lucida, Newbouldia laevis, Elaeis guineensis, Chromolaena odorata, Cola spp, Trema guineensis,, Pycnanthus angolensis, Brachystegia eurycoma, Ficus spp, Vernonia spp, Spondia mombim and Cassia siamea .*

Herbs: The following herbs species were enumerated in the proposed project area: *Aspilia africana, Ipomea spp, Commelina erecta, Calopogonium sp, Centrosema pubescens, Phyllanthus amarus, Tridax procumbens, Sida acuta, Euphorbia heterophylla, E. hirta, Spigellia anthelmia, and Waltheria indica.*

Grasses: The following grasses species were enumerated in the proposed project area*: Panicum maximum, Andropogon tectorum, Brachiaria lata, Imperata cylindrical, Coix spp.*

Trees of the families Mimosaceae (e.g *Albizia zygia),* Anacardiaceae (e.g*, Mangifera indica, Spondias mombin*), Sterculiaceae (e.g Cola spp) *and* Caesalpinaceae *(e.g Cassia siamea)* are particularly common in the study area. Within the study area the dominant trees were thus *Albizia zygia,* (Mimosaceae), *Alchornea cordifolia* (Euphorbiaceae) and *Trema orientalis (*Ulmaceae*)* and these forms an association. Of the smaller trees and shrubs, species of *Newbouldia laevis, Lecaniodiscus cupanioides and Ficus spp* are common. The herbaceous genera enumerated belong mainly to the families Euphorbiaceae, and Asteraceae. The commonest monocotyledonous plants belonged to the families Poaceae and Palmae.

The results of the mean plant density and diversity, as well as biomass of the herbaceous in Table 4.10.2 Within the study area especially in the fallowland, mean tree and shrub density of the proposed project site is 395/ha, the herbs have biomass of between 15kg/ha and 50kg/ha during the study.

Plant species diversity is high in the old fallowland vegetation and the stem girth measurements at breast height are of medium sizes. Due to this, timber sized trees are few in the study project area (see Plates 4.10.1- 4.10.11).

4.10.2.4.Aquatic Macrophytes

Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands. The surface of water had macrophytes, mainly *Pistia stratoides, Nymphaea lotus,* which is perennial herb with submerged rhizomes and large leaves that float on water. The edges of few rivers or swamps or pools of stagnant water encountered along the routes had grasses and sedges mainly *Andropogon gayanus*, *Cyperus spp*, and herbs include *Ipomoea aquatic, Commelina erecta and Ludwigia erecta*

Table 4.10.2: Plant density, diversity and biomass of vegetation within the study area

S/N	Vegetation Type	Mean Plant Density		Biomass of herbaceous layer (kg/ha)	Species Diversity Index
		Trees and Shrubs (No/ha)	Herbaceous layer (No/m^2)		
1	Vegetation/Fallow	395	185	1250	0.750
2	Farmland	110	215	525	0.410
3	Aquatic macrophytes	-	388	-	0.255

Source: SEEMS, 2017

4.10.2.5.Structures and Physiognomy

The vegetation of the fallowland is typically of lowland rainforest. In this lowland rainforest, the trees and shrubs form a canopy. In terms of its vertical structure, the lowland rainforest profile shows a tree stratum, 8-21 m high (storey A) with isolated crowns but varies from almost closed in some places to open during the sampling period. Below this tree stratum and indistinctly differentiated from it, is a canopy layer of trees with touching crowns and an understorey of trees with spreading crowns, followed by shrub stratum and ground vegetation. Finally, is the herb stratum dominating the ground cover and consisting mainly of herbs and grasses growing up to about 1.0-3.0 m high during the sampling period. About 75% of the plant species are Phanerophytes, whereas about 10% are Hemicryptophytes (mainly grasses), 7% Crytophytes (including geophytes) and 6% Therophytes (annual plants). Few Epiphytes and Chamaephytes were enumerated. Within the woody plants, very tall ones (Megaphanerophytes) were few in the old fallowland/secondary regrowth forest. Most of the Phanerophytes here were evergreen and do not shed their leaves during the dry season. About 70% of the stems encountered were less than 30 cm girth at breast height and *Chrysophilum albidium* dominated the trees that are greater than 120 cm girth class.

Table 4.10.3: Comparative Features of the Vegetation Types found in the Study Area

Grid Co-ordinate and Station	Vegetation Types	Dominant and Common Plant Species	Density of Woody species	Species diversity	Maximum tree height
Likosi/Ogijo Substation : (i)06^0 46.365 ' N 003^0 31.907'E (ii) 06^0 46.443 ' N 003^0 31.901'E (iii) 06^0 46.545 ' N 003^0 31.885'E	Fallowland Cassava Farmland Fallowland	*Panicum maximum, Ficus exasperata, Vernonia spp, Sida acuta,Psidium guajava, Alchornea cordifolia, Jatropha curca, Musa spp, Vernonia spp, Chromolaena odorata, Morinda lucida, Moringa oleifera, Anthocleista vogelli, Andropogon tectorum, Harungana spp,*	Medium	Medium	7 m

		Cola spp., Manihot esculentus			
Mosimi : 06^0 46.355 ' N 003^0 33.233' E	Cassava Farmland	*Cola nitida, Spondias mombin, Panicum maximum, Tridax procumbens, Ficus spp, Carica papaya, Sida acuta, Aspilia africana, Manihot esculentus*	Low	Low	6 m
Ologbun : (i)06^0 46.121 ' N 003^0 30.868' E (ii) 06^0 46.117 ' N 003^0 30.856' E	Fallowland Cassava Farmland	*Ficus exasperata, Elaeis guineensis, Cocos nucifera, Citrus spp, Chromolaena odorata, Ageratum conyzoides, Spondias mombin, Anthocleista vogelli, Panicum maximum, Carica papaya, Tridax procumbens. Manihot esculenta*	low	Very low	7 m
Shosho Ogbara/Redeem Substation 06^0 45.410 ' N 003^0 29.329' E	Fallowland	*Ficus exasperata, Alchornea cordifolia, Panicum maximum, Mangifera indica, Elaeis guineensis, Cola nitida, Musa spp, Anthocleista vogelli, Chromolaena odorata, Ageratum conyzoides, Psidium guajava, Sida acuta, Tridax procumbens.*	Medium	Medium	9 m
(a) Igaun: 06^0 42.337 ' N 003^0 23.016' E	Fallowland/ Freshwater Swamp Forest	*Raphia hookeri, Alchornea cordifolia, Bambusa vulgaris, Cleistopholis patens, Ferns, Swamp grasses,*	Low	low	8 m
Magboro: : 06^0 43.322' N 003^0 22.770' E	Fallowland	*Alchornea cordifolia, Cola gigantea, Sida acuta, Cassia spp, Cleistopholis patens,*	low	Medium	5 m
MFM Substation 06^0 45.092' N 003^0 23.143' E	Fallowland/ Freshwater Swamp Forest)	*Raphia hookeri, Alchornea cordifolia, Bambusa vulgaris, Cleistopholis patens, Ficus spp., Ferns, Swamp grasses, Alchornea cordifolia,*	Low	Medium	9 m
Ori : 06^0 52.670 ' N 003^0 27.408' E	Farmland with many medium trees and shrubs	*Chrysophyllum albidium, Rauvolvia vomitoria, Newbouldia laevis, Trema orientalis, Pycnanthus angolensis, Alchornea cordifiloia, Carica papaya, Elaeis guineensis, Cola nitida, Albizia zygia, Ficus exasperata, Blighia sapida, Terminalia, spp, Musa spp., Manihot esculentus*	Medium	High	15 m

Oriola : (i)06^0 49.343 ' N 003^0 31.905' E (ii) 06^0 49.329 ' N 003^0 31.831' E	(i)Fallowland/15- 20 years Secondary Regrowth Forest. (ii) Farmland of Cassava and Cola nitida	*Spondias mombin, Cleistopholis patens, Cola nitida, Alstonia boonei, Lecaniodiscus cupanioides, Manihot esculentus, Blighia sapida, Pycnanthus angolensis,*	High	High	15 m
Wichtech: 06^0 51.758 ' N 003^0 32. 729' E	Fallowland	Albizia zygia, Spondias mombin, Harungana madagascariensis, *Trema orientalis, Cola nitida, Chromolaena odorata, Ficus exasperata, Elaeis guineensis, Sida acuta, Tridax procumbens, Aspilia africana, Waltheria indica, Euphorbia spp,*	Medium	Medium	7 m
Adewolu : 06^0 52.428 ' N 003^0 23.779' E	Fallowland/Farmland	*Albizia zygia, Spondias mombin, Alchornea cordifolia, Ficus exasperata, Chromolaena odorata, Panicum maximum, Musa spp, Manihot esculentus,*	Medium	Medium	4 m
Oke Oko: 06^0 51.720 ' N 003^0 22.666' E	Fallowland	*Alchornea cordifolia, Raphia hookeri, Elaeis guineensis, Panicum maximum, Luffa spp., Chromolaena odorata, Climbers,* Harungana madagascariensis, Mucuna spp.,	Medium	Medium	7 m
Jaguna : (i)06^0 51.073' N 003^0 18.204' E (ii)06^0 51.073' N 003^0 18.204' E	Fallowland/Derived Guinea Savanna Farmland	*Vitex doniana, Cocos nucifera, Chromolaena, Andropogon tectorum, Newbouldia laevis, Ageratum conyzoides, Manihot esculenta, Tridax procumbens, Carica papaya, Musa spp., Imperata cylindrical*	Medium	Medium	8 m
Ibokuru : (i)06^0 50.991 ' N 003^0 13.730' E (ii) 06^0 51.001' N 003^0 13.779' E	Farmland Fallowland	*Elaeis guineensis, Tridax procumbens, Zea mays, Blighia sapida, Solanum spp., Chromolaena odorata, Newbouldia laevis, Ficus exasperata, Lecaniodiscus cupanioides, Panicum maximum, Albizia zygia, Senna siamea, Morinda lucida, Mallotus opposifolus, Amaranthus spp.*	High	High	6 m
Ejio : 06^0 50.975 ' N 003^0 12.674' E	Fallowland	*Newbouldia laevis, Albizia zygia, Ficus exasperata, Chromolaena odorata,*	Medium	Medium	5 m

		Morinda lucida, Lantana camara, Climbers,			

4.10.2.6.Plant in Agricultural land

Few plants belonging some families are cultivated in farms. The system of farming practiced in the area is mainly land rotation and bush fallowing with mixed cropping. The farm land constituted a great portion (about 55%) of the study area. The crops include *Manihot esculenta* (cassava), *Musa sapientum* (plantain) and green leafy vegetables (e.g *Abelmoschus esculentus* or Okra, *Solanum* spp). In most cases, crop plants are mixed and the density was low but the farm sizes were small, ranging from 0.02- 0.05ha. Most of these crops were planted on ridges or mounds but were harvested during the dry season. The farmlands are in various state of maintenance. The farms were weeded regularly using the hoe to reduce competition from weeds during the rainy season.

4.10.2.7.Plant Pathology

Generally, plants in the study area were generally healthy with no obvious signs of stress except some few scattered pathological problems like chlorotic and necrotic leaf spot. Leaf spots were the dominant disease symptoms on the foliage of unhealthy plants. Most of the leaf spot diseases were caused by *Cercospora spp*. The disease severity indices revealed that the few diseases encountered were of very light to moderate infection and are common and comparable in nature and intensity to those on plant species all over the forest zone of the country. The appearance and the state of health of the plant communities and of the commonest species were quite normal except the evidence of drought condition as a result of effect of dry season. There was no evidence of endemic vegetation problems. None of the diseases was unusual either in its nature or severity.

4.10.2.8.IUCN Status of the flora

IUCN Red List is set as precise criteria to evaluate the extinction risk of species and subspecies. The aim is to convey the need for conservation to the public and policy makers, as well as help the international community reduce activities leading to species extinction. In addition, IUCN provide scientifically based guide and actions to conserve biological diversity (IUCN, 2007).

The IUCN status of the plant resources for the studied area was evaluated using IUCN version 2017 -3 criterion. The results showed that *Mitragyna ledermannii (*sampled in the riparian habitat*)* was the only Vulnerable (VU) species.

4.10.2.9.Alien species and Invasive species

In the Lot 2 study area, *Euphorbia heterophyla* and *Chromolaenia odorata* were the two alien plant species recorded. Whereas *Euphorbia heterophylla* (a herb) occurred occasionally *Chromolaenia odorata* (a shrub) was widespread occurring mostly in fallow land with low-medium density. The local and common name for the plant in the area (independence weed) seem to suggest that it was introduced into the country at about the time Nigeria gained independence from its colonial master (Great Britain) in 1960, i.e. about six decades ago. The local name connotes that it is a stubborn plant, as it is difficult to eradicate while it easily suppresses and/or out compete other plants, notably other shrubs and herbs. In recent time, about three decades ago, another alien sun flower shrub, *Thitonia diversifolia* has also been introduced and seems to be out competing *Chormolaena odorata* through fairly common, seems to be most frequent in the coastal sandy beach area. Similarly, *Dalbergia sissooo* (a fern) occurs in the saline swamp (commonly called the mangrove swamp fresh) section of the general project area. It is usually associated with the true mangrove plants, notably the red mangroves (*Rhizophora spp*) and the white mangroves *(Avicinia spp).* However, this and *Nypa fruticans* which has also invaded most of Nigerian coastal marine waters were not found in the lot 2 area.

Plate 4.10.1: Fallowland vegetation with *grasses (e.g. Panicum maximum*) as the dominant grass species and *Chromolaena odorata* as the dominant shrubby/herbaceous species along the routes in the study area.

Plate 4.10.2: Farmland of *Manihot esculenta* (cassava) along the routes in the study area.

Plate 4.10.3: Fallowland vegetation with many woody species such *as Spondias mombin, Trema orientalis* and shrubs such as *Chromolaena odorata* and *herbaceous plants such as Aspilia africana a*long the routes in the study area.

Plate 4.10.4: Fallowland vegetation of Secondary Regrowth Forest with *Elaeis guineensis* and few Aquatic macrophytes species *a*long the routes in the study area.

Plate 4.10.5: Farmland of *Manihot esculenta* (cassava) and *Musa* spp. along the routes in the study area.

Plate 4.10.6: Fallowland vegetation with many woody species such *as Elaeis guineensis, Anthocleista vogelli, Raphia hookeri, Mangifera indica* and shrubs such, *Chromolaena odorata* and *herbaceous plants such as Waltheria indica a*long the routes in the study area.

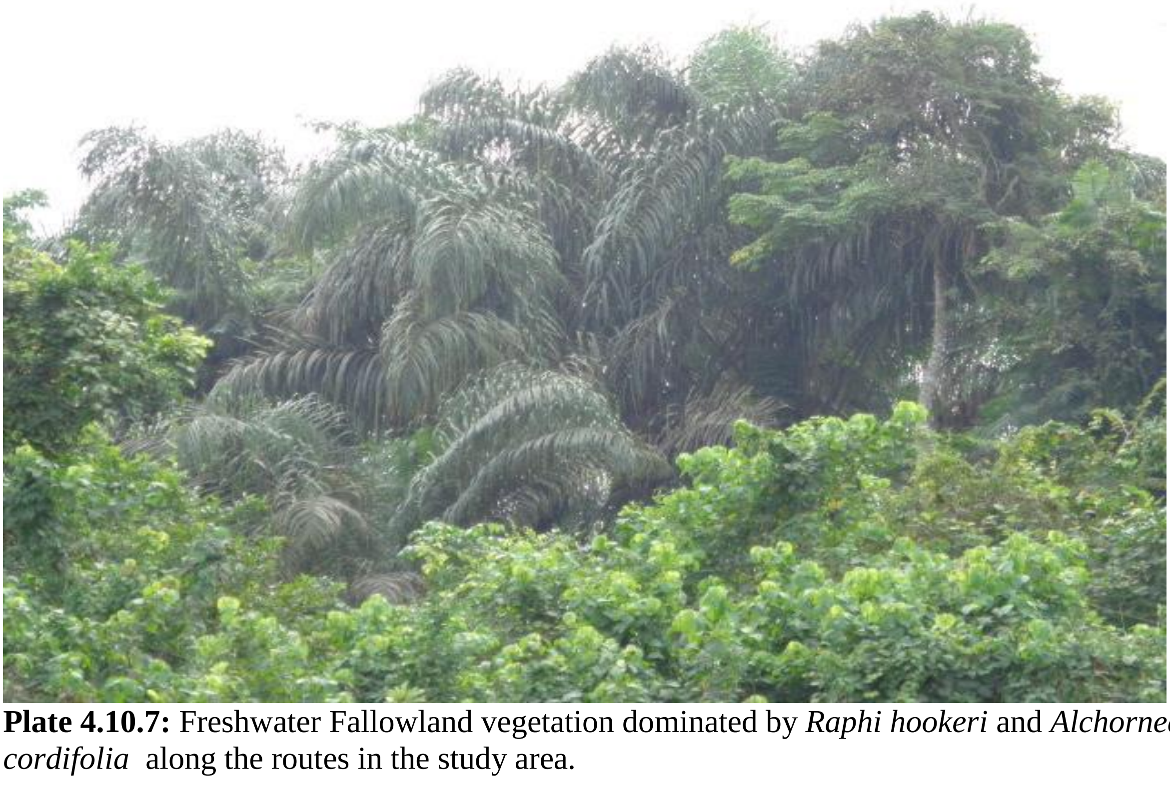


Plate 4.10.7: Freshwater Fallowland vegetation dominated by *Raphi hookeri* and *Alchornea cordifolia* along the routes in the study area.

Plate 4.10.8: Freshwater Fallowland vegetation dominated by *Raphi hookeri* along the routes in the study area.

Plate 4.10.9.: Farmland of *Manihot esculenta* (cassava) with *Carica papaya* in fruit along the routes in the study area.

Plate 4.10.10: Aquatic macrophytes species (*Ludwigia* spp) by the river bank along the routes in the study area.

Plate 4.10.11: Farmland of *Manihot esculenta* (cassava), Musa spp. with *Cocos nucifera* (Coconut) in fruit and *Musa* spp. along the routes in the study area.

Plate 4.10.11: Leafy Vegetables (Solanum, Okra, Amaranthus) encountered in various farmlands along Transmission Lines

4.10.3. Terrestrial Wildlife Fauna

4.10.3.1.Methodology

Direct and indirect methods were used to ascertain the presence of animal species in the area.

Direct Observation: -Actual sighting of the animal species involving: spot identification, behavioural features and indices of various species were done during the survey.

Indirect Observation: -This involved sighting of signs (e.g. footprints, spoors and calls) left by an animal and information received from the farmers and local hunters living within the sampled area.

Other Indirect signs used to estimate animal abundance include: faecal pellets and dung piles. Each time an animal or group of animals is encountered, the following information were recorded according to Gaston *et a/. (2000).*

- Species type
- Number of animal counted
- Mode of detection (whether sight, vocalization or sound produced by an animal
- moving through the vegetation)
- Time sighted
- Observer's location
- Animal - Observer distance
- Animal activity when first detected

Plate 4.10.12: ESIA consultants with local hunter

4.10.3.2. Results and Discussion

The survey along RoW of the proposed transmission line was based on both interview of local people (usually community leader) and actual field investigation. Records of wildlife forms of the study area consisting of inventories carried out by direct sighting in the habitats, literature from National Resources Conservation Council (1992) and interviews with local communities show that the major wildlife components of the study area belong to the vertebrate classes of Reptilia, Amphibia, Aves and Mammalia. Their habitats include the farmlands and residential areas. Wildlife resources especially mammals reported in the area are remarkably few, because the project area has been exposed to significant human impacts from industrial development, hunting and clearance for agriculture. These would explain the sparse wildlife around the project area and suggest a less likely occurrence of rare or endangered species compared to unimpacted areas. The list of wildlife Species sighted or reported in and around the project area is provided in Table 4.10.4.

Mammals occasionally sighted during the period of study or reported to occur in the project area include the Gambian Sun Squirell (*Heliosciurus gambianus*) and small brown rat (*Arvicanthis* niloticus), common rats (*Rattus rattus),* House Mouse (*Mus musculus*), Giant rat (*Cricetomys emini*), African palm squirrel (*Epixerus ebii*), and Grass cutter (*Thryonomys swinderianus*). The presence of the big mammals like the Bates Pygmy Antelope (*Neotragus batesi*), Maxwell Duiker (*Cephalopus maxwelli*) and the African Civet Cat (*Cirettictis civetta)* was confirmed by the people farming within the proposed project area. The people also confirmed the dominance of the rodents: Giant Pouch Rat (*Cricetomys gambianus);* small brown rat (*Arvicanthis niloticus*) and Cane Rat (*Thryonomys swinderianus*) in the project area.

The Avian population, the dominant in terms of species types and number were most noticeable. The weaver bird, *Ploessus cuculatus* and the common garden bulbul *Pyconotus barbatus* were the most common birds in the area. Francolin (*Francolinus bicalcaratus*) was however the only bird of economic importance. The Bronze Manikin (*Lonchura cucullatus*) also occurred in all the locations sampled. The small birds (about 4 cm in length) with barred rump and flank were observed to be roosting and nesting on small trees and shrubs and were seen feeding on seeds of grasses particularly those of *Panicum* species. The Weaver birds (*Ploessus cuculatus*) were observed only in areas with plenty of grasses with seeds on them. Other species include the black kites (*Milvus nigrans*), Chicken Hawk (*Accipter erythropus*), Cattle Egret (*Ardeola ibis*), Great White Egret (*Egretta alba*), Francolin, Pin-Tailed Whydah (*Vidua macroura),* Pied Crow (*Corvus albus*), Wood Pecker (*Dendropicos pyrrhogaster*).

The reptilian fauna sighted or reported to occur in the area consists of snakes (Royal Pyton (*Pyton regis*), Black cobra (*Naja melanoleuca*)), Black tree snake (*Thrasops occidentalis*) Rainbow lizard (*Agama agama*), Nile Monitor Lizard (*Veranus niloticus*) and frogs (Dicoglossus sp), Long-legged frog (*Ptychodena* sp) and toad (*Bufo regularis*) common along the wet stream channels.

A number of species sighted in the rainy season but not during the dry season include the mouse-brown sun bird (*Anthreptes gabonicus*) (which is known to be dependent on nectars of flowers) and Black and White-tailed hornbill (*Tockus fasciatus*). Six (6) reptilian species which were not sighted during the rainy period were sighted during the dry season. These are the rainbow lizard, Nile monitor lizard (*Varanus niloticus*), the black cobra (*Naja nigricollis*) and the West African Green tree mamba (*Dendroaspis viridis*).

Table 4.10.4:List of Fauna Species sighted or reported in and around the project area

Common Nane	Biological Name	Number Seen
MAMMALS		
Common Rats	*Rattus rattus*	5
House Mouse	*Mus musculus*	4
Giant Bush Rat	*Cricetomys gambianus*	2
African Palm Squirrel	*Epixerus ebii*	2
Ground Squirrel	*Xenus erythropus*	IH*
Grass Cutter	*Thryonomys swinderianus*	IH
African Civet	*Civettictis civetta*	2
Bates Pygmy Antelope	*Neotragus batesi*	1
Bushbuck	*Tragelaphus scriplus*	IH
Maxwell's Duiker	*Cephalopus maxwelli*	1
Yellow backed duiker	*Cephalopus* silvicultor	IH
AVIAN		
Black Kites	*Milvus nigrans*	8
Chicken Hawk	*Accipter erythropus*	2

Common Nane	**Biological Name**	**Number Seen**
Cattle Egret	*Ardeola ibis*	IH
Great White Egret	*Egretta alba*	IH
Common Vultures	*Necrosyrtes monarchus*	2
Francolin	*Francolinus bicalcaratus*	IH
Pin-Tailed Whydah	*Vidua macroura*	IH
Pied Crow	*Corvus albus*	IH
Wood Pecker	*Dendropicos pyrrhogaster*	IH
Bronze Manikin	*Lonchura cucullatus*	IH
Village Weaver Bird	*Plesiositagra cucullatus*	10
White-Crested hornbill	*Tropicranus albocristatus* Cassin	IH
Nectar Bird	*Anthreptes collaris* Vieil.	IH
REPTILIA AND AMPHIBIANS		
Royal Pyton	*Pyton regis*	1
Black Cobra	*Naja melanoleuca*	IH
Green Tree Mamba	*Dentroaspis viridis*	
Black Tree Snake	*Thrasops occidentalis*	IH
Rainbow Lizard	*Agama agama*	10
Nile Monitor Lizard	*Veranus niloticus*	5
Frog	*Dicoglossus sp*	3
Long-Legged Frog	*Ptychodena sp*	2
Toad	*Bufo regularis*	2

**IH interview with communities, hunters, or literature search*

Literature review and information gap analysis revealed a dearth of information on the wildlife of the project area, resulting in an unclear picture of wildlife diversity, abundance and distribution. Most of the wildlife taxa would, therefore, be classified as not evaluated or "data deficient" based on IUCN (1994) guidelines. This implies that data is insufficient to assign conservation status to these wildlife taxa. Under these circumstances, the IUCN (1994) recommends that such organisms should be given the same degree of protection as threatened taxa, at least until their status can be evaluated. Other than the small mammals whose conservation status may be considered as satisfactory (survival not threatened), most vertebrate wildlife would be considered as rare (and therefore vulnerable). Some of the mammalian (*Neotragus batesi*, *Athercunus africanus* and *Tragelephus spekei*), avifauna (Family Arceidae) and reptilian (Pyton (*Morelia spilotata*) and Crocodyius) species identified are threatened or endangered and international trade is either prohibited or requiring licenses (NEST, 1991).

Plate 4.10.13: Bates Pygmy Antelope

Plate 4.10.14: Nile Monitor Lizard

4.10.3.3.IUCN Status of fauna

Analysis for the conservation status of the species censored in the proposed project area was conducted using IUCN, 2017 Red List of Threatened species. Results revealed that none of the censored species were threatened.

4.10.4. Hydrobiology

4.10.4.1.Methodology

It is a common knowledge that the occurrence and distribution of aquatic organisms are greatly influenced by water quality hence water quality and Hydrobiology are treated together in the present study as often done in most environmental studies. Tebbutt (1992) noted that living organisms are rarely abundant in under-ground water sources. Thus, in this present study, only surface water stations were considered for the Hydrobiology studies as presented in Table 4.10.5. The Hydrobiology aspect of the study broadly encompassed aquatic invertebrate biodiversity, their community structure and functioning. The main biota involved were: Phytoplankton flora, zooplankton fauna and benthic macro invertebrates. The assessment of community metabolism was based on the determination of primary photosynthetic productivity and respiration rate, carried out in all the selected surface water sampling stations. Quantitative plankton sample for both phytoplankton and zooplankton was collected at each of the surface water bodies by passing 30 L volume of the water sample through fine meshed (50 µm) plankton net to a concentrate volume of 30 ml. The concentrate sample was preserved in 5% formalin solution for later examination in the laboratory under a compound microscope. Samples were also collected for primary productivity by the white and black oxygen evolution method (Vollenweider, 1974). Sediment samples were collected from each station using a grab or shovel of known surface area as appropriate, depending on the depth of the station. Sediment samples were collected for the determination of Physico-chemical characteristics and for the occurrence of benthic macro invertebrates. Samples for macro invertebrates were sieved through a 1 mm mesh sized sieve using the water from the station. All recorded invertebrates animals were carefully picked using a camel hairbrush and preserved in10 % formalin solution in a labelled specimen bottle.

4.10.4.2.Results and Discussion

a. Plankton studies

The planktonic composition of the waterbodies from the area comprised 67 species of phytoplankton and 22 species of zooplankton. The phytoplankton flora comprised six major taxonomic groups of algae (Bacillariophyta, Cyanophyta, Euglenophyta, Chlorophyta, Charophyta and Chrysophyta) for both net and total plankton analyses. Bacillariophyta was the most diverse taxon with 17 species, while Chrysophyta had the lowest number of species with just one species. Based on the number of species, the major phytoplankton taxonomic groups can be ranked in the order: Bacillariophyta (34 species) > Charophyta (9 species) > Cyanophyta (8 species) = Euglenophyta (species) > Chlorophyta (7 species) > Chrysophyta (1 species).

Six major taxonomic groups of zooplankton were recorded namely: Rotifera (11 species), Copepoda (6 species), Cnideria (1 species), Diptera (2 species), Ostracoda (1 species) and Ciliophora (1 species). Rotifera was the most diverse taxon with 11 species followed by Copepoda and Diptera respectively, whereas, Cnideria, Ostracoda and Ciliophora each had only one representative species. They can be ranked based on the number of species in each taxon *viz*: Rotifera > Copepod > Diptera > Cnideria = Ostracoda = Ciliophora (Table 4.10.6).

Table 4.10.6: Grid Location and site description with sampling date and time of the Water Quality/Hydrobiology Sampling Stations

SN	Station	Water Type/Source	Site Description	Location/Grid Coordinate			Sampling Date	Sampling Time
				Northing (N)	Easting (E)	+Altitude (m)		
1	Station 3	Surface water/Stream	Stream at Oriola Village, Via Ijagon at the back of proposed Golden Crown Estate by Bustom Homes and Properties Ltd.	0558889	0754209	45 ± 6	19/12/2017	12: 44 p.m.
2	Station 5	Surface water/Stream	Stream at the entrance of Shosho-Ogbara village	0554174	0747125	26 ± 3	19/12/2017	5: 41 p.m.
3	Station 8	Surface water/River	Rver at the bridge on the road to Gan-Un Community, Magboro	0543116	0741709	11 ± 5	20/12/2017	9: 42 a.m.
4	Station 9	Surface water/Stream	Stream at proposed MFM Sub-Station in Makogi Community	0542512	0746593	12 ± 4	20/12/2017	11: 25 a.m.
5	Station 10	Surface water/Stream	Stream at the channel along the proposed Green Spring Estate Project Magboro.	0541800	0743233	9 ± 4	20/12/2017	1: 49 p.m.
6	Station 11	Surface water/Stream	River at Ori village (River Kori)	0550877	0760129	31 ± 6	21/12/2017	8: 48 a.m.
7	Station 12	Surface water/Stream	Stream down the fish pond at Omu-Apempe Community	0549122	0760463	28 ± 5	21/12/2017	9: 47 a.m.
8	Station 13	Surface water/River	Ogun River at Ifesowapo, Oke-Oko Community	0541662	0758525	13 ± 4	21/12/2017	11: 20 a.m.
9	Station 15	Surface water/River	River at Adewolu Community	0543193	0760502	20 ± 7	21/12/2017	1: 30 p.m.
10	Station 16	Surface water/Stream	Stream at Jaguna village towards the Transmission Line crossing	0533482	0757639	27 ± 5	21/12/2017	4: 05 p.m.
11	Station 18	Surface water/Stream	Stream at Abese Community	0524119	0757129	53 ± 4	22/12/2017	8: 20 a.m.
12	Station 19	Surface water/Stream	Stream at Ibokuru Community	0526004	0757159	29 ± 6	22/12/2017	9: 35 a.m.

N = North, E = East, m = meters, + = above mean sea level (amsl).

Table 4.10.6: Checklist and outline classification of recorded planktonic organisms from the study area

S/N	Plankton type	Major taxon	Species
1	Phytoplankton	Bacillariophyta (Diatoms)	*Achnantes* sp.
2			*Achnanthidium gracillimum*
3			*Amphora bicapitata*
4			*Bacillaria* sp.
5			*Brachysira styriaca*
6			*Cymbella lanceolata*
7			*Diadesmis* sp.
8			*Diatoma hyemale*
9			*Eunotia naegelii*
10			*Eunotia* sp.
11			*Flagilaria crotonensis*
12			*Geissleria* sp.
13			*Gyrosigma acuminatum*
14			*Hantzchia amphioxus*
15			*Luticola* sp.
16			*Mastogloia elliptica*
17			*Navicula capitatoradiata*
18			*Navicula cincta*
19			*Navicula cryptoceph*
20			*Navicula cuspidata*
21			*Navicula* sp.
22			*Navicula vaneeri*
23			*Navicula viridula*
24			*Nitzschia palea*
25			*Nitzschia* sp.
26			*Peridiniopsis thompsonii*
27			*Pinnularia brebissonii*
28			*Pinnularia* sp.
29			*Pleurosigma* sp.
30			*Sellaphora* spp.
31			*Stephanodiscus* spp.
32			*Synedra famelica*
33			*Synedra* sp.
34			*Synedra ulna*
35		Cyanobacteria (Blue-green algae)	*Anabaena* spp.
36			*Aphanocapsa litoralis*
37			*Arthrospira* sp.
38			*Oscillatoria aghardii*
39			*Oscillatoria limosa*
40			*Oscillatoria princeps*
41			*Oscillatoria tenuis*
42			*Phormidium* sp.
43		Euglenophyta	*Euglena acus*
44			*Euglena anabaena*
45			*Euglena mutabilis*
46			*Euglena oxyuris*
47			*Euglena* sp.
48			*Phacus pyrum*
49			*Phacus acuminatus*
50			*Phacus* spp.
51		Chlorophyta	*Crucigenia* sp.
52			*Oocystis* sp.
53			*Peurococcus* sp.
54			*Chaetoceros* spp.
55			*Corethron* sp.

S/N	Plankton type	Major taxon	Species
56			*Microthamnion* sp.
57			*Stigeoclonium* spp.
58		**Charophyta**	*Closterium ehrenbergii*
59			*Closterium gracile*
60			*Closterium kuetzingii*
61			*Closterium leiblenii*
62			*Closterium pseudolunula*
63			*Closterium setaceum*
64			*Mougeotia* sp.
65			*Spirogyra fluviatilis*
66			*Spirogyra* sp.
67		**Chrysophyta**	*Mallomonas caudata*
1	**Zooplankton**	**Rotifera**	*Argonotholca foliacea*
2			*Argonotholca* sp.
3			*Ascomorpha ovalis*
4			*Ascomorpha* sp.
5			*Brachionus caudatus*
6			*Brachionus patulua*
7			*Filinia longiseta*
8			*Hexarthra mira*
9			*Lecane* sp.
10			*Polyarthra dolichoptera*
11			*Polyarthra remata*
12		**Copepoda**	Bivalve larva
13			Nauplius larvae
14			*Cyclops scutifer*
15			*Cyclops* spp.
16			*Mesocyclops edax*
17			*Mesocyclops* sp.
18		**Cnidaria**	*Hydra* sp.
19		**Insecta (Diptera)**	*Chaoborus* sp. Larva
20			*Chironomus* sp. Larva
21		**Ostracoda**	*Cyclocypris serena*
22		**Ciliophora**	*Stylonychia mytilas*

b. Phytoplankton flora composition and primary photosynthetic productivity

The total abundance of the major phytoplankton taxa in the net plankton analysis of the water samples from the area ranged from 600 Org./m^3 (Chlorophyta) to 5700 Org./m^3 (Cyanobacteria). Bacillariophyta occurred the most while Chrysophyta had the least occurrence (recorded in only two stations). The dominance of the blue-green algae (Cyanobacteria) in terms of number (i.e. abundance) is an indication of biological/organic pollution in some of the sampled surface waterbodies from the area. The richest station was Station 3 with 12 phytoplankton species; it was also highest in abundance with 7000 individuals as well as the most diverse (Margalef diversity index = 1.242) (Table 4.10.7). It is noteworthy, that Station 3 was sited in the least disturbed ecosystem in the study area. Station 11 was the poorest with two phytoplankton species and with the least total abundance of 100 individuals, as well as the least diverse with Margalef diversity index = 0.217.

Only five major taxa were represented in the total plankton analysis of the water samples from the area namely: Bacillariophyta, Cyanophyta, Euglenophyta, Chlorophyta and Charophyta. The total abundance of the major phytoplankton taxa in the total plankton analysis ranged from 1300 Org./m^3 (Charophyta) to 9200 Org./m^3 (Bacillariophyta). Based on their total abundance values in the total plankton analysis the major taxa of phytoplankton can be ranked as: Bacillariophyta (9200 Org./m^3) > Cyanophyta (6500 Org./m^3) > Euglenophyta (4700 Org./m^3) > Chlorophyta (4200 Org./m^3) > Charophyta (1300 Org./m^3). Bacillariophyta occurred the most from the waterbodies in the area, present in all but one station (92% total occurrence) while Charophyta was the least occurred, recorded in six stations (50% total occurrence). The richest station was Station 9 with 25 phytoplankton species and highest in abundance with 7700 individuals as well as the most diverse (Margalef diversity index = 2.682). Stations 5, 13 and 18 were the poorest with one phytoplankton species and with the least total abundance of 50, 50 and 100 individuals respectively. They were also the least diverse with Margalef diversity index of 0.000 (Table 4.10.8).

The average gross primary production was of 8.07±1.68 Kcal/m^3/day comprising 5.64±1.73 Kcal/m^3/day (70%) respiration and 2.43±0.70 Kcal/m^3/day (30%) net production. Thus the value of respiration was more than double the value of the net production (Table 4.10.9) suggesting a heterotrophic community with more respiring organisms (secondary producers/consumers) than the primary producers.

Table 4.10.7: The abundance (Org./m^3) and occurrence (%) of phytoplankton (Net Plankton analysis) from the investigated waterbodies in the study area

S/N	Taxon	Station											Total	Mean± S.E.	% Occurrence
		3	5	8	10	11	12	13	15	16	18	19			
	Bacillariophyta														
1	*Nitzschia* sp.	0	0	0	0	50	50	0	0	0	0	0	100	9±6	18
2	*Pleurosigma* sp.	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9
3	*Bacillaria* sp.	0	0	0	0	0	50	0	0	0	0	50	100	9±6	9
4	*Stephanodiscus* sp.1	200	0	250	50	0	0	100	50	100	100	50	900	82±25	73
5	*Hantzchia amphioxus*	0	0	0	0	0	0	0	0	50	0	0	50	5±5	9
6	*Peridiniopsis thompsonii*	0	0	0	0	0	0	0	0	50	0	0	50	5±5	9
7	*Nitzschia palea*	0	0	0	0	0	0	0	0	50	50	0	100	9±6	18
8	*Brachysira styriaca*	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
9	*Stephanodiscus* sp.2	50	0	0	0	0	0	0	0	0	0	50	100	9±6	9
10	*Navicula cincta*	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
11	*Diatoma hyemale*	0	0	50	100	0	0	50	0	0	0	0	200	18±10	27
12	*Sellaphora* sp.1	0	0	100	0	0	0	0	0	0	0	0	100	9±9	9
13	*Sellaphora* sp.2	0	0	50	0	0	0	0	0	0	0	0	50	5±5	9
14	*Eunotia* sp.	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
15	*Pinnularia* sp.	400	0	0	0	0	0	0	0	0	0	0	400	36±36	9
16	*Navicula viridula*	50	0	0	50	0	0	0	0	0	0	0	100	9±6	9
17	*Flagilaria crotonensis*	0	0	0	300	0	0	0	0	0	0	0	300	27±27	9
18	*Navicula cryptoceph*	0	0	0	50	0	0	0	0	0	0	0	50	5±5	9
19	*Navicula vaneeri*	0	0	0	0	0	0	50	0	0	0	0	50	5±5	9
20	*Synedra* sp.	0	0	0	0	0	0	50	0	0	0	0	50	5±5	9
21	*Navicula* sp.	0	0	0	0	0	0	50	0	0	0	0	50	5±5	9
22	*Synedra ulna*	0	0	0	0	0	0	50	0	0	0	0	50	5±5	9

S/N	Taxon	Station											Total	Mean± S.E.	% Occurrence
		3	5	8	10	11	12	13	15	16	18	19			
Total		750	0	450	550	50	150	350	50	250	150	250	3000	273±71	91
	Cyanobacteria														
23	*Oscillatoria aghardii*	50	0	0	0	0	0	0	0	1600	0	100	1750	159±144	27
24	*Arthrospira* sp.	0	0	0	0	0	0	0	0	850	0	50	900	82±77	18
25	*Oscillatoria princeps*	350	0	2200	0	0	0	0	0	300	0	0	2850	259±198	27
26	*Oscillatoria tenuis*	0	0	0	0	0	0	0	0	100	0	0	100	9±9	9
27	*Phormidium* sp.	0	0	0	0	0	0	0	50	0	0	0	50	5±5	9
28	*Aphanocapsa litoralis*	0	0	50	0	0	0	0	0	0	0	0	50	9±6	9
Total		400	0	2250	0	0	0	0	50	2850	0	150	5700	518±308	45
	Euglenophyta														
29	*Phacus acuminatus*	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9
30	*Euglena mutabilis*	150	0	0	0	0	0	0	0	0	50	0	200	18±14	18
31	*Euglena oxyuris*	400	50	0	0	0	0	0	0	0	0	0	450	41±36	18
32	*Euglena anabaena*	0	0	0	150	0	0	0	0	0	0	0	150	14±14	9
Total		550	50	0	150	0	50	0	0	0	50	0	850	77±49	45
	Charophyta														
33	*Closterium gracile*	50	50	0	150	50	0	50	0	0	0	0	350	32±14	45
34	*Closterium leiblenii*	0	0	50	0	0	0	0	0	0	0	0	50	5±5	1
35	*Spirogyra fluviatilis*	4950	3050	0	0	0	0	50	0	0	0	0	8050	732±504	27
36	*Mougeotia* sp.	300	0	0	0	0	0	0	0	0	0	0	300	27±27	9
37	*Closterium kuetzingii*	0	50	0	150	0	0	0	0	0	0	0	200	18±14	9
Total		5300	3150	50	300	50	0	100	0	0	0	0	8900	809±578	55
	Chlorophyta														
38	*Stigeoclonium* sp.1	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9

S/N	Taxon	Station											Total	Mean± S.E.	% Occurrence
		3	5	8	10	11	12	13	15	16	18	19			
39	*Chaetoceros* sp.1	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9
40	*Stigeoclonium* sp.2	0	0	0	0	0	50	0	0	0	50	0	100	9±6	18
41	*Chaetoceros* sp.2	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9
42	*Stigeoclonium* sp.3	0	0	0	0	0	50	0	0	0	0	0	50	5±5	9
43	*Microthamnion* sp.	0	0	0	0	0	0	0	50	100	0	0	150	14±10	18
44	*Stigeoclonium* sp.4	0	0	0	0	0	0	0	0	0	0	100	100	9±9	9
45	*Corethron* sp.	0	0	0	0	0	0	0	50	0	0	0	50	5±5	9
Total		0	0	0	0	0	250	0	100	100	50	100	600	55±26	45
	Chrysophyta														
46	*Mallomonas caudata*	0	50	0	5600	0	0	0	0	0	0	0	5650	514±509	18
Total		0	50	0	5600	0	0	0	0	0	0	0	5650	514±509	18
	Total Major Taxa														
	Total Bacillariophyta	750	0	450	550	50	150	350	50	250	150	250	3000	273±71	91
	Total Cyanobacteria	400	0	2250	0	0	0	0	50	2850	0	150	5700	518±308	45
	Total Euglenophyta	550	50	0	150	0	50	0	0	0	50	0	850	77±49	45
	Total Charophyta	5300	3150	50	300	50	0	100	0	0	0	0	814	895±578	55
	Total Chlorophyta	0	0	0	0	0	250	0	100	100	50	100	600	55±26	45
	Total Chrysophyta	0	50	0	5600	0	0	0	0	0	0	0	5650	514±509	9
	Total Phytoplankton	7000	3250	2750	6600	100	450	450	200	3200	250	500	24750	2250±775	100
	Diversity Indices														
	Richness (S)	12	5	7	9	2	9	8	4	9	4	8	46	-	-
	Individuals	7000	3250	2750	6600	100	450	450	200	3200	250	500	24750	-	-
	Dominance_D	0.512	0.882	0.651	0.724	0.500	0.111	0.136	0.250	0.333	0.280	0.140	0.180	-	-
	Simpson_1-D	0.488	0.118	0.349	0.276	0.500	0.889	0.864	0.750	0.667	0.720	0.860	0.820	-	-
	Shannon_H	1.217	0.317	0.809	0.712	0.693	2.197	2.043	1.386	1.440	1.332	2.025	2.329	-	-
	Evenness_e^H/S	0.282	0.275	0.321	0.227	1.000	1.000	0.964	1.000	0.469	0.947	0.947	0.223	-	-

S/N	Taxon	Station											Total	Mean± S.E.	% Occurrence
		3	5	8	10	11	12	13	15	16	18	19			
	Margalef	1.242	0.495	0.758	0.910	0.217	1.309	1.146	0.566	0.991	0.543	1.126	4.448	-	-
	Equitability_J	0.490	0.197	0.416	0.324	1.000	1.000	0.983	1.000	0.656	0.961	0.974	0.608	-	-

Source: SEEMS, 2017

Table 4.10.8: The abundance (Org./m^3) and occurrence (%) of phytoplankton (Total Plankton analysis) from the investigated waterbodies in the study area.

S/N	Total	Station												Total	Mean±S.E.	% Occurrence
		3	5	8	9	10	11	12	13	15	16	18	19			
	Bacillariophyta															
1	*Achnantes* sp.	0	0	300	100	0	0	150	0	100	150	0	0	800	67±28	42
2	*Achnanthidium gracillimum*	150	0	450	100	0	0	100	0	100	100	0	0	1000	83±37	50
3	*Amphora bicapitata*	0	0	50	50	50	0	0	0	0	0	0	0	150	13±7	25
4	*Cymbella lanceolata*	0	0	50	0	0	0	0	0	0	0	0	0	50	4±4	8
5	*Diadesmis* sp.	0	0	50	100	0	0	0	0	150	0	0	0	300	25±14	25
6	*Eunotia naegelii*	50	0	50	400	0	0	100	0	50	0	100	50	800	67±32	58
7	*Eunotia* sp.	50	0	250	750	0	0	150	0	50	0	0	0	1250	104±63	42
8	*Geissleria* sp.	0	50	0	0	0	0	0	0	0	0	0	0	50	4±4	8
9	*Gyrosigma acuminatum*	0	0	0	0	0	0	0	0	0	0	0	50	50	4±4	8
10	*Luticola* sp.	0	0	50	100	0	0	100	0	0	0	0	0	250	21±11	25
11	*Mastogloia elliptica*	0	0	0	50	50	0	0	0	0	0	0	0	100	8±6	17
12	*Navicula capitatoradiata*	0	0	50	0	0	0	0	0	0	0	0	0	50	4±4	8
13	*Navicula cuspidata*	0	0	100	500	0	0	200	0	0	150	0	0	950	79±43	33
14	*Navicula viridula*	100	0	450	1100	50	50	950	0	100	0	0	0	2800	233±113	58
15	*Pinnularia brebissonii*	0	0	0	50	0	0	0	0	0	0	0	0	50	4±4	8
16	*Pinnularia* sp.	0	0	0	0	0	0	50	0	0	0	0	0	50	4±4	8
17	*Stauroneis* sp.	50	0	50	0	0	0	0	0	0	0	0	0	100	8±6	17
18	*Stephanodiscus* sp.2	0	0	50	0	0	0	50	0	0	50	0	0	150	13±7	25
19	*Synedra famelica*	0	0	50	50	0	0	0	0	50	100	0	0	250	21±10	33
Total		400	50	2000	3350	150	50	1850	0	600	550	100	100	9200	767±307	92
	Cyanobacteria															
20	*Anabaena* sp.1	0	0	0	250	0	50	0	0	0	0	0	0	300	25±21	17
21	*Anabaena* sp.2	0	0	0	0	0	0	0	0	0	50	0	0	50	4±4	8

S/N	Total	Station												Total	Mean±S.E.	% Occurrence
		3	5	8	9	10	11	12	13	15	16	18	19			
22	*Arthrospira* sp.	50	0	50	50	0	0	0	0	0	2800	0	0	2950	246±232	33
23	*Oscillatoria aghardii*	0	0	300	1800	0	50	300	0	50	300	0	0	2800	233±147	50
24	*Oscillatoria limosa*	0	0	0	200	0	0	0	0	0	0	0	0	200	17±17	8
25	*Phormidium* sp.	0	0	0	0	0	0	50	50	100	0	0	0	200	17±9	25
Total		50	0	350	2300	0	100	350	50	150	3150	0	0	6500	542±301	67
	Euglenophyta															
26	*Euglena acus*	0	0	0	50	0	0	0	0	0	0	0	0	50	4±4	8
27	*Euglena anabaena*	0	0	0	0	0	2100	0	0	0	0	0	0	2100	175±175	8
28	*Euglena mutabilis*	50	0	100	200	150	50	0	0	50	50	0	0	650	54±19	58
29	*Euglena* sp.	300	0	100	350	0	100	0	0	0	150	0	0	1000	83±36	42
30	*Phacus* sp.1	0	0	0	0	0	0	0	0	0	50	0	0	50	4±4	8
31	*Phacus pyrum*	0	0	0	0	0	50	0	0	0	0	0	0	50	4±4	8
32	*Phacus* sp.2	0	0	0	0	800	0	0	0	0	0	0	0	800	67±67	8
Total		350	0	200	600	950	2300	0	0	50	250	0	0	4700	392±193	58
	Charophyta															
33	*Closterium ehrenbergii*	0	0	0	100	0	0	0	0	0	0	0	0	100	8±8	8
34	*Closterium gracile*	50	0	0	450	0	0	100	0	0	0	0	0	600	50±37	25
35	*Closterium kuetzingii*	0	0	50	0	0	0	0	0	0	0	0	0	50	4±4	8
36	*Closterium pseudolunula*	0	0	100	100	0	0	100	0	0	0	0	0	300	25±13	25
37	*Closterium setaceum*	0	0	0	0	150	50	0	0	0	0	0	0	200	17±13	17
38	*Spirogyra* sp.	0	0	0	50	0	0	0	0	0	0	0	0	50	4±4	8
Total		50	0	150	700	150	50	200	0	0	0	0	0	1300	108±58	50
	Chlorophyta															
39	*Crucigenia* sp.	250	0	50	700	50	0	250	0	200	0	0	0	1500	125±60	50
40	*Oocystis* sp.	0	0	0	0	50	0	0	0	0	0	0	0	50	4±4	8
41	*Peurococcus* sp.	0	0	0	50	0	0	0	0	0	0	0	0	50	4±4	8
Total		350	0	350	2150	400	100	650	0	200	0	0	0	4200	350±175	58

S/N	Total	Station												Total	Mean±S.E.	% Occurrence
		3	5	8	9	10	11	12	13	15	16	18	19			
	Total Major Taxa															
	Total Bacillariophyta	400	50	2000	3350	150	50	1850	0	600	550	100	100	9200	767±307	92
	Total Cyanobacteria	50	0	350	2300	0	100	350	50	150	3150	0	0	6500	542±301	67
	Total Euglenophyta	350	0	200	600	950	2300	0	0	50	250	0	0	4700	392±193	58
	Total Charophyta	50	0	150	700	150	50	200	0	0	0	0	0	1300	108±58	50
	Total Chlorophyta	350	0	350	2150	400	100	650	0	200	0	0	0	4200	350±175	58
	Total Phytoplankton	1950	100	5450	14650	2600	5000	5050	100	1800	7900	200	200	45000	3750±1238	100
	Diversity Indices															
	Richness (S)	10	1	21	25	8	8	14	1	11	11	1	2	41	-	-
	Individuals	1100	50	2750	7700	1350	2500	2650	50	1000	3950	100	100	23300	-	-
	Dominance_D	0.165	1.000	0.095	0.109	0.383	0.710	0.171	1.000	0.115	0.515	1.000	0.500	0.072	-	-
	Simpson_1-D	0.835	0.000	0.905	0.891	0.617	0.290	0.830	0.000	0.885	0.486	0.000	0.500	0.929	-	-
	Shannon_H	2.024	0.000	2.650	2.601	1.409	0.745	2.200	0.000	2.276	1.220	0.000	0.693	2.971	-	-
	Evenness_e^H/S	0.757	1.000	0.674	0.539	0.511	0.263	0.645	1.000	0.886	0.308	1.000	1.000	0.476	-	-
	Margalef	1.285	0.000	2.525	2.682	0.971	0.895	1.649	0.000	1.448	1.208	0.000	0.217	3.978	-	-
	Equitability_J	0.879	0.000	0.871	0.808	0.677	0.358	0.834	0.000	0.949	0.509	0.000	1.000	0.800	-	-

Source: SEEMS, 2017

Table 4.10.9: Primary productivity and respiration of the investigated waterbodies from the study area

S/N	Sampling Code No:	Respiration ($Kcal/m^3/day$)	Net production ($Kcal/m^3/day$)	Gross production ($Kcal/m^3/day$)
1	**Station 3**	4.32 (86%)	0.72 (14%)	5.04
2	**Station 5**	1.44 (67%)	0.72 (33%)	2.16
3	**Station 8**	23.04 (97%)	0.72 (3%)	23.76
4	**Station 9**	10.08 (97%)	0.36 (3%)	10.44
5	**Station 10**	1.44 (29%)	3.60 (71%)	5.04
6	**Station 11**	2.88 (40%)	4.32 (60%)	7.20
7	**Station 12**	2.88 (80%)	0.72 (20%)	3.60
8	**Station 13**	4.32 (35%)	7.92 (65%)	12.24
9	**Station 15**	1.44 (40%)	2.16 (60%)	3.60
10	**Station 16**	5.76 (89%)	0.72 (11%)	6.48
11	**Station 18**	4.32 (43%)	5.76 (57%)	10.08
12	**Station 19**	5.76 (80)	1.44 (20%)	7.20
	Range.	1.44 – 23.04	0.36 – 7.92	2.16 – 23.76
	Mean±S.E	5.64±1.73 (70%)	2.43±0.70 (30%)	8.07±1.68

c. Zooplankton fauna composition

The zooplankton fauna composition of the net plankton analysis from the investigated surface waterbodies in the area comprised 22 species belonging to 16 genera and 6 major animal groups, namely: Rotifera (9 species), Copepoda (8 species), Diptera (2 species), Ciliophora (1 species), Cnideria (1 species) and Ostracoda (1 species). Rotifera were the most occurred and most abundant taxon, occurring in eight sampling stations (73%) with total abundance of 1800 Org/m^3. Four major taxa Diptera, Ciliophora, Cnideria and Ostracoda occurred in only one station (9% occurrence) each. Whereas, each of the Ciliophora, Cnideria and Ostracoda had 50 Org/m^3 total abundance, Diptera had a total abundance of 100 Org/m^3. The richest station was Station 3 with 10 zooplankton species; it was also the highest in abundance with 750 individuals as well as the most diverse (Margalef diversity index = 1.360) (Table 4.10.10). It is noteworthy, that Station 3 was cited in the least disturbed ecosystem in the study area which may be the reason for being the highest in terms of abundance, occurrence and diversity of zooplankton species among the surveyed stations in the study area. Stations 5 and 11 were the poorest with no zooplankton species recorded and with the least total abundance of 0 individuals, as well as the least diverse with Margalef diversity indices = 0.000 (Table 4.10.10).

The zooplankton fauna composition of the total plankton analysis from the investigated surface waterbodies in the area comprised eight species belonging to seven genera and two major animal groups, namely: Rotifera (7 species) and Molusca (1 species). Rotifera were the most occurred and most abundant taxon, occurring in five sampling stations (42%) with total abundance of 800 Org/m^3. Molusca occurred in only one station (Station 9) with total abundance of 100 Org/m^3. Stations 9, 10, 11 and 18 were the richest stations with two zooplankton species. Stations 9 and 11 were the highest in abundance with 300 individuals as well as the most diverse (Margalef diversity indices = 0.175) (Table 4.2.6.4.7). Stations 3, 5, 8, 12, 13, 15 and 16 were the poorest with no zooplankton species recorded and with the least total abundance of 0 individuals, as well as the least diverse with Margalef diversity indices = 0.000 (Table 4.10.11).

Table 4.10.10: The abundance (Org./m^3) and occurrence (%) of zooplankton (Net Plankton analysis) from the investigated waterbodies in the study area

S/N	Taxon	Station 3	5	8	10	11	12	13	15	16	18	19	Total	Mean±S.E.	% Occurrence
	Rotifera														
1	*Argonotholca* sp.	0	0	0	0	0	50	0	0	100	50	50	250	23±10	36
2	*Polyarthra remata*	0	0	0	0	0	0	150	0	200	0	0	350	32±22	18
3	*Hexarthra mira*	250	0	300	0	0	0	0	0	50	0	50	650	59±33	36
4	*Argonotholca foliacea*	0	0	0	0	0	0	0	0	0	0	150	150	14±14	9
5	*Ascomorpha ovalis*	0	0	150	0	0	0	0	0	0	0	0	150	14±14	9
6	*Filinia longiseta*	50	0	50	0	0	0	0	0	0	0	0	100	9±6	18
7	*Brachionus patulua*	0	0	0	50	0	0	0	0	0	0	0	50	5±5	9
8	*Polyarthra dolichoptera*	0	0	0	50	0	0	0	0	0	0	0	50	5±5	9
9	*Lecane* sp.	0	0	0	50	0	0	0	0	0	0	0	50	5±5	9
Total		300	0	500	150	0	50	150	0	350	50	250	1800	164±50	73
	Copepoda														
10	*Mesocyclops* sp.	100	0	0	0	0	0	0	0	0	0	50	150	14±10	18
11	*Mesocyclops edax*	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
12	*Cyclops scutifer*	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
13	*Cyclops* sp.1	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
14	*Cyclops* sp.2	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
15	*Cyclops* sp.3	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
16	Nauplius larvae sp.1	50	0	0	100	0	0	0	0	50	0	0	200	18±10	27
17	Nauplius larvae sp.2	50	0	0	0	0	0	0	0	0	0	0	50	5±5	9
Total		450	0	0	100	0	0	0	0	50	0	50	650	59±40	36
	Ciliophora														
18	*Stylonychia mytilas*	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
Total		0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
	Insecta (Diptera)														
19	*Chaoborus* sp. Larva	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
20	*Chironomus* sp. Larva	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
Total		0	0	0	0	0	0	0	0	0	0	100	100	9±9	9
	Cnidaria														
21	*Hydra* sp.	0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
Total		0	0	0	0	0	0	0	0	0	0	50	50	5±5	9
	Ostracoda														

S/N	Taxon	Station											Total	Mean±S.E.	% Occurrence
		3	**5**	**8**	**10**	**11**	**12**	**13**	**15**	**16**	**18**	**19**			
22	*Cyclocypris serena*	0	0	0	0	0	0	0	50	0	0	0	50	5±5	9
Total		0	0	0	0	0	0	0	50	0	0	0	50	5±5	9
	Total Major Taxa														
	Total Rotifera	300	0	500	150	0	50	150	0	350	50	250	1800	164±50	73
	Total Copepoda	450	0	0	100	0	0	0	0	50	0	50	650	59±40	36
	Total Ciliophora	0	0	0	0	0	0	0	0	0	0	50	50.00	5±5	9
	Total Insecta (Diptera)	0	0	0	0	0	0	0	0	0	0	100	100.00	9±9	9
	Total Cnidaria	0	0	0	0	0	0	0	0	0	0	50	50.00	5±5	9
	Total Ostracoda	0	0	0	0	0	0	0	50	0	0	0	50.00	5±5	9
	Total Zooplankton	750	0	500	250	0	50	150	50	400	50	500	2700.00	245±77	82
	Diversity Indices														
	Richness (S)	10	0	3	4	0	1	1	1	4	1	8	22	-	-
	Individuals	750	0	500	250	0	50	150	50	400	50	500	2700	-	-
	Dominance_D	0.164	0.00	0.460	0.280	0.00	1.000	1.000	1.000	0.344	1.000	0.160	0.104	-	-
	Simpson_1-D	0.836	0.00	0.540	0.720	0.00	0.000	0.000	0.000	0.656	0.000	0.840	0.896	-	-
	Shannon_H	2.079	0.00	0.898	1.332	0.00	0.000	0.000	0.000	1.213	0.000	1.973	2.659	-	-
	Evenness_e^H/S	0.800	0.00	0.818	0.947	0.00	1.000	1.000	1.000	0.841	1.000	0.899	0.649	-	-
	Margalef	1.360	0.00	0.322	0.543	0.00	0.000	0.000	0.000	0.501	0.000	1.126	2.658	-	-
	Equitability_J	0.903	0.00	0.817	0.961	0.00	0.000	0.000	0.000	0.875	0.000	0.949	0.860	-	-

Table 4.10.11: The abundance (Org./m^3) and occurrence (%) of zooplankton (Total Plankton analysis) from the investigated waterbodies in the study area

S/N	Taxon	Station												Total	Mean±S.E.	% Occurrence
		3	5	8	9	10	11	12	13	15	16	18	19			
	Rotifera															
1	*Filinia longiseta*	0	0	0	200	0	0	0	0	0	0	0	0	200	17±17	8
2	*Argonotholca* sp.	0	0	0	0	0	0	0	0	0	0	50	0	50	4±4	8
3	*Argonotholca foliacea*	0	0	0	0	0	0	0	0	0	0	100	0	100	8±8	8
4	*Ascomorpha* sp.	0	0	0	0	0	0	0	0	0	0	0	50	50	4±4	8
5	*Brachionus caudatus*	0	0	0	0	50	0	0	0	0	0	0	0	50	4±4	8
6	*Polyarthra remata*	0	0	0	0	50	50	0	0	0	0	0	0	100	8±6	17
7	*Hexarthra mira*	0	0	0	0	0	250	0	0	0	0	0	0	250	21±21	8
Total		0	0	0	200	100	300	0	0	0	0	150	50	800	67±29	42
	Molusca															
8	Bivalve larvae	0	0	0	100	0	0	0	0	0	0	0	0	100	8±8	8
Total		0	0	0	100	0	0	0	0	0	0	0	0	100	8±8	8
	Total Major Taxa															
	Total Rotifera	0	0	0	200	100	300	0	0	0	0	150	50	800	67±29	42
	Total Molusca	0	0	0	100	0	0	0	0	0	0	0	0	100	8±8	8
	Total Zooplankton	0	0	0	300	100	300	0	0	0	0	150	50	900	75±33	42
	Diversity Indices															
	Richness (S)	0	0	0	2	2	2	0	0	0	0	2	1	8	-	-
	Individuals	0	0	0	300	100	300	0	0	0	0	150	50	900	-	-
	Dominance_D	0.000	0.000	0.000	0.556	0.500	0.722	0.000	0.000	0.000	0.000	0.556	1.000	0.173	-	-
	Simpson_1-D	0.000	0.000	0.000	0.444	0.500	0.278	0.000	0.000	0.000	0.000	0.444	0.000	0.827	-	-
	Shannon_H	0.000	0.000	0.000	0.637	0.693	0.451	0.000	0.000	0.000	0.000	0.637	0.000	1.904	-	-
	Evenness_e^H/S	0.000	0.000	0.000	0.945	1.000	0.785	0.000	0.000	0.000	0.000	0.945	1.000	0.839	-	-
	Margalef	0.000	0.000	0.000	0.175	0.217	0.175	0.000	0.000	0.000	0.000	0.200	0.000	1.029	-	-
	Equitability_J	0.000	0.000	0.000	0.918	1.000	0.650	0.000	0.000	0.000	0.000	0.918	0.000	0.916	-	-

d. Physico-chemical characteristics of surface water sediments

On the average, the sediment texture from the area was sandy with the particles sizes distributed in the sediment as follows: Sand (range = 67.7 - 96.7 %, mean = 88.1±2.4 %); Silt (range = 0.0 – 32.3 %, mean = 0.0 – 32.3 %); Clay (range = 0.0 – 19.4 %, mean = 5.8±1.7 %)

The sediment samples ranged from moderately acidic (pH = 5.57) to neutral (pH = 7.06) and on the average slightly acidic (pH = 6.11±0.14) in nature for the pH values measured in water. Likewise, the pH values measured in neutral salt (KCl) ranged from being strongly acidic (pH = 5.24) to neutral (pH = 6.68) and on the average being moderately acidic (pH = 5.79±0.12) in nature. Conductivity values of the sediment samples ranged from 33.0 to 190.0 μScm^{-1} with mean value of 114.1±13.6 μScm^{-1} (Table 4.10.12).

The exchangeable acidity ranged from 0.20 to 0.90 cmol/kg with mean value of 0.53±0.07 cmol/kg. The exchangeable base cations Na^+, K^+ Ca^{2+} and Mg^{2+} ranged from 0.18 to 0.96 cmol/kg; 0.30 to 1.43 cmol/kg; 1.25 to 16.92 cmol/kg; and 0.36 to 2.82 cmol/kg with mean values of 0.36±0.06 cmol/kg; 0.64±0.08 cmol/kg; 4.87±1.21 cmol/kg and 0.98±0.23 cmol/kg respectively. The sum of the basic cations Na^+, K^+ Ca^{2+} and Mg^{2+} were dominant in the sediment samples amounting to about 93 % on the average of the effective cation exchange capacity (ECEC) of the sediments. The cationic hierarchy of dominance was in the order: $Ca^{2+} > Mg^{2+} > K^+ > H^+ > Na^+ > Al^{3+}$. The major anions Cl^- and SO_4^{2-} ranged from 7.20 to 20.74 ppm and 0.13 to 0.40 ppm with mean values of 14.83±1.26 ppm and 0.21±0.03 ppm respectively (Table 4.10.12).
The nutrients compounds Total Nitrogen, Available Phosphorus, Organic Carbon and Organic Matter ranged from 0.04 to 0.21 %, 3.11 to 37.12 ppm, 0.24 to 1.92 % and 0.41 to 3.31 % with mean values of 0.12±0.01 %, 15.17±3.60 ppm, 1.11±0.18 % and 1.92±0.31 % respectively.

The heavy metals/trace elements of the sediments from the area occurred over the wide range 0.04 ppm (Co) – 151.13 ppm (Fe) (Table 4.10.12). They can be categorized based on their mean values as follows:

- < 1.00 mg/kg = Cu
- 1.00 - 10.00 mg/kg = Ni > Cr > Cd > Co > Zn
- 11.00 – 100.00 mg/kg = Fe > Pb
- >100.00 mg/kg = Mn

The mean concentrations of most of the heavy metals/trace elements were mostly below their geochemical background levels (GBL) except for cadmium (Cd) and lead (Pb) that were with higher mean values than their geochemical background levels. This is an evidence of contamination of the sediments from the area with cadmium (Cd) and lead (Pb). The sources of cadmium in the environment include anthropogenic activities such as: presence/uses in batteries, colourant/pigments in plastics/ceramics/glasses, fabric printing, photography, cigarettes/tobacco, fertilizers, fungicides, germicides rodenticides etc. Likewise, sources of lead in the environment could be largely due to due to vehicle exhaust and industrial uses; metal alloys; solder; construction; brass pipe fittings; lead batteries; gaskets gasoline additives; pesticides; lead labels on specimens; ceramic clay bodies and glazes; glass production; metal coatings; foil; lead-acid batteries; battery clamps; cables; radiation shields; ammunition; fireworks; plastics; glass (including beads); linotype printing blocks; mordant in textiles; salts used to speed curing time of drying oils; old house paint; paints; pigments; geological specimens etc. (Podsiki, 2008). In the area sources of cadmium could be primarily due to the use of fertilizers, fungicides, germicides rodenticides from farmlands and also disposal of cadmium coated batteries as well as fabric printing which is common is some communities in the area. Lead sources in the area could be from the use of petroleum products, pesticides at homes and farmlands, disposal of lead containing batteries as well as textile productions.

e. **Benthic macro-invertebrate fauna**

The benthic macro-invertebrate fauna from the area comprised 20 different species. The major represented taxa include: Annelida, Insecta, Mollusca and Malacostraca. The insecta was the most abundant with total abundance of 3275 Org./m^2 from nine different representative species while malacostraca was least abundant with a total abundance 1025 Org./m^2 with two recorded species. The order of the total abundance of the major recorded taxonomic groups from the area was: Insecta (3275 Org./m^2) > Mollusca (2550 Org./m^2) > Annelida (1125 Org./m^2) > Malacostraca (1025 Org./m^2). Insecta was present in all the sampling stations (100%), while Mollusca and Malacostraca were recorded in six stations (50%) and Annelids found in five stations (42%). Station 13 had the highest total abundance of benthic macro-invertebrates with 1375 Org./m^2 while Station 19 had the least with 225 Org./m^2. The abundance composition of benthos in the stations was in the order:

- ≤ 500 Org./m^2 = Station 9 > Station 11 > Station10 > Station 18 > Station 19
- 501 - 1000 Org./m^2 = Station 12 > Station 8 > Station 3 > Station 15 > Station 16 > Station 5
- > 1000 Org./m^2 = Station 13

The richest stations were Stations 3 and 15 with 9 species of benthos, while Station 8 was the poorest with 2 species of benthos. The order of species richness of the stations was: Station 3 (9 species) = Station 15 (9 species) > Station 12 (7 species) > Station 13 (6 species) = Station 16 (6 species) > Station 5 (5 species) = Station 10 (5 species) = Station 11 (5 species) = Station 18 (5 species) > Station 9 (4 species) = Station 19 (4 species) > Station 8 (2 species) (Table 4.10.13).

Melanoides tuberculata was the most abundant species of benthos with total abundance of 1500 Org./m^2. On the other hand, *Melanopsis* sp. was the least abundant species of benthos with total abundance of 25 Org./m^2. Odonata larvae were the most occurred taxa, present in eight stations (67%) while *Tubifex tubifex*, *Dyticus* sp., *Melanopsis* sp. and *Pomacea* sp. were the least occurred, found in only one station (8%) from the area. The occurrence of *Tubifex tubifex* in Station 8 is an indication of biological/organic pollution in the station.

Table 4.10.12: Physico-chemical characteristics of sediment from the area

S/N	Parameter	Station												Range	Mean±S.E.	(GBL)
		3	5	8	9	10	11	12	13	15	16	18	19			
	Physical															
1	Textural Classification	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Silty-Sand	Sand	Sand	Sand			
2	Composition of Sand (%)	93.7	83.7	90.7	92.7	87.0	96.7	91.7	80.6	67.7	83.7	93.7	95.0	67.7 - 96.7	88.1±2.4	NS
3	Composition of Silt (%)	4.3	5.3	8.3	1.3	0.0	0.3	1.3	0.0	32.3	13.3	4.3	2.6	0.0 – 32.3	6.1±2.6	NS
4	Composition of Clay (%)	2.0	11.0	1.0	6.0	13.0	3.0	7.0	19.4	0.0	3.0	2.0	2.4	0.0 – 19.4	5.8±1.7	NS
	General Chemical															
5	pH in H_2O	6.34	6.29	6.95	5.57	5.60	5.87	5.72	5.75	6.03	7.06	6.25	5.85	5.57 - 7.06	6.11±0.14	NS
6	pH in KCl	5.91	5.98	5.92	5.38	5.47	6.68	5.57	5.53	5.69	6.27	5.83	5.24	5.24 - 6.68	5.79±0.12	NS
7	Conductivity (μScm^-)	142	146	134	128	190	54	82	146	33	125	56	133	33.0 - 190.0	114.1±13.6	NS
	Exchangeable Cations/Anions															
8	Exchangeable Acidity (cmol/kg)	0.30	0.40	0.80	0.40	0.90	0.60	0.40	0.40	0.20	0.50	0.60	0.90	0.20 - 0.90	0.53±0.07	-
9	Al^{3+} (cmol/kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 - 0.00	0.00±0.00	-
10	H^+ (cmol/kg)	0.30	0.40	0.80	0.40	0.90	0.60	0.40	0.40	0.20	0.50	0.60	0.90	0.20 - 0.90	0.53±0.07	-
11	Na^+ (cmol/kg)	0.30	0.21	0.29	0.43	0.38	0.31	0.22	0.29	0.41	0.96	0.18	0.32	0.18 - 0.96	0.36±0.06	23600[(b)]
12	K^+ (cmol/kg)	0.69	0.48	0.51	0.79	0.60	0.57	0.32	0.72	0.68	1.43	0.30	0.63	0.30 - 1.43	0.64±0.08	20900[(b)]
13	Ca^{2+} (cmol/kg)	4.52	2.87	2.13	6.91	3.40	2.77	1.70	6.51	5.29	16.92	1.25	4.14	1.25 - 16.92	4.87±1.21	41500[(b)]
14	Mg^{2+} (cmol/kg)	0.86	0.84	0.49	2.33	0.99	0.36	0.63	2.82	0.43	0.93	0.37	0.76	0.36 - 2.82	0.98±0.23	23300[(b)]
15	CEC (cmol/kg)	6.67	4.80	4.22	10.86	6.27	4.61	3.27	10.74	7.01	20.74	2.70	6.75	2.70 – 20.74	7.39±1.42	NS
16	Base Saturation (%)	95.5	91.7	81.0	96.3	85.6	87.0	87.8	96.3	97.1	97.6	77.8	86.7	77.8 – 97.6	90.0±1.9	NS
17	Chloride (Cl^-) (mg/kg)	20.20	16.00	10.90	15.20	7.20	20.20	10.00	10.00	16.00	19.20	18.00	15.00	7.20 - 20.20	14.83±1.26	NS
18	Sulphate (SO_4^{2-}) (mg/kg)	0.16	0.25	0.15	0.15	0.40	0.33	0.30	0.14	0.19	0.15	0.13	0.16	0.13 - 0.40	0.21±0.03	NS
	Nutrients															
19	Total Nitrogen (%)	0.11	0.12	0.08	0.21	0.13	0.12	0.14	0.04	0.09	0.05	0.09	0.20	0.04 - 0.21	0.12±0.01	NS
20	Available Phosphorus (ppm)	3.76	33.02	10.29	3.53	21.48	37.12	23.53	26.74	4.59	7.35	7.47	3.11	3.11 - 37.12	15.17±3.60	NS
21	Organic Carbon (%)	1.06	1.55	0.43	1.92	1.41	1.36	1.81	0.27	0.72	0.24	0.69	1.89	0.24 - 1.92	1.11±0.18	NS
22	Organic Matter (%)	1.83	2.67	0.74	3.31	2.43	2.34	3.12	0.47	1.24	0.41	1.19	3.26	0.41 – 3.31	1.92±0.31	NS
	Heavy Metals															
23	Cd (mg/kg)	3.20	2.80	3.60	1.80	1.20	2.50	1.80	1.50	2.70	3.20	3.80	2.70	1.20 - 3.80	2.57±0.24	0.20[(a)]
24	Cr (mg/kg)	6.10	5.80	6.90	7.30	4.80	3.30	2.80	4.00	3.60	2.90	4.10	3.50	2.80 - 7.30	4.59±0.45	100[(a)]
25	Co (mg/kg)	2.50	3.50	2.90	3.60	2.70	1.30	1.70	1.10	1.50	2.30	1.90	2.00	1.10 - 3.60	2.25±0.24	25[(b)]
26	Cu (mg/kg)	0.80	0.68	0.55	0.49	0.30	0.51	0.42	0.49	0.63	0.59	0.60	0.57	0.30 - 0.80	0.55±0.04	55[(a)]
27	Fe (mg/kg)	78.00	81.00	63.00	88.00	74.00	91.00	96.50	89.00	68.50	73.00	81.50	80.00	63.00 - 96.50	80.29±2.82	56300[(a)]
28	Mn (mg/kg)	95.00	114.00	132.50	128.00	88.50	117.00	127.00	130.50	140.80	128.50	130.00	101.50	88.50 - 140.80	119.44±4.76	950[(a)]
29	Ni (mg/kg)	8.50	10.70	11.30	10.60	12.00	9.00	8.60	9.40	7.20	6.90	9.00	9.20	6.90 - 12.00	9.37±0.45	75[(a)]
30	Pb (mg/kg)	18.50	21.00	14.70	13.20	16.70	11.50	18.20	19.00	14.80	15.30	11.80	14.00	11.50 - 21.00	15.73±0.86	12.5[(a)]
31	Zn (mg/kg)	1.33	1.42	1.16	1.27	1.03	1.08	1.29	1.41	0.98	0.86	0.91	0.67	0.67 - 1.42	1.12±0.07	80.0[(c)]

GBL = Geochemical Background Levels, [a] = (Average Earth Crust values of elements) – Schropp and Windom (1988), [b] = (Global Earth Crust values of elements) – Lide (2009), [C] = (Average Continental Crust values) – Taylor and McLennan (1995)

Table 4.10.13: Benthic macro-invertebrate fauna abundance (Org./m^2) and occurrence in the investigated waterbodies from the study area

S/N	TAXON	STATION												Total	Mean±S.E.	Occurrence (%)
		3	**5**	**8**	**9**	**10**	**11**	**12**	**13**	**15**	**16**	**18**	**19**			
	ANNELIDA															
1	*Hirudo* sp.	-	-	-	-	-	-	50	-	200	50	25	-	325	27±17	33
2	*Tubifex tubifex*	-	-	800	-	-	-	-	-	-	-	-	-	800	67±67	8
	INSECTA															
3	*Dyticus* sp. Larvae (Beetle)	-	-	-	-	-	-	-	50	-	-	-	-	50	4±4	8
4	*Dineutus* sp. (Whirligig Beetle)	75	-	-	-	50	-	-	-	25	-	-	-	150	13±7	25
5	*Gyrinus* sp. (Whirligig Beetle)	125	-	-	-	100	-	-	-	50	-	-	-	275	23±13	25
6	*Lethocerus* sp. (Hemiptera/Bug)	-	-	-	-		-	-	-	50	-	-	-	50	4±4	17
7	*Aquarius* sp. (Hemiptera/Bug)	50	-	-	-	50	50	50	-	50	-	75	50	375	31±8	58
8	*Geris* sp. (Hemiptera/Bug)	50	-	-	-	-	25	50	-	25	-	50	50	250	21±7	50
9	Odonata (Damsel-fly larvae)	100	150	-	100	50	75	-	100	75	100	-	-	750	63±15	67
10	Odonata (Dragon-fly larvae)	125	175	-	150	100	100	-	150	125	225	-	-	1150	96±23	67
11	*Chironomus* sp. (midge-larvae)	-	-	125	-	-	-	-	-	100	-	-	-	225	19±13	17
	MALACOSTRACA															
12	Decapod Crab	-	-	-	-	-	-	-	-	-	-	50	100	150	23±13	17
13	*Macrobrachium* sp.	-	-	-	100	-	200	250	-	-	200	100	25	875	135±67	50
	MOLLUSCA															
14	*Bulinus* sp.	150	175	-	-	-	-	-	50	-	100	-	-	475	40±19	33
15	*Lanistes* sp.	50	50	-	-	-	-	-	-	-	25	-	-	125	10±6	25
16	*Lymnaea* sp.	-	25	-	-	-	-	-	25	-	-	-	-	50	4±3	17
17	*Melanoides tuberculata*	-	-	-	-	-	-	500	1000	-	-	-	-	1500	125±90	17
18	*Melanopsis* sp.	-	-	-	-	-	-	25	-	-	-	-	-	25	2±2	8
19	*Physa* sp.	-	-	-	150	-	-	25	-	-	-	-	-	175	15±12	17
20	*Pomacea* sp.	50	-	-	-	-	-	-	-	-	-	-	-	50	4±4	8
	Total Annelida	-	-	800	-	-	-	50	-	200	50	25	-	1125	94±66	42
	Total Insecta	525	325	125	250	350	250	100	300	500	325	125	100	3275	273±42	100
	Tota Malacostraca	-	-	-	100	-	200	250	-	-	200	150	125	1025	85±28	50
	Total Mollusca	250	250	-	150	-	-	700	1075	-	125	-	-	2550	213±98	50

	TOTAL	775	575	925	500	350	450	950	1375	700	700	300	225	7825	652±94	100

4.10.5. Water and Sediment Microbiology

A total of nine bacteria species isolates were recorded from water and sediment sources in the project area. The nine species belong to the three genera: *Pseudomonas* (4 spp), *Klesbsilla* (4 spp) and *Citrobacter* (1 sp). All the nine isolates were recorded in sediment samples (mean frequency of isolate = 42.7%) as opposed to only 6 isolates in surface water and 5 isolates in groundwater (Table 4.10.14) *Pseudomonus, pseudomaller, Klebsilla, rhinoscleromatis, and Citrobacter freundi* were not recorded in water source but occurred in sediment samples. The most widely occurring isolates were *Pseudomonas aeruginosa* (100%) and *Klebsiella edwaerdsii* (89-100% occurrence).

The fungal flora comprised 27 species isolates (Table 4.10.15) consisting of 18 isolates in sediment samples and 21 isolates in water sources (both surface and ground water) Eight isolates were common to all the water and sediment samples of which *mucor hiemalis* (92-100%) and *Trichoderma* sp (58-89%) were the most widely distributed. The others were *Aspergillus fumigatus, A flavus*, Cladosporium, herbarium, *Mucor mucedo, Rhizopus oryzea* and *Rhizopus stolonifera*. The isolates limited to sediment samples were *Aspergillus niger, Clonostachy rosea, fusarium* sp, *Penicillium expansium.* On the other hand, species limited to water samples *were microporium audounii, Mucor eretus* and *Penicillium roqueforti*. Qualitatively, the dominant genera were *Aspergillus* (4 spp), *Mucor* (4 spp), *Penicillium* (4 spp) and *Rhizopus* (3 spp) while the most widely distributed were *Mucor hiemalis* (92-100%), *Aspergillus fumigatus* (17-50%) and *Trichoderma* sp (58-89%) respectively. Tables 4.2.8.3 and 4.2.8.4 show the distribution of recorded species isolates in water and sediment respectively. The number of bacterial isolates per station was in the range of 1-4 (median/ mode =2) in groundwater as opposed to 2-4 (median / mode=2) in surface water and 2-5 (median / mode = 4) in sediment samples. On the other hand, the number of fungal isolates per sample was 4-7 (median/mode = 6) as opposed to 3-6 (median = 3) in surface water and 3-7 (median = 5) in sediments (Tables 4.10.16 and 4.10.17).

The abundance of Total heterotrophic bacteria (THB) occurred in the order of surface water >groundwater>sediment with median counts of 3.2 x 10^7cfu/ml, 6.4 x 10^6cfu/ml and 8.5 x 10^5cfu/ml respectively (Table 4.10.17). Total heterotrophic fungi (THF) abundance was usually less than that of THB with median counts of 9.7 x 10^5cfu/ml for ground water, 4.8 x 10^7cfu/ml in surface water and 3.1 x 10^5cfu/ml in sediment samples (Table 4.10.18). The level of coliform MPN was less than100cell/100ml in most of the samples (Table 4.10.17), although values indicative of pollution was also recorded for both surface and subsurface water sources in the study area. Thus, there was no significant difference in the bacteriological quality of both surface and subsurface water sources in the area. This could be due to the high water table and the free interaction between surface and subsurface water sources. Fungal abundance based on median counts was in the order of surface water>groundwater>sediment with median values of 4.1 x 10^7cfu/ml, 9.7 x 10^5cfu/ml and 3.0 x 10^5cfu/ml respectively. The fact that THB was much higher than THF may be due to the generally alkaline medium of the water sources. It is interesting to note that some of the recorded bacterial and fungal isolates are known to be oil degraders, they include *Pseudomonas* spp, some of which have also been implicated as being involved in respiratory infection, arthritis and osteomyelitis. However, the common bacteria indicators of faecal pollution were not recorded, notably *Escherichus coli* and other related coliform bacteria.

Table 4.10.14: Occurrence frequency of bacterial species isolates in Groundwater (GW), Surface (SW) and Sediment Samples in the Study Area

SN	Taxon	% Occurrence		
		GW (n=9	SW (n=12)	Sediment (n=12)
1	*Pseudomonas aeruginora*	100	100	100
2	*Pseudomonas cepacia*	22	17	17
3	*Pseudomonas pseudomaller*	0	0	8
4	*Pseudomonas stutzeri*	0	8	17
5	*Klebsiella edwardii*	89	92	100
6	*Klebsiella ozoenae*	22	17	67
7	*Klebsiella pneumoniae*	11	8	50
8	*Klebsiella rhinoscleromatis*	0	0	17
9	*Citrobacter freundii*	0	0	8
	Total bacteria isolates	5	6	9
	mean % frequency	27.1	26.7	42.7
	median % frequency	11	0	17
	mode % frequency	0	0	17

GW=Groundwater (borehole, handdug wells)
SW= Surface water (rivers/streams/ponds)
Source: SEEMS, 2017

Table 4.10.15: Frequency of Occurrence (%) of Fungal isolates in Groundwater (GW), Surface (SW) and Sediment Samples in the Study Area

SN	Taxon	% Occurence		
		GW (n=9	SW (n=12)	Sediment (n=12)
1	*Absisia* sp	11	0	0
2	*Aspergillus fumigatus*	33	17	50
3	*Aspergillus flavus*	22	17	17
4	*Aspergillus glaucus*	0	0	67
5	*Aspergillus niger*	0	0	8
6	*Aureobasidium pullulans*	11	0	8
7	*Botrylis* sp	11	0	0
8	*Cladosporium herbarium*	78	17	8
9	*Clonostachy rosea*	0	0	8
10	*Fusarium* sp	0	0	8
11	*Microsporium audouinii*	11	8	0
12	*Mucor eretus*	89	83	0
13	*Mucor hiemalis*	100	92	100
14	*Mucor mucedo*	11	25	8
15	*Mucor rouxii*	11	0	0
16	*Neurospora sitophila*	0	8	0
17	*Penicillum camemberti*	0	0	8
18	*Penicillium expansium*	0	0	17
19	*Penicillium italicum*	11	0	25
20	*Penicillium roqueforti*	33	42	0
21	*Rhizopus japonicus*	11	0	58
22	*Rhizopus oryzea*	11	17	17

SN	**Taxon**	**% Occurence**		
		GW (n=9	**SW (n=12)**	**Sediment (n=12)**
23	*Rhizopus stolonifera*	11	17	33
24	*Scopulariopsis brevicaulis*	0	8	0
25	*Trichoderma* sp	89	58	83
26	*Trichophyton schoenleinii*	0	8	8
27	*Trichosporium* sp	0	8	0
	Total bacteria isolates	17	14	18
	mean % frequency	20.5	15.7	19.7
	median % frequency	11	8	0
	mode % frequency	11	0	0

GW=Groundwater (borehole, handdug wells)
SW= Surface water (rivers/streams/ponds)
Source: SEEMS, 2017

Table 4.10.16: Occurrence of microbial species isolates in water samples from the area

S/N	Taxon	Groundwater samples										Surface water samples												
		Station										Station												
		1	2	4	6	7	14	17	20	21	% Freq.	3	5	8	9	10	11	12	13	15	16	18	19	% Freq.
Bacteria																								
1	*Pseudomonas cepacian*	+	-	-	-	+	-	-	-	-	22	-	-	+	-	-	+	-	-	-	-	-	-	17
2	*Pseudomonas aeruginosa*	+	+	+	+	+	+	+	+	+	100	+	+	+	+	+	+	+	+	+	+	+	+	100
3	*Klebsiella edwardsii*	+	+	+	+	+	+	+	-	+	89	+	+	+	-	+	+	+	+	+	+	+	+	92
4	*Klebsiella pneumoniae*	+	-	-	-	-	-	-	-	-	11	-	-	-	+	-	-	-	-	-	-	-	-	8
5	*Klebsiella ozoenae*	-	-	+	-	-	-	+	-	-	22	-	-	-	-	-	+	-	-	-	-	+	-	17
6	*Psudomonas stutzeri*	-	-	-	-	-	-	-	-	-	0	-	+	-	-	-	-	-	-	-	-	-	-	8
Fungi																								
7	*Mucor hiemalis*	+	+	+	+	+	+	+	+	+	100	+	-	+	+	+	+	+	+	+	+	+	+	92
8	*Mucor eretus*	+	+	+	+	-	+	+	+	+	89	+	-	-	+	+	+	+	+	+	+	+	+	83
9	*Penicillium roquefortii*	+	+	+	-	-	-	-	-	-	33	-	+	+	-	-	+	+	+	-	-	-	-	42
10	*Aureobacidium pullulans*	+	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
11	*Botrytis sp.*	+	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
12	*Tricoderma sp.*	-	+	+	+	+	+	+	+	+	89	-	-	+	-	-	+	+	+	+	-	+	+	58
13	*Rhizopus japonicus*	-	+	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
14	*Cladosporium herbarium*	-	+	+	+	+	-	+	+	+	78	-	-	-	-	-	-	-	-	-	-	+	+	17
15	*Aspergillus flavus*	-	-	-	-	+	-	+	-	-	22	+	-	+	-	-	-	-	-	-	-	-	-	17
16	*Rhizopus oryzae*	-	-	-	+	-	-	-	-	-	11	-	+	-	-	-	+	-	-	-	-	-	-	17
17	*Trichophyton schoenleinii*	-	-	-	-	-	-	-	-	-	0	-	+	-	-	-	-	-	-	-	-	-	-	8
18	*Penicillium italicum*	-	-	-	+	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
19	*Aspergillus fumigatus*	-	-	-	+	-	-	+	+	-	33	-	-	-	-	-	+	-	+	-	-	-	-	17
20	*Mucor rouxii*	-	-	-	-	+	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
21	*Absidia sp.*	-	-	-	-	+	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	0
22	*Rhizopus stolonifer*	-	-	-	-	-	-	-	+	-	11	-	-	+	+	-	-	-	-	-	-	-	-	17
23	*Neurospora sitophila*	-	-	-	-	-	-	-	-	-	0	-	-	+	-	-	-	-	-	-	-	-	-	8
24	*Scopulariopsis brevicaulis*	-	-	-	-	-	-	-	-	-	0	-	-	-	-	+	-	-	-	-	-	-	-	8
25	*Mucor mucedo*	-	-	-	-	-	+	-	-	-	11	-	-	-	-	-	-	+	-	-	-	+	+	25
26	*Microsporium audouinii*	-	-	-	-	-	-	-	-	+	11	-	-	-	-	-	-	-	+	-	-	-	-	8
27	*Aspergillus glaucus*	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	0
28	*Trichosporon sp.*	-	-	-	-	-	-	-	-	-	0	-	+	-	-	-	-	-	-	-	-	-	-	8

S/N	Taxon	Groundwater samples										Surface water samples												
		Station										Station												
		1	2	4	6	7	14	17	20	21	% Freq.	3	5	8	9	10	11	12	13	15	16	18	19	% Freq.
	Total bacteria species	4	2	3	2	3	2	3	1	2	100	2	3	3	2	2	4	2	2	2	2	3	2	100
	Total fungi species	5	6	5	7	6	4	6	6	5	100	3	4	6	3	3	6	5	6	3	2	5	5	100
	Total microbial species	9	8	8	9	9	6	9	7	7	100	5	7	9	5	5	10	7	8	5	4	8	7	100

Source: SEEMS, 2017

Table 4.10.17: Occurrence of Microbial species isolates in sediment samples

S/N	Taxon	Station												
		3	5	8	9	10	11	12	13	15	16	18	19	% Freq.
Bacteria														
1	*Klebsiella ozoenae*	+	+	+	+	+	+	+	-	-	-	-	+	67
2	*Klebsiella edwardsii*	+	+	+	+	+	+	+	+	+	+	+	+	100
3	*Pseudomonas aeruginosa*	+	+	+	+	+	+	+	+	+	+	+	+	100
4	*Pseudomonas pseudomallei*	-	+	-	-	-	-	-	-	-	-	-	-	8
5	*Klebsiella pneumoniae*	-	+	+	+	-	-	-	+	-	+	-	+	50
6	*Citrobacter freundii*	-	-	+	-	-	-	-	-	-	-	-	-	8
7	*Pseudomonas cepacia*	-	-	-	-	+	-	-	-	-	+	-	-	17
8	*Pseudomonas stutzeri*	-	-	-	-	+	-	+	-	-	-	-	-	17
9	*Klebsiella rhinoscleromatis*	-	-	-	-	-	-	-	+	-	-	+	-	17
Fungi														
10	*Mucor mucedo*	+	-	-	-	-	-	-	-	-	-	-	-	8
11	*Trichoderma sp.*	+	-	+	-	+	+	+	+	+	+	+	+	83
12	*Aspergillus fumigatus*	+	-	+	-	+	-	+	-	-	+	+	-	50
13	*Rhizopus japonicus*	+	+	+	+	-	+	-	-	-	+	-	+	58
14	*Mucor hiemalis*	+	+	+	+	+	+	+	+	+	+	+	+	100
15	*Penicillium camemberti*	+	-	-	-	-	-	-	-	-	-	-	-	8
16	*Aspergillus glaucus*	-	+	+	-	+	+	+	-	+	+	+	-	67
17	*Penicillium italicum*	-	+	-	-	+	-	-	+	-	-	-	-	25
18	*Aureobasidium pullulans*	-	-	+	-	-	-	-	-	-	-	-	-	8
19	*Cladosporium hebarum*	-	-	-	+	-	-	-	-	-	-	-	-	8
20	*Rhizopus stolonifer*	-	-	-	-	+	-	-	+	-	+	-	+	33
21	*Aspergillus flavus*	-	-	-	-	-	+	-	-	-	+	-	-	17
22	*Penicillium expansium*	-	-	-	-	-	+	-	-	-	-	-	+	17
23	*Clonostachy rosea f*	-	-	-	-	-	+	-	-	-	-	-	-	8
24	*Trichophyton schoenleinii*	-	-	-	-	-	-	-	+	-	-	-	-	8
25	*Aspergillus niger*	-	-	-	-	-	-	-	-	+	-	-	-	8
26	*Fusarium sp.*	-	-	-	-	-	-	-	-	+	-	-	-	8
27	*Rhizopus oryzae*	-	-	-	-	-	-	-	-	-	-	+	+	17
	Total bacteria species	**3**	**5**	**5**	**4**	**5**	**3**	**4**	**4**	**2**	**4**	**3**	**4**	**100**
	Total fungi species	**6**	**4**	**6**	**3**	**6**	**7**	**4**	**5**	**5**	**7**	**5**	**6**	**100**
	Total microbial species	**9**	**9**	**11**	**7**	**11**	**10**	**8**	**9**	**7**	**11**	**8**	**10**	**100**

Source: SEEMS, 2017; *Freq. = Frequency*

Table 4.10.18: Microbial abundance in water samples from the area

S/N	Sample No	THB@35°C (cfu/mL)	THF @30°C (cfu/mL)	Coli MPN (Cells/100mL)
		Groundwater samples		
1	1	3.2×10^7	9.7×10^5	28.0
2	2	1.7×10^7	9.0×10^5	93.0
3	4	5.5×10^7	6.8×10^5	1.1×10^3
4	6	3.5×10^7	5.1×10^5	10.0
5	7	2.3×10^5	5.3×10^5	10.0
6	14	7.1×10^7	3.4×10^7	93.0
7	17	1.6×10^5	4.8×10^7	15.0
8	20	3.1×10^5	5.9×10^7	Nil
9	21	3.2×10^7	3.5×10^7	1.1×10^3
	Range	$1.60 \text{ X } 10^5 – 7.10 \text{ X } 10^7$	$3.40 \text{ X } 10^5 – 5.90 \text{ X } 10^7$	Nil – $1.10 \text{ X } 10^3$
	Total	$2.34 \text{ X } 10^8$	$1.46 \text{ X } 10^8$	$2.45 \text{ X } 10^3$
	Mean ± S.E.	$2.60 \text{ X } 10^7 \pm 8.38 \text{ X } 10^6$	$1.62 \text{ X } 10^7 \pm 8.03 \text{ X } 10^6$	$2.72 \text{ X } 10^2 \pm 1.57 \text{ X } 10^2$
		Surface water samples		
1	3	2.6×10^5	3.6×10^7	4.0
2	5	8.8×10^7	1.2×10^5	15.0
3	8	1.4×10^5	5.8×10^5	2.4×10^2
4	9	6.0×10^2	3.9×10^7	8.0
5	10	7.5×10^5	4.2×10^7	4.0
6	11	1.2×10^5	7.3×10^7	15.0
7	12	3.9×10^7	5.1×10^5	15.0
8	13	2.1×10^7	4.5×10^7	93.0
9	15	7.0×10^7	6.0×10^7	14.0
10	16	1.0×10^5	5.6×10^7	23.0
11	18	1.3×10^7	4.4×10^7	1.1×10^3
12	19	2.9×10^7	5.7×10^7	1.1×10^3
	Range	$6.00 \text{ X } 10^2 – 8.80 \text{ X } 10^7$	$1.20 \text{ X } 10^5 – 7.30 \text{ X } 10^7$	$4.00 \text{ -}1.10 \text{ X } 10^3$
	Total	$2.61 \text{ X } 10^8$	$4.53 \text{ X } 10^8$	$2.63 \text{ X } 10^3$
	Mean ± S.E.	$2.18 \text{ X } 10^7 \pm 8.67 \text{ X } 10^6$	$3.78 \text{ X } 10^7 \pm 7.15 \text{ X } 10^6$	$2.19 \text{ X } 10^2 \pm 1.20 \text{ X } 10^2$

Source: SEEMS, 2017

Table 4.10.19: Microbial abundance in sediment samples from the area

S/N	Sample No	THB@35°C (cfu/g)	THF @30°C (cfu/g)
1	3	8.3×10^5	3.9×10^5
2	5	1.2×10^7	2.2×10^5
3	8	1.21×10^6	1.6×10^5
4	9	6.6×10^5	1.3×10^5
5	10	3.0×10^6	2.4×10^5
6	11	5.2×10^5	2.9×10^5
7	12	8.4×10^5	3.1×10^5
8	13	9.6×10^5	4.5×10^5
9	15	2.3×10^5	3.2×10^5
10	16	1.08×10^6	3.8×10^5
11	18	6.1×10^5	4.4×10^5
12	19	9.1×10^5	2.5×10^5
	Range	$2.3 \text{ X } 10^5 – 1.20 \text{ X } 10^7$	$1.30 \text{ X } 10^5 – 4.50 \text{ X } 10^5$
	Total	$2.29 \text{ X } 10^7$	$3.58 \text{ X } 10^6$
	Mean ± S.E.	$1.90 \text{ X } 10^6 \pm 9.30 \text{ X } 10^5$	$2.98 \text{ X } 10^5 \pm 2.99 \text{ X } 10^4$

Source: SEEMS, 2017

4.10.6. Fishery Study

4.10.6.1. Methodology

The source of information on the fish and fisheries of water bodies in the study area was based largely on the assessment of catches / fish landing by fisherfolks and or interview with them. This has been supplemented with available information from literature especially on Oyan Reservoir.

4.10.6.2. Results and Discussion

Fish (both finfish and shell fish) always constitute the most important resource of most aquatic systems especially in major waterbodies. This is based on the fact that fish fauna occupies the terminal position in the ecological chain of any aquatic environment and many fish species are commercially important. Fishes are the source of cheap high-quality protein much needed by human population hence fishing and fish marketing provide job opportunities to a wide variety of people. In addition, it may provide recreational satisfaction to many people.

The entire project area (Lots 1,2 & 3) falls within the Ogun – Osun river basin, one of the 12 major drainage basins into which Nigeria is divided. The main rivers in the basin and in the project, area is the River Ogun with R. Oyan and Ofiki as the major tributaries. In the Lot 2 project area, River Ogun is crossed by the transmission line at Ifesowapo, Oke-Oko community (0541662N and 0758525E). In addition, three 2-3 other rivers and eight streams were encountered and surveyed. With regard to fisheries development, the Oyan reservoir, an impoundment on River Oyan is the most important waterbody not only in the study area but in the entire Ogun State. Whereas the reservoir covers 4,000 ha, all the other 23 waterbodies exploted for fisheries in the state are generally below 100ha (range = 1-100 ha, median 4ha). Fishing in the area is undertaken at subsistence level while full time fisherfolks operate on Oyan Reservoir and a few community owned ponds, and lakes. The major fishing methods employed for fish catch include cast nets, gill traps (mostly basket traps). These gears are usually deployed from wooden boats or dug out canoes most of which are peddled by hand while a few are driven by outboard engine. Cast nets are operated any time of the day while gill nets are usually set in the evening (between 7.00 and 9.00pm) and retrieved in morning (between 8am – 10am). It is generally believed that higher catches are recorded during high water level (flood period) that at low water level (base flow).

The most commercially abundant fish in the area is the catfish *Chrysicltys nigrodigitatus*. Others include *Chrysichthys auratus,* the cichlids *Tilapia zilli*, *Sarotherodon galilaeus, catfish Synodontis spp*, *Hydrocynus brevis* (Tiger fish) and *Mormymus rume.* Table 4.10.20 shows the checklist of fish recorded in Ogun River in the coastal region. They comprise both freshwater and brackish species. The most widely recorded being *Chrysichthys nigrodigitatus* (33.82%), *Sadinella maderensis* (21.69%) and *Tilapia zilli* (17.6%).

Table 4.10.20: Fish species distribution, abundance and total estimate in Ogun State estuary

Family	Fish species	Local name	Percentage contribution	Estimated catch (tonnes) year
Bagridae	*Chrysichthys nigrodigitatus*	Igangan/obokun	33.82	190.61
	Chrysichthys auratus	Ponmu	2.48	90.36
Channidae	*Chana obscura*	Korowo	0.10	0.82
Cichlidae	*Tilapia zilli*	Epiya	17.63	142.95
	Sarotherodon galilaeus	Ajigi	1.00	7.44
Clupeidae	*Pellonula leonensis*	Wesafun	0.86	72.33
	Sadinella maderensis	Salanpore	21.69	83.11
Schilbedae	*Schilbe mystus*	Seke	5.18	100.59
	Sphyraena	Ogan	0.87	5.88
Sphyraenidae	*Barracuda*	Esun	0.08	1.40
Mochokidae	*Synodontis schall*	Akokoniko	0.11	1.67
Monodachylidae	*Psettias sabae*	Akaraba	0.04	0.85
Hepsetidae	*Hepsetus odoe*	Ijakere	0.20	2.12
Mormyridae	*Heperopisus bebe*	Lele	0.02	0.55
	Mormyrus rume	Lele ofe	0.41	12.96
	Petrocephalus ansorgii	Lele oloje	0.01	0.20
Cynoglossidae	*Cynoglossus senegalensis*	Abo	0.23	2.18
Distichodontidae	*Ichthyoborus monodi*	Lamisoro	0.02	0.45
Elopidae	*Elops lacerta*	Sugbon	2.49	18.99
Notopteridae	*Paprocranus afer*	Lakoro	0.09	2.86
	Xenomystus nigri	Lakoro	0.07	1.51
Osteoglossidae	*Heterotis niloticus*	Aika	0.02	7.19
Pomadasydae	*Pristopoma jubelini*	Ikekere	0.05	1.31
Polynemidae	*Polydactylus quadrifilis*	Omokoro	0.16	3.66
Gobiidae	*Gobius schlegelii*	Ajebute	0.07	0.37
Mugilidae	*Mugil cephalus*	Atoko	3.00	69.31
Alestidae	*Alestes macrolepidotus*	Afere	0.28	2.47
	Alestes longipinnis	Agaranpo	0.13	1.31

Gymnarchidae	*Gymnarchus niloticus*	Eja osan	0.03	5.00
Anabantidae	*Ctenopoma kingsleyae*	Ekiki	0.03	0.32
Polypteridae	*Polypterus senegalus*	Lakasa	0.08	0.51
Soliedae	*Citharichthys spoilopterus*	Iya abo	0.13	0.54
Carangiae	*Caranx hippos*	Owere	0.04	0.99
Palaemonidae	*Macrobranchium vollenhovenii*	Ede	8.57	4.23

4.10.7. Ecosystem Services

IFC 2012 recognizes that maintaining ecosystem services are fundamental to sustainable development. Ecosystem services are the benefits people including businesses derive from plant resources (IFC 2012). Ecosystem services are organized into four types namely provisioning services (food, medicine and raw materials), regulating services (Carbon sequestration and storage, Local climate regulation (air quality), Waste water treatment and detoxification, Regulation of water flow, Biological control, Erosion prevention and maintenance of soil fertility and Moderation of extreme events such as storm and shorelines), supporting services (Soil Formation, Nutrient Cycling, Primary Productivity and Habitat Mediation& space) and cultural services (Spiritual and religious values, Knowledge systems and Educational values, Inspiration, Aesthetic Values, Social Relations, Sense of Place, Cultural diversity, Cultural Heritage Values and Recreation and Ecotourism). Impacts on biodiversity often adversely affect the delivery of ecosystem services. Vegetation plays indispensable roles in creating and preserving a stable and high-quality environment. It moderates local climates, reduces soil erosion and regulates stream flow by forming a protective screen over the land. Vegetation also influences local climate by reducing wind speed and temperature extremes and by increasing atmospheric humidity. Vegetation is also the major factor controlling the conservation of soil and water (Fu Bojie, 1989) while its canopy intercepts raindrops and reduces the kinetic energy of rainfall thereby minimizes soil dispersion by raindrop impact (Lal, 1974). It has been a basic support for the society, providing goods such as timber, game-meat, fodder, medicinal plants and services such as soil formation and protection, watershed protection and climatic amelioration (Rapport and Whiteford, 1999). All indicates that vegetation provides not only tangible products for our use and consumption but also performs vital environmental protection functions. The leaves and barks of many tropical forest trees also serve as sources of drugs, resins gums and latex. Vegetation cover forms habitats for a great variety of wildlife which are of economic and aesthetic value. Many Nigerians depend on wildlife as their main source of animal protein. The functional ecosystem services played by the censored plant species in the study area was evaluated via desk top review. The uses of ecosystem services in the project area are in Table 4.10.21

Table 4.10.21: Indigenous uses of Ecosystem services in the Communities

Ecosystem Services	Average Percentage Usage	Frequency of Harvesting/Usage (%)			Relative Importance		
		Often	Weekly	Occasionally	Very Important	Important	Not Available
Collection of woods for Fuel wood in the wild	13	41	19	4	32	19	13
Collection of woods for Charcoal in the wild	11	32	22	10	27	21	10
Harvesting of Medicinal plants in the wild	9	15	19	36	14	18	37
Collection of Wild fruits	7	4	8	51	6	10	48
Sand Mining for sale & construction	25	56	5	3	3	4	57
Fishing	1	1	2	61	1	4	58
Hunting	5	2	5	57	4	6	53
Grazing	5	2	6	56	10	13	41
Basket Weaving	2	1	3	61	2	6	56
Broom making	3	1	4	58	2	6	56
Production of alcoholic	3	2	4	57	4	6	54

Ecosystem Services	Average Percentage Usage	Frequency of Harvesting/Usage (%)			Relative Importance		
		Often	Weekly	Occasionally	Very Important	Important	Not Available
beverages							
Collection of Grass for Thatching	2	1	3	60	3	7	53
Collection of Clay for Building	1	1	3	60	1	4	59

F=frequency, Wk=weekly, OF=often, VIM=very important, NA=not available, IM=important, OC=occasionally.
Source: Field survey, 2017

According Table 4.10.21, the most exploited ecosystem services are collection of woods for fuel wood in the wild (13 %), collection of woods for charcoal in the wild (11%), harvesting of medicinal plants in the wild (9%), and collection of wild fruits (7%), while the least exploited ecosystem services are fishing (1%), and collection of clay for building (1%).

4.10.7.1 Provisioning Services

The economic importance of these plants varies and they include their uses as fuel, timber, dyes, vegetable, edible fruits and seed trees, medicinal and religious plants and sponge. The economic trees include *Elaeis guineensis*, *Mangifera indica*, *Cola nitida*, *Chysophyllum albidum*, *Psidium guajava*, *Moringa oleifera*, *Cocos nucifera* and *Carica papaya*. The study area thus has some other plants that are economically important (Table 4.10.3).

4.10.7.2 Regulatory Services

As could be seen in Table 4.10.3, *Panicum maximum, Andropogon tectorum, Brachiaria lata, Imperata cylindrical, Coix spp. are the grasses which* used for regulatory services in the study area. Some of the species in the study area are applied to addressing carbon sequestration and storage, regulation of water flow, local climate regulation, erosion prevention and maintenance of soil fertility, and biological control.

4.10.7.3 *Supporting Services*

Table 4.10.3 showed that the medicinal habitat species are being found in the study area. These are: *Mangifera indica, Cola nitida, Morinda oleifera, Morinda lucida* (Oruwo).

4.10.4 Cultural Services

These are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences (Sarukhán and Whyte 2005). IFC 2012 grouped this services into cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, Cultural heritage values and Recreation and ecotourism. Some of species like *Raphia hookeri, Bambusa vulgaris* were found in the project area that serves cultural values. They are applied to addressing spiritual/religious values, and aesthetic values

4.13.8.7 Ecosystem services of faunal groups

Analysis on the ecosystem services provided by the fauna species across the fauna group was conducted. The ecosystem services reviewed are provisional services (food and energy, medicine, raw material), regulatory services (biological control, pollination), supportive services and cultural services.

A total of 33 fauna species were reviewed as offering ecosystem services. A breakdown of the number of species with respect to fauna group revealed that the Avian taxon with 13 species was the group with the highest number of species offering ecosystem services, this was followed by Mammals with11 species, reptiles with 6 species, while the amphibians with 3 species recorded the least number of species with ecosystem services. However, the total may exceed 33 as some species provides two or more ecosystem services. The fauna species are in Table 4.10.4.

Table 4.10.22: Ecosystem services of faunal groups

	MAMMALS	AVES	REPTILES	AMPHIBIANS
Provisional services	9	2	5	2
Regulatory services	1	2	-	1
Supportive services	1	2	2	-
Cultural services	2	2	2	1
Total	**13**	**8**	**9**	**4**

Source: Field Survey, 2017

4.11. Human Environment

4.11.1. Introduction

4.11.1.1. Political context

Nigeria is a Federal Republic made up of 36 States and a Federal Capital Territory. Nigeria became an independent state in 1960 and a republic in 1963. It started off with three regions namely Eastern, Northern and Western regions until a fourth; the Mid-West region was created in 1963. Nigeria experienced the first military coup in 1966, and a thirty-month civil war from 1967 to 1970. The military government created 12 states from the four regions in 1967. Between 1967 and 1996, the 12 states were further divided into 19, then 21 and finally 36 states. Ogun State was created in 1976 out of the then Western State. Lagos state was created on the 27th May 1967 by virtue of the state creation and Transitional Provisions Decree No.14 of 1967.Lagos state is known as the financial hub of Nigeria.

4.11.1.2. Country location and Administrative structure

Nigeria lies between latitudes 4^{o} and 14^{o} north of the equator and longitudes 3^{o} and 15^{o} east of the Greenwich meridian on the west coast of Africa. It covers a total area of 923,766 square kilometres consisting of 910,768 square kilometres of land and 13,000 square kilometres of water with the coast line stretching up to 853 kilometres. The entire country is divided into 36 states and federal capital territory. These are further sub-divided into 770 local government areas which form the third tier of government while the central and state governments form the first and second tier respectively. The third tier consists of the Local Government Areas. The country practices a presidential system of government consisting three arms of government: the executive, the legislature and the judiciary (Nigerian 1999 Constitution). The executive consists of both elected and appointed members, while members of legislature, both at federal and state levels are elected. This pattern is similar to what obtains at the Local Government level, except that there is no third arm (the judiciary) at the

LGA level. Another major difference between the central government structure and that of the state is the presence of two legislative chambers at the center (i.e. the Senate and the House of Representatives), while the states have just one.

The LGA administration is run by an elected Executive Chairman and appointees of the Chairman representing the executive arm of local government administration. There is also the legislature made up of ten Counselors elected from the wards in the LGA. The Chairman is the chief security officer of the LGA and the office is important in the operations of the proposed project.

The communities have a well-defined hierarchical political structure with traditional leadership through Kings (Oba) or Baale, chiefs and community Heads. The traditional authority structures are similar in all the communities. This governance structure is graphically represented in Figure 4.3.4

At the community level, the traditional authority structure hardly varies from one community to another with the traditional head (King or Baale) and chiefs jointly administering their political, economic and social affairs. Authority in each community is at two levels. The first is the traditional ruling council composed of the village chiefs and headed by the village head (the "Baale"). The second is the Community Development Association (CDA) comprising of an elected Chairman and some Executive Members. All CDAs operate under the leadership of one Community Development Secretary (CDS) who is coordinates the activities of all CDAs in the area. The Community Development Association (CDA) mobilizes the different sections and interest groups in the Community for development purposes. The CDA reports to the CDS who takes issues to Council of Elders. There is also a Youth Organization with elected Chairman and members in each community.

Three broad groups are identifiable in each of the communities – male elders, youths and women. The role of male elders is traditional governance of the communities. They dominate the political arena and the decision-making positions, while the youth leaders are usually at the bottom rungs of the ladder of authority. The traditional role of the youths includes constituting a labour force in development projects, security of the community and to enforce law and order. Though, each of the communities has a women leader, but traditionally, there is a limit to the involvement of women in the political governance of these local settlements. Generally, women play a subdued role in the communities, usually placed at the background. Each of the communities has a patriarchal familial arrangement.

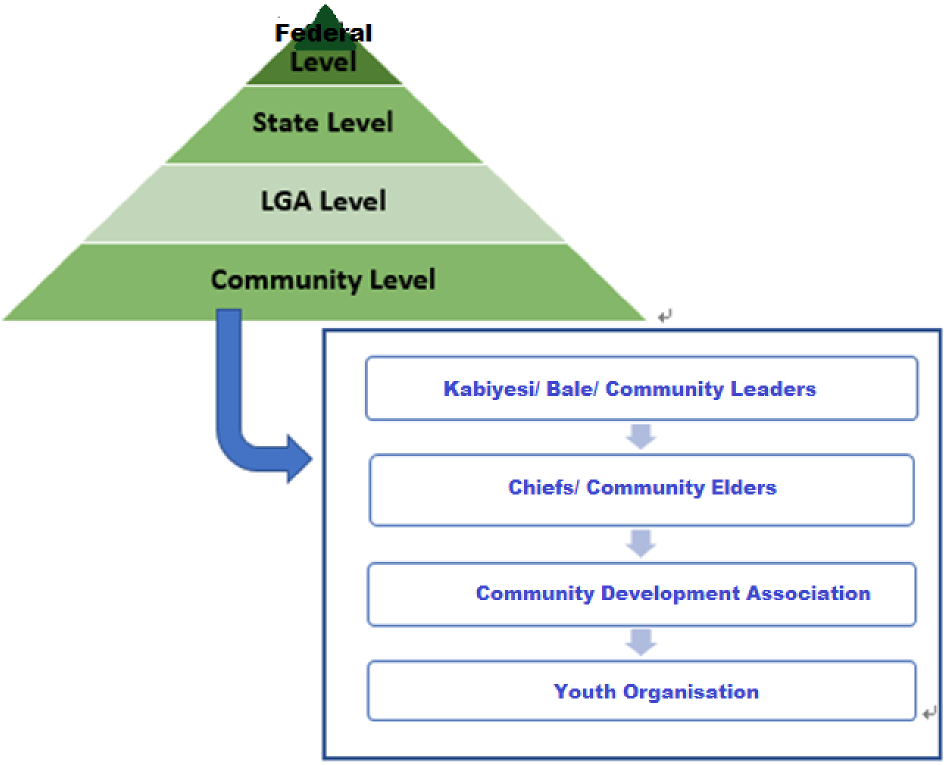


Figure 4.11.1: Administrative structure

4.11.2. Socio-Economic Baseline

4.11.2.1.Methodology

Data accumulation for the baseline information starts with some reviews and desktop studies of various reports on Nigeria. This provides the context within which the baseline information about Ogun State, the affected Local Government Areas (LGAs) and the immediate settlements around the project site will be appreciated. Finally, mostly data in statistical representation and charts, reflected in this ESIA, were obtained from structured consultations with the traditional rulers, community heads, and officials of the LGAs as well as members of the affected communities.

Human environmental baseline data was gathered using a combination of desktop studies and field surveys. It covers the following social components: demography, land uses, land ownership, administrative and socio-cultural institutions, infrastructures, economics and livelihood, cultural heritage and health.

The baseline socio-economic and health status of the project area was assessed using questionnaire distributed to selected members of the affected communities. The data was supplemented by interview of selected adults and youths in each community. One hundred and twenty-nine (129) community members were interviewed. The only health facility located at Likosi was equally surveyed.

4.11.2.2. Overview of project area

Following the 2006 census, the National Population Commission (NPC) published the population of Nigeria as 140,431,790 comprising 71,345,488 males and 69,086,302 females. The NPC estimated annual population growth at 3.2% (NDHS, 2008). The current population, projected at 3.2% annual growth and using the exponential model is 180,735,714, with a density is 198.6 per square kilometer. A higher male population and sex ratio of 103 was recorded for the country. Children (age 0-14) constituted 41.8% of the population while those less than 20 years were 52.3% and those less than 25 years 61.9%. The elderly (65 years and above) were 3.2% of the population. The age dependency ratio was 82.0. Given these proportions, the population of Nigeria is quite young. Average household size in Nigeria is 4.9 (NBS 2012).

According to the 2006 census, Lagos State has a population of 10,694,915 (NBS, 2012), with a projected population of 12,130,986.7 for the year 2015 (NBS, 2012). The population of Ogun State according to the 2006 census is 4,424,096, with a projected population of 5,037,594.173 for the year 2015 (NBS, 2012). The density of Lagos state and Ogun State are 3304.55 and 307.17 square kilometers respectively. In Lagos State, children aged (0-14 years) constituted 30.3% of the population, those from (15-44 years) constitute 49.3%, (45-64 years) constitute 15.28% while 2.8% of the population are 65 years and above. The age dependency ratio of the population in the state is 70.9%. Similarly, children (age 0-14 years) in Ogun state constituted 38.3%, those within (15-44 years) are 39.9%, those within (45-64years) are 15.3%, while the elderly (65years and above) occupy 3.6% of the population. The age dependency ratio of the population in the state is 88.5%.

Table 4.11.1: Relevant livelihood indices in the project states

Livelihood Indices	Ogun state	
Population	4,424,096	
Literacy	78.8	
Youth Literacy in any language	Male	Female
	98.2	88.1
Adult literacy in English language	Male	Female
	80.3	77.2
Infant Mortality	67	
Life expectancy	53years	

Source: NBS (2012)

4.11.2.3. Host Local Government Areas

The affected Local Government Areas are Ewekoro, Ifo, Obafemi Owode and Sagamu. Ogun state government recently, divided the twenty Local Government Areas into Local Council Development Authorities (LCDAs). So, there are thirty-seven (37) LCDAs recently created by the State Government. However, these LCDAs are not recognized by the Federal Government and most of the indigene are yet to get used to the LCDA as most of them mention them when you ask for their local government areas. In this report, the Local Government Areas will be used rather than the recently created LCDAs. There is one newly created LCDA out of Ewekoro, three from Obafemi Owode, three from Ifo and two from Sagamu local government area (Table 4.11.2).

4.11.2.4.Host Communities

In this ESIA study, out of the 80 communities potentially affected by the project, only 39 were selected for the study. These selected communities are listed in the Table 4.11.2 below together with their GPS coordinates. The selected communities are potentially affected by the proposed project in terms of household and development. Also, the selection of 39 communities was based on their acceptance of the proposed project during Line Route survey and their eagerness to see it succeed.

Table 4.11.2: Communities Potentially Affected by the Project

S/N	Section	LGA/State	LCDA**	Community	Coordinates (WGS 84, Zone 31N)	
					Easting	**Northing**
1	Ogijo – Redeem	Ewekoro, Ogun State		Ejio*	523559	756807
2				Abese*	526306	757203
3			Sagamu/ Remo South	Ibokuru*	525182	757145
4		Ifo		Afidipan		
5				Asa Elegun*	546793	760434
6				Aworan*	538531	758065
7				Igbo Aare		
8			Ifo	Jagunna*	533508	758129
9				Koole		
10				Kori Oja*	551289	760229
11				Lukosi Ode		
12				Luwani		
13				Moro		
14		Obafemi Owode	Ofada/ Mokoloki	Olosan*	545324	760514
15			Ofada/ Mokoloki	Abule Ori*	550503	760201
16			Ofada/ Mokoloki	Abisodun*	544626	759460
17			Ofada/ Mokoloki	Adewolu*	543292	759224
18				Agbawon Etido*	539983	756968
19				Aiyetoro		
20				Apode*	527833	757917
21			Ofada/ Mokoloki	Asa Bala*	547348	760451
22				Eleworo*	544636	760196
23				Erifu Olorunsogo*	534869	760876
24				Onibadan		
25				Otere Oba		
26				Shokan*	532074	759052
27			Ofada/ Mokoloki	Ropo*	545133	760441
28				Oniyan		
29				Shodipo		

				Agbawajo		
30				Unilag Estate*	548375	760498
31				Yanbi*		
32			Ofada/ Mokoloki	Orile Igbeyin*	556450	760858
33				Oshile		
34				Otere Alase		
35			Ofada/ Mokoloki	Otere Apena*	553823	759042
36			Ofada/ Mokoloki	Otere Peki*	555665	760381
37				Ogunji*	558239	760908
38				Otere Parapo*	555098	759949
39	MFM – Existing Benin (Omotosho)			Gbarawe*	557498	760618
40				Ganun*	542487	740955
41				Makogi*	543808	744649
42				Ikija*	539380	757573
43				Iyedi Balogun		
44				Lajioku		
45			Ofada/ Mokoloki	Mosadomi*	546223	760207
46				Agbadamu*	550537	760000
47				Mose Ejiogbe		
48				Odofin		
49			Ofada/ Mokoloki	Oke Oko*	542470	758443
50				Oloko		
51			Ofada/ Mokoloki	Oluwo Oshin*	544156	759002
52			Ofada/Mokoloki	Omu Penpe*	549170	760723
53	Ogijo– Existing Ikorodu/Sagamu	Sagamu		Aberebi		
54				Agbonmagbe		
55			Sagamu/ Remo South	Alado*	558832	749671
56				Alaga Awolate		
57			Sagamu/ Remo South	Dejuwogbo*	558780	748970
58				Erelu		
59				Ewu-Balogun Sokoya		
60				Ewu-Lisa	558751	752871
61				Gbara		
62				Igbepa		
63				Igodo		
64				Ijemo		
65				Isore		
66				Lakaye		

67				Likosi*	558181	747460
68				Makun-Sagamu		
69				Mologun Onipiteye*	560403	749146
70				Ogunkanra		
71			Sagamu/ Remo South	Oke Ate Ajebo	560266	756841
72				Olatilewa		
73				Ologbun Ogunberu	557400	748729
74				Ologbun Maparo		
75				Ologbun Shofidiya		
76				Onileowo		
77				Ranodu		
78				Shofidiya		
79				Simawa*	555781	749136
80				Soso	554092	746834

***While members of majority of the potentially affected communities can conveniently mention their LGA, the same cannot be said of the LCDAs. Most of them do not know which LCDA they belong to.*

**The 39 communities identified for the study*

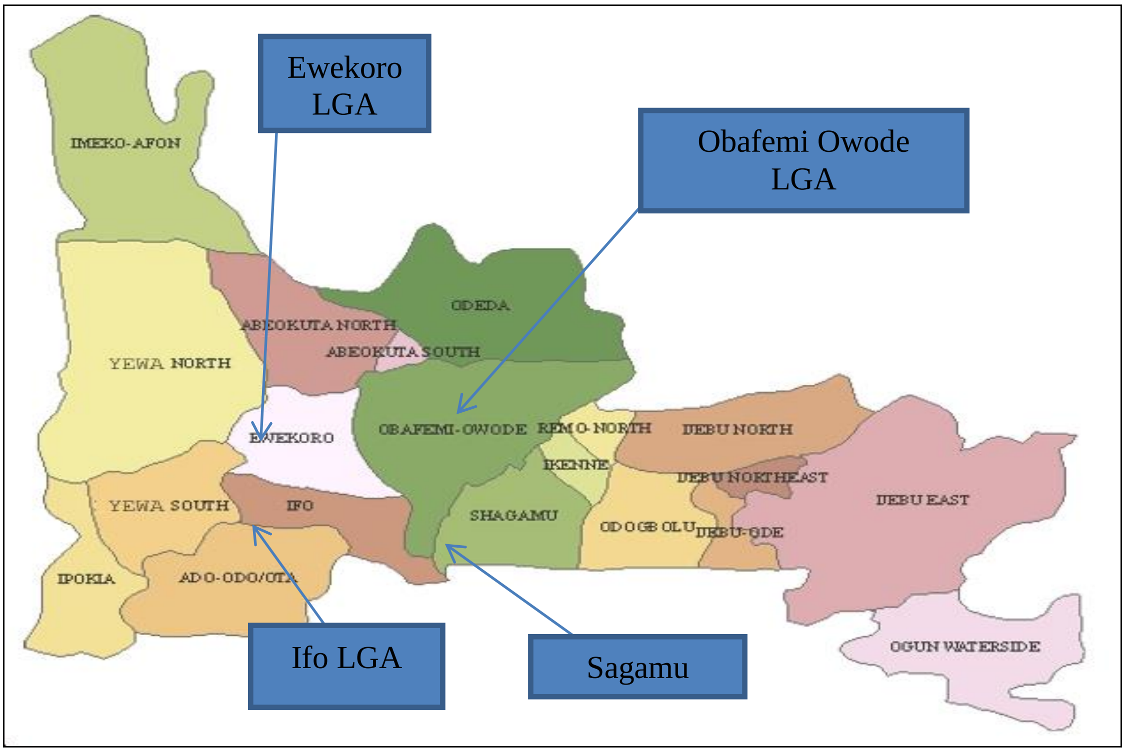


Figure 4.11.1a: Map of Ogun State Showing the LGAs

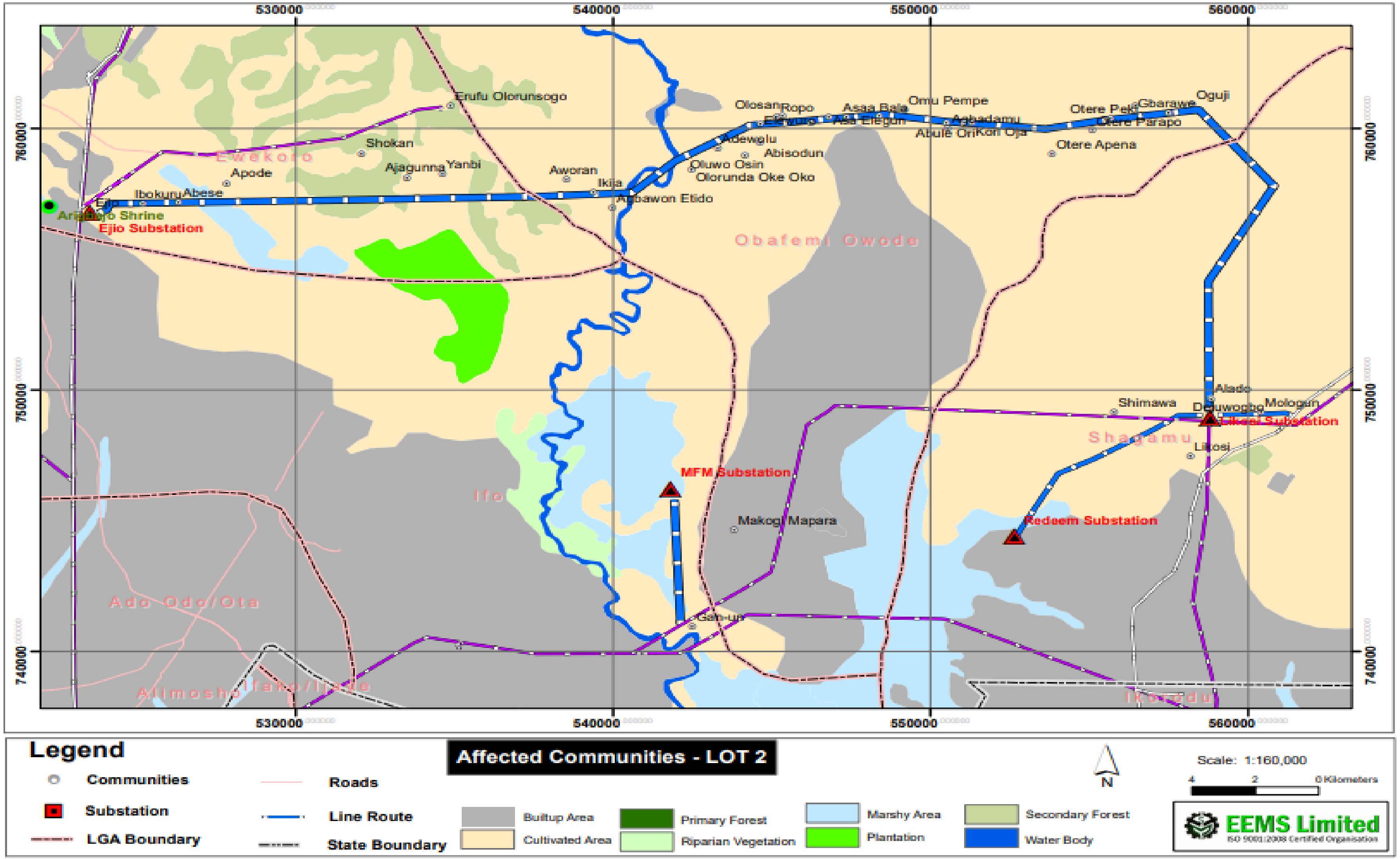


Figure 4.11.1b: Location of Selected communities out of Potential Affected Communities in the Proposed Project Area
Source: SEEMS, 2017

4.11.3. Household Characteristics

In the selected communities, one hundred and twenty-nine (129) community members (including youths, women and aged persons) were engaged in one-on-one discussions. The selection of sample was proportional to the size of the selected communities. Twenty-one (21) individuals were interviewed in Ewekoro LGA, 32 in Ifo, 34 in Obafemi Owode and 42 in Sagamu LGAsSome basic background charactersitics of all the one hundred and twenty-nine members were collected (See the questionnaire in Appendix 1). The administration of questionnaires was conducted by SEEMS's team who ensured that all selected a complete enumeration of selected respondents. Data were collected using both quantitative and qualitative approaches. The quantitave approach involved using the already prepared questionnaire to solicit information from the 129 selected members of the communities. In addition to this, focus group discussion and in-depth interviews were conducted with selected groups and members of the potentially affected communities.

a. Age and Gender Distribution

Based on the interactions with members of the communities, it was observed that majority of the household heads are between 35 and 64 years (Table 4.11.3). According to participants in focus group discussions, a significant number of youths have moved to urban centres to work in the factories and to look for white collar jobs. However, the proportion of youth in the area is still fairly large which indicates a general likelihood for future growth of the populations in the communities.

The field survey revealed that the household population structure is made up of almost equal proporotion of male (50%) and female (49%) members. Majority of the respondents engaged in this survey are in age group 35-49 (61%). Another 22% are in age group 50-64 (Table 4.11.5).

Table 4.11.3: Age Distribution of Respondents of the study area

Age	Local Government				
	Ifo %	Ewekoro %	Obafemi %	Sagamu %	Total %
15-34	0	24	15	7	10
35-49	33	35	62	66	61
50-64	67	29	21	19	22
>65	0	12	3	8	7
Total	100	100	100	100	100

Source: SEEMS, 2017

Table 4.11.4: Age and Gender Distribution

Age	Local Government Area							
	Ifo		Ewekoro		Obafemi		Sagamu	
	Male %	Female %	Male %	Female %	Male %	Female %	Male %	Female %
1-18	16	57	35	25	37	34	37	36
19-39	33	14	40	56	36	38	38	40
40-65	50	29	14	18	21	28	23	24
>65	0	0	11	0	6	0	1	0
Total	1	2	12	12	22	24	64	63

Source: SEEMS, 2017

Table 4.11.5: Sex Composition of Household Members

LGA	Male %	Female %	Total %
Ifo	46	54	1
Ewekoro	51	49	12
Obafemi	49	51	23
Sagamu	51	49	64
Total	51	49	100

Source: SEEMS, 2017

b. Martial status of head of houshold

All of the adult respondents are married and none of them is either divorced or separated. The common marriage type is monogamy. The proportion of those with 2 or 3 wives are fairly high (16.3%). Focus Group Discussions (FGD) and in-depth interviews with key informants revealed that few men married many wives which is contrary to what prevails in many Yoruba communities where men more than one woman in order to increase the stock of their family labour supply. With the exception of Sagamu local government area, majority of the households were male-headed (80%).

All of the adult respondents are married and none of them is either divorced or separated. The common marriage type is monogamy (Table 4.11.6). The proportion of those with 2 or 3 wives are fairly high (16%). Focus Group Discussions (FGD) and in-depth interviews with key informants revealed that few men married many wives which is contrary to what prevails in many Yoruba communities where men more than one woman in order to increase the stock of their family labour supply. With the exception of Sagamu local government area, majority of the households were male-headed (80%).

Table 4.11.6: Marriage Type of Household Head

Nature of Marriage	Local Government Area				
	Ifo %	Ewekoro %	Obafemi %	Sagamu %	Total %
Monogamy	2	11	22	65	84
Polygamy	0	12	20	68	16
Total	2	11	21	66	100

Source: SEEMS, 2017

Table 4.11.7 which shows the marital status of respondents suggests that for cultural reasons, more matured people were given priority when it comes to some issues especially those pertaining to household matters. Again, young people do not have enough patience to attend to matters like this one. More importance was attached to the exercise because of the perception of the people concerning the exercise; so married persons who hope to benefit from any of the socio-economic mitigation measures were more eager to participate in the exercise. Table 4.11.8 shows that while a high proportion of household members are married, a higher proportion of the members are still single in all the affected local government areas.

Table 4.11.7: Marital Status of Household Heads

	Local Government				
Marital Status	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Single	0	0	0	1	1
Married	100	100	100	98	98
Widowed	0	0	0	0	0
Divorced/Separated	0	0	0	1	1
	100	100	100	100	100

Source: SEEMS, 2017

Table 4.11.8: Marital Status of Household Members

	Local Government				
Marital Status	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Single	54	59	59	59	59
Married	46	41	41	40	40
Widowed	0	0	0	1	1
Divorced/Separated	0	0	0	0	0
	100	100	100	100	100

Source: SEEMS, 2017

c. Houshold size

Information on household size of the communities in each of the LGAs is presented in Table 4.11.9. As could be seen in Table 4.11.9, the dominant household size in the project area are those made up of 3-4 persons, accounting for 42% of the households. It was discovered that significant proportions of the households (34%) are made of 1-2 persons. Table 4.11.9 shows that an insignificant proportion of the households are made up of more than 11 persons.

Table 4.11.9: Household Size of Project Area

	Local Government				
Household Size	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
1-2	46	32	30	35	34
3-5	46	45	41	42	42
6-10	7	21	24	20	21
11-15	1	2	5	3	3
>15	0	0	0	0	0
Total	100	100	100	100	100

Source: SEEMS, 2017

d. Ethnic Compostion

The inhabitants of the project area are predominantly of the Yoruba race, belonging to one of the six ethnic groups making up Ogun State (The Ijebus, Egba, Awori, Yewa, etc). Other tribes/nationalities represented are the Eguns, Igbos, Hausa/Fulani, Igedes, and Igala. The latter groups of people constitute less than 2% of the population. The language of the majority of the people of the area is Yoruba but this is however broken into dialects. The main reason for the presence of these other ethnic groups in the area, especially the Igedes and Igbos is due to availability of open land for farming purposes. Mostly, the Hausas are the pastoralist and the few that engage in sugarcane farming.

Table 4.11.10: Ethnic Composition of Respondents

	Local Government				
Ethnicity	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Yoruba	100	85	94	90	90
Igbo	0	4	5	7	5
Igede	0	12	1	0	2
Egun	0	0	0	2	1
Igala	0	0	0	1	1
Hausa/Fulani	0	0	0	1	1
Total	100	100	100	100	100

e. Religion

The study revealed that the inhabitants of the area professed to be either Christians or Muslims. However, the adherents of these two popular religions also practice traditional religion. Christians accounted for 71% while Muslims are next with about 26%. Only very small proportion of the inhabitants (3%) professed Traditional religion. Interactions during the FGDs and in-depth interviews however, revealed that a number of those who professed to be either Muslim or Christian also practice Traditional religion. Some of the settlements have a number of traditional festivals that are celebrated yearly. In spite of the differences in religious adherence, there has been reportedly no recorded religious riot in the past four decades in the study area, a factor that is conducive to economic development.

Most of the settlements claimed to have sacred groves and celebrate festivals or worship different deities. Some of the mentioned sacred groves and deities include: Egungun, Ogun, and Oro festivals. The main reasons for these festivals according to most of the respondents are to avert evil afflicting the people, to bring peace, and for protection. In most cases strangers and women are forbidden from entering or get into the shrines.

f. Vulnerable Groups

Evidence from focus group discussion and in-depth interviews, it was observed across the LGAs covered that the most vulnerable are the non-indigenes who have no control over the land on which they work, the children, most of have no access to basic amenities like schools, recreation facilities, and good health among others. It is evident from the survey that most of the women are also vulnerable. The level of vulnerability of these groups of people will be examined during RAP.

Four (4) individuals with disabilities were identified during the survey. These physically challenged persons were impacted by the proposed RoW; their buildings which have reached completion levels are directly affected by the line routes. Two of these disabled are cripples while another two have sight problem. These four individuals will require special attention and should be given preference in the process of implementation, and appropriate action taken to protect their interest. One of them cripples, Mr Taiwo Enock Ayininuola, a 52 year old stock broker specifically requested for resettlement. He has four (4) bedroom bungalow and two (2) rooms self-contained at the back of the main building.

4.11.4. Economic Environment

4.11.4.1. Occupation

Majority of inhabitants of the affected communities are artisans (67%) (Table 4.11.11). Other subsidiary occupations are Industry (16), trading (10%), and farming. For most of the people, farming is their secondary occupation. Women are mainly involved in trading as their primary occupation while farming is secondary. Farming which is the secondary occupation of majority of people in the affected communities is both tree cropping and subsistent with maize, rice, cassava, plantain and beans as the main crops. The economic cropping found in the area includes kolanut, oil palm (growing wild). A few of the inhabitants are hunters, with hunting carried out at subsistence level as well as for recreation. Evidence from focus group discussions indicates that the level of unemployment (for salaried jobs which the people especially the youths prefer) is high.

A few observations regarding the occupational study indicate that (i) the youths are not necessarily jobless contrary to what obtain elsewhere; some of them have acquired artisan training, some are petty traders, contractors, political jobbers while almost all follow their parents to the farm in a typical peasant settlement. (ii) Farming is the primary occupation of an average non-native while it is the secondary occupation of most of the natives. (iii) Civil servants include teachers in private schools and even nurses in few existing private hospitals. (iv) Hunting and sand mining, etc. are typically secondary occupation of some of the residents.

Table 4.11.11: Occupational distribution of Respondents

	Local Government				
Occupation	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Artisan	35	82	68	60	63
Teaching/Nursing	0	6	3	1	2
Industry	47	6	15	20	19
Trading	0	0	6	15	11
Farming/Hunting	18	6	9	4	5
Total	100	100	100	100	100

Source: SEEMS, 2017

Table 4.11.12: Employment Status of Respondents

	Local Government				
Employment Status	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Self-employed	67	82	85	80	81
Government employment	0	6	6	7	6
Private Agency	23	12	9	13	13
Total	100	100	100	100	100

Source: SEEMS, 2017

Table 4.11.13: Employment Type of Respondents

	Local Government				
Employment Type	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Agriculture	33	6	12	2	5
Industry		12	3	7	6
Services	67	76	53	69	66
Others		6	32	22	23
Total	100	100	100	100	100

Source: SEEMS, 2017

4.11.4.2. Industry

One of the challenges faced by virtually all affected communities is lack of alternative economic activities such as employment in formal sector and industries. Majority of the inhabitants are service providers working as labourers and as artisans. Agriculture happened to be their secondary occupation. There is no industry in the whole of the project area. The only piggery and poultry farm located in in the project area is the one cited at Ogunji community. However, there are few blocks making industries in few of the communities. Two of such block industries are within Likosi/Dejuwogbo substation. Though, some women were seen frying Gari, but they could not be regarded as industries as they were mostly low key with only the mother and probably one of her daughters involved in the process.

4.11.4.3. Income

According to World Bank ranking, anybody subsisting on less than US$1.00 (about N150) per day is classified as poor. Those earning N5,000 or less per month are considered as poor. According to the Federal Office of Statistics (now National Bureau of Statistics (NBS)), the average national incomes for urban and rural dwellers are N6,349 and N4,819.6, respectively with a combined average of N5,150 and poverty level of 57.8%. Given the national levels of income and poverty, it may be inferred that the communities are below the national average performance.

4.11.4.4. Education Level

Literacy and educational characteristics are basic indices of human development. Evidence from field survey as well as focus group discussions and in-depth interview indicate that education and literacy rates are low among the population in the affected communities however, with the exception of Ifo where almost 67% attained tertiary level of education. Majority of the respondents did not go beyond secondary school. Another 37% of respondents from this LGA also had tertiary education. Generally, as much as 20% of the respondents had primary or no formal education in all LGAs. This means that almost 1 out of every 5 persons aged 15 – 65 in the affected settlements had never been to or completed primary school. Though, literacy level is generally low for both male and female, the rates are slightly higher for males than for their female counterparts; these gender differences are however, not wide enough to stimulate measures to reverse the pattern.

4.11.5. Existing Infrastructure

a. Eductaional facility

With the exception of few communities (Ejio, Likosi, Ewu Lisa, Ganun, Simawa, Sagamu) Primary schools are not easily accessed within a 1–5 km radius of settlements. Even most of the schools in the aforementioned communities are privately owned with tuition fees which many of the household cannot afford. There is no single public Secondary school in the whole of the area. So Secondary schools are also not so easily accessed. This may be one of the reasons for the low educational level of most of the inhabitants of the area. Majority of the Secondary school-age children attend schools at Sagamu, Ifo, Abeokuta or one of the neigbouring communities outside the project area. The project area has not benefitted from the free and free and compulsory education of Ogun State government. The proposed project will not be affecting any the schools in the areas.

b. Water

Availability and access to safe drinking water is a major issue in the community. The main sources of water for household use are: borehole, pipe borne/well, and streams Some individuals in Likosi and Ejio and Gan-un communities have borehole/potable water supply. The main sources of water for domestic use in other communities are river and rainwater.

c. Electricity

Few of the communities (Ejio, Likosi, Sagamu and Gan-un) are connected to national grid; although electricity supply to these communities was reported to be irregular and unreliable. Majority of the households use kerosene for lighting, while fuel wood is used for cooking.

d. Health care facility

The Primary Health Care Centre at Likosi and Sagamu General Hospital are the only heath facilities serving the whole communities in the project area.

e. Security facility

Apart from Sagamu Local Government Area, none of the other 76 communities in the project affected area has police station. People around the project area go as far as Abeokuta, Ifo and probably Mowe to access police stations. As parts of their traditional roles, the traditional head and youth leaders are expected to see to the security of the community and enforce law and order. However, most of the communities still place much reliance on their traditional deities at the point of need and for their protection from crimes and upheavals.

f. Transporartion facility

The communities are connected to the main trunk road (Ifo-Abeokuta express) by a network of roads, although many of them are in a state of disrepair. Transportation is majorly by commercial motor vehicles and motorized cycles.

g. Waste management

The household waste stream comprises both bio-degradable and non-bio-degradable products, such as human waste, vegetable matter, food remnants, plastics and other assorted organic materials. Various forms of wastes are also generated by craftsmen, such as automobile mechanics, carpenters. Wastes are disposed of generally by free litter. Majority of the residents of the affected areas burn their solid wastes. However, dumping of wastes on the open ground behind living homes or into the bush is also a common method in the area. The dump sites were poorly maintained with domestic animals foraging through the wastes. The health risk of this includes breeding of vectors, likelihood of fire and contamination of water. Because of the scarcity of water, many households do not use the water closet system for disposal of human waste. Evidence from focus group discussion and in-depth interview indicate that most of the respondents dispose their sewage/waste through the bush and stream/river drainage channels. This method of waste disposal creates ideal situation for vector and air-borne diseases and constitutes an unsafe sanitary condition in the community.

4.11.6. Community Health

A health assessment of the communities along the RoW and line routes of the transmission line was carried out with the aim of determining the current state of health of the communities which will serve as a baseline for further monitoring. The main purpose of the health study was to produce a baseline report on the health status of the communities in the project area which could be used for subsequent impact assessments and development of a Health Management Plan (HMP) for the proposed project. Specifically, the objectives of this health impact assessment were to (i) determine the likely impact of the project on the health and wellbeing of the population in the neighbouring communities and (ii) assess the existing health care services available within the communities.

4.11.6.1.Prevalence of Diseases in in the study area

All the communities except two do not have a functional health facility which makes estimation of disease burden difficult. The two functional health facilities in the area are the General Hospital in Sagamu and Primary Health Centre in Likosi. The Health Centre in Ejio is not functioning. From the In-depth interview and group discussions as well as the oral interview conducted it was gathered that the commonest ailment suffered by indigenes is malaria, due to a high prevalence of mosquitoes, which are freely bred in stagnant waters created in the rainy season by the prevailing poor drainage conditions. This was reported by participants in focus group discussions. This is followed by upper respiratory tract infection. Malaria is the number one cause of morbidity in sub-Saharan Africa, and the project area is devoid of potable water, thus the high rate of water-borne diseases. This survey thus recognized the need to (i) upgrade the existing health facility in Likosi and establishment of new ones where necessary (ii) make provision of potable water a priority (iii) provide facility for sanitary waste disposal and (iv) empower members of the communities through regular community health education programmes.

It is evident from during the survey that the people have belief in the efficacy of traditional medicine and patronize herbalist for their health needs. Even though the people do not have any taboo that could impede access to healthcare in their communities, however the high patronage of herbalist, spiritual homes, juju priests which is influenced by their traditional beliefs that attribute every illness to a diabolical cause can be deterrent to patronizing orthodox health care. Evidence from physical examination of the inhabitants of the study area showed a high incidence of debilitating physical health conditions such as rough skin, skin diseases of various types, fungi infection, and dental problems.

4.11.6.2. Infectious diseases

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) have become very important public health concern in Nigeria. However, there are no data on sexual practices, knowledge and beliefs about HIV/AIDS and other Sexually Transmissible Infections (STIs) in the study area. Therefore, several questions were included in this study to ascertain the level of their awareness about specific health problems including HIV/AIDS. Both men and women were asked about their sexual practices. They were also asked about what they believed was the mode of transmission of HIV and where they sought treatment for STIs. Condom use and availability were also reported.

4.11.6.3. Immunization Status in Chilren

The proportion of children under 5 years old immunized against DPT, BCG, OPV and Measles were more than 75% across all sampling stations. These figures were above the national target of 70% (BCG and TT for pregnant women) and over 65% for the other antigens in the National Programme on Immunization. Oral Polio Vaccine (OPV) was the most commonly received vaccine in all the project communities. This may partly be due to the OPV given during the National Immunization days (NIDs) set aside by the Federal Ministry of Health through the National Programme on Immunization every year. Each child below 5 years is expected to receive two drops of OPV during each round of NID. The fact that the few health facilities available in the communities had inadequate record of immunization is an indication of the low practice of routine immunization.

4.11.7. Housing and Living Conditions

In all the communities surveyed there were a mix of housing types ranging from modern houses built with bricks to mud houses which were predominant in most of the communities. While the modern houses appear conducive the same cannot be said of the mud houses most of which were poorly ventilated, with poor flooring and roofing materials. Most of the houses lack toilet facilities therefore human wastes were often disposed into the surrounding bush.

Data from this study reveal that 47.3% of the houses that respondents live are houses built with cement block and zinc roof, 36% were houses built with cement block and asbestos roof. Forty-one percent of houses in Ewekoro were built with mud and plastered with zinc roof, while another 12% were built with Timber with zinc roof. This implies that 17% of the respondents' houses were traditional and peculiar to rural communities. Also, significant number of the houses were in serious dilapidated condition as either the walls were cracked, plaster peeling off or even part of it already fallen. Most of the (17%) houses have average of

4 bedrooms and 1-2 households in each house with an average of 6 people per household. One common feature in most of the rural communities is that an average of 3 persons sleeps in a room. Overcrowding is depicted in many of the houses and this will facilitate the spread of communicable diseases.

Table 4.11.14: Type of Structure

	Local Government				
Type of Structure	**Ifo %**	**Ewekoro %**	**Obafemi %**	**Sagamu %**	**Total %**
Mud and Wattle Thatch	0	0	0	1	1
Mud and Wattle Zinc	0	41	12	4	9
Earth Block/Thatch	0	6	0	0	1
Earth Block /Zinc	0	0	0	1	1
Cement Block/Zinc	33	29	53	52	49
Cement Block/Asbestos	67	12	29	42	37
Timber Wall/Zinc	0	12	6	0	3
Total	100	100	100	100	100

Source: SEEMS, 2017

4.11.8. Indigenous People

IFC Performance Standard 7 recognizes Indigenous Peoples as social groups with identities that are distinct from mainstream groups in national societies. Indigenous people are not applicable in Nigeria. However, the Federal Government recognises ethnicity. Nigeria has three largest ethnic groups that include the Yoruba, Hausa–Fulani and Igbo, representing 71 percent of the population. The project is located in South-west Nigeria and the people living in this region are mainly the Yoruba ethnicity.

4.11.9. Land Use

The Transmission Line mostly passed through built-up environment, fallowland and farmlands. The built-up environment close to the proposed transmission line are mostly made of shops, shanties and few living houses. The farmlands mostly consisted of cassava (55%), maize (10%), vegetable farms (15%), plantain/banana (10%) and a mosaic of tree crops such as palm tree (10%).

4.11.10. Property Ownership

The properties owned by the respondents in the communities are of two main types. These are farmlands and land. Evidence from Panel Discussions and In-depth interviews showed that the common patterns of land ownership in the community are through inheritance, outright purchase and tenant/lease.

Although the prevalent land tenure system in the communities is through inheritance, FGD and in-depth interviews with key informants revealed that land could be purchased. Land ownership is vested in lineage membership and land cannot be leased out or sold without the knowledge of the lineage head. The issue of land ownership is sensitive in the project area.

4.11.11. Cultural Heritage

There are archaeological and sacred sites, such as traditional burial grounds and shrines in the communities. These sites are highly valued by the people and considered sacred and encroachment in such areas would attract serious resentment from the communities. The people celebrate several traditional festivals, the observance of which is believed to be for the general well-being of the people (see Plates 4.11.1 - 4.11.8).

Plate 4.11.1: Osun Shrine- Ejio

Plate 4.11.2: Oluweri Mapojo Shrine- Ibokuru

Plate 4.11.3: Orisa Obanta- Jaguna

Plate 4.11.4: Ojualale Shrine- Ikija

Plate 4.11.5: Lagindigbi Orisa- Olorunsogo

Plate 4.11.6: Orisa Nla- Omu Penpe

Plate 4.11.7: Orisa Igunnuko- Kori Oja

Plate 4.11.8: Yemoja Shrine- Yanbi

4.11.12. Affected community buildings

A total of 943 structures were surveyed to be within the RoW of proposed Transmission Lines and Likosi/Dejuwogbo Substation. Details pertaining ownership and validity is presented in the RAP report. Table 4.11.15 presents the tentative findings.

Table 4.11.15: Numbers of Structure within the RoW of proposed Transmission Lines and Likosi/Dejuwogbo Substation

LGA	Total Affected	Building	Tomb (grave site)	Shrine
Ewekoro	55	33	11	11
Ifo	62	50	12	Nil
Obafemi Owode	232	216	Nil	16
Sagamu	594	579	10	5
Total	**943**	**878**	**33**	**32**

Source: SEEMS, 2017

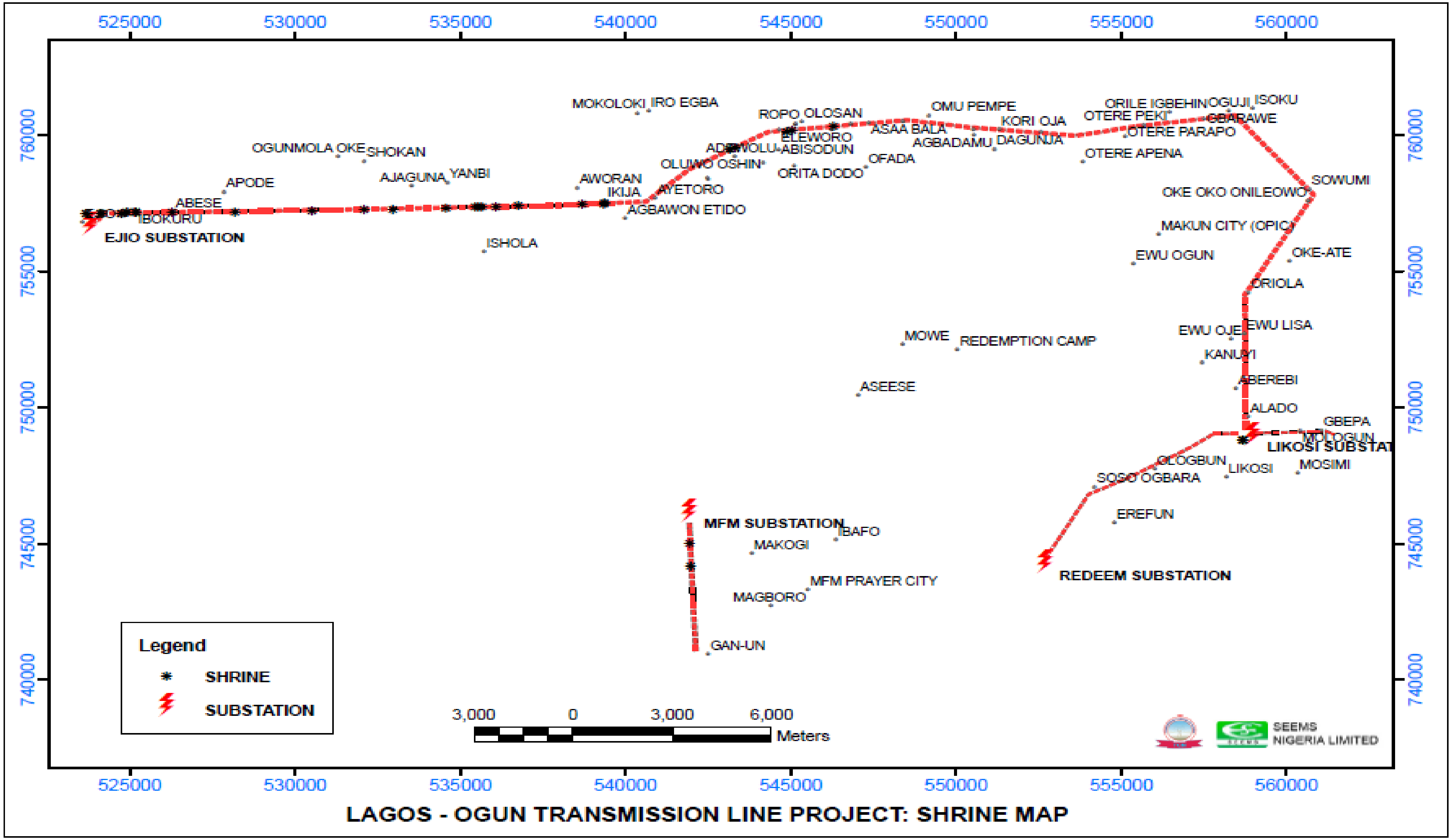


Figure 4.11.2: Location Map for cultural heritage (Shrine) along Proposed Transmission Lines Projects

4.12. Stakeholder Consultation

4.12.1. Objective

Consultation is the process of seeking information from parties or persons (stakeholders) affected by or having environmental responsibilities or interests about the environmental implications of project activities (Lee and Wood, 1995; Nwafor, 2006). It is designed to establish open and interactive communication that will elucidate community and environmental concerns and proffer appropriate mitigation options for all identified negative impacts. It involves information dissemination and interaction/dialogues with the affected communities and other stakeholders on the ESIA of the proposed project. Interaction with people and eliciting feedback allows the affected populations to influence the decision-making process by raising issues that should be considered in project design, mitigation, monitoring and management plans; and the analysis of alternatives.

Stakeholder identification and consultation at an early stage of an EIA is considered critical in the assessment of interest, concerns, relationships, assumptions, their level of influence and the ways in which they affect project risks. Previous experience shows that certain potentially contentious issues (such as land acquisition, relocation and resettlement) never get to the public domain if the correct consultation process is maintained from the conceptual stage of any development. A number of regulatory bodies including the World Bank (Operational Directive (OD) 4.01), International Finance Corporation (IFC), Nigeria Federal Ministry of Environment (FMEnv) and JICA also require that affected groups and non-governmental organizations (NGOs) be consulted as part of the environmental assessment of projects and particularly those with potentially significant impacts.

The primary purpose of consultation is to protect the interests of affected settlements, especially the poor and vulnerable and ensure project sustainability. This process gives room for effective discussion, dialogue and agreements amongst all parties interested in or are to be affected by a proposed project. The overall result would be the optimization of the potentials of the proposed project and maximization of its benefits. Furthermore, it ensures that any fear or apprehension about the nature, scale and impact of the project shall be addressed fully; hence eliminating costly delays.

In accordance with the regulatory requirements, consultation was accorded high priority in the proposed project planning and pre-development activities as an integral part of the Environmental and Social Impact Assessment (ESIA) of the proposed project. The consultation programme was set up prior to baseline data gathering to ensure that stakeholders were involved from onset and duly informed on progress of the works, and that the concerns (issues) raised by the stakeholders, with regard to the project works, could be identified and addressed. The issues were fed back into the EIA process and tied into environmental and social sensitivities that were used in the description of potential impacts.

4.12.2. Stakeholder Information and Consultation Rounds

Three stakeholder information and consultation rounds were planned, and two has been implemented through the development of the line route survey, the ESIA study and RAP of this project. They were planned according to key stages, or decision moments, throughout the study where the informed participation of stakeholders were likely to make the most significant contribution to the success of the project.

These included the scoping stage (1st round), the preliminary route assessment and the documentation of the affected communities and displaced households stage (2nd round). The third round of consultatons is scheduled for the disclosure of ESIA Draft Report which will be anchored by Federal Ministry of Environment (3rd round).

Table 4.12.1 outlines the studies' stakeholder engagement process and presents, for each consultation round, the specific engagement objectives, target groups and implementation periods.

Table 4.12.1 Stakeholder Consultation Implementation

ROUND	OBJECTIVES	TARGET GROUPS	IMPLEMENTATION PERIOD
Stage 1: Environmental and Social Scoping	Present the project and the ESIA process to key authorities; Identify key issues, concerns and expectations related to the project and study area; Complete the stakeholders' list and validate the general approach for consultations.	Transmission Company of Nigeria (TCN) Concerned Ministries State and LGA Administration Customary Chief's of areas affected by the line National Conservation of Nigeria	May/June 2017
Stage 2: Line Route Survey/ESIA/ RAP Stage	Involve key stakeholders in the analysis of the « hot spots » identified along with the provisional line route. Inform affected communities and involve them in environmental and social optimization of the line route; Identify the concerns and expectations of affected communities, displaced households and women; Inform affected households of their rights and options for resettlement.	Transmission Company of Nigeria (TCN) Concerned ministries Local authorities State-level and LGA-level authorities and technical services. Affected people and their leaders. Women representatives. Customary chiefs.	Oct./Nov. 2017
Stage 3: Disclosure of ESIA Report	Ensure compliance of the proposed measures with the requirements of regulatory authorities; Evaluate the social acceptability of the project and its proposed measures.	Federal Ministry of Environment Transmission Company of Nigeria (TCN) Concerned ministries at national and state levels. Local authorities and community leaders from affected LGAs. NGOs	To be determined by Federal Ministry of Environment

4.12.3. Stakeholder Identification and Mapping

Two main categories of Stakeholders have been identified:

- Primary stakeholders - are those that will be directly or indirectly affected by the project; and

- Secondary stakeholders - are those having an interest in the project or the ability to influence its outcome, either positively or negatively.

In the case of the project, the scenario is such that the land is acquired from the leaders and members of the affected communities who have consented. These communities have been informed and have agreed to release the portions covered by the transmission line and substations based on adequate compensation. However, it should be noted that land in Likosi substation had already been acquired by TCN since 2008 and it is expected that no compensation will be paid on Likosi land. This historical fact may influence the list of stakeholders. Hence, the next few paragraphs will discuss the identified stakeholders for the transmission lines and substations as well as indication of their stake in the project.

a. Government Authorities

Federal and State governments as well as Local government constitute important stakeholders within the projects engagement framework. Some are regulators who issue the necessary permits while others may provide information on demography, climatic conditions, etc. Engagement with these agencies must live throughout the project life span. During this scoping phase of this project, the following stakeholders were identified.

- Federal Ministry of Environment (FMEnv), Abuja;
- The Federal Ministry of Power, Works and Housing, Abuja;
- The Nigerian Electricity Regulatory Commission (NERC), Abuja;
- The Ogun State Team;
- The Nigerian Gas Company (NGC);
- Energy Commission of Nigeria (ECN)
- Nigerian Railway Corporation (NRC)

The Project falls within four LGAs located within Ogun state. TCN together with the consultants engaged with the relevant council departments of the LGAs and asked them to consider the project activities in the wider planning for the LGAs. In addition, the following Ministries and Ministerial Agencies within Ogun state and Federal Government will be engaged throughout the project lifecycle to ensure that they are kept informed and are given an opportunity to provide input in their respective planning areas

b. Communities and Traditional Institutions

Traditional institutions, their councils and the leaders of the social groups in the community (such as women, youths, market women and local farmers) is engaged on a continu The last sentence in this section has actually answered the question about how the vulnerable groups were treated during the survey. Meetings with these groups follow local practices and norms and is held prior to any wider communication in the villages in order to respect the traditional structures. The Project affected communities so far identified are listed in Table 4.11.3

c. Vulnerable Groups

Typical Corporate Social Responsibility (CSR) initiatives are designed to favour these groups as much as practicable. Women have been identified as vulnerable group for the project, due to their economic vulnerability and inability to participate in decision-making processes within the traditional context. Women in the project area are not always able to attend or speak freely at open meetings and/or may have household restrictions on when they are able to attend such meetings. In most of the community's consultations women were given privilege to participate and make contributions. Some of them were engaged in special interviews to have an in-depth knowledge of their plights and their concern.

Plate 4.12.1: Interview with Physically Challenged Man at Ologbun Community

Other potential vulnerable groups identified as part of the EIA include the elderly, youth and migrant farmers. Vulnerability of these groups is also based on reduced opportunities to participate in local decision-making, as well as their economic vulnerability, particularly with regard to employment. As such, engagement activities have been designed to ensure representation of these groups among stakeholders, and to seek to understand potential project interactions with their livelihood opportunities and agency within the communities.

d. Non-Governmental Organizations (NGOs)

NGOs are organisations which declare interest in a given project and try to influence decisions on such projects through direct contact or public opinion. NGOs may also have data and insight into the dynamics of a given project and may become useful partners in the project. The main mechanism for engagement with relevant NGOs germane to the project will be through face-to-face meetings at key stages of project development (during the EIA and at the onset of construction). NGO (NCF) was involved during scoping of this study to contribute how the project will be executed without issues that can affect the masses and environment.

It is important to note that stakeholder identification is an ongoing process, and thus stakeholders will continue to be identified during different stages of the project. Table 8 presents the main stakeholder groups

Table 4.12.2: List of identified stakeholders

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Neighbouring/Host Communities (See Table 4 for the list of communities)	• Communities living along the Transmission Lines and close to the substations site ; • Other communities within the project area of influence; • Vulnerable groups within these communities; and • Workforce recruited from the communities.	• Village Head ('Baale'); • Community Development Association; • Religious leaders; • Village elders; and • Sagamu, Ewekoro, Obafemi Owode and Ifo LGAs
Institutional Stakeholders	• Social infrastructure, like schools, health facilities and emergency services.	• Political Parties; and • Project investors (TCN, JICA).
Regulatory Authorities		• Federal Ministry of Environment; • The Federal Ministry of Power, Works and • Housing, Abuja; • The Transmission Company of Nigeria (TCN), Abuja; • Ogun State Team • The Nigerian Gas Company • National Environmental Standards and Regulations Enforcement Agency (NESREA)
Other Groups		• NGOs and Civil Society; • Media; • Other projects in the area; and • Universities and other institutions doing research in the area.

Table 4.12.3 below gives an overview of the stakeholder groups and their concerns, expectations and influence on the Project.

Table 4.12.3: Stakeholder Mapping

Stakeholder Category	Relevant Stakeholders	Profile/Status	Concerns surrounding the Project	Expectations from the project	Nature of influence on Project
Primary	Communities living along the Transmission Lines and close to the substations site	These communities may directly be impacted by the project and may experience cumulative impacts	Additional impacts and risks to existing situation.	Support in social infrastructure and employment at the site.	Protest and/or causing delays.
Primary	Other communities within the Project area of influence.	Directly impacted by cumulative impacts and risks from Lafarge's site with past impacts and risks.	Additional impacts and risks to existing situation.	Support in social infrastructure and employment at the site.	Protest and/or causing delays.
Primary	Construction labour force recruited from the communities.	Temporary employment and income from construction activities.	Labour and Working Standard risks and employment opportunities.	Employment and good wages.	Protests if employment opportunities are disappointing.
Secondary	Community.	- Discussion of community concern;	- Youth empowerment;	- Youth empowerment;	Protest and/or causing delays.

Stakeholder Category	Relevant Stakeholders	Profile/Status	Concerns surrounding the Project	Expectations from the project	Nature of influence on Project
		- Discussion with the vulnerable groups, women and youths; - Discussion on TCN workers integration into the community; and - The need for a grievance mechanism throughout the project.	- Provision of basic social amenities and infrastructure; and - Influx of workers.	- Provision of basic social amenities and infrastructure; and - Compensation.	
Secondary	Federal Ministry of Environment.	- Registration of the Project; - Scope of data collection and ToR approval; - Issues concerning site visits; - ESIA process and scope of the ESIA - Approval for one season waiver.	No concerns on the status of the project.	Submission of Draft Report and processing fee payment. Panel review meeting as part of third stage stakeholder consultation	ESIA Permit.
Secondary	Transmission Company of Nigeria.	Transmission of generated power to the national grid	- Transmission Line (TL) and Substation operation; - MOU between TCN and JICA	- Agreed MOU; - Approved TL design; and - Approved Substation site	Permit and Execution of the project.
Secondary	Federal Ministry of Works, Power and Housing.	Moderation of parties involved.	MOU between TCN and JICA	- Agreed MOU; and - Electricity supply.	Permit and Execution of the project.
Secondary	Nigerian Gas Company/ Nigerian Railway Corporation	Meeting with TCN on the RoW acquisition.	Transmission line alignment design.	Notification on transmission line construction.	Project execution.
Secondary	Ogun State Ministry of Environment; and Ogun State Environmental Protection Agency (OGEPA).	Compliance monitoring of approved ESMP.	Environmental degradation.	Compliance with approved ESMP.	Project execution.
Secondary	National Environmental Standards and Regulations Enforcement Agency (NESREA).	Compliance monitoring of approved ESMP.	Environmental degradation.	Compliance with approved ESMP.	Project execution.
Secondary	Local Government Area (LGA)/ Local Council Development Authority (LCDA)	- Engagement with affected communities; - Potential positive impacts (employment opportunities for local people and provision of electricity); and - Community Development.	Environmental degradation and community development programme implementation.	Compliance with approved ESMP and implementation of community projects.	Project Execution.

The host Local Government Areas are: Ifo, Ewekoro, Obafemi Owode and Sagamu and the host communities include those listed in Table 4.3.4. Pre-entry consultations were held with the Executive Councils, Elders and Youths of the host communities between December 15 and 16 at Local Government Secretariat. During these periods discussions and consultations enabled the stakeholders to be informed of the intent of the proponent and a collection of the views of the people about the proposed project.

4.12.4. Consultation Activity

The summary of consultation activity conducted to date are given in Table 4.12.4. The detail is provided in Appendix 5.

Table 4.12.4: Stakeholder Engagement Activities to Date

Stakeholder Engagement	Engagement Activity	Stakeholders	Number of Participants	Venue	Date/Time	Specific Discussion Areas
STAGE 1: SCOPING						
Government Agencies – Federal, State and Local Government Authority Regulatory Authorities.	Meeting with State and Local Council Officials.	Federal Ministry of Environment, Abuja.	6	Environment House, Abuja	May 10, 2017 July 11, 2017	• Registration of the Project; • Scope of data collection and ToR approval; • Issues concerning site visitation; • EIA process and scope of the EIA; • Approval for one season waiver; and • Approval for the substation and the lines.
		Ogun States	35	Governor's office Secretariat	May 3,2017 Every last Thursday of the Month	
		Sagamu, Ewekoro, Owode Obafemi & Ifo LGA	7	Each Secretariat	November 19 -30 January 10, 2018	
STAGE 2: Line Route survey/ESIA/RAP Studies						
Baseline Data Collection: Community Engagement, engagement with local groups and traditional leaders.	Meeting with Traditional Rulers and Youths.	The head and chiefs of host communities.	129	Each host community as in Table 4.11.3	December 18 -23, 2017	• Formal presentation of the project; • Discussion of community concern; and • The need for a grievance mechanism throughout the project life.
Government Agencies – Federal, State and Local Government Authority Regulatory Authorities.	Meeting with Local Government Officials.	Sagamu South; Sagamu West and Ofada/Mokoloki LCDAs and others	155	Sagamu South LCDA Secretariat, Ejio Town Hall and Ofada/Mokoloki LCDA Secretariat	December 15-16, 2017	• Engagement with affected communities; • Potential positive impacts (provision of electricity and employment of opportunities for local people; and • Community development in general.
		Federal Ministry of Environment,	18	Redemption Camp	July 11, 2017	• Issues pertaining to appropriate location of the Substations

		Abuja.				
		Transmission Company of Nigeria, Abuja.	10	Redemption Camp	December 20, 2017	• Engagement with Redeem Officials to take decision on the appropriate substation location
Non-Governmental Agency (NGO) –		Nigerian Conservation Foundation (NCF)	12	NCF Office, Lekki, Lagos	March 7, 2018	• Discussion on potential impacts of proposed projects on biodiversity • NCF shows their interest for the collaboration of TCN`s project if there is any opportunity

Plate 4.12.1: Meeting with Balees at Likosi axis

Plate 4.12.2: Monthly progress meeting with Ogun State team

Plate 4.12.3: Meeting with Dejuwogbo/Alado/Mosu community

Plate 4.12.4: Stakeholder engagement meeting at Ejio town

Plate 4.12.5: Meeting at Ewusi Place, Sagamu

Plate 4.12.6: Stakeholder engagement meeting at Likosi/Redeem axis

Plate 4.12.7: Stakeholder meeting at MFM/Ofada axis

Plate 4.12.8: Meeting with Jaguna Community

4.12.5. Outcome of the consultation

Table 4.12.5: Stage1- Scoping Stage

Topic	**Concerns, Comments and Recommendations**	**Stakeholders having made the comment / recommendation**	**Actions to Address Concerns**
Location of Proposed Sites	Some sites are under acquisition while others are free. The ones that are free, Government will acquire for the project in the interest of the public but the project will be responsible for the processing charges.	OGSG/ Bureau of Lands and Survey	The lands needed will be compiled and sent to OGSG
	The Governor mentioned need to raise the lines where crossing rail lines eg. Lagos –Ewekoro (Lafarge Cement) rail line at Apomu village	Bureau of Lands and Survey	This shall be included in the EPC contract
Project Components	Requested additional substation besides Lot 1,2 &3 project components. These are as follows; • In Ijebu Area, which will be in Obere to feed Ogun East. • Aiyetoro to feed the communities along Benin Border, Idi-Iroko, Waasimi axis. The State Government will provide land and fast track approval of the substation sites and RoW acquisition, while TCN will pay for the processing only.	Department Power/Energy, Governor's Office	TCN explained that there will be no need for building substations as the proposed substations will be sufficient for the areas mentioned. All that is needed is to invest in distribution infrastructure
Substations Sites	**Likosi/Dejuwogbo** – Confirmation of Survey plan because of trespasser. TCN needs to send survey plan in order to know the steps to take possession of TCN acquired land **Redeem and MFM Substations: -** Preparation and signing of MOU beyween the parties	Ogun State Team/ TCN Team	Application along with supporting documents will be prepared and submitted
Transmission Lines Row	**Ejio – Likosi/Dejuwogbo** – Issue of approval for the Transmission Line (TL) to pass through Makun City Estate **Likosi- Existing Sagamu/Ikorodu** – Confirmation of proposed Omotosho- Benin 330Kv DC TL coordinates	Ogun State Property Investment Corporation (OPIC)	

Table 4.12.6: Stage2- Line Route Survey, ESIA and RAP studies

Topic	Concerns and Comments	Stakeholders having made the comment / recommendation	Actions to Address Concerns
Social Infrastructure	There is a general concern regarding the provision of basic social infrastructure and amenities such as health facilities, schools, and potable water supply. These facilities are grossly inadequate in the affected communities	Affected Communities Leader	The participants were informed that the project will attract development to the communities.
Health and Safety	• Concern on the likely problem for the neighbouring communities and the fear that the project would not generate additional problems like vibration, noise, EMF and gaseous emission; • Concern on health hazard and EMF effect; and • Hoped that the substations would be built in line with the highest safety standards and would create the minimum disruption to communities	Affected Communities (Community Leader, Women Leader Youth Leader)	The interests and concerns of the community will be put into consideration. Their project will be executed with the highest standard and in a way that their safety and health will not be jeopardized.
Electricity	• Non-availability of power to aid artisanship, thereby affecting quality of life. • Where available, power supply has been irregular	Affected Communities (Community Leader, Women Leader Youth Leader)	The participants were informed that the transmission line will evacuate power to the substations which will in turn step it down before it is distributed through the national grid where it will get to the populace and enhance the quality of life.
Compensation for lost assets	The issue of fair and adequate compensation was raised in virtually all communities especially for those whose occupation will be affected by the TL RoW	Local Government Chairmen/Affected Communities (Community Leader, Women Leader Youth Leader)	The stakeholders were informed that the project already has in place a RoW acquisition process which includes enumeration, valuation and compensation. They were informed that this process will be followed with community survey to ensure that all affected persons are identified and included in the compensation program. They were also assured that compensation payment will be in line with current market prices. In

Topic	Concerns and Comments	Stakeholders having made the comment / recommendation	Actions to Address Concerns
			addition, a grievance redress mechanism will be developed and communicated to all affected parties in case there are issues
Employment	• `Requested that some of their indigenes who are qualified are given special consideration in employment so as to forestall a situation whereby their folks can only be labourers; and • Appeal for employment of their youths in order to give empower them economically	Local Government Chairmen/Affected Communities (Community Leader, Women Leader Youth Leader)	The participants were informed that a Community Relations and Engagement Plan will be developed prior to project commencement that will cover all terms and modalities of engagement to ensure that affected communities are equitably represented

CHAPTER FIVE
ASSOCIATED AND POTENTIAL IMPACT

5.1 INTRODUCTION

This chapter provides information on the assessment of potential environmental and socio-economic impacts from the proposed Project. The impacts from both short-term construction phase and the long-term operational phase are being considered. A description of the assessment methodology used to assess the significance of impacts, taking into account impact magnitude and sensitivity of receptors and resources affected, is provided below.
The following primary Project activities (= source of potential impacts) are considered in this assessment:

Project Phase	Project Activity
Pre-Commissioning	Route Selection/Land Take
	Mobilization of Equipment and Personnel
Land Preparation	Clearing of way leave
	Tower spotting
Construction	Assembly and erection of transmission line towers and ancillary facilities/structure
	Construction of Access Roads
	Concrete works and foundation pilling
	Excavation, Compaction and Backfilling
	Cutting Trees and removal of vegetation debris
	Influx of labour
	Waste generation
	Demobilization of workforce
	Site clean-up and restoration
Operation & Maintenance	Maintenance of way leave
	Transmission line inspection
	Power transmission
Decommissioning	Dismantling of Tower and conductor lines
	Containment of wastes and debris

The following environmental indicators, receptors or resources affected by potential impacts were considered:

Biophysical Environment:
- Air quality;
- Noise, vibration & EMF;
- Soils and geology;
- Water resources;
- Terrestrial ecology.

Human Environment:
- Visual amenities;
- Community level impacts
- Community health, safety and security;

- Resettlement;
- Labour and working conditions;
- Infrastructure;
- Employment and economy; and
- Cultural Heritage.

For each of the above mentioned environmental component, the associated with the potential impacts of Project activities are identified and evaluated of the significance of the impacts. A summary table of all potential impacts with their significance is presented in Tables 5.17.1a and 5.17.1b.

5.2 IMPACT ASSESSMENT METHODOLOGY

This section describes the overall approach used for the assessment of impacts. Topic-specific methodologies are described under each section of the impact assessment. In general, the assessment of impacts will pass through an iterative process involving the following four key elements:

1. Prediction of potential impacts and their magnitude (i.e., the consequences of the proposals on the natural and social environment);
2. Evaluation of the importance (or significance) of impacts taking the sensitivity of the environmental resources or human receptors into account;
3. Development of mitigation measures to avoid, reduce or manage the impacts or enhancement measures to increase positive impacts; and
4. Assessment of residual significant impacts after the application of mitigation and enhancement measures.

Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed until they are as low as reasonably practicable for the Project.

5.2.1 Nature/Type of impacts

There are number of ways that impacts may be described and quantified. The definitions adopted for this ESIA are described in Box 5-1 below

Box 5-1: Definition of impacts

1	**Nature of Impact:** An impact is essentially any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. Negative – an impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor. Positive – an impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.
2	**Type of Impact:** Direct (or primary) – impacts that result from the direct interaction between a planned project activity and the receiving environment (e.g., between stack emissions and the ambient air quality). Secondary – impacts that result from the primary interaction between the Project and its environment as a result of subsequent interactions within the environment. Indirect – impacts that result from other activities that are encouraged to happen as a consequence of the Project.
3	**Temporal Scale of Impact:**

	Temporary - impacts are predicted to be of short duration, reversible and intermittent/occasional in nature. The receptor will return to a previous state when the impact ceases or after a period of recovery. Short-term - impacts that are predicted to last only for a limited period (i.e., during construction) but will cease on completion of the activity, or as a result of mitigation measures and natural recovery (e.g., non-local construction workforce-local community interactions). Long-term - Impacts that will continue for the life of the project but cease when the project stops operating (i.e. 20 years). These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period.
4	**Spatial Scale of Impact:** On-site – impacts that are limited to the Project site. Local - impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community. For this ESIA, local impacts are restricted to the Project site and adjacent areas. Regional - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries (i.e Ogun State). National - impacts that affect nationally important environmental resources; affect an area that is nationally important/protected; or have macro-economic consequences (ie Nigeria). International - impacts that affect internationally important resources such as areas protected by International Conventions. Trans-boundary - impacts that are experienced in one country as a result of activities in another.

5.2.2 Assessment of Significance

There is no statutory definition of 'significance' and its determination is therefore necessarily partially subjective. For the purposes of this ESIA, the following definition of significance has been adopted:

"An impact is significant if, in isolation or in combination with other impacts, it should, in the judgment of the ESIA team, be taken into account in the decision-making process, including the identification of mitigation measures (by the Project) and consenting conditions (from Regulators and Stakeholders)."

Criteria for assessing the significance of impacts stem from the following key elements:

- Status of **compliance** with relevant Nigerian legislation, policies and plans and any relevant Nigerian or industry policies, standards or guidelines;

- The **magnitude** (including nature, scale and duration) of the change to the natural or socio-economic environment (eg an increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through stakeholder engagement;

- The nature and **sensitivity** of the impact receptor (physical, biological, or human). Where the receptor is physical, the assessment considers the quality, sensitivity to change and importance of the receptor. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact; and

- The **likelihood** (probability) that the identified impact will occur. This is estimated based upon experience and/or evidence that such an outcome has previously occurred.

For this assessment, significance has been defined based on five levels described in Box 5-2.

Box 5-1: Categories of significance

Positive impacts provide resources or receptors, most often people, with positive benefits. It is noted that concepts of equity need to be considered in assessing the overall positive nature of some impacts such as economic benefits, or opportunities for employment.
Negligible impacts (or Insignificant impacts) are where a resource or receptor (including people) 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 ('Minor impact') is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
An impact of moderate significance ('Moderate impact') 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. Clearly to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is ALARP. This does not necessarily mean that 'Moderate' impacts have to be reduced to 'Minor' impacts, but that moderate impacts are being managed effectively and efficiently.
An impact of major significance ('Major impact') is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones such as employment, in coming to a decision on the Project.

For environmental impacts the significance criteria used in this ESIA is shown in

Table *5.2.1*

Table 5.2.1 Overall significance criteria for environmental impacts

Receptor sensitivity (or resource value)	**Impact magnitude**		
	Low	Medium	High
Low	Minor	Minor	Moderate
Medium	Minor	Moderate	Major
High	Moderate	Major	Major

For social impact assessment, the perceptions of stakeholders, expressed as opinions around certain issues, can be as important as actual impacts. Consequently, the concept of perception is explicitly brought into the evaluation of significance after an impact is evaluated. When an impact is of significant stakeholder concern, this may be cause to raise the significance rating. This prompts the formulation of more rigorous and appropriate mitigation measures which focus on the source of the impact and also address stakeholder perceptions. The risk of not addressing stakeholder perceptions is that reputational damage could arise, resulting in the loss of a 'social license to operate'.

Magnitude of Impact

The term 'magnitude' covers all the dimensions of the predicted impact to the natural and social environment, including:

- the nature of the change (what resource or receptor is affected and how);
- the spatial extent of the area impacted or proportion of the population or community affected;
- its temporal extent (ie duration, frequency, reversibility); and
- where relevant (accidental or unplanned events), the probability of the impact occurring.

For biophysical impacts, the definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided in Box 5-1.

For social 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 (1) resulting in a positive or negative effect on their well-being (a concept combining an individual's health, prosperity, their quality of life, and their satisfaction).

Sensitivity of resources and receptors

Sensitivities are defined as aspects of the natural or social environment which support and sustain people and nature. Once affected, their disruption could lead to a disturbance of the stability or the integrity of that environment.

For ecological impacts, sensitivity can be assigned as low, medium or high based on the conservation importance of habitats and species. For habitats, these are based on naturalness, extent, rarity, fragility, diversity and importance as a community resource.

For socio-economic impacts, the degree of sensitivity of a receptor is defined as ‘a stakeholder’s (or groups of stakeholders’) resilience or capacity to cope with sudden changes or economic shocks’. The sensitivity of a resource is based on its quality and value/importance, for example, by its local, regional, national or international designation, its importance to the local or wider community, or its economic value.

Likelihood

Terms used to define likelihood of occurrence of an impact are explained in

Table ***5.2.2***.

Table 5.2.2: Explanation of terms used for likelihood of occurrence

Definition of likelihood		
High probability	Refers to a very likely impact	Refers to very frequent impacts
Medium probability	Refers to a likely impact	Refers to occasional impacts
Low probability	Refers to a very unlikely impact	Refers to rare impacts
	As far as one-time events (e.g. air emissions) or slowly developing effects are concerned (e.g. impacts on local life style)	As far as possibly recurring impacts are concerned, such as accident or unplanned events (e.g. traffic accident, fire)

5.3 AIR QUALITY

5.3.1 Construction phase

Emissions from vehicles and equipment (SO_2, CO, NOx, CO_2, PM)

The movement of vehicles for the construction will result in PM, SO_2, CO, NO_x, CO_2 emissions. It is noteworthy to mention that the quantity of emissions is dependent on the vehicle type, amount and their conditions. Light-duty petrol vehicles not equipped with pollution control devices have the highest exhaust emissions during acceleration, followed by deceleration and idling cycles. Frequent cycle changes characteristic of congested urban traffic patterns thus tends to increase pollutant emissions. At higher cruise speeds HC and CO emissions decrease, while NO_x and CO_2 emissions increase. Emissions from diesel-fuelled vehicles include particulate matter, NO_x, SO_2, CO and HC, the majority of which occurs from the exhaust. Operating at higher air-fuel ratios (about 30:1 as opposed to 15:1 characteristic of petrol-fuelled vehicles with electronic fuel injection engines), diesel-powered vehicles tend to have low HC and CO emissions, despite having considerably higher particulate emissions.

Particulates emitted from diesel vehicles consist of soot formed during combustion, heavy HC condensed or adsorbed on the soot and sulphates. In older diesel-fuelled vehicles the contribution of soot to particulate emissions is between 40% and 80%. The black smoke observed to emanate from poorly maintained diesel-fuelled vehicles is caused by oxygen deficiency during the fuel combustion or expansion phase. Particulate emissions from petrol-driven vehicles are usually negligible. Such emissions when they do occur would result from unburned lubricating oil, and ash-forming fuel and oil additives.

The impact of emissions arising from vehicles and equipment's associated with construction activities is considered to be ***minor*** as due to the relatively low number of vehicles and equipment compared to the already existing traffic load on the roads and relatively short duration of the construction phase.

Dust emission from land preparation and vehicle movements

The dust emissions arising from the construction activities of the Project are as a result of land preparation activities and vehicle movements. Dust emissions have the potential to create impact on the close receptors due to the physical appearance, deposition on the roof of the residential areas and creating nuisance for the surrounding community. Removal of material usually takes place with a bulldozer, cleared material is then stored in piles for later use or during rehabilitation procedures. Fugitive dust is generated during the clearing of material, as well as from wind-blown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the material, usually by truck, to the stock piles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation.

The temporary nature of construction differentiates it from other fugitive dust sources as to estimation and control of emissions. Construction consists of a series of different operations, each with its own duration and potential for dust generation. In other words, emissions from any single construction site can be expected (1) to have a definable beginning and an end and (2) to vary substantially over different phases of the construction process. This is in contrast to most other fugitive dust sources, where emissions are either relatively steady or follow a discernible annual cycle. Furthermore, there is often a need to estimate area wide construction emissions, without regard to the actual plans of any individual construction project. For these reasons, either area wide or site-specific emissions are not directly calculated and modelled.

The impact of this phase on air quality is of ***minor*** significance and consequence because of the relatively short duration of the construction, the limited earthworks required on the site and the involvement of a limited number of construction vehicles.

Estimated Land deforestation in relation to Green house gases (GHG)

New construction of long-distance lines, or even of transmission lines and substations, may affect carbon stored in biomass and soil. An obvious example would be clearing forest for a long-distance transmission line, which would result in a one-time release of the carbon stored in the vegetation. This impact would be common for new transmission investments in areas with high forest cover, and possibly for electrification and distribution projects that involve new feeder lines. Estimated land deforested area using worst case scenario (i.e 100% usage excluding water bodies, built-up area and other activity) is shown in Table 5.3.1.

Table 5.3.1: Estimated land deforested for the proposed project component

S/N	Project component	Km	Voltage	RoW (m)	Land acquired Area (ha)	Estimated Land Deforestation (ha)
I	Ejio to Likosi/Dejuwogbo	48.74	330	50	243.7	216.98
II	Likosi/Dejuwogbo to Redeem (Abule Oba) (Oba Abule)	7.83	132	30	23.4	19.17
III	Likosi/Dejuwogbo to Ikorodu/Shagamu	2.41	132	30	7.23	5.41
IV	MFM (Makogi) to Ikeja West	4.99	330	95	47.4	30.48
V	Likosi/Dejuwogbo Substation		330/132	-	25.0	12.50
VI	Redeem (Abule Oba) (Oba Abule) Substation	-	132/33	-	9.62	9.62
VII	MFM (Makogi) Substation	-	330/132	-	19.69	19.69

Total GHG Emission (tCO_2e) from activities related to the project is summarized in Table 5.3.2.

Table 5.3.2: Estimated Total GHG Emission from deforestation in relations to the Project

Activity	Associated GHG Emission (tCO_2e)
Worst case scenario for the Forest clearing	24,972.23
Total	**24, 972.23**

The estimated GHG worst case scenario for the forest clearing during the land preparation stage for the proposed project is 24, 972.23 tCO_2e. Since the transmission line route was selected to avoid and minimize the forest area as reasonably practical as well as the fact that the GHG emission during construction stage is short and temporarily, the impact on climate change is considered to be ***minor.***

5.3.2 Operation phase

The operation of the transmission line will not contribute to atmospheric emissions directly but in fugitive form and deforestation activities during line maintenance. The substation operation will emit through the use of ancillaries and hence the predicted impacts are ***minor***.

Climate change impact during operational stage

Sulphur hexafluoride is an extremely potent greenhouse gas that is used for several purposes when transmitting electricity through the power grid. Several factors affect SF_6 emissions from electric power systems, such as the type and age of the SF_6-containing equipment and the handling and maintenance procedures practiced by electric utilities. Because of its long-life span and high global warming potential (GWP), even a relatively small amount of SF_6 can impact the climate. The electric power industry uses roughly 80 percent of all SF_6 produced worldwide. Ideally, none of this gas would be emitted into the atmosphere. In reality, significant leaks occur from aging equipment, and gas losses occur during equipment maintenance and servicing. With a GWP 22,800 times greater than carbon dioxide (CO_2) and an atmospheric life of 3,200, one pound of SF_6 has the same global warming impact of 11 tons of CO_2 (USEPA, 2017). Results are presented in Table 5.3.3

Table 5.3.3: Estimated Greenhouse Gases Emissions for Each Substation

Parameter	**Energy Data Input kWh**	**ton CO_2/kWh**	**lb SF_6/kWh as CO_2 equivalent**
Likosi/Dejuwogbo (Ogijo) Substation			
500MVA Transformer	240,000	197	2,167
150MVATransformer	120,000	98.4	1,082.4
100MVA Transformer	80,000	65.6	721.6
Total	**-**	**361**	**3,971**
Weighted average	**-**	**120.3**	**1,323.7**
Redeem (Abule Oba) (Oba Abule) Substation			
60 MVA Transformer	48,000	78.8	866.8
60 MVA Transformer	48,000	157.6	866.8
Total	**-**	**534**	**1,733.6**
Weighted average	**-**	**178**	**577.9**
MFM (Makogi) Substation			
150MVATransformer	120,000	98.4	1,082.4
150MVATransformer	120,000	98.4	1,082.4
60 MVA Transformer	48,000	157.6	866.8
60 MVA Transformer	48,000	157.6	866.8
Total	**-**	**512**	**3,898.4**
Weighted average	**-**	**170.6**	**1,299.5**

When there are significant leaks occur from aging equipment, and gas losses occur during equipment maintenance and servicing, the project will have a significant contribution of the emission of GHG emissions with estimated total emissions of 3,971 lb SF_6 /kWh as CO_2 equivalent at Likosi/Dejuwogbo (Ogijo) Substation, 1,733.6 lb SF_6 /kWh as CO_2 equivalent at Redeem (Abule Oba) Substation and 3,898.4 lb SF_6 /kWh as CO_2 equivalent at MFM (Makogi) Substation.

Sulfur hexafluoride is used in insulation and current interruption applications in transmission network systems (IPCC 2006c). SF_6 is used in gas-insulated switch. Estimates fugitive SF_6 emissions based on total length of transmission lines and a default fugitive emission factor. gear and substations, gas circuit breakers, and—less frequently—in high-voltage gas-insulated lines. SF_6 may escape as fugitive emissions during the manufacturing, installation, use, maintenance, and disposal of this equipment. Distribution equipment that is sealed may not emit any SF_6 during use, but transmission equipment often requires periodic refilling and so has higher fugitive emissions during use. The amount of SF_6 emissions during operation and decommissioning is related to the number and type of equipment used, as well as to the maintenance and recycling procedures. This source of emissions could occur in all project categories, depending on the type of equipment installed, refurbished, or maintained. SF_6 emission was estimated using the Climate Registry: 2009 Electric Power Sector Protocol v1.0 (http://www.theclimateregistry.org/). The estimated total GHG Emission from operations and maintenance activities related to the project per year is 9, 504.67tCO2e.

Table 5.3.4: Estimated Total GHG Emission from operations and maintenance activities related to the Project per Year

Activity	**CO_2 Emission (tCO_2e)**
Vegetation control	3,745.83
TL Inspection	0.744
Transmission Lines Fugitive SF_6 Emission	49.66
Total estimated GHG for Substations (Table 5.3.4)	5708.5
Total	**9,504.67**

As discussed above, a certain amount of GHG will be emitted during the operational stage. However, the improvement of electricity grid would contribute to mitigate the GHG emission as a whole and also identified as the key action plan for climate change Nigeria`s nationally determined contribution (NDC) implementation.

Therefore, the climate change impact during the operational stage is considered to be minor, assuming that the maintenance shall be conducted appropriately. However, since the GHG will be emitted during the maintenance and under the as a result of uncommon condition, the rating of greenhouse gases emission during operation necessary mitigation measure is required. It is considered to be ***moderate***.

However, the proposed project is improvement of transmission line system in Nigeria, which is in line with Nigeria`s nationally determined contribution (NDC) implementation.

5.4 NOISE, VIBRATIONS AND EMF

5.4.1 Construction Phase

Noise sources associated during the construction phase of the proposed transmission lines and associated substations project include traffic and equipment's used for earthworks, concreting, installation, tower erection and stringing.

The detailed breakdown of activities is not available at this stage, and as the Contractor has not yet been appointed, no construction plant inventory is available at the time of assessment. Therefore, an assumed plant inventory is provided in Table 5.4.1. Assumptions have made regarding the type, number and Sound Pressure Levels (SPLs) of construction plant, based on similar projects and publicly available data. It has been assumed that only one of each type of plant will be on-site during any day or night period.

Table 5.4.1: Assumed Construction Equipment Sound Pressure Level Inventory

Construction Equipment	SPL, dB(A)
Bulldozer	115
Backhoe	96
Impact pile driver	101
Fuel truck	104
Welding machine	101
Cranes	106
Dump truck	105
Grader	114
Fork lifts	112
Compressors	104
Generators	93

Noise impacts will be more predominant within 100 m of the activity areas. People live within few meters of the substation perimeter in Likosi/Dejuwogbo, Redeem (Abule Oba) and MFM (Makogi) substation, and hence will be disturbed during construction. The baseline noise levels around these three areas are similar which are which are 40.90 dBA, 32.60 dBA and 39.50 dBA. The areas are considered to be low noisy zones and below W.H.O. guideline for community noise of 55dBA for day-time standard. The proposed construction timeframes for this project estimates that all construction will take place over a period of 9 months. The construction activity will be undertaken during day-time. Construction activities will be concentrated and done sequentially so that no area is prone to extensive duration of noise impacts. There will be some noise generated from the movement of tractors and trucks transporting the materials and equipment but the traffic volumes are expected to be occasional.

Considering the construction activity schedule and nature of construction, overall noise impact on nearby sensitive receptors with embedded controls in place will be of ***moderate*** significance, especially at where residential area is close to the construction area.

5.4.2 Operation Phase

The likely noise impacts from operation of the transmission line are due to:

- Maintenance and repair activities; and
- 'Corona discharge' from the overhead lines.

Noise and vibration sources generated during maintenance of the towers will be infrequent and extremely low. Also, according to Federal Republic of Nigeria Official Gazette (S.1.6 of Electricity Supply Regulations) Section 60 and 61, electromagnetic field impact may be insignificant.

A corona discharge is an electrical discharge resulting from the ionization of the air around the conductor, generally generating power losses and ambient noise. The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kilo volts [kV]) and even greater with ultra-high voltage lines. Therefore, considering the voltage grade of the Project transmission line and that it will only reach its maximum during rainy events, it is highly unlikely that the corona discharge noise will exceed the normal background noise levels in the area.

The impact of noise is considered to be ***minor*** during operational stage**.**

5.5 GEOLOGY AND SOILS

5.5.1 Construction Phase

Impact on geology and soil structure

Change to geology and soil structure (through erosion and compaction) digging of foundation pits for the towers and the cutting of vegetation are the main activities at this phase which are likely to affect soil structure. The topography of the area is an undulating/complex terrain due to the natural endowment and artificial activities along the proposed Transmission Lines and Substations project. Below is the range of topography for each of the proposed route:

Ejio - Likosi = 11m – 105m
Likosi – Ikorodu/Sagamu = 91m – 100m
Likosi – Redeem (Abule Oba) = 24m – 100m
MFM (Makogi) – Ikeja West = 6m – 13m
Likosi Substation = 10m-100m
Redeem (Abule Oba) Substation = 5m-60m
MFM (Makogi) Substation = 2m-6m

However, excavated soil, if kept uncovered and unprotected will be rendered vulnerable to erosion. Compaction of soil during backfilling of foundation pits might lead to temporary effects on natural infiltration of rainwater. Removal of vegetation and trees during construction, especially on the slopes would render soil vulnerable to erosion. Most of these impacts are temporary, localised and marginal and significance of impact is therefore rated as ***minor***.

Potential contamination of soil from inadvertent release of hazardous or contaminating material

Pollution of soil and groundwater is a risk primarily related to the spilling of fuel and/or liquid chemicals during transport, during storage, or during handling (transfer of one container to the other) or lubrication, refuelling, etc. The causes of such spilling are e.g. road accidents, leakage from storage containers (due to corrosion or other damage), negligent or careless conduct of handlers, etc. Pollution of soil and ground water is also possible if solid and / or liquid waste is improperly disposed. Percolate from such waste enters into the soil and ground water. Infiltration of sanitary waste may also reach groundwater.

Spilling of fuel or other liquid chemicals or percolate from dumped waste in soil and/or ground water result in long lasting damage to the functionality of the polluted soil and/or groundwater as resource and decrease habitat quality, primary production and biodiversity. The effects are reversible, but only on a very long -time scale (decades or longer). The effect in soil is often of limited spatial extent. The impact on ground water can cover very large areas.

The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi/Dejuwogbo and Redeem (Abule Oba) are poor earthing media. The conductivity of the subsoils may need to be enhanced to improve their earthing capacity. Where the subsoil resistivity is < 180 ohm-m, there is the tendency for buried metallic structures contained in the platform of the proposed transmission lines tower and substation to be corroded, over a significantly long period of time. There is high risk of settlement of the proposed transmission lines tower foundation and substation, where the subsoil is clayey and incompetent based on the very low layer resistivity values.

This rating is very much dependent on the soil and geology impact's scale of the spill. Given the low sensitivity of the surrounding areas and the medium magnitude of the potential consequences of an uncontrolled spill, impact is rated as ***minor***.

5.5.2 Operation Phase

The only source of impact on soils during the operation of the transmission line is the potential contamination of soil from inadvertent release of hazardous or contaminating material, such as fuel from vehicles or aluminium oxide pain. Low frequency of inspections and painting as well as involving experience personnel will reduce likelihood of such a contamination considerably. Impact is therefore considered ***minor***.

5.6 WATER RESOURCES

5.6.1 Construction Phase

Impact on hydrogeology due to construction of tower foundation and access road

The project will cross Ogun River and swampy areas in Oniyan. The width of Ogun River where the transmission line will pass is approximately 120 m. Since the span between transmission towers is 300 – 400m, no construction activity such as construction of tower foundation within the Ogun River is expected, therefore, impact on hydrogeology of Ogun River is considered to be negligible. The project crosses artificial swamp area, where artificial mining has taken place, River Wagunu at Abese and natural swamp area. The construction activities, such as construction of access road and tower would potentially disturb the hydrogeology of the swampy area. However, only limited area is disturbed and the impact on hydrogeology of swampy area is considered to be ***minor***.

Potential contamination on water resource

The impact of ground and surface water contamination from accidental spills and improper disposal of excavated materials, waste and wastewater is similar to those described in the soils and geology section above. Given the low sensitivity of the surrounding areas and the medium magnitude of the potential consequences of an uncontrolled spill, impact is rated as ***moderate***.

5.6.2 Operation Phase

The impact on the surface water and hydrogeology of the area during operation and maintenance shall be very low due to the usage of standardised operation procedure. Therefore, the impact is considered as ***minor***.

5.7 TERRESTRIAL ECOLOGY

5.7.1 Construction Phase

Impact on Terrestrial flora and Fauna

For setting up the transmission line, there will be requirements of localized clearance of vegetation, which may affect/disturb flora and fauna within the RoW. Flora and fauna may also be disturbed by dust emissions, light, noise and vibration, traffic movement (risk of collision) and potential accidental spillages and sediment run-off that would affect their habitat. Considering the fact that the above impact will be localised and that the ecosystems have a low sensitivity; the impacts are considered ***minor***.

Transmission line construction will require vegetation clearing along a 53.73 km long and 50 m wide corridor for 330kV as well as 10.24 km long and 30 m wide for 132kV, corresponding to an area of 313.85 ha, including three new substations. Vegetation clearing will lead to a permanent loss of woody species in terrestrial habitats found along the corridor.

The project area falls largely within the lowland rainforest zone of Nigeria, mostly made up of mixtures of trees, shrubs, herbs and grasses. With regards to floristic composition, the entire area was relatively homogenous and comprised a total of 32 plant species belonging to 16 families/sub families. The families with the highest species include Mimosaceae, Compositae, Sterculiaceae, Anacardiaceae, Euphorbiaceae, Ceasalpinaceae. Fifteen trees and shrub species each recorded 50 % occurrence frequency among which *Albizia zygia, Mangifera indica* (Mango), *Spondia mombim, Cassia siamea and Cola spp* were particularly common Grasses (Poaceae) and palms (Palmae).These are commonest monocotyledon plants.

Mean tree and shrub density in proposed the project area was 395/ha while herbaceous biomass was in the range of 15kg/ha.

An inventory of the wildlife thus recorded is provided. They comprise mostly terrestrial vertebrates notably amphibians, reptiles, Aves (birds) and mammals. A number of mammalian wildlife occurring commonly in most parts of Nigeria were recorded in the study area. Incidentally, they are mainly small to medium size mammals which constitute the bulk of the bush meat trade in the Country. They include mice, rodents, squirrels, grass cutter, and the ungulates (mostly deer and antelopes) as well as wild eats and dogs (Civet cats). However, following the general pattern in the Country, the avian fauna and population was the most noticeable and dominant in the study area. The most occurring of them were the weaver birds (e.g. *Ploessus cuculatus)* and the common garden bulbul *Pyconotus barbatus* were the most common birds in the area. Francolin (*Francolinus bicalcaratus*) was however the only bird of economic importance. Mortality could occur during vegetation clearing operations.

The two major NGOs who have been on the vanguard of biodiversity in Nigeria are the Nigerian Field Society (NFS) and The National Conservation Foundation (NCF). The journal of NFS, ***The Nigerian Field***, is a goldmine of information on the biodiversity of Nigeria especially its vertebrate fauna (Amphibians, reptiles, birds and mammals) and terrestrial flora. Reference is made to the ongoing Biodiversity Action Plan (BAP) of the NCF to enhance forest re-vegetation and mitigate the effects of climate change on the Nigerian forest which is fast decreasing. The re-vegetation occurs naturally in the forest when people are being restricted by deforestation prohibition law.

Management measures, such as targeted clearing measures and compensation for area and field tree loss, will limit the impacts. In certain cases, vegetation clearing operations will consist of only cutting a few scattered trees and other woody vegetation under transmission lines within 4m wide.

Impact due to the introduction of Alien species

Vegetation clearing for the construction of the power line and access roads will cause habitat disturbances that could create suitable conditions for the establishment of invasive species. The spread of invasive species can have negative impacts on local species, by modifying plant community composition. Alien invasive species have the potential to substantially modify wildlife habitat which can impact associated fauna populations. In this study area, the impact is considered ***minor***.

5.7.2 Operation Phase

Impact and terrestrial flora and fauna

Avian collision with transmission lines can occur in large numbers if located within daily flyways or migration corridors, which is not the case of the Project area. Further, the possibilities of such collision are low as stated during consultation meeting with National Conservation Foundation. Therefore, impact of avian collision is considered ***minor***.

Impact on terrestrial ecology of routine clearance of vegetation is also considered ***minor*** as localised and in an already degraded ecosystem.

Impact on Ecosystem Service

Many use-value species, such as *laeis guineensis*, *Mangifera indica*, *Cola nitida*, *Chysophyllum albidum*, *Psidium guajava*, *Moringa oleifera*, *Cocos nucifera* and *Carica papaya* will need to be cleared, reducing their availability for local communities, especially at Oke Ate/Oniyan community areas. Moreover, creation of access roads may expose forest areas to increased human activities. This may have impacts on existing flora and fauna that may be of use to the local communities. However, since the affected area would be limited to the proposed RoW (30m width or 50 m width) and the local species will regenerate again with similar habitat, for that reason, impact will be considered as ***minor.***

5.8 Aquatic Ecology

5.8.1 Construction Phase

Impact on Aquatic Ecology

The construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands. The surface of water had macrophytes, mainly *Pistia stratoides*, *Nymphaea lotus,* which is perennial herb with submerged rhizomes and large leaves that float on water. The edges of few rivers or swamps or pools of stagnant water encountered along the routes had grasses and sedges mainly *Andropogon gayanus*, *Cyperus spp,* and herbs include *Ipomoea aquatic*, *Commelina erecta and Ludwigia erecta.* These mainly are found around at Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun along Ejio-Likosi/Dejuwogbo Transmission Line and Likosi/Dejuwogbo-Redeem (Abule Oba) Transmission Line respectively.

Construction activities can influence water quality or modify flooding patterns and surface water flow over a certain period of time. The project may not avoid access road construction on wetlands/swamp. Construction activities could also cause an increase in suspended solids in wetlands and aquatic environments, which could result in siltation of feeding sites and breeding grounds of some species, particularly for fish species. Furthermore, an increase of organic matter in aquatic environments could lead to an increase in biochemical oxygen demand (BOD) and a decrease in dissolved oxygen that could be locally harmful for aquatic fauna species. Water could also become contaminated by accidental oil and hydrocarbon spills. In lentic or stagnant aquatic environments, the contamination could exacerbate the impacts of the spills because contaminants could become locally concentrated. Rapid response measures in case of a spill will reduce associated impacts.

Impact on aquatic and semi-aquatic habitats will be limited in areas where there will be direct construction of pylons and substations [*i.e. tower foundation*]. Impacts will be local and the magnitude will be ***moderate***.

5.8.2 Operational Phase

Impact on Aquatic Ecology

During the operation phase, maintenance of the RoW requires regular clearing of vegetation in some swampy area like oniyan village in order to reduce short-circuit risks caused by electric arcing. This means, clearing of vegetation will affect aquatic habitats within the RoW in some swampy area. Therefore, the impact will be considered ***minor***.

5.9 VISUAL AMENITIES

5.9.1 Construction Phase

Site clearance and site development

Before actual construction starts the RoW for the transmission lines will be cleared of high vegetation, all structures and an access road along the RoW will be laid. Construction material and facilities for the labour force will be located at different sites along the RoW and the substations. Towers will be erected in the landscape and lines will be attached to the towers.

These physical interventions will change the view of the landscape near the RoW for the period of the construction, but also during operation of the transmission lines. However, the presence of the construction lay-down area and labour facilities will only be temporary. People living close to the construction sites will experience this change in visual amenities directly. It is estimated that over 1,000 people of the affected communities along the RoW will experience this change.

However, currently the landscape is not considered as very valuable. The location is close to Lagos City and urban activities are sprawling into the area. Over 70% of the affected areas in the RoW are currently farmland, secondary forest and swamp.

This impact is of temporary nature, affecting a relatively number of people, in an already industrial landscape and is therefore considered ***minor***.

Site waste management

Since no construction camp will be required, domestic waste will be limited to waste generated from construction workers. Domestic waste might be disposed to construction area, creating visual impact. Construction waste will be disposed by registered Ogun State Environmental Protection Agency (OGEPA) waste contractor.

Such impact is likely to be experienced by the villagers inhabiting near the construction area. The duration of the construction activity is short term in nature. Sensitivity of the area is varied, high in undeveloped area (e.g. Forest area) and low in developed area. The potential impact on Visual and aesthetics due to storage and disposal of municipal waste from labour camp and construction waste without mitigation major is considered to be ***moderate*** significance.

5.9.2 Operation Phase

Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. Cumulative with the other power lines this may result in a loss of the visual amenity. The people living in the affected communities may experience this visual change. However, in the already disturbed landscape with industrial and urban activities and with little general beauty in its landscape. Overall this impact is considered ***moderate***.

5.10 Land Planning and Use

5.10.1 Construction Phase

Agricultural activities will be affected during the construction work because of the restriction of farming within the acquired area. The total land take is 353.46 ha consisting 55.32 ha for the 3 substations and 298.15 ha for the line. Over a thousand families will loose certain portions of their crop land. Loss of land and crops will have to be compensated before the beginning of the construction. This aspect is detailed in the RAP.

Impacts of land acquisition and changes in land use can lead to moderate magnitude with long-term effects. Since less than 5000 population (in about 1000 household) out of a total community population of over a million, the impact significance is still considered ***major*** because it has to do with means of livelihood.

5.10.2 Operation Phase

Enhancement of local economy as a result of stabilization of electric power may change the land use in the project area. The degree and nature of the impact would be varied and it is difficult to predict the impact. However, stabilization of the electricity would mainly contribute to improve the condition of existing development area and pressure will be on natural environmental area (forest, swampy area) is assumed. Therefore, the impact on land use during the operational stage is considered to be ***major***.

5.11 STAKEHOLDER AND COMMUNITY EXPECTATION/RELATIONS MANAGEMENT

5.11.1 Construction Phase

The construction activities for the Transmission Lines and Substations may cause community concerns linked to impacts associated with issues like air and dust emissions, traffic, influx and community safety/security, noise/vibrations and the adverse impacts and inconveniences experienced from these issues.

In addition to the above, community/stakeholder perceptions may arise around cumulative impacts resulting from existing Ikeja-West Transmission, Omotosho Transmission Line, Egbin Transmission Line, Ogijo Iron Smelting Company and Olorunsogo Power Station operations. There are legacy issues present on account of environmental pollution from existing Transmission Lines reported stakeholder concerns around it, which will potentially reflect on the proposed Transmission Line and Substations project. Especially some people living around Likosi/Dejuwogbo axis, along RoW of Omotosho Transmission Lines may feel concerned about the additional activities of the transmission line construction of potential impacts on their health, safety and/or security. Although the number of people may be considered as limited and the construction activities are only temporary, the impact can be very serious for some people, especially for people with reduced resilience. The potential impact is considered ***major***.

5.11.2 Operation Phase

Community concerns about cumulative impacts of the existing activities along proposed Transmission Lines and Substations will continue from the construction phase into the operation phase.

The operation and maintenance of the proposed projects may cause community concerns linked to impacts associated with issues like nuisance of noise and concerns of potential electrocution, bush fires and electromagnetic fields and interference of radio/TV transmission.

Noise can be generated by transmission lines, by the so-called Corona effect. This is a limited breakdown of electricity in the air. Conductors are designed to reduce this effect. However, at certain times a ‘hissing’ sound can be heard, sometimes with a low frequency ‘hum’. Other noise emissions in the operation phase maybe experienced in times of maintenance at the towers or lines. This will only be temporary and with limited frequency.

There is a risk of electrocution when people come in contact with the lines, which are under power. This may happen when towers or lines would fall to the ground due to e.g. strong winds or overheating. When a snapped line comes in contact with dry bush, a bush fire may be ignited. However, these are very rare incidents.

Further, the people living close to the RoW may have concerns about electromagnetic fields imposing health impacts. A wide safety zone within which no human habitation or activity is allowed will ensure that such effects are reduced to the minimum. Exposure stays within the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Another nuisance people near the RoW of the transmission lines may experience is an interference of the high voltage transmission lines with radio and TV transmission.

Some people living really close to existing Omotosho, Egbin and Ikeja-West Transmission Lines RoW of the proposed Transmission Lines and Substations, in Likosi/Dejuwogbo, Shimawa, and Iganun may feel concerned about the accumulation of these nuisances and potential impacts on their health, safety and/or security. Although the number of affected people may be considered limited, the impact can be very serious for some people, especially for people with reduced resilience. These reported stakeholder concerns, will potentially reflect on the new projects in the operation phase. The impact is considered **major**.

Households living near the RoW, who have currently erratic power supply and who will not get connected to the transmission line, may feel disappointed by not benefiting from the Project, while experiencing adverse impacts. They may feel that '*the power goes over their heads, leaving them in the dark'.* This will count for the communities affected by the RoW.

This is considered a **major** impact, because there may be some accumulation of disappointment over time, as already for some period reliable electricity supply is not provided, while industrial activity, power distribution and transmission are increasing in the area. However, the number of people living in these communities is relatively limited.

5.12 COMMUNITY HEALTH, SAFETY AND SECURITY

5.12.1 Construction Phase

Construction activities in the area, creating increased traffic movements, use of heavy equipment, influx of outside worker and the clearance of the RoW, generate potential impacts on community health, safety and security. The following potential impacts and risks have been identified:

Safety risk due to construction activities

There will be increased risks of traffic safety incidents on public roads affecting especially people living close to the access roads to the construction sites and the users of these roads. Currently the prevalence rate of injuries is low along the Lagos-Ibadan Expressway. The proposed project will involve transportation of heavy equipment and construction material to the site, which is an additional load to the current traffic on the roads. Roads may temporarily be obstructed or diverted to allow for movement of heavy equipment and materials. As this is a temporary activity with limited transportation movements, this risk is considered **minor**.

Health risk due to the construction activity

There will a temporary influx of outside workers to the construction site, but also passing through the communities. There is no labour camp foreseen; the workers will stay overnight with their households or existing accommodation may be sought nearby. The presence of non-resident workers may create opportunities for local businesses, especially in food and beverage business. Temporarily this may contribute to an increased income to the area. However, potentially, frictions between outside labour and local population may arise, due to differences in wealth and culture. There may be a disappointment with the local population of affected communities about them not being hired for the construction works, while external workers involved come in. Looking at the limited time of construction and the lack of a labour camp, this impact is considered. In addition, with the influx of outside workers there is a potential for an increase in prevalence of sexually transmitted diseases in the communities. However, no worker camp will be required for the project and the project will require the limited number of workers, risk on community health and safety due to the influx of workers is **minor** significance.

The clearance of the RoW and the movements of heaving equipment create small pools at the surface and therewith an increase in mosquito breeding areas on site. This may potentially induce an increase in prevalence of malaria and other mosquito borne diseases in communities, which is already considered quite high. However, because of the temporary nature and the limited number of people living close to the construction sites, this risk is considered **minor**.

Clearing of vegetation and movement of equipment in the RoW will lead to soil surface exposure and compaction. Herewith, potentially soil erosion may carry soil to nearby streams, affecting the water quality in these streams. The water of these streams is used for domestic use (no drinking water) by the households living close, so that temporarily they may not be able to use the water for their purposes. Based on the temporary nature of the impact and the limited number of people affected this impact is considered **minor**.

Security risk due to the construction activity
With the construction activities, valuable materials and equipment and the presence of a labour force come to the construction site. Opportunistic people (possibly local youth) or organised crime may be tempted to steal materials from the site, to raid construction workers or force to obtain some benefits from the Project in another way. These security risks may threaten all staff working at the construction site and neighbours.

The construction yard will be secured by a permanent fence at an early stage of construction. Security guards will be employed to patrol the site and control access 24 hours a day. All vehicles entering and leaving the site will be searched. All personnel will be required to display personal identification and all visitors will be required to sign in. The EPC Contractor will be responsible for site security during construction. Since security guards on site and security forces in the area are in place from the Government, the risk is considered ***minor***

5.12.2 Operation Phase

The operation and maintenance of transmission lines create a number of potential external safety risks to the communities living close to the RoW. The likelihood of these risks is generally low, because the RoW under the transmission lines will be cleared of any structure, high vegetation and there will be no people residing in this area anymore after the resettlement process.

Safety risks occur when towers collapse or transmission lines snap and consequent electrocution occurs at the immediate site by the high tensions touching the ground. When inflammable material (like dry bushes) is present at the electrocution site a bush fire maybe ignited, resulting potentially in damage of properties or injuries. The design requirements include towers and foundations within specified high tolerances and they will be inherently safe (see 330/132 kV transmission line specifications, volume 3A of 5, Material & Installation Specifications, TCN, December 2013). Past experience indicates that, although such failure would create a potentially serious hazard, the probability of such failure is extremely low. When ignorant people think they can tap electricity from the high voltage line, direct electrocution may occur.

Electrocution and related fires can have severe impacts to the people experiencing this. However, the likelihood is low and the lines are not crossing areas that are densely used, so that these impacts are considered ***minor***.

5.13 RESETTLEMENT

The land in the RoW for the Transmission Lines need to be acquired by TCN according to the Nigerian and International legislation. It is not allowed to keep structures, like houses or sheds or tall trees in the RoW. Also cropping is not allowed. A separate Resettlement Action Plan has been prepared for the Proposed Transmission Line and Substation projects, providing all details of the land take and related impacts. These impacts are considered ***Major.***

5.14 LABOUR AND WORKING CONDITIONS

5.14.1 Construction Phase

Occupational accident risk

In the construction phase there will be job opportunities for construction workers for the preparation of the RoW and the installation of the towers, conductors and transmission lines. At this moment in time the number of workers required has not been assessed yet. Also, the construction period is not known yet.

It is expected that the majority of the workers can probably be sourced locally, from within 30 km of the construction location. The majority of the employees required during construction will be unskilled and semi-skilled labourers. To manage construction traffic and parking needs, transport will be provided. Since there is quite some unemployment among the people, and especially the youth, living in the communities near the proposed RoW, there will be quite some eagerness to find temporary employment in the construction of the project. This creates the risk that the EPC Contractor may get tempted to recruit labour force against insufficient labour and working conditions to save costs. The impact is considered as ***minor***

In the construction, occupational accidents may occur particularly among unskilled labour force, ranging between minor incidents such as cuts and major incidents related with working at height, tower collapse and the risk of electrocution. Also, the area around swamp is undeveloped area and there would be possible hazards, like snake bite and scorpion sting in the clearance of the vegetation. In view of the number of construction workers, the use of quite some unskilled labour, albeit internationally managed, the risk of occupational accidents is considered ***moderate***

Security risk

With the construction activities, valuable materials and equipment and the presence of a labour force will come to the construction site. Opportunistic people (possibly local youth) or organised crime may be tempted to steal materials from the site, to raid construction workers or force to obtain some benefits from the Project in another way. These security risks may threaten all staff working at the construction site.

The construction yard will be secured by a permanent fence at an early stage of construction. Security guards will be employed to patrol the site and control access 24 hours a day. All vehicles entering and leaving the site will be searched. All personnel will be required to display personal identification and all visitors will be required to sign in. The EPC Contractor will be responsible for site security during construction. Since these works do not take place in a remote area, security guards on site, security forces in the area are in place from the Government and from TCN, the risk is considered **minor.**

5.14.2 Operation Phase

Operation and maintenance of the transmission line will involve regular surveillance and clearing of transmission line RoW to avoid interference of activities in the RoW with the transmission lines. All tall vegetation and trees (including potential economic trees) within 10 meters of the conductor wires on the line will be cut. Safety audits and repairs will be implemented in the operation phase. In case of snapped lines or collapsed towers emergency repairs will have to be done.

Similar to the construction phase, potentially workers may be exploited and occupational health & safety risks may occur in the regular and emergency maintenance and repair works. The likelihood of these risks is lower, as there will be less labour hired and fewer activities, compared to the construction phase. This risk of exploitation is considered **minor** and the health and safety risks **is moderate**.

5.15 EMPLOYMENT AND ECONOMY

5.15.1 Construction Phase

Next to local labour in the construction, there will be opportunities for Nigerian staff, who have specific skills and experience in working in transmission line projects. The employment opportunities form a ***positive impact***, although temporarily. Also, there will be direct employment opportunities in terms of small-scale business. These shall improve local economy and impacts are being considered as ***Positive.***

5.15.2 Operation Phase

Employment opportunities for local people in the operation and maintenance of the Transmission Lines and substations are quite limited. There are no regular jobs related to the operation of the transmission line. TCN will have their own staff to perform safety audits, maintenance and repair. Only for the regular clearance/ of vegetation and possibly other objects in the RoW, local unskilled labour may be hired for only a few days' work.

The improved electricity supply to the national grid is expected to create improve businesses and socio-economic development in the country. This will create a **positive** contribution to the national socio-economic development of Nigeria.

5.16 INFRASTRUCTURE

5.16.1 Construction Phase

The temporary influx of outside workers to the area in the construction phase may pose an additional pressure on social infrastructure, like medical posts, emergency services, water supply and sanitation, solid waste management and road infrastructure. There is no specific need for continuous access along the entire route of the transmission line, although continuous access generally provides the simplest and least extensive method of access to individual structures and the proposed easement area. Access tracks will be upgraded progressively as construction works progress. There is no need to construct new access road along Lot 2 proposed Transmission Lines and substations. Hence, the impact is considered **minor**.

The available health facilities in the project area may experience additional pressure as a result of potential occupational health and safety incidents, traffic accidents and an increase in malaria and STD prevalence.

Social infrastructure is currently not very well developed (see chapter 4) and additional demand for these services may result in reduced capacity for the communities. However, the number of outside workers is expected to be limited and no labour camp is foreseen. Therefore, this impact is considered **minor**.

5.16.2 Operation Phase

In the operation phase this impact is not applicable.

5.17 CULTURAL HERITAGE

5.17.1 Construction Phase

There are shrines located within the RoW and these need to be relocated. The shrines are located along proposed Ejio-Likosi/Dejuwogbo and MFM (Makogi) Transmission Lines. In the Resettlement Action Plan, the relocation of these shrines is described. The shrines will be relocated to a nearby location in consultation with the local communities through compensation process. Worshipping at the shrines can continue at the new location. The impact of the relocation of shrines is considered minor.

There are various cultural festivals in the area. Potentially the construction works generating additional traffic, noise and dust may interact with these cultural festivals, affecting the experience and value of these festivals. This is a ***minor*** impact.

5.17.2 Operation Phase.

Like for the construction phase, potentially the maintenance works generating additional traffic, noise and dust may interact with these cultural festivals, affecting the experience and value of these festivals. This is a ***minor*** impact.

5.18 CUMULATIVE IMPACTS

5.18.1 Defining of Cumulative Impacts

In theory, any development such as the proposed project may be taking place at the same time as other developments, causing impacts affecting the same resources or receptors, such that the impacts on these resources and receptors from all potential development will be cumulative. According to the Performance Standard, cumulative impacts can be defined as impacts that:

> **"*result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.*"**

Generally, Cumulative Impacts are considered to be impacts that act with impacts from other projects such that:

- The sum of the impacts is greater than the parts; or
- The sum of the impacts reaches a threshold level such that impact becomes significant.
- The types of cumulative impacts that may be relevance are detailed in *Box 5-3* below:

Box 5-3: Types of Cumulative Impacts Relevant to the Project

- **Accumulative**: the overall effect of different types of impacts at the same location. An example would be fugitive dust emissions, construction noise and construction traffic all impacting the local communities as a nuisance/ disturbance.
- **Interactive**: where two different types of impacts (which may not singly be important) react with each other to create a new impact (that might be important) (e.g. water abstraction from a watercourse might exacerbate the impacts caused by increased sediment loading).
- **Additive or In-combination**: where impacts from the primary activity (i.e. the construction and operation of the Project) are added to impacts from third party activities e.g. other major projects in the vicinity of the Project which are already occurring, planned or may happen in the foreseeable future).

- Performance Standard suggests that in identifying cumulative impacts, "cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities".

5.18.2 Identification of Relevant Development(s)

The focus of the cumulative impact assessment is on the combination effects of the Project with potential future development in the immediate area around the Project site. Our assessment cumulative impacts regarding the potential project in view, depends on the status of other projects and the level of data available to characterize the magnitude of the impacts.
In view of the paucity of available information regarding such future developments, this assessment follows a generic pattern and focuses on key issues and sensitivities for this project and how these might be influenced by cumulative impacts with a combination of other developments. Consultations with local and state authorities and identification of relevant and significant developments via searches of relevant documents provided invaluable assistant in this assessment. The main developments identified are;

- Cumulative impacts from other projects within 10 km square radius
- Those likely to arise from other transmission line projects

The following proposed and existing projects within 10 km square radius are expected to exert cumulative impacts. They are

- Lafarge Ewekoro Cement Plant Line 1- An operating 2.2 million metric tonnes per annum clinker cement plant
- Lafarge Ewekoro Cement Line 2–An Operating 2.5 million metric tonnes per annum clinker cement plant
- Lafarge 90Mw Dual Fuel (Gas and LPFO) Fired Power Plant
- Lagos-Ibadan Expressway
- Olorunsogo Gas Fired Power Plants Phase I and II (333MW open cycle and 750MW- combined cycle respectively)
- 132kv transmission line – An existing transmission line linking Ota to Abeokuta.
- 330 kv transmission line – An existing transmission line linking Olorunsogo Power Plant
- 132 kv Ikorodu/Shagamu 132 kV 2x D/C Transmission Line- An existing transmission line linking Shagamu – Ikorodu towns
- 330 kv DC Benin (Omotosho) Transmission Line- An existing transmission line linking Egbin Transmission Line
- 330 kv DC Egbin Transmission Line- An existing transmission line linking Egbin Power Plant
- 330 Kv D/C Ikeja West Transmission Line

5.18.3 Cumulative impact

Air Quality, Noise and Vibration levels

Given the findings of impact assessment and distance of the aforementioned sources, it appears unlikely that the cumulative impact on noise and air quality will be significant. Also, the cumulative impact of existing transmission lines on corona effect will be

moderate due to the type of damper used. It should however be noted that this statement is based on professional judgment only.

Electromagnetic Field (EMF)

Cumulative impacts may lead to health impairments which may arise from electromagnetic fields generated as a consequence of the charge on the conductors. Based on Transmission Lines right of way standard, electromagnetic field impact may be low or insignificant due to the avoidance of building directly under high tension along within the study area. However, scientific knowledge about the health effects of EMFs is based on a large number of technological, epidemiological, animal and environmental studies. Many outcomes have been examined, but so far no conclusive evidence or connection has been drawn. This is due to overlooking the combined effects of multiple sources (like mobile phone, television e.t.c) and the difficulty of correlating every effect with its cause, and because many of the effects are exhibited in the long-term surpassing the timescale of the technologies that caused them, and rendering any later investigation out of focus (Zaffanella, 1993).

Traffic

The construction phase will require large amounts of material and equipment to be transported to the Project site. It is expected that on- going developmental projects along Lagos -Ibadan expressway which will place pressure on the local road network especially during the construction phases of the projects.

Given the foregoing, there is increased potential for accidents and disruption to the road traffic network for local users associated with the increase in traffic movements from overlapping construction traffic. It is expected that the traffic management plan to be developed for the project will consider other traffic movements associated with the development of the project in view which will help to mitigate this impact. However, in overall consideration, this impact is considered to be ***moderate*** due to the high likelihood of accidents occurring.

Economy, Employment and Skills

The operation of the various considered projects earlier outlined is proposed to occur simultaneously with the project in view. As such, the economic, employment and skills development opportunities will be greater for all the projects combined than a single project.

It should be noted that expectations regarding economic development, employment and skills development will be high amongst stakeholders in the local community and as such, in the event that one project does not meet expectations, there is the potential for all projects within the area to be the target of this negative outcome.

Based on the above, the cumulative impacts of the various proposed industrial projects on the economy, employment opportunities and skills development within the communities is expected to be ***positive***.

5.19 SUMMARY OF IMPACTS

Tables 5.19.1a and 5.19.1b presents the summary of various activities involved in the project development and the significant impacts associated with each of them on the environment and social.

Table 5.19.1a: Summary of Project Activities and Significance of Potential Impacts during Site Preparation and Construction

Indicator	Potential impact	Receptor	Significance
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx, PM and CO_2 as GHG)	Affected communities in area of influence and region	Minor
	Elevated dusted levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Minor
Noise, vibration & EMF	Nuisance noise and vibration from construction activities	Affected communities in area of influence Construction workers	Moderate
Geology and Soil	Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads) The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi/Dejuwogbo and Redeem (Abule Oba) are poor earthing media.	Soil on Likosi/Dejuwogbo and Redeem (Abule Oba)	Minor
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminium oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Minor
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater	Moderate
	Exploitation of water resources (e.g. casting of foundations) sourced from nearby water bodies through tanks	Local surface water resources	Minor
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Minor
	Loss of vegetation due to clearance activities and introduction of alien species	Flora and fauna within the RoW and Substation	Minor
Aquatic ecology	Construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands.	Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun	Moderate
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the RoW and/or the site for the substation.	People living close to the construction sites.	Minor

Indicator	Potential impact	Receptor	Significance
	Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate
Land Planning and Use	Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. In addition, dealing with community/stakeholder perceptions around cumulative impacts linked to new transmission lines and substations operations. Management of legacy issues on account of environmental pollution from the stakeholder concerns around existing transmission lines.	Affected communities in area of influence like Gaun-un, Likosi/Dejuwogbo/Dejuwogbo, Thames College area	Major
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users	Minor
	Temporary influx of outside workers in the communities, risking tensions between outside (partly possibly expatriate) labour and local population, due to differences in wealth and culture.	Affected communities in area of influence	Minor
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor

Indicator	Potential impact	Receptor	Significance
	Risk of an increase in prevalence of malaria and other mosquito borne diseases in communities due to creation of mosquito breeding areas on site.	Affected communities in area of influence	Minor
	Risk of erosion into streams, which are used as source of domestic water for the communities	Affected communities in area of influence	Minor
	Security risks may threaten all staff working at the construction site and neighbours because of opportunistic people and organized crime.	Construction site and neighbour	Minor
Resettlement	Households living in the RoW need to be relocated and assets in the RoW will be lost	Affected properties and livelihood	Major
Labour and working conditions	Exploitation of workers	Labour force	Minor
	Activities and staff at site may create security risks	All staff working at the construction site	Minor
	Risk of health & safety incidents amongst labour force, including minor incident's such as cuts and major incidents such as loss of life	Construction labour force	Moderate
Employment and economy	Creation of temporary jobs for local's residents and Nigerian nationals with skilled trades	Local residents of affected communities and Nigerian nationals	Positive
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the company	Nigerian companies and local SMEs	Positive
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management and upgrading of existing access roads	Affected communities in area of influence	Minor
Cultural heritage	shrines are located within the RoW along the transmission line and need to be relocated.	Affected communities-	Minor
	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the RoW	Minor

Table 5.19.1b: Summary of Project Activities and Significance of Potential Impacts during Operation and Maintenance

Indicator	Potential impact	Receptor	Significance
Air quality	Exposure to emissions from operational vehicles but very limited and other activities	Workers on site, communities in area of influence	Minor
	GHG: Fugitive emission from line maintenance and Transmission Lines. Also, accidental significant leaks from aging equipment, and gas losses occur during equipment maintenance and servicing	RoW, Likosi/Dejuwogbo, Redeem (Abule Oba) and MFM (Makogi) Substations	Moderate
Noise, vibration & EMF	Noise from overhead line due to Corona effect (Humming effect) and EMF effect	Affected communities along the RoW	Minor
Geology and Soils	Potential contamination of soil from inadvertent release of hazardous or contaminating material	Soil along RoW and substations	Minor
Water resources	The impact on the surface water shall be very low due to the usage of standardized operating procedures	Local groundwater	Minor
Terrestrial ecology	Avian collision	Birds in the area of influence	Minor
	Loss of vegetation due to routine clearance of vegetation as well as fauna	Flora and fauna within the RoW and substation	Minor
Aquatic ecology	Loss of woody species, comprising trees and shrubs, as they can grow taller above 4m	Flora within the RoW and substation	Minor
Visual amenities	Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. Cumulative with the other power lines this may result in a loss of the visual amenity.	Likosi/Dejuwogbo, MFM (Makogi) Shimawa axis communities near RoW	Moderate
Land planning and use	Stablisation of electricity will lead to increase in land use and pressure on natural environmental area	Substation areas e.g Redeem (Abule Oba) & MFM (Makogi)	Major
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with operation phase issues (like air and dust emissions, traffic, and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. Dealing with community/stakeholder perceptions around cumulative impacts linked to the new plant and existing cement plant operations. Disappointment about electricity supplied to national grid, while locally electricity supply has reduced reliability	Affected communities in the area of influence	Major

Indicator	Potential impact	Receptor	Significance
Community Health, Safety and Security	External safety risks of electrocutions, bush fires, line snapping, tower collapses	Affected communities along the RoW	Minor
Labour and working conditions	Exploitation of workers	Labour force for maintenance work	Minor
	Occupational H&S risks in operation and maintenance	Labour force	Moderate
Employment and Economy	Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Nigeria	Positive
Cultural heritage	Potential interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities in the RoW	Minor

CHAPTER SIX

MITIGATION MEASURE

6.1 INTRODUCTION

As presented in Chapter 5, the proposed Lagos and Ogun Transmission Lines and Associated Substations Project has the potential to impact the various components of the biophysical, health and social environment of the project area. The identified negative impacts have been ranked variously as low, medium and high. To preserve the environment, a number of steps have been taken to mitigate the significant, high and medium ranking negative impacts, as well as enhance those impacts identified as positive. The mitigation measures proffered for the predicted impacts of the proposed project activities took cognizance of the following:

- Environmental laws in Nigeria, with emphasis on permissible limits for waste streams (FMEnv (formerly FEPA), 1991);
- Best available Technology for sustainable Development;
- Feasibility of application of the proposed mitigation measures in Nigeria;
- View some concerns of stakeholders as expressed during extensive consultations carried out during the study.

The residual effects that may remain after the application of the impact mitigation measures have also been discussed for further reduction of residual impacts to as low level as possible.

6.2 METHODOLOGY

Definition of mitigation measures

Mitigation measures are developed to avoid, reduce, remedy or compensate for any negative impacts identified, and to create or enhance positive impacts such as environmental and social benefits. In this context, the term "mitigation measures" includes operational controls as well as management actions. These measures are often established through industry standards and may include:

- changes to the design of the project during the design process (eg changing the development approach);
- engineering controls and other physical measures applied (eg waste water treatment facilities);
- operational plans and procedures (eg waste management plans); and
- the provision of like-for-like replacement, restoration or compensation.

For impacts that are assessed to be of **Major** significance, a change in design is usually required to avoid or reduce these. For impacts assessed to be of **Moderate** significance, specific mitigation measures such as engineering controls are usually required to reduce these impacts to ALARP levels. This approach takes into account the technical and financial feasibility of mitigation measures. Impacts assessed to be of **Minor** significance are usually managed through good industry practice, operational plans and procedures.

In developing mitigation measures, the first focus is on measures that will prevent or minimise impacts through the design and management of the Project rather than on reinstatement and compensation measures.

Assessing residual impacts

Impact prediction takes into account any mitigation, control and operational management measures that are part of the project design and project plan. A residual impact is the impact that is predicted to remain once mitigation measures have been designed into the intended activity. The residual impacts are described in terms of their significance in accordance with the categories identified in Box 5-2 of Chapter 5.

Social, economic and biophysical impacts are inherently and inextricably interconnected. Change in any of these domains will lead to changes in the other domains. This section looks at how the local way of life might change as a result of the proposed Project Potential changes to local culture, livelihoods, health and well-being, personal and communal property rights are examined.

6.3 AIR QUALITY

Construction Phase

Air pollutant emission

Regarding impacts of emissions from vehicles and equipment engines the following mitigation measures are recommended:

- Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations;
- Stationary generators shall be well located to facilitate emission plume dispersion;
- Cover properly loose materials and keep top layers moist;
- Use binder material for erosion and dust control for long term exposed surfaces;
- Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt;
- Spray surfaces prior to excavation;
- Use covered trucks for the transportation of materials that release dust emissions; and
- Speed limits on-site of 15kph on unhardened roads and surfaces.

With the implementation of the above measures the residual air quality impacts can be expected to be ***minor***.

Green House Gas Emission

In consideration of the Climate Change under the construction phase, the impact of vegetation clearing, resulting to reduction of carbon sink ability of the environment and the use of equipment and vehicles during the construction resulting to the release of GHG gases shall be mitigated through the use of good international practice, including maintaining and operating all vehicles and equipment engines in accordance with manufacturers recommendations, location of stationary generators to facilitate dispersion, restriction of vegetation clearing to only the required area and the use of experienced drivers and fuel efficient equipment, vehicles and machineries during construction activities. Even the implementation of above mitigation measure, GHG emission cannot be avoided. Therefore, the impact on climate change is considered to be kept as ***minor***.

Operation Phase

For Climate Change, the impact of SF_6 shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques.

Since impact is considered **minor**, the best practices measures have been identified to mitigate the impact to the minimum level.

6.4 NOISE, VIBRATION AND EMF

Construction Phase

The following recommendations for mitigation measures are outlined below:

- Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings;
- Select 'low noise' equipment or methods of work;
- Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources);
- Avoid dropping materials from height, where practicable;
- Avoid metal-to-metal contact on equipment;
- Maintain and operate all vehicles and equipment in accordance with manufacturers recommendations;
- Avoid mobile plant clustering near residences and other sensitive land uses;
- Ensure periods of respite are provided in the case of unavoidable maximum noise level events;
- Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the TCN Community Relation Officer;
- Noisy activities (activities that can be heard in nearby communities) restricted to day-time working hours.

With the implementation of the above measures the residual noise and vibration impacts can be expected to be ***minor***.

Operation Phase

The minor impact of noise emissions during operation can be reduced by choosing good conductors/damper for design and construction to minimise corona effects and avoid overloading of transmission lines because of EMF effect. Also, installation of mesh at strategic areas will reduce EMF effect to the minimal level. In addition, RoW will be secured where no residential structure is allowed to be built. However, the noise emission cannot be completely blocked. Therefore, the residual impact will be ***minor***.

6.5 GEOLOGY AND SOIL

Construction Phase

Impact on geology and soil structure

The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi/Dejuwogbo and Redeem (Abule Oba) are poor earthing media. The subsoil conductivity may need to be artificially enhanced to ensure proper earthing of high voltage substations. Where the subsoil resistivity is < 180 ohm-m, there is the tendency for buried metallic structures contained in the foundation base of transmission line tower to be corroded over a significantly long period of time. Such metallic structures should be protected against corrosion. Also, where the subsoil is clayey and incompetent, transmission line tower foundation should be anchored on friction piles to prevent settlement.

The following mitigation measures to reduce impacts on soil structure from compaction and erosion are recommended:

- Construction of foundations to be undertaken in the dry season;
- Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers;
- Protect excavated soil materials from erosion;
- Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season; and
- Use of existing track for transport of man and material to the extent possible;

Potential soil contamination

With regards to soil contamination impacts, the following measures will be implemented:

- Implement effective site drainage on the construction camp to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas;
- Install oil/water separators and silt traps before effluent, leaves the site;
- Minimise bare ground and stockpiles to avoid silt runoff;
- Bounding of areas where hazardous substances are stored (eg fuel, waste areas);
- Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains;

- Regular checking and maintenance of all generator and equipment to minimize the risk of fuel or lubricant leakages;
- Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques;
- Set-up and apply procedure regarding dealing with contaminated soils;
- Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed of correctly; and
- Spread sheet underneath the tower structure prior to start any painting activity.

With the implementation of the above measures the residual soil and geology quality impacts can be expected to be ***minor***.

Operation Phase

Since impact is considered to be kept as ***minor***, no additional measures have been identified.

6.6 WATER RESOURCES

Construction Phase

Impact on Hydrogeology
The construction activities, such as construction of access road and tower would potentially disturb the hydrogeology of the swampy area. The residual impact is considered to be ***minor***.

Potential contamination on water resource
Same as in section 6.5 for on the prevention of spills and leakage of hazardous substances to surface and ground water. The residual impacts on surface and groundwater can be expected to be ***minor***.

Operation Phase

Since impact is considered ***minor***, no additional measures have been identified because best practices and guidelines shall be used for all operation.

6.7 TERRESTRIAL ECOLOGY

Construction Phase

Impact on Terrestrial flora and Fauna
The following recommendations for mitigation measures are outlined below:

- Limit lightening on site;
- Sensitivity training to staff and anti-poaching policy; and
- Site clearance activities to be restricted to the minimum required area.

The residual impacts on terrestrial ecology can be expected to be ***minor***.

Impact due to the introduction of alien species

Vegetation clearing for the construction of the power line and access roads will cause habitat disturbances that could create suitable conditions for the establishment of invasive species. The spread of invasive species can have negative impacts on local species, by modifying plan community composition. Alien invasive species have the potential to substantially modify wildlife habitat which can impact associated fauna populations. In this study area, the residual impact is being kept as ***minor***.

Operation Phase

Impact on Ecosystem Service

Many use-value species, such as *laeis guineensis*, *Mangifera indica, Cola nitida*, *Chysophyllum albidum*, *Psidium guajava*, *Moringa oleifera*, *Cocos nucifera* and *Carica papaya* will need to be cleared, reducing their availability for local communities, especially at Oke Ate/Oniyan community areas. Moreover, creation of access roads may expose forest areas to increased human activities. This may have impacts on existing flora and fauna that may be of use to the local communities. The residual impacts on ecosystem service can be expected to be ***minor*** due to the clearing of habitat during Transmission Line maintenance.

6.8 AQUATIC ECOLOGY

Construction Phase

As in section 5.8.1, impact on aquatic and semi-aquatic habitats will be limited in areas where there will be direct construction of pylons and substations [*i.e. tower foundation*]. The residual impacts will be ***minor***.

Operation Phase

During the operation phase, maintenance of the RoW requires regular clearing of vegetation in order to reduce short-circuit risks caused by electric arcing. This means no vegetation will be allowed to grow above 4 m and 4m wide within the RoW. In this case, the most affected forms of flora will surely be woody species, comprising trees and shrubs, as they can grow taller. Therefore, the residual impact will be considered as ***minor***.

6.9 VISUAL AMENITIES

Construction Phase

The minor impact of the change in visual amenities can be reduced by maintaining the construction site in orderly condition and do not distribute material over many sites before usage. Following mitigation measure will be implemented.

- Provision of education to construction workers for waste management
- Construction waste will be appropriated managed at the site and disposed by licensed company

.

Applying above mitigation measure and challenges of tower erection, the residual impact will be ***minor***.

Operation Phase

To reduce the permanent impact on the visual amenities of the landscape it is advised that smaller trees and vegetation can be kept, so that there is still green scenery present. The towers have quite an open structure which will not hampering the view very much. However, since the presence of transmission tower and line change the landscape in the area, especially forest area, the residual impact is considered ***moderate*****.**

6.10 LAND PLANNING AND USE

Construction Phase

Agricultural activities will be affected during the work because of the restriction of farming within the wayleave. The total land take is 353.46 ha consisting 55.32 ha for the 3 substations and 298.15 ha for the line. Over a thousand families will loose certain portions of their crop land Loss of land and crops will have to be compensated before the beginning of the construction. This aspect is detailed in the RAP and the residual impact is considered to be ***moderate*** because it has to do with means of livelihood.

Operational Phase

The stabilization of the electricity would mainly contribute to improve the condition of existing development area and pressure will be on natural environmental area (forest, swampy area) as the land acquisition is considered to be difficult. Government shall regulate the acquisition of land in the study area due to rapid acquisition of Estate/Developer. This will make cost of land to increase drastically. However, the residual impact on land planning and use is m***oderate***.

6.11 STAKEHOLDER AND COMMUNITY EXPECTATION/RELATIONS MANAGEMENT

Construction Phase

The concerns of the close-by communities of cumulative effects of environmental and safety/security impacts and inconveniences of the transmission lines in combination with the existing activities within 5km radius of the project site will need serious attention.

By implementing a package of mitigation and enhancement measures, the concerns can be reduced to a manageable level for the majority of the community members. However, there may be vulnerable people, who need special attention to reduce the effects to an acceptable level.

The following package of measures should be taken:

- Follow mitigation for construction phase air quality, noise and traffic;
- Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting;
- Set-up, manage and effectively manage construction phase grievance mechanism system. Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in the ESMP;
- Engage communities in the monitoring activities to enhance transparency and involvement.
- Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Coordinate Stakeholder Engagement of all partners of industrial site, implement; and
- Ongoing reporting to stakeholders on the overall environmental performance of the plant and the steps taken to mitigate any adverse environmental impacts.

With a proper, continuous and serious implementation of the above-mentioned measures the experience of cumulative impacts can be reduced to ***moderate*** level.

Operation Phase

In the operation phase the same package of mitigation and enhancement measures should be continued from the construction phase as described above. This package, when implemented rigorously, continuously and with participation of the affected communities, can support the project in bringing the community impact to a **minor** to **moderate** level. However, potentially certain community members may not be satisfied with the mitigation and enhancement measures and may still provide resistance, also to negotiate better benefit sharing mechanisms.

The follow measures apply in the operation phase:

- Follow mitigation for operation phase air quality, noise and traffic;
- Inform communities about details of operation activities ;
- Set-up, manage and manage grievance mechanism ;
- Sharing of independent monitoring reports of all monitoring actions as mentioned in this ESMP;
- Engage communities in the monitoring activities to enhance transparency and involvement;
- Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities.
- Explain effects of electromagnetic fields to communities to limit concerns. Keep fields within limits of International Commission on Non-Ionizing Radiation Protection (ICNIRP); and
- Interference with radio/TC transmission during rain needs to be explained to the communities.

6.12 COMMUNITY HEALTH, SAFETY AND SECURITY

Construction Phase

To reduce the potential adverse impacts and risks of the construction works on the community health, safety and security, the following mitigation measures should be implemented.

To reduce traffic accident risks the Contractor should implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. If this plan is thoroughly implemented, this residual risk can be ***minor***.

A Local Content Plan should be prepared to facilitate involvement of local labour as much as possible. The implementation of the plan will enhance ability to locate local hires and Nigerian nationals. This plan should include provisions for hiring women and for “equal pay for work of equal value”. A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants. Further a code of behaviours for workers should be developed, which should be trained and periodically refreshed, as needed based on community liaison/grievance mechanism feedback. This will help in reducing the potential for frictions between outside labour and local community members to a ***minor*** level.

To reduce the risk of an increase in STD prevalence, awareness raising material and condoms should be provided to all workers. Herewith the risk can be mitigated to a ***minor*** level.

The construction site should be managed to eliminate potential mosquito breeding sites. This includes the prevention of surface water ponding and an avoidance of outside storage of tires. For unavoidable ponding monitor for mosquito larvae and treat with a US-EPA (or similar) approved mosquito larvicide as needed. These measures can bring this risk to a ***minor*** level.

With the construction activities, valuable materials and equipment and the presence of a labour force come to the construction site. Opportunistic people (possibly local youth) or organised crime may be tempted to steal materials from the site, to raid construction workers or force to obtain some benefits from the Project in another way. These security risks may threaten all staff working at the construction site and neighbours. Since security guards on site and security forces in the area are in place from the Government, the residual impact is to be kept as ***minor***

Operation Phase

To reduce the external safety risks for the people living close to the operational transmission line the following measures should be implemented by TCN, as operator of the lines:

- To prevent as much as possible emergencies and to manage the response to emergencies when they occur in the operation phase of the Project an emergency response plan should be developed and implemented following TCN’s standards and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines and collapsed towers, roles and responsibilities and emergency response. This plan should be coordinated with TCN and the Local Government;
- Annually a safety audit of substations transmission lines, towers and RoW should be performed to identify potential safety risks in an early stage and keep maintenance at high standards, so that snapping of lines or collapsing of towers is prevented as much as possible; and
- The affected communities in the area of influence of the transmission lines should be informed about the safety risks related to the high voltage electricity, the do’s and don’ts in the RoW and the response measures in place, when an incident happens (from the emergency response plan). Sign boards will be placed on the towers to warn about the electrocution risk.

With the serious implementation of the above measures the residual safety risks can be expected to be reduced to a ***minor*** level.

6.13 RESETTLEMENT

A separate resettlement framework has been prepared, describing the land take, resettlement process, compensation eligibility, way forward, grievance mechanism and foreseen monitoring. For the affected households, which need to be physically resettled micro-plans will be developed to secure their livelihood, legal rights and proper compensation.

The owners of the assets in the RoW will receive compensation for their lost assets. These affected people experience economic impacts by losing their cropping plots, valuable trees, (unfinished) structures and various kinds of businesses. However, in majority these people are not highly dependent on these assets for their livelihood. Compensation of the value of these assets will off-set these economic impacts.

The seven businesses, located in the RoW, will need to set-up new premises outside of the RoW. Here the businesses will be compensated by a fixed economic rehabilitation grant.

The shrines located in the RoW will be relocated just outside the RoW in consultation with the affected communities through compensation process.

If the plan is properly implemented the impacts of the physical resettlement of households and the economic impact of the owners of assets in the RoW can be managed to an acceptable ***minor*** level (see RAP report).

6.14 LABOUR AND WORKING CONDITIONS

Construction Phase

To prevent the exploitation of the workforce, the Contractor should comply with the provisions in the Labour Act of Nigeria and the international ILO conventions. The following items apply specifically for this Project:

- Develop transparent human resources policies and procedures for recruitment process, working conditions, terms of employment wages, worker-employer relations, non-discrimination policy, monitoring, roles and responsibilities;
- Provide reasonable, and if applicable negotiated, working terms and conditions;
- Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way;
- No use of child labour (workers under age 18) or forced labour is allowed;
- Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required;
- Provide proper work place facilities for water/sanitation/rest rooms;
- If case of retrenchment needs first viable alternatives are analysed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared;
- No hiring of short-term labour to be made at the site gate; and
- A worker’s grievance mechanism will be in place.

If indeed the Contractor implements their human resources procedures in line with the Nigerian Labour Act and ILO Conventions and his held by these through their construction contract, the risk of exploitation of the labour force can be kept to a ***minor*** level.

Security risks can be mitigated by preparing and implementing a security and emergency response plan in close cooperation with security and local security forces. If security measures are well implemented these risks can be reduced to a ***minor*** level.

To prevent and respond effectively to occupational health & safety incidents a project specific health and safety procedures needs to be developed and implemented, based on TCN's HSE guidelines, including provisions for training and certifications to be followed by all workers including subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention. Consult with local health facilities to be prepared in case of incidents that need medical help.

To prevent and manage occupational health & safety risks the following measures need to be implemented:

- ensure proper design, construction and installation of towers and associated facilities;
- train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record;
- special focus on slip-trip, fall from height and electrocution in maintenance and repair works;
- audit management of electrocution incidents;
- emergency prevention and management;
- provide and maintain first aid facilities at all places where electrocution risks exist and train staff to use these; and
- provide and use personal protection equipment.

When all measures mentioned above are well implemented, the risk of occupational health & safety incidents can be kept to an acceptable level, to a ***minor*** level. However, these incidents cannot be prevented at all times.

Operation Phase

The same mitigation measures apply for the operation as for the construction phase to reduce the risks of labour force exploitation, to a ***minor*** level and the risks of occupational health & safety, to a ***minor*** level. However, TCN is the responsible organisation for the implementation of these measures, following their TCN procedures for the management of these risks.

The following main items apply to reduce risks of labour exploitation to an acceptable level:

- Follow human resources policies and procedures of TCN, following Nigerian Labour Law and ILO conventions;
- Provide reasonable, and if applicable negotiated, working terms and conditions;
- Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way;
- No use of child labour (workers under age 18) or forced labour;
- Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required; and

- A worker’s grievance mechanism will be in place.

TCN should follow their Occupational HSE plan following Nigerian and international requirements:

- train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record;
- special focus on slip-trip, fall from height and electrocution in maintenance and repair works;
- audit management of electrocution incidents;
- emergency prevention and management;
- provide and maintain first aid facilities at all places where electrocution risks exist and train staff to use these; and
- provide and use personal protection equipment.

6.15 EMPLOYMENT AND ECONOMY

Construction Phase

To enhance the ***positive*** impact of employment opportunities for local residents a local content plan needs to be prepared to enhance the ability to locate local hires and Nigerian nationals. This plan should include provisions for hiring women and youth and for “equal pay for work of equal value”. A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.

To enhance the positive impact of opportunities for local businesses and entrepreneurs the local content plan should also facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. This plan should include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.

Operation Phase

The ***positive*** impact of an important contribution to the national grid, enhancing socio-economic development in the country, can only be reached when the transmission lines are kept in good order ensuring reliable electricity supply, without power cuts and at a stable frequency and voltage.

6.16 INFRASTRUCTURE

Construction Phase

In the preparation and execution of the construction works the Contractor (together TCN) should coordinate with medical posts and emergency services about the potential of an increase demand of these services. Preparedness can be raised for temporary water supply to the communities, additional waste management and an increase in demand for medical services.

Proper and independent facilities for water supply, sanitation, solid and liquid waste need to be installed at the construction site, so that pressure on community infrastructure in limited. Also, there is no need to construct new access road along Lot 2 proposed Transmission Lines and substations. Therefore, the residual impact is ***minor***.

Operation Phase

In the operation phase this impact is not applicable.

6.17 CULTURAL HERITAGE

Construction Phase

The shrines, that are now present in the RoW, will be relocated to a location outside the RoW and agreed with the local communities through compensation process, where the worshippers can continue to use them. The exact location and ceremony for relocation will be managed by the communities. The residual impact will be ***minor***.

When the timing of construction activities is coordinated with the local cultural festivals, the potential of undesired interaction can be avoided, making this impact ***minor***.

Operation Phase

Also, in the operation phase the timing of maintenance activities should be coordinated with the Communities to avoid interference between maintenance and the festivals. The residual impact is ***minor.***

6.18 SUMMARY OF MITIGATION MEASURES

Tables 6.18.1a and 6.18.1b presents the summary of mitigation measures on various activities involved in the project development and the significant impacts associated with each of them on the environment and social.

Table 6.18.1a: Summary of Mitigation Measures on Project Activities and Significance of Potential Impacts during Site Preparation and Construction

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx, PM and CO_2 as GHG)	Affected communities in area of influence and region	Minor	Use good international practice: • Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations • Stationary generators to be located to facilitate dispersion	Minor
	Elevated dusted levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence	Minor	Use good international practice: • Cover properly loose materials and keep top layers moist • Use binder material for erosion and dust control for long term exposed surfaces • Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt • Spray surfaces prior to excavation • Use covered trucks for the transportation of materials that release dust emissions • Speed limits on-site of 15kph on unhardened roads and surfaces	Minor
Noise, vibration & EMF	Nuisance noise from construction activities	Affected communities in area of influence Construction workers	Moderate	Use good international practice: • Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings • Select 'low noise' equipment or methods of work • Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources). • Avoid dropping materials from height, where practicable • Avoid metal-to-metal contact on equipment • Maintain and operate all vehicles and equipment's in accordance with manufacturers recommendations • Avoid mobile plant clustering near residences and other sensitive land uses • Ensure periods of respite are provided in the case of unavoidable maximum noise level events • Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the CLO. • Noisy activities (activities that can be heard in nearby communities) restricted to day-time working hours	Minor
Geology and Soil	-Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of	Soil on construction site	Minor	• Construction of foundations to be undertaken in the dry season. • Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. • Protect excavated soil materials	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	vegetation (at the tower foundation pits and possibly parts of the access roads)			from erosion. • Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. • Use of existing track for transport of man and material to the extent possible.	
	-The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi/Dejuwogbo and Redeem (Abule Oba) are poor earthing media.	Soil on Likosi/Dejuwogbo and Redeem (Abule Oba) Substation		• The subsoil conductivity may need to be artificially enhanced to ensure proper earthing of high voltage substations. The metallic structures should be protected against corrosion. Also, where the subsoil is clayey and incompetent, transmission line tower foundation should be anchored on friction piles to prevent settlement.	
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminium oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Minor	Use good international practice: • Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. • Install oil/water separators and silt traps before effluent, leaves the site. • Minimise bare ground and stockpiles to avoid silt runoff. • Bunding of areas where hazardous substances are stored (eg fuel, waste areas). • Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains. • Regular checking and maintenance of all generator and equipment to minimize the risk of fuel or lubricant leakages. • Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques. • Set-up and apply procedure regarding dealing with contaminated soils. • Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed of correctly. • Spread sheet underneath the tower structure prior to start any painting activity.	Minor
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater-well and bore hole	Moderate	See above measures to mitigate ‘Potential contamination of soil’ impact	Minor

Indicator	**Potential impact**	**Receptor**	**Significance (pre-mitigation)**	**Mitigation or enhancement measures**	**Significance (post-mitigation)**
	Exploitation of water resources (e.g. casting of foundations) sourced from nearby water bodies through tanks	Ogun River, River Wagunu, Streams	Minor	Regular inspection/checks to minimize the impacts on the waterbodies	Minor
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Minor	• See above measures on air quality, noise and vibration, soils and water resources. • Limit lightening on site. • Sensitivity training to staff and anti-poaching policy.	Minor
	Loss of vegetation due to clearance activities	Flora and fauna within the ROW and Substation	Minor	• Site clearance activities to be restricted to the minimum required area.	Minor
Aquatic ecology	Construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands.	Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun	Moderate	TCN shall maintain acquire RoW for clearing and upgrade existing roads	Minor
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the RoW and/or the site for the substation.	People living close to the construction sites.	Minor	Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor
	Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate	Registered Ogun State Ministry of Environment waste contractor shall be engaged to dispose domestic waste and construction waste	Minor
Land Planning and Use	Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major	• Site clearance activities to be restricted to the minimum required area. • Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas • RAP process will mitigate the impact to the minimum level	Moderate
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc)	Affected communities in area of influence	Major	Follow mitigation for construction phase air quality, noise and traffic. Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting Set-up and effectively monitor construction grievance mechanism	Moderate

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	and adverse impact/inconveniences resulting from it. In addition dealing with community/ stakeholder perceptions around cumulative impacts linked to existing transmission lines and substations operations. Management of legacy issues on account of environmental pollution from stakeholder concerns around existing transmission lines.			Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP. Engage communities in the monitoring activities to enhance transparency and involvement. Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Ongoing reporting to stakeholders on the overall environmental performance of the systems and the steps taken to mitigate any adverse environmental impacts.	
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users	Minor	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.	Minor
	Temporary influx of outside workers in the communities, risking tensions between outside (partly possibly expatriate) labour and local population, due to differences in wealth and culture.	Affected communities in area of influence	Minor	A Local Content Plan should be prepared to facilitate involvement of local labour. See HR policies and procedures below. No hiring of short-term labour to be made at the site gate. Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour. Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Minor
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor	Provide STD awareness material to all workers. Provide condoms to workers.	Minor
	Risk of an increase in prevalence of malaria and other mosquito borne diseases in communities due to creation of mosquito breeding areas on site.	Affected communities in area of influence	Minor	Manage site to eliminate potential mosquito breeding sites including – eliminate surface water ponding and no outside storage of tires. For unavoidable ponding monitor for mosquito larvae and treat with a US-EPA (or similar) approved mosquito larvicide.	Minor
	Risk of erosion into creeks, which are used as source of domestic water for the communities	Affected communities in area of influence	Minor	Erosion prevention measures especially in locations close to creeks and cropped fields by keep construction sites flat, clearing lose soil from the site and covering with geo-textile if needed.	Minor
Resettlement	Households living in the RoW need to be relocated and assets	Affected properties and livelihood	Major	Follow principles and procedures of Resettlement Action Plan (RAP) Report prepared for the proposed	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	in the RoW will be lost			project, including way forward, micro-plans per affected household.	
Labour and working conditions	Exploitation of workers	Labour force	Minor	• Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • Provide proper work place facilities for water/sanitation/rest rooms. • If case of retrenchment needs first viable alternatives are analysed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. • A worker's grievance mechanism will be in place.	Minor
	Activities and staff at site may create security risks	All staff working at the construction site	Minor	Make security plan and emergency response and contacts with security forces.	Minor
	Risk of health & safety incidents amongst labour force, including minor incident's such as cuts and major incidents such as loss of life	Construction labour force	Moderate	Develop project specific health and safety procedures based on TCN standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Local residents of affected communities and Nigerian nationals	Positive	Prepare a local content plan to enhance ability to locate local hires and Nigerian nationals. Include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the company	Nigerian companies and local SMEs	Positive	Prepare a local content plan to facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to	Positive

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				prepare for upcoming opportunities.	
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Minor	Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. Upgrading of existing access roads.	Minor
Cultural heritage	shrines are located within the RoW along the transmission line and need to be relocated.	Affected communities-	Minor	The shrines will be relocated to outside the RoW, where the local communities will continue to use them. The exact location and ceremony for relocation will be managed by the communities	Minor
	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the RoW	Minor	Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor

Table 6.18.1b: Summary of Mitigation Measures on Project Activities and Significance of Potential Impacts during Operation and Maintenance

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Exposure to emissions from operational vehicles but very limited and other activities	Workers on site, communities in area of influence	Minor	Best practices will mitigate the impact to the minimum level	Minor
	GHG: Fugitive emission from line maintenance and Transmission Lines. Also, accidental significant leaks from aging equipment, and gas losses occur during equipment maintenance and servicing	RoW, Likosi/Dejuwo gbo, Redeem (Abule Oba) and MFM (Makogi) Substations	Moderate	Impact of SF_6 shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques.	Minor
Noise, vibration & EMF	Noise & EMF from overhead line due to Corona effect and EMF effect	Affected communities along the RoW	Minor	• Noise generation is unavoidable. • Use of conductors conforming to IS standard to minimize corona effect during rainy weather conditions • Avoiding over loading Transmission Lines	Minor

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				• Installation of mesh at strategic places	
Geology and Soils	Potential contamination of soil from inadvertent release of hazardous or contaminating material	Soil along RoW of TL and Substation	Minor	Best practices and guidelines shall be used for all operation.	Minor
Water resources	No impact on the surface water and hydrogeology of the area is anticipated	Local groundwater	Minor	Best practices and guidelines shall be used for all operation.	Minor
Terrestrial ecology	Avian collision	Birds in the area of influence	Minor	Visibility of Double circuit will not allow the birds to collide with power line	Minor
	Loss of vegetation due to routine clearance of vegetation	Flora and fauna within the RoW	Minor	Maximum of 7.5m wide within centre line of RoW shall be maintained for Transmission Lines maintenance	Minor
Aquatic ecology	Loss of woody species, comprising trees and shrubs, as they can grow taller above 4m	Flora within the RoW and substation	Minor	As in Terrestrial ecology	
Visual amenities	Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. Cumulative with the other Transmission lines this may result in a loss of the visual amenity.	Likosi/Dejuwogbo, MFM (Makogi) Shimawa axis communities near RoW	Minor	• The RoW does not affect forests or valuable landscapes. Vegetation will be felled, but if possible smaller trees can be kept. • Towers have an open structure, not hampering the view very much.	Moderate
Land planning and use	Stablisation of electricity will lead to increase in land use and pressure on natural environmental area	Substation areas e.g Redeem (Abule Oba) & MFM (Makogi)	Major	Government shall regulate the acquisition of land in the study area	Minor
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with operation phase issues (like air and dust emissions, traffic, and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. Dealing with community/stakeholder perceptions around cumulative impacts linked to the existing cement plant operations within the study area.	Affected communities in the area of influence	Major	Follow mitigation for operation phase air quality, noise and traffic. Inform communities about details of operation activities Set-up, manage and manage grievance mechanism Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP. Engage communities in the monitoring activities to enhance transparency and involvement. Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Explain effects of electromagnetic fields to communities to limit concerns. Keep fields within limits of International Commission on	Moderate

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Disappointment about electricity supplied to national grid, while locally electricity supply has reduced reliability			Non-Ionizing Radiation Protection (ICNIRP). Interference with radio/TC transmission during rain needs to be explained to the communities	
Community Health, Safety and Security	External safety risks of electrocutions, bush fires, line snapping, tower collapses	Affected communities along the RoW	Moderate	Develop an emergency response plan following TCN and international best practice including provisions for prevention and response to electrocution, bush fires, repair of snapped lines and collapsed towers, roles and responsibilities. Coordinate with emergency services of LGAs Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures. Communicate to communities in RoW the safety risks of the transmission lines and provide response measures. Put sign boards on towers about electrocution risk.	Minor
Labour and working conditions	Exploitation of workers	Labour force for maintenance work	Minor	• Follow human resources policies and procedures of TCN, following Nigerian Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • A worker’s grievance mechanism will be in place.	Minor
	Occupational H&S risks in operation and maintenance	Labour force	Moderate	TCN should follow their Occupational HSE plan following Nigerian and international requirements: train staff, monitor and keep record. Special focus on slip-trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. Use personal protection equipment. Have medical emergency equipment at hand.	Minor
Employment and Economy	Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Nigeria	Positive	Regular maintenance of the project to ensure reliable production of power	Positive

Indicator	**Potential impact**	**Receptor**	**Significance (pre-mitigation)**	**Mitigation or enhancement measures**	**Significance (post-mitigation)**
Cultural heritage	Potential interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities in the RoW	Minor	Consult with local communities on festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	Minor

CHAPTER SEVEN
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1 INTRODUCTION

This chapter provides the ESMP for the Lagos and Ogun Transmission Lines and Associated Substations Project. Elements of this plan will be taken forward and incorporated into a comprehensive project Environmental and Social Management System (ESMS) that will be used to deliver the Project's HSE regulatory compliance objectives and other related commitments.

This ESMP is a delivery mechanism for environmental and social mitigation and enhancement measures made in the ESIA Report. The purpose of the ESMP is to ensure that these recommendations are translated into practical management actions which can be adequately resourced and integrated into the Project phases. The ESMP is, therefore, a management tool used to ensure that undue or reasonably avoidable adverse impacts of construction and operation are prevented or reduced and that the positive benefits of the Projects are enhanced (Lochner, 2005).

The ESMP has been developed to meet international standards on environmental and social management performance, specifically those set out by the World Bank, IFC and JICA Guidelines. The ESMP is intended to cover those activities described in Chapter 3 of this EIA report. It covers project activities during construction and operation and will be subject to thorough reviews prior to the commencement of activities to ensure completeness. The ESMP does not include measures for activities related to equipment and facility fabrication being done offsite. It should be noted that this provides the outline requirements for environmental management. Provision will be made for updating the outline ESMP once the detailed project design is complete and for adapting the ESMP to relevant project stages as part of the overall ESMS.

The plan details the mitigation and enhancement measures TCN have committed to implement through the life of the Project and includes desired outcomes; performance indicators; targets or acceptance criteria; monitoring and timing for actions and responsibilities. TCN will have principal responsibility for all measures outlined in the ESMP for the construction phase. TCN is responsible for the implementation of the measures in the operation phase. Both may delegate responsibility to its contractors, where appropriate. In cases where other individuals or organisations have responsibility for mitigation or enhancement measures, this is clearly indicated in Tables 7.2a and 7.2b. Capacity building and training requirements are also described, where these relate to specific skills required to deliver the ESMP action in question.

7.2 OBJECTIVES OF ESMP

The ESMP is essential for successfully implementing the Project's social and environmental performance throughout the life of the Project. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision making and day-to-day operations. It establishes a framework for tracking, evaluating and

communicating environmental and social performance and helps ensure that environmental and social risks and liabilities are identified, minimised and managed. The ESMP will be a living document and will continue to develop during the design and construction phase to enable continuous improvement of the Project's social and environmental performance.
In particular, the objectives of the ESMP are to:

- promote environmental and social management and communicate the aims and goals of the ESMP;
- ensure that all workers, subcontractors and others involved in the Project meet legal and other requirements with regard to environmental and social management;
- incorporate environmental and social management into project design and operating procedures;
- address concerns and issues raised in the ESIA's stakeholder consultation process and those that will 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 (ie mitigation measures identified in the ESIA); and
- prepare and maintain records of project environmental and social performance (ie monitoring, audits and non-compliance tracking).

7.3 ORGANISATION

Roles and responsibilities

TCN is committed to provide resources essential to the implementation and control of the ESMP in the construction phase of Substations and the Transmission Lines Project. The major roles and responsibilities of TCN is provided in Table 7.3.1 below.

Resources include the appropriate human resources and specialised skills. TCN will have dedicated personnel competent on the basis of appropriate education, training, and experience that will manage and oversee the HSE aspects of Project construction and operation.

Table7.3.1: Roles and Responsibilities

Project Manager	Oversee and coordinate all activities pertaining to the project and responsible for safety during the construction phase.
General Manager	Manage all technical operations pertaining to the project and responsible for safety during the operations phase.
HSE Manager	Ensure that TCN operates in accordance with its HSE plans and assists line management in performing their line duties.
Facilities/Site Engineer	Monitor, report and ensure the efficient working conditions of all facilities on site
Community/ Regulatory Liaison Officer	Liaise with the host communities and regulators on TCN 's behalf
Federal Ministry of Environment	Ensure that environmental recommendations in the ESIA to mitigate against construction impacts are implemented
Ogun State Ministry of Environment	Ensure that environmental recommendations in the ESIA to mitigate against construction impacts are implemented

The management and regulatory responsibilities on a project of this magnitude mandate stakeholders' commitments to environmental and socio-economic issues attached to project sustainability. TCN, as a Government organisation, has a mandatory responsibility under the Nigerian law to perform its operations in the best environmentally and socio-economically sustainable way. So, also, the regulatory agencies (Ogun State Ministry of Environment) are empowered by law to take responsibility for the monitoring of the operations of all organizations operating within the boundaries of the country/state to ensure environmental and socio-economic sustainability of the recipient communities.

The host communities also have an important stake in the environmental and socio-economic sustainability of the project by giving the required support to both the operators and the regulators.

Transmission Company of Nigeria (TCN)

TCN has established a policy and schedule for responsibilities and training on matters relating to the environment and communities. There is a line responsibility for which all level of staff is accountable. Line management will take full responsibility for environmental issues.

A focal point, the Management Safety, Health and Environmental Committee, consisting of the General Manager, Assistant General Manager (Health, Safety and Environment (HSE) Division Team), Directors, and Head of Engineering, Company HSE Manager, Company Doctor, HSE Reps –Logistics, has been set up to coordinate HSE performance and is responsible for compliance with safety and environmental standards and regulations. The Committee is charged with the following specific tasks:

- The developing and maintaining of the Environmental and Social Management Plan (ESMP) and associated plans for materials management, waste management, accident preparedness and response, inspection and monitoring, staff training;
- The implementation of the Environmental Management Plan related tasks;
- Conducting or organising periodic audits;
- Initiating or organising corrective actions when necessary;
- Preparing and managing documentation related to environmental performance;
- Regular and incidental reporting to the TCN management; and
- Liaising and reporting to the appropriate environmental regulatory authorities.

TCN's management thus, affirms total commitment to safety and plans to ensure that all environmental considerations are integrated into related activities. Induction and training courses for staff are part and an effective parcel of environmental management system, which is of paramount importance to TCN.

Contractors (EPC)

Prior to assigning any contract, TCN will pre-qualify each contractor according to commercial, technical, quality assurance and its past performance on HSE standards so as to satisfy TCN requirements and policies. Each contractor will assign an HSE Manager whose responsibility is to ensure that environment, health and safety regulatory requirements are met and that ESMP requirements are properly implemented.

In principle, the Contractor responsible for construction of the beams shall be responsible for implementing those aspects of the ESIA recommendations pertaining to the engineering, procurement and construction phase of the project.

Regulatory agencies

Regulatory agencies (Federal Ministry of Environment, National Environmental Standards and Enforcement Agency and Ogun State Ministry of Environment) are empowered by law to take responsibility for the monitoring of the operations of all organizations operating within the boundaries of the country/state to ensure environmental and socio-economic sustainability of the potentially affected communities.

Communities

Leaders and traditional institutions of the potentially affected communities will assist in public sensitization effort to advance implementation of ESMP.

Training and awareness

TCN will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions. The Project recognizes that it is important that employees at each relevant function and level are aware of the Project's environmental and social 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, biodiversity and soil/water contamination);
- necessity of conforming to the requirements of the ESIA and ESMP, in order to avoid or reduce those impacts; and
- roles and responsibilities to achieve that conformity, including those in respect of change management and emergency response.

The HSE Coordinator is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. The HSE Coordinator will also periodically verify that staff are performing competently through discussion and observation.

Employees responsible for performing site inspections will receive training by drawing on external resources as necessary. Training will be coordinated by the HSE coordinator prior to commissioning of the facilities. Upon completion of training and once deemed competent by management, staff will be ready to train other people.

Similarly, the Project will require that each of the sub-contractors institute training programmes for its personnel. Each subcontractor is responsible for site HSE awareness training for personnel working on the job sites. The subcontractors are also responsible for identification of any additional training requirements to maintain required competency levels.

The subcontractor training program will be subject to approval by TCN and it will be audited to ensure that:

- training programs are adequate;
- all personnel requiring training have been trained; and
- competency is being verified.

TCN's training programme will be followed to make permanent staff, contractor staff and temporarily hired staff aware of the ESIA and ESMP contents, their roles and responsibilities in the implementation of the ESMP and the additional requirements related to international standards.

Communication

TCN after the transfer of operation will maintain a formal procedure for communications with the regulatory authorities and communities. The HSE Coordinator is responsible for communication of HSE issues to and from regulatory authorities whenever required. Meetings will be held, as required, between TCN and the appropriate regulatory agency and community representatives to review HSE performance, areas of concern and emerging issues. Dealings will be transparent and stakeholders will have access to personnel and information to address concerns raised.

The Project will 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 will 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 will be informed on how to implement the grievance procedures.

Documentation

TCN for the operation phase will control HSE documentation, including management plans; associated procedures; and checklists, forms and reports, through a formal procedure. All records will be kept on site and will be backed up at several offsite locations (including secure cloud storage facilities). Records will be kept in both hard copy and soft copy formats. And all records will be archived for the life of the project.

Furthermore, the document control procedure will describe the processes that the Project will employ for official communication of both hardcopy and electronic (through the internet) document deliverables. In addition, it will describe the requirement for electronic filing and posting and for assignment of document tracking and control numbers (including revision codes).

The HSE Coordinator is responsible for maintaining a master list of applicable HSE documents and making sure that this list is communicated to the appropriate parties. The HSE Coordinator is responsible for providing notice to the affected parties of changes or revisions to documents, for issuing revised copies and for checking that the information is communicated within that party's organisation appropriately.

The subcontractors will be required to develop a system for maintaining and controlling its own HSE documentation and describe these systems in their respective HSE plans.

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 will implement a formal procedure to manage changes in the Project that will apply to all project activities.

The objective of the procedure is to ensure that the impact of changes on the health and safety of personnel, the environment, plant 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, 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 ESIA 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; and
- the appropriate TCN person accepts the responsibility for the change.

As information regarding the uncertainties becomes available, the Project ESMP will be updated to include that information in subsequent revisions. Environmental and social, as well as engineering feasibility and cost, considerations will be taken into account when choosing between possible alternatives.

Operational control procedures

Each potentially significant impact identified in the ESIA 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 ESMP.

Operational control procedures will be reviewed and, where appropriate, amended to include instructions for planning and minimising impacts, or to at least reference relevant documents that address impact avoidance and mitigation.

Emergency preparedness and response

TCN will prepare plans and procedures to identify the potential for, and response to, environmental accidents and health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them.

Emergency preparedness and response will be reviewed by TCN on at least an annual basis and after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement.

Emergency exercises will be undertaken on a regular basis to confirm adequacy of response strategies. Investigations of accidents or incidents will follow formal documented procedures.

Checking and corrective actions

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.

Monitoring

Monitoring will 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. Monitoring parameters are included in the ESMP table provided in Tables 7.4.1a and 7.4.1b.

Monitoring methodologies or processes must be put in place in order to ensure the efficacy of the mitigation measures identified in the ESIA. Monitoring methodologies should be established to address the following:

- Alteration to the biological, chemical, physical, social and health characteristics of the recipient environment;
- Alterations in the interactions between project activities and environmental and social sensitivities, and interactions among the various sensitivities;
- Monitor the effectiveness of the mitigation and enhancement measures;
- Determination of long term and residual effects;
- Identification of Project specific cumulative environmental and social effects, if applicable;
- Social monitoring is focused on following the community relations of TCN. The quarterly FMEnv monitoring shall be performed with involvement of the communities. This joint monitoring will support good community relations, by creating trust and involvement;

- At the construction site inspections should be performed on human resources procedures, occupational health, safety and security risks management, emergency planning and the open water on malaria larvae; and
- The recruitment, human resources procedures, HSE training and awareness of the labour force in the construction as well as the operation phase should be monitored to know their origin in line with the local content plant and the level of knowledge and awareness on the code of conduct, STD prevention and occupational H&S measures.

The FMEnv guidelines require an environmental monitoring plan as part of an ESIA. The aim of the monitoring programme is to ensure that the negative environmental and social impacts identified in this ESIA are effectively mitigated in the construction and operation stages of the proposed Project.

Auditing

Beyond the routine inspection and monitoring activities conducted, audits will be carried out internally by TCN to ensure compliance with regulatory requirements as well as their own HSE standards and policies. Audits to be conducted will also cover the subcontractor self-reported monitoring and inspection activities. The audit shall be performed by qualified staff and the results shall be reported to TCN to be addressed.

The audit will include a review of compliance with the requirements of the ESIA and ESMP 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; and
- training activities and record keeping.

There will be a cycle of audits into specific areas of the Project. The frequency of audits will be risk based and will vary with the stage of the Project and will depend on the results of previous audits.

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.

TCN will implement a formal non-compliance and corrective action tracking procedure for investigating the causes of, and identifying corrective actions to, accidents or environmental or social non-compliances. This will ensure coordinated action EPC Contractor and its subcontractors. The HSE coordinator will be responsible for keeping records of corrective actions and for overseeing the modification of environmental or social protection procedures and/or training programs to avoid repetition of non- conformances and non-compliances.

Reporting

Throughout the Project, TCN will keep the regulatory authorities informed of the Project performance with respect to HSE matters by way of written status reports and face-to-face meetings. TCN will prepare a report on environmental and social performance and submit it to FMEnv. The frequency of this reporting will be quarterly.

If required, TCN will provide appropriate documentation of HSE related activities, including internal inspection records, training records, and reports to the relevant authorities. Subcontractors are also required to provide HSE performance reporting to TCN on a regular basis through weekly and monthly reports. These will be used as inputs to the above.

7.4 PROPOSED MANAGEMENT PLAN

The Environmental and Social mitigation and enhancement measures, monitoring and management responsibility for impacts during construction and operation of the Project is given in Tables 7.4.1a and 7.4.1b. These measures will be adopted by TCN and imposed as conditions of contract on the sub-contractors hired for the Project.

Additional detailed policies and plans will need to be developed to support the implementation of this ESMP and as part of the development of standalone ESMP. 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. These will be finalised with Project Team where appropriate in consultation with the FMEnv and other key stakeholders. A full list of the management plans for this Project is provided below:

- Occupational Health and Safety Management Plan.
- Waste Management Plan;
- Hazardous Materials Management Plan;
- Traffic Management Plan;
- Emergency Response Plan;
- Stakeholder Engagement Plan (see for more details Chapter 4);
- Community Development Programme;
- Local Content Plan; and
- Human Resources Policies and Procedures.

Table 7.4.1a: Environmental and Social Monitoring Plan for Proposed Lagos and Ogun States Transmission Lines and Substations Projects for Construction Phase (Lot2)

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx and CO_2 as GHG)	Affected communities in area of influence and region (Average of 40 Machines/Vehicles	Minor	Use good international practice: • Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations • Stationary generators to be located to facilitate dispersion	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Record for routine maintenance - Visual observation of site equipment and operation vehicle	TCN	-Daily Visual Inspection -Monthly measurement & review - Annual formal reporting	400,000/quarter
	Elevated dusted (PM) and other pollutants (SO_2, CO, N O_2 and NMHC) levels in nearby communities as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected communities in area of influence (24 sampling points)	Minor	Use good international practice: • Cover properly loose materials and keep top layers moist • Use binder material for erosion and dust control for long term exposed surfaces • Regular cleaning of equipment, drains and roads to avoid excessive buildup of dirt • Spray surfaces prior to excavation • Use covered trucks for the transportation of materials that release dust emissions • Speed limits on-site of 15kph on unhardened roads and surfaces	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual observation & photographic records -Particulate monitoring	TCN	-Daily Visual Inspection -Daily measurement & review - Quarterly formal reporting in accordance with FMEnv Procedure and Guidelines	640,000/quarter
Noise, vibration & EMF	Nuisance noise from construction activities	Affected communities in area of influence Construction	Moderate	Use good international practice: • Develop a detailed plan that relates to noise control for relevant work	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Record for routine maintenance - Community Liaison	TCN	-Daily Measurement -Monthly measurement & review	200,000/quarter

		workers-(24 sampling points)		practices and discuss this with construction staff during health & safety briefings • Select 'low noise' equipment or methods of work • Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources). • Avoid dropping materials from height, where practicable • Avoid metal-to-metal contact on equipment • Maintain and operate all vehicles and equipment's in accordance with manufacturers recommendations • Avoid mobile plant clustering near residences and other sensitive land uses • Ensure periods of respite are provided in the case of unavoidable maximum noise level events • Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the CLO. • Noisy activities (activities that can be heard in nearby communities) restricted to day-time					- Quarterly formal reporting in accordance with FMEnv Procedure and Guidelines	

				working hours						
Geology and Soil	-Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation (at the tower foundation pits and possibly parts of the access roads) -The high resistivity subsoils at the upper 2 m beneath the proposed substations at Likosi and Redeem are poor earthing media.	Soil on construction site (18 sampling points) Soil on Likosi and Redeem Substation	Moderate	• Construction of foundations to be undertaken in the dry season. • Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. • Protect excavated soil materials from erosion. • Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season. • Use of existing track for transport of man and material to the extent possible. • The subsoil conductivity may need to be artificially enhanced to ensure proper earthing of high voltage substations. The metallic structures should be protected against corrosion. Also, where the subsoil is clayey and incompetent, transmission line tower foundation should be anchored on friction piles to prevent	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Record of weather condition	TCN	During Construction	810,000/quarter

				settlement.						
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminium oxide paint, etc)	Soil on construction site, especially by construction camp and each tower	Minor	Use good international practice: • Implement effective site drainage on the construction yard to allow for the directed flow of surface water off site. This shall include cut-off drains to divert surface runoff from exposed soils or construction areas. • Install oil/water separators and silt traps before effluent, leaves the site. • Minimise bare ground and stockpiles to avoid silt runoff. • Bunding of areas where hazardous substances are stored (eg fuel, waste areas). • Remove all water accumulation within bunds using manually controlled positive lift pumps not gravity drains. • Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages. • Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques. • Set-up and apply	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	-Daily Visual Inspection -Monthly measurement & review - Quarterly formal reporting in accordance with FMEnv Procedure and Guidelines	960,000/ quarter

				procedure regarding dealing with contaminated soils. • Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed of correctly. • Spread sheet underneath the tower structure prior to start any painting activity.						
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater/ surface (18 sampling points)	Moderate	See above measures to mitigate 'Potential contamination of soil' impact	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	-Daily Visual Inspection -Monthly measurement & review - Quarterly formal reporting according to FME procedure and Guidelines	820,000 per Quarter
	Exploitation of water resources (e.g. casting of foundations) sourced from nearby water bodies through tanks	Ogun River, River Wagunu, Streams	Minor	Regular inspection/checks to minimize the impacts on the waterbodies	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	-Daily Visual Inspection	No Cost
Terrestrial ecology	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence (Random Sampling)	Minor	• See above measures on air quality, noise and vibration, soils and water resources. • Limit lightening on site. • Sensitivity training to staff and anti-poaching policy.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Observation and photographic record -Awareness on terrestrial ecology within RoW & environe	TCN	-Daily Inspection -Monthly measurement & review - Quarterly formal reporting according to FME procedure and Guidelines	240,000 per quarter

	Loss of vegetation due to clearance activities	Flora and fauna within the ROW and Substation	Minor	• Site clearance activities to be restricted to the minimum required area.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	-Daily Visual Inspection -Monthly measurement & review - Quarterly formal reporting	
Aquatic ecology	Construction of the roads, vegetation clearing, and pylon construction may cause wetland and riparian habitat loss Aquatic macrophytes are represented by the plants in river and vegetation supported by wetlands.	Oniyan (Ogun River), Abese (River Wagunu), Asa Elegun, Kori, and Mologun	Moderate	TCN shall maintain acquire RoW for clearing and upgrade existing roads	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Observation and photographic record -Awareness on aquatic ecology within RoW & environe	TCN	-Daily Inspection -Monthly measurement & review - Quarterly formal reporting according to FME procedure and Guidelines	210,000 per quarter
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the RoW and/or the site for the substation.	People living close to the construction sites.	Minor	Maintain construction site in orderly condition and do not distribute material over many sites before usage.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	Weekly	Include in EPC Contract
	Domestic waste might be disposed to construction area, creating visual impact.	Construction workers and neighbours	Moderate	Registered Ogun State Ministry of Environment waste contractor shall be engaged to dispose domestic waste and construction waste	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	Weekly	Include in EPC Contract

Land Planning and Use	Change in land use caused by land take for towers, vegetation clearance, and access restriction	Project affected people along the RoW	Major	• Site clearance activities to be restricted to the minimum required area. • Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas • RAP process will mitigate the impact to the minimum level	Moderate	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection and photographic record	TCN	Monthly review meeting	No cost
Stakeholder and Community expectation/ relations Management	Management of Community concerns linked to impacts associated with construction phase issues (like air and dust emissions, traffic, influx and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. In addition dealing with community/ stakeholder perceptions around cumulative impacts linked to the new plant and transmission lines and substations operations. Management of legacy issues on account of environmental pollution from stakeholder concerns around existing transmission lines.	Affected communities in area of influence	Major	Follow mitigation for construction phase air quality, noise and traffic.	Moderate	See above	See above	See above	See above	No cost
				Inform communities about details of construction activities (e.g., employment opportunities, schedule, timing of noise activities, traffic including movements of oversized loads) by billboards, posters and community meeting		EPC Contractor/TCN /FME, OGMEnv & LGA	Record of engagement activities and outcome	TCN	Monthly	
				Set-up and effectively monitor construction grievance mechanism		EPC Contractor/TCN /FME, OGMEnv & LGA	Awareness, Records and outcome of grievance mechanism	TCN	Weekly	No Cost
				Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.		TCN/FME, OGMEnv & LGA	Compliance monitoring with plan	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGA	Monthly	1,950,000/ Annum
				Engage communities in the monitoring activities to enhance transparency and involvement.		TCN/FME, OGMEnv & LGA	Following monitoring activities	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro	Following monitoring activities	No Cost

								LGA		
				Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Coordinate Stakeholder Engagement of all partners of industrial site, prepare and implement Stakeholder Engagement Plan		EPC Contractor/TCN /FME, OGMEnv & LGA	Compliance with SEP	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGA	Continuous process	1,200,000/ annum
Community Health, Safety and Security Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users	Minor	Ongoing reporting to stakeholders on the overall environmental performance of the plant and the steps taken to mitigate any adverse environmental impacts.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Check compliance plan and record for traffic incidents	TCN	Weekly	No Cost
	Increased risks of traffic safety incidents on public roads Temporary influx of outside workers in the communities, risking tensions between outside (partly possibly expatriate) labour and local population, due to differences in wealth and culture.	People living close to access roads and road users Affected communities in area of influence	Minor	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Maintain worker's origination	TCN	Monthly review	5,000,000
				A Local Content Plan should be prepared to facilitate involvement of local labour. See HR policies and procedures below. No hiring of short-term labour to be made at the		EPC Contractor/TCN /FME, OGMEnv & LGA	Record on labour force on awareness of code of conduct in community relations	TCN	Weekly	No Cost

				site gate.						
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor	Develop a code of behaviours for workers. All workers to receive training on community relations and code of behaviour. Periodic refreshing as needed based on community liaison/grievance mechanism feedback.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Record on awareness on STD with labour force and prevalence of STD	TCN	Monthly/Quarterly Check	2,500,000
	Potential for increase in prevalence of sexually transmitted diseases in local communities	Affected communities in area of influence	Minor	Provide STD awareness material to all workers. Provide condoms to workers.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual inspection of site - Periodic testing of stagnant surface water	Site HSE Manager	Daily	No Cost
	Risk of an increase in prevalence of malaria and other mosquito borne diseases in communities due to creation of mosquito breeding areas on site.	Affected communities in area of influence	Minor	Manage site to eliminate potential mosquito breeding sites including – eliminate surface water ponding and no outside storage of tires. For unavoidable ponding monitor for mosquito larvae and treat with a US-EPA (or similar) approved mosquito larvicide.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Visual inspection on site	Site HSE Manager	Daily	No Cost
	Risk of erosion into creeks, which are used as source of domestic water for the communities	Affected communities in area of influence	Minor	Erosion prevention measures especially in locations close to creeks and cropped fields by keep construction sites flat, clearing lose soil from the site and covering with geo-textile if needed.	Minor	TCN/FME, OGMEnv & LGA	Monitoring of compensation process	TCN	Periodically	Budget in RAP Report

Resettlement	Households living in the RoW need to be relocated and assets in the RoW will be lost	Affected properties and livelihood	Moderate	Follow principles and procedures of Resettlement Action Plan (RAP), including way forward, micro-plans per affected household.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Approval of human resources policies and guidelines -Compliance check	TCN	Weekly compliance check	No Cost
Labour and working conditions	Exploitation of workers	Labour force	Minor	• Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Compliance check for security plan	TCN	Weekly	No cost

				Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • Provide proper work place facilities for water/sanitation/rest rooms. • If case of retrenchment needs first viable alternatives are analysed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. A worker's grievance mechanism will be in place.						

	Activities and staff at site may create security risks	All staff working at the construction site	Minor	Make security plan and emergency response and contacts with security forces.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	-Visual observations of work areas for non-compliant -Incident report records	TCN	Weekly	No cost
	Risk of health & safety incidents amongst labour force, including minor incident's such as cuts and major incidents such as loss of life	Construction labour force	Moderate	Develop project specific health and safety procedures based on TCN standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	- Compliance with local content plan	TCN	Monthly	TBD
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Local residents of affected communities and Nigerian nationals	Positive	Prepare a local content plan to enhance ability to locate local hires and Nigerian nationals. Include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive	EPC Contractor/TCN /FME, OGMEnv & LGA	Check on opportunities for other companies	TCN	Before construction starts/ Monthly	No cost
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the company	Nigerian companies and local SMEs	Positive	Prepare a local content plan to facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and	Positive	EPC Contractor/TCN /FME, OGMEnv & LGA	Check on HSE plan	TCN	Before construction starts/ Quarterly	No cost

				services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.						
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management	Affected communities in area of influence	Minor	Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. Upgrading of existing access roads.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Check on HSE plan	TCN	Weekly	No cost
Cultural heritage	shrines are located within the RoW along the transmission line and need to be relocated.	Affected communities-	Minor	Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited. Upgrading of existing access roads.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Monitoring of shrine usage	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGA /TCN	Before construction starts/ at relocation	No cost
	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities along the RoW	Minor	Consult with local communities on festivals and potentials for interaction with construction works. If required cease works on the specific dates.	Minor	EPC Contractor/TCN /FME, OGMEnv & LGA	Compliance with schedule	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGA /TCN	Before construction starts/ at relocation	No cost

TCN- Transmission Company of Nigeria; FME-Federal Ministry of Environment; OGMEnv- Ogun State Ministry of Environment & LGA- Local Government Authority

Table 7.4.1b: Environmental and Social Monitoring Plan for Proposed Lagos and Ogun States Transmission Lines and Substations Projects for Operation Phase (Lot2)

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
Air quality	Exposure to emissions from operational vehicles but very limited and other activities	Workers on site, communities in area of influence	Minor	Best practices will mitigate the impact to the minimum level	Minor	TCN/FME, OGMEnv & LGA	Procedural check on Maintenance of Transmission Lines and Substations	TCN	Annually & every three years for FME Audit	170,000/ substation
	GHG: Fugitive emission from line maintenance and Transmission Lines. Also, accidental significant leaks from aging equipment, and gas losses occur during equipment maintenance and servicing	RoW, Likosi, Redeem and MFM Substations	Moderate	Impact of SF_6 shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques.	Minor	TCN/FME, OGMEnv & LGA	Procedural check on Maintenance of Transmission Lines and Substations	TCN	Annually & every three years for FME Audit	500,000/ substation
Noise, vibration & EMF	Noise & EMF from overhead line due to Corona effect and EMF effect	Affected communities along the RoW	Minor	• Noise generation is unavoidable. • Use of conductors conforming to IS standard to minimize corona effect during rainy weather conditions • Avoiding over loading Transmission Lines • Installation of mesh at strategic places	Minor	TCN/FME, OGMEnv & LGA	Visual monitoring of the level of encroachment	TCN	Prior to the complaint Annually & every three years for FME Audit	150,000/ substation

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
Geology and Soils	Potential contamination of soil from inadvertent release of hazardous or contaminating material	Soil along RoW of TL and Substation	Minor	Best practices and guidelines shall be used for all operation.	Minor	TCN/FME, OGMEnv & LGA	Procedural check on Maintenance of Transmission Lines and Substations	TCN	Annually & every three years for FME Audit	450,000/ substation
Water resources	No impact on the surface water and hydrogeology of the area is anticipated	Local groundwater	Minor	Best practices and guidelines shall be used for all operation.	Minor	TCN/FME, OGMEnv & LGA	Procedural check on Maintenance of Transmission Lines and Substations	TCN	Annually & every three years for FME Audit	350,000/ substation
Terrestrial ecology	Avian collision	Birds in the area of influence	Minor	Visibility of Double circuit	Minor	TCN	Visual check assessment	TCN	Annually & every three years for FME Audit	160,000/ substation
	Loss of vegetation due to routine clearance of vegetation	Flora and fauna within the RoW	Minor	Maximum of 7.5 m wide within centre line of RoW shall be maintained	Minor	TCN	Visual check assessment	TCN	Annually & every three years for FME Audit	
Aquatic ecology	Loss of woody species, comprising trees and shrubs, as they can grow taller above 4m	Flora within the RoW and substation	Minor	Maximum of 7.5 m wide within centre line of RoW shall be maintained		TCN/FME, OGMEnv & LGA	Visual check assessment	TCN	Annually & every three years for FME Audit	160,000/ substation
	Ecosystem service	Flora and fauna within the RoW and substations	Minor	Maximum of 7.5 m wide within centre line of RoW shall be maintained	Minor	TCN/FME, OGMEnv & LGA	Visual check assessment	TCN	Annually & every three years for FME Audit	No Cost
Visual amenities	Transmission lines and towers will be visible from far and become an extrinsic element in the landscape. Cumulative with the other Transmission lines this may result in a loss of the visual amenity.	Likosi, MFM Shimawa axis communities near RoW	Minor	• The RoW does not affect forests or valuable landscapes. Vegetation will be felled, but if possible smaller trees can be kept. • Towers have an open structure, not	Minor	TCN/FME, OGMEnv & LGA	Visual check assessment	TCN	Annually	No cost

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
				hampering the view very much.						
Land planning and use	Stablisation of electricity will lead to increase in land use and pressure on natural environmental area	Substation areas e.g Redeem & MFM	Major	Government shall regulate the acquisition of land in the study area	Minor	TCN/FME, OGMEnv & LGA	Visual check assessment	TCN	Annually	No cost
Stakeholder and Community expectation/relations Management	Management of Community concerns linked to impacts associated with operation phase issues (like air and dust emissions, traffic, and community safety/security, noise/vibration, etc) and adverse impact/inconveniencies resulting from it. Dealing with community/stakeholder perceptions around cumulative impacts linked to the new plant and existing cement plant operations. Disappointment about electricity supplied to national grid, while locally electricity supply has reduced reliability	Affected communities in the area of influence	Major	Follow mitigation for operation phase air quality, noise and traffic.	Moderate	See above	See above	See above	See above	No cost
				Inform communities about details of operation activities (e.g., employment opportunities) by by billboards, posters and plant visit		TCN/FME, OGMEnv & LGA	Record of engagement activities and outcome	TCN	Quarterly	No cost
				Set-up, manage and manage grievance mechanism		TCN/FME, OGMEnv & LGA	Awareness, Records and outcome of grievance mechanism solution	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Annually	No Cost
				Sharing of independent monitoring reports of all monitoring actions during construction as mentioned in this ESMP.		TCN/FME, OGMEnv & LGA	Compliance monitoring with plan	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Monthly	1,950,000/ Annum
				Engage communities in the monitoring activities to enhance transparency and involvement.		TCN/FME, OGMEnv & LGA	Following monitoring activities	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Continuous process	No Cost

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
				Enhance ongoing consultations with local communities (with good representation) by TCN to create continuous dialogue, trust and planning of community development activities. Coordinate Stakeholder Engagement of all partners of industrial site, prepare and implement Stakeholder Engagement Plan .		TCN/FME, OGMEnv & LGA	Compliance with SEP	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Annually	1,200,000/ annum
				Explain effects of electromagnetic fields to communities to limit concerns. Keep fields within limits of International Commission on Non-Ionizing Radiation Protection (ICNIRP).		TCN/FME, OGMEnv & LGA	Compliance with SEP	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Annually	1,200,000/ annum
				Interference with radio/TC transmission during rain needs to be explained to the communities		EPC Contractor	Compliance with SEP	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Annually	No Cost
Community Health, Safety and Security	External safety risks of electrocutions, bush fires, line snapping, tower collapses	Affected communities along the RoW	Moderate	Develop an emergency response plan following TCN and international best practice including provisions for prevention and response to	Minor	TCN	Compliance with HSE Plan	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAs	Annual	No cost

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
				electrocution, bush fires, repair of snapped lines and collapsed towers, roles and responsibilities. Coordinate with emergency services of LGAs						
				Annual safety audit of the transmission lines and poles and maintenance of the RoW to keep free of higher vegetation and structures.		TCN/FME, OGMEnv & LGA	Annual Audit	TCN	Annual	No cost
				Communicate to communities in RoW the safety risks of the transmission lines and provide response measures. Put sign boards on towers about electrocution risk.		TCN/FME, OGMEnv & LGA	Compliance with SEP	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAs	Quarterly/Yearly	500,000
Labour and working conditions	Exploitation of workers	Labour force for maintenance work	Minor	• Follow human resources policies and procedures of TCN, following Nigerian Labour Law and ILO conventions. • Provide reasonable, and if applicable negotiated, working terms and conditions. • Establish worker's grievance mechanism, so	Minor	TCN/FME, OGMEnv & LGA	Compliance with HR policies and procedures	TCN	Annually	No cost

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
				that potential conflicts can be dealt with in an early and proper way. • No use of child labour (workers under age 18) or forced labour. • Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. • A worker's grievance mechanism will be in place.						
	Occupational H&S risks in operation and maintenance	Labour force	Moderate	TCN should follow their Occupational HSE plan following Nigerian and international requirements: train staff, monitor and keep record. Special focus on slip-trip, fall from height and electrocution in maintenance and repair works, emergency prevention and management. Use personal protection equipment. Have medical emergency equipment at hand.	Minor	TCN/FME, OGMEnv & LGA	Control and Audit HSE Plan	TCN	Annually	No cost

Indicator	Potential impact	Receptor	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)	Action Party/ Regulator	Monitoring	Responsibility for Monitoring	Timing/Frequency of Monitoring	Estimated Cost (₦)
Employment and Economy	Improved electricity supply for the national grid, creating opportunities for businesses and economic development in the country.	National level Nigeria	Positive	Regular maintenance of the project to ensure reliable production of power	Positive	TCN/FME, OGMEnv & LGA	Check on opportunities for other companies	Ministry of Power	Continuous process	No cost
Cultural heritage	Potential interactions between maintenance works and cultural festivals due to traffic, noise and/or vibration impacts	Affected communities in the RoW	Minor	Consult with local communities on festivals and potentials for interaction with maintenance works. If required cease works on the specific dates.	Minor	TCN/FME, OGMEnv & LGA	Compliance with agreements about timing of activities	Mokoloki/Ofada, Obafemi Owode, Ifo, Sagamu West, Sagamu South & Ewekoro LGAS	Annually	No Cost

TCN- Transmission Company of Nigeria; FME-Federal Ministry of Environment; OGMEnv- Ogun State Ministry of Environment & LGA- Local Government Authority

CHAPTER EIGHT

DECOMMISSIONING PLAN

8.1 INTRODUCTION

The proposed transmission line project with the facilities and their ancillary installations have a life expectancy after which the performance of the project scales to diminishing returns or the project is no more viable and then will be decommissioned in accordance with a plan and TCN standard procedures that meet local regulatory requirements and international standards. As required in the Guidelines for the ESIA study, the decommissioning Plan for the proposed project is presented below. The incorporation of remediation plans into the overall project planning is essential because it allows proponents to understand the need for restoring the environment into its original, or near its original status when abandonment plans are being conceptualized. Operating projects beyond the designed lifespan makes it economically unproductive as returns from such investment become unattractive. The transmission line and the ancillary installations have a life expectancy. The facility will be designed, built and maintained to operate efficiently for the life cycle (>25years) after which it will be decommissioned.

8.2 STAKEHOLDERS CONSULTATION FOR DECOMMISSIONING

The project-decommissioning plan will include consultation with various stakeholders including host communities, nearby facility owners, regulatory bodies and experts.

As the Project approaches the end of its economic viability, plans will be put in place to wind down operations and maintenance. This will allow for a carefully planned redeployment and, where necessary, disengagement of personnel as appropriate.

8.3 PRE-DECOMMISSIONING ACTIVITIES

Prior to engaging in decommissioning works, the Proponent will develop a decommissioning plan in accordance with regulatory requirements at the time of decommissioning. Decommissioning and restoration activities will be performed in accordance with all relevant statutes in place at the time of decommissioning.

8.4 DECOMMISSIONING ACTIVITIES

At the end of the facilities utility, all equipment will be decommissioned. In general, the activities to be carried out during the decommissioning phase shall include the following:

- Dismantling of towers including excavation
- Dismantling of all surface equipment including conductors and grounding wires
- Removal and disposal of concrete works
- Removal and disposal of conductors, etc

8.5 IMPACTS AND MITIGATION MEASURES

<u>Impacts</u>

The potential impacts that might result from the decommissioning phase of the proposed project include:

- physical disturbance of the environment arising from the removal of the towers and ancillary equipment,
- potential hazards/accidents associated with decommissioning activities, and
- waste management problems

The strategy to be adopted for site remediation shall depend on the prevailing biophysical and social environmental attributes and the attendant impacts that may result from such an action as discussed in Chapter 6. The following measures need to be planned for implementation after decommissioning:

- Facilities and ancillary equipment shall be dismantled completely
- All equipment and debris shall be removed from the environment
- Good waste management plan shall be implemented.

- **Acoustics (Noise)**: Sources of noise during decommissioning would be similar to those during construction and would be caused primarily by construction equipment and vehicular traffic
- **Air Quality:** Emissions generated by activities during the decommissioning include vehicle emissions; diesel emissions from large construction equipment and generators; and fugitive dust from many sources such as structure removal, backfilling, dumping, reclamation of disturbed areas (grading, seeding, planting), and truck and equipment traffic.
- **Ecological Resources:** Removal of aboveground structures would eliminate the impacts to wildlife that occur during operation (e.g., bird collisions with transmission lines and habitat fragmentation).
- **Environmental Justice:** Issues that could be of concern during decommissioning and site reclamation are noise, dust, and visual impacts, as well as possible restoration of fish and wildlife populations for subsistence users.
- **Hazardous Materials and Waste Management:** Impacts could result if these wastes were not properly handled and were released to the environment.
- **Human Health and Safety:** Potential impacts to worker and public health and safety during decommissioning and site reclamation would be similar to those during construction; and relate to earthmoving, use of large equipment, dismantling of industrial components, and transportation of overweight and oversized materials.
- **Land Use**: Upon decommissioning, land use impacts resulting from construction and operation of an energy transmission project could be largely reversed depending on the end use selected for the RoW. No permanent land use impacts would occur during this phase.
- **Socio-economics:** Direct impacts would include the creation of new jobs for workers during decommissioning.
- **Soils and Geologic Resources:** Activities during decommissioning that would result in impacts to soils include removal of access roads, transmission line components, and other ancillary structures. Surface disturbance, heavy equipment traffic, and changes to surface runoff patterns could cause soil erosion. Soil erosion impacts include soil nutrient loss and reduced water quality in nearby surface water bodies.

- **Transportation:** Short-term increases in the use of local roadways would occur during decommissioning and site reclamation. Overweight and oversized loads could cause temporary disruptions to local traffic.
- **Water Resources**: Water would be used for dust control for road traffic, dismantling of towers, pipelines, substations, and other buildings, and for consumptive use by the construction crew. It might be trucked in from off-site or obtained from local groundwater wells or nearby surface water bodies, depending on availability.

Mitigation Measures

The strategy to be adopted for site remediation shall depend on the prevailing biophysical and social environmental attributes and the attendant impacts that may result from such an action as discussed in Chapter 6. The following measures need to be planned for implementation after decommissioning:

- Facilities and ancillary equipment shall be dismantled completely
- All equipment and debris shall be removed from the environment
- Good waste management plan shall be implemented.

For abandonment, strict adherence to facilities abandonment policy of TCN, which includes restoring the project environment to its original status as much as possible, shall be encouraged. The procedure shall be in accordance with approved Environmental and Social Management Plan (ESMP) and international industry standards. It is expected that if these measures are implemented, an environmentally friendly site restoration after decommissioning will be achieved.

Decommissioning of the transmission line and the ancillary installations will result in potential for work-related injuries and fatality from the dismantling process but increase land available for agriculture and other land use from the restoration of land to its original situation as much as possible and hand over of the reclaimed land to the original community and landowners

All facility components that can be used or recycled will be identified and quantified. Vehicles for the operation and other facilities will be scrapped and / or moved to other locations. Cleared locations will be re- vegetated using fast growing native plant species.

8.5 REPORTING

As required by regulations, a post-decommissioning report will be prepared and submitted to the Nigerian Regulators. The report will provide the following details:

- Overview of decommissioning facilities
- Details of methods used for decommissioning
- Nature of decommissioning (partial or whole)
- Record of consultation meetings
- Details of recyclable/reusable materials/facility components
- Decontaminated facilities
- Decommissioning schedule
- State of the surrounding environment
- Waste management plan
- Plans for restoration/remediation where necessary

CHAPTER NINE

CONCLUSIONS AND RECOMMENDATIONS

The Transmission Company of Nigeria (TCN) plans to construct Lagos and Ogun State Transmission Lines and Associated Substations Project. These projects have been conducted in accordance with the regulatory requirements established by the Federal Republic of Nigeria and international standards. The potential impacts have been identified and evaluated for the project on the existing environment (biophysical, social and health). Mitigation measures have been recommended for unavoidable impacts considered significant, to reduce the rating of their identified adverse effects to levels as low as reasonably practicable (ALARP). Recommendations have also been made to enhance the benefits of the identified positive impacts. A project-specific Environmental and Social Management Plan (ESMP) for assessing the effectiveness of the mitigation measures in controlling identified significant impacts has been recommended.

The ESIA has shown that with the implementation of the recommended mitigation measures embodied in the Environmental and Social Management Plan could be executed and decommissioned with minimal adverse impacts on the environment. The Projects will result in substantial economic benefits to the local economy and Federal Government of Nigeria through increased electric power transmission and distribution. The local communities shall also benefit immensely from the project through employment opportunities and increased financial flows from supply of materials and contracts as well as community development projects that TCN will be committed to put in place.

REFRENCES

Akintola, J.O. (1986): *Rainfall distribution in Nigeria 1892-1983*. Impact Publishers (Nig.) Ltd Nigeria

African Development Bank. 2001. '*Environmental and Social Assessment Procedures*: Public Sector Operations of the African Development Bank.

Agunloye, O.,1984. Soil aggressivity along steel pipeline route at Ajaokuta. Journal of Mining and Geology, Vol.21, Nos. 1 & 2, pp. 97 - 101.

Barber, C. (1974): Major and trace element associations in limestones and dolomites. *Chemical Geology* 14(4): 273 - 280.

Baeckmann, W.V. and Schwenk,W.,1975. Handbook of cathodic protection: The theory and practice of electrochemical corrosion protection techniques. Portucullis Press. Surrey. 396pp.

DPR (1991): *Environmental Guidelines and Standards for Petroleum Industry in Nigeria.* Department of Petroleum Resources (DPR)

EGASPIN (2002): *The Environmental Guidelines and Standards for Petroleum Industry in Nigeria.* Department of Petroleum Resources (DPR)

Federal Environmental Protection Agency, FEPA (1991): *Guidelines and Standards for Environmental Control, Lagos*

Federal Environmental Protection Agency, FEPA (1992): Environmental Impact Assessment Decree No 36, Supplement to critical Gazette Extraordinary No 73, Lagos

FEPA (1991): *National Interim Guidelines and Standards for Industrial effluents, gaseous emission and hazardous wastes in Nigeria.* Federal Environmental Protection Agency (FEPA)

Federal Government of Nigeria Decree No 24 of 1972.

Federal Environmental Protection Agency, the Presidency, Abuja, 1995 *Environmental Impact Assessment Procedural Guidelines.*

Federal Republic of Nigeria (1977). *Atlas of the Federal Republic of Nigeria*.

Food and Agricultural Organization (FAO), 1977. *Guidelines for Soil profile description*, Rome. 66 pp.

FORMECU (1998). *Vegetation and Land Use Changes in Nigeria.*

Greig-Smith, P. (1983): *Qualitative Plant Ecology* 3rd edition Blackwell Scientific Publication Oxford.

Geological Survey Nigeria (1974). Geological Map of Nigeria. Publication of the Geological Survey of Nigeria.

Government of Nigeria, Ministry of Agriculture and Rural Development; Federal Department of Forestry (1977). *Vegetable and Land Use data compiled on Side Looking Airborne Radar*.

Health Canada (August 2012). "*Guidelines for Canadian Drinking Water Quality".* https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table-health-canada-2012.html.

Hutchinson, J. and Dalziel, J.M. (1954-1972). *Flora of West Tropical Africa* (2nd Edition by Keay R.W.J. and Hepper F.N.). Crown Agents for Overseas Government.

International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012)

JICA (2016). Preparatory Survey for Power Transmission Project in the Federal Republic of Nigeria Interim Report, Ist Edition, Japan International Cooperation Agency, 1-249

Jones, H. A. & R. D. Hockey (1964). The geology of part of South-western Nigeria. *Geological Survey of Nigeria Bull*. No. 31, 1-87, 8 pb.

Keay R.W.J. (1959). An outline of Nigerian vegetation. 3rd edition. Government printers. Lagos. 46pp

Key, A. (1956): Pollution of surface water in Europe. World Health Organisation Bulletin; 14: 845-948.

Lafarge Africa Plc (2016). Environmental Management Plan (EMP) for the Alternative Fuel of Kiln firing at Ewekoro, prepared by SEEMS Nigeria Limited, Chapter 6

Lafarge Africa Plc (2012). Impact Mitigation Monitoring Report of Lakatabu Expansion Project at Lafarge WAPCO Ewekoro Plant Prepared SEEMS Nigeria Limited, Chapter 4

Lal, R. (1974). Soil erosion and shitting Agriculture, F.A.O. Soil Bulletin 48-41.

Hutchinson, J. and J.M. Dalziel (1954-1972). Flora of West Tropical Africa (Revised by R.W.J. Keay and F.N. Hepper). Crown Agents, London.

Lochner, P. (2005). Guideline for Environmental Management Plans. CSIR Report No ENV-S-C. 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

Leopold, L.B., Clarke, F.E., Hanshaw, B.B. and Balslay (1971): *A procedure of evaluating environmental impacts.* Washington D.C. US Geological Survey Circular 645

Leamer, Edward E. (1995). "A Trade Economist's View of U.S. Wages and Globalisation", forthcoming in Susan Collins (ed), Imports, Exports and the American Worker, Brookings Institution, Washington DC.

Lide, D. R. (2009): *CRC Handbook of Chemistry, Physics, Geophysics, Astronomy and Acoustics, abundance of elements in the Earth's Crust and in the sea*; 89th Ed. CRC Press, Boca Raton; Fl. (Section 14 -17).

National Bureau of Statistics (2012). "*Annual Abstract of Statistics".* http://www.nigerianstat.gov.ng

Nigerian Industrial Standards (NIS) (2007): *Nigerian Standard for Drinking Water Quality.* (Price group D, © SON 2007 NIS 554: 20; ICS 13.060.20. 07). 30pp.

NIMET (2017) *Weather, Climate and Water Information on Nigeria.* Nigeria Meteorological Agency.www.nimetng.org.

NIPP (2012). Environmental Impact Assessment of Olorunsogo Power Plant Phase II, Olorunsogo, Ogun state, Prepared by Godirra Chemicals, Chapter 4

Nwafor, J. C. (2006). Environmental Impact Assessment for Sustainable Development The Nigerian Perspective (1st ed.). EDPCA Publishers

Nova Scotia Environment (2008): *The drop on water colour.* The Nova Scotia Environment report available @: www.gov.ns.ca/nse/water. 8pp. Visited on 13th December, 2017.

NPC (1991): *National Population Commission. Census '91 Final Results*, Ogun State.

NPC (1994): Census '91: *National Summary*. National Population Commission, Abuja

Offodile, M.E. (1992). An approach to groundwater study and development in Nigeria. Mecon Services Ltd.,Jos. Nigeria. pp 138.

Papadakis, J. (1965): *Crop Ecologic Survey in West Africa (Liberia, Ivory Coast, Ghana, Togo, Dahomey, Nigeria).* Vol II FAO, Rome.

Podsiki, C. (2008): Charts of heavy metals, their salts and other compounds. AIC-PA, Health and Safety Committee, November 2008 Publication. 24pp.

Rapport, D.J. and Whiteford, W.G. (1999). How ecosystem respond to stress? Bioscience 49(3): 193-203.

Sanford W.W. (1980). Savanna: a general review. In pp3-23, Sanford, W.W., Yesufu H.M. and Ayeni J.S.O. (eds.). *Selected Papers from the man and Biosphere State –of-knowledge Workshop on Nigerian Savanna*

Schropp, S. J. and Windom, H. L. (1988) (eds.): *A Giude to the interpretation of metal* *concentrations in estuarine sediments. Office of The Water Policy, Florida Department of Environmental Protection Report, April, 1988. 74pp.*

SEEMS (2015): Climate Data Analysis Report for Environmental Audit of Lafarge Facility, Ewekoro in Ogun State.

Slansky, M. (1962) Contribution à l'étude géologique du bassin sédimentaire ctier du Dahomey et du Togo. Mém. BRGM, No. 11, 165 p.

The Presidency, Federal Republic of Nigeria, 1992. *National Environmental Impact Assessment Decree No. 86.*

The World Bank Operational Policies (OP 4.01). *Environmental Assessment*

Taylor, S.R., McLennan, S.M., (1995). The geochemical evolution of the continental crust. Rev. Geophys. 33, 241–265.

Tebbutt, C. (1992). Sustainable Water development: opportunities and constraints. *Water International* 13: 189.

Vollenweider, R. A. (Ed.) (1974): *A manual on methods for measuring primary productivity in aquatic environments.* IBP Handbook No: 12; Blackwell Scientific Publications; Oxford; 2nd Edition. 225pp.

World Health Organization (WHO) (2011): *Guidelines for Drinking Water Quality*: 4th Edition, Geneva, 2011. 541pp.

USEPA (2017). Energy and the Environment, *Greenhouse Gas Equivalencies Calculator, United State Environmental Protection Agency.* www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Zaffanella, L. (1993). *Survey of Residential Magnetic Field Sources.* Volume 1: Goals, Results and Conclusions. Electric Power Research Institute (EPRI), Palo Alto, CA, 1-224.

APPENDICES

APPENDIX 1

(SIA/HIA QUESTIONNAIRE)

PROJECT- LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATIONS PROJECTS

SOCIAL IMPACT ASSESMENT (SIA) AND HEALTH IMPACT ASSESSMENT (HIA) QUESTIONNAIRES

QUESTIONNAIRE FOR SOCIAL IMPACT ASSESSMENT (SIA)

1. SETTLEMENT CODE

1.1 Date of Interview _________________

1.2 Name of village/Quarter____________

1.3 Population………………………

1.4 L. G. A _________________________

1.5 State ___________________________

1.6 Ethnic Groups ____________________

2. RESPONDENT SOCIAL DATA

2.1 Sex
- 2.1.1 Male
- 2.1.2 Female

2.2 Age
- 2.2.0 <10 years
- 2.2.1 11 - 20 years
- 2.2.2 21 – 30 years
- 2.2.3 31 – 40 years
- 2.2.4 41 – 50 years
- 2.2.5 51 – 60 years
- 2.2.6 Over 61 years

2.3 Marital Status
- 2.3.1 Single
- 2.3.2 Married
- 2.3.3 Divorced
- 2.3.4 Widow
- 2.3.5 Widower

2.4 Level of Education
- 2.4.1 Primary School
- 2.4.2 Secondary School
- 2.4.3 Vocational / Technical School
- 2.4.4 Tertiary School
- 2.4.5 No Formal Education

2.5 Employment/Occupation
- 2.5.1 Farming/Hunting
- 2.5.2 Fishing
- 2.5.3 Technician
- 2.5.4 Trading
- 2.5.5 Business / Contractor
- 2.5.6 Teaching
- 2.5.7 Civil Servant
- 2.5.8 Retired
- 2.5.9 Student / Apprentice
- 2.5.10 Unemployed
- 2.5.11 Others (Specify)

2.6 Skills
- 2.6.1 Mason
- 2.6.2 Welder
- 2.6.3 Technician
- 2.6.4 Fisherman
- 2.6.5 Politician
- 2.6.6 Transporter
- 2.6.7 Unskilled

2.7 Length of Service
- 2.7.1 0 – 5 years
- 2.7.2 6 – 10 years

2.7.3 11 – 20 years
2.7.4 21 – 30 years
2.7.5 Above 30 years

2.8 What is your annual income?
2.8.1 1,000 - 10,000
2.8.2 11,000 - 20,000
2.8.3 21,000 - 30,000
2.8.4 31,000 - 40,000
2.8.5 41,000 - 50,000
2.8.6 51,000 - 60,000
2.8.7 61,000 - 70,000
2.8.8 71,000 - 80,000
2.8.9 Above 80,000

2.9 Family size
2.9.1 1- 3
2.9.2 4 – 6
2.9.3 7 – 10
2.9.4 11 – 15
2.9.5 16 – 20
2.9.6 Above 20

2.10 Age Distribution of household (Including Parents)
MALE Age range FEMALE
2.10.1 0 - 14
2.10.2 15 – 24
2.10.3 25 – 34
2.10.4 35 - 44
2.10.5 45 - 54
2.10.6 Above 55

2.11 Distribution of household occupation
MALE Status FEMALE
2.11.1 Student / Apprentice
2.11.2 Business / Contractor
2.11.3 Technician
2.11.4 Farming/Fishing/Hunting
2.11.5 Teaching
2.11.6 Civil servant
2.11.7 Married / House Wife
2.11.8 Unemployed
2.11.9 Others (Specify)

2.12 How many births in the last 12 months?
2.12.1 :.......................................

2.13 How many deaths in the last 12 months
2.13.1 :.......................................

2.14 List the common sickness in the settlement ?
2.14.1 :.......................................
2.14.2 :.......................................

2.15 List the Environmental problems in the settlement
2.15.1 Soil infertility
2.15.2 Pest attack / invasion
2.15.3 Soil salinity
2.15.4 Erosion
2.15.5 Rain storm / flooding
2.15.6 Others (specify)
2.15.7 No idea

2.16 Status of Respondent
2.16.1 Traditional Ruler/Head of Settlement
2.16.2 Church Leader
2.16.3 Traditional Chief/Councillor
2.16.4 Family head
2.16.5 Union Leader
2.16.6 Doctor/Nurse/Herbalist
2.16.7 Immigrant/Settler
2.16.8 Visitor
2.16.9 Others (Specify)

2.17 Who should speak for your community on project matters?.
2.17.1 Chief

2.17.2 Community chairman
2.17.3 Community secretary
2.17.4 Youth leader
2.17.5 Church leader

2.18 How long have you lived in the settlement
2.18.1 0 – 5 years
2.18.2 6 – 10 years
2.18.3 11 – 15 years
2.18.4 16 – 20 years
2.18.5 Above 20 years
2.18.6 Since birth

2.19 What is your religion
2.19.1 Traditional
2.19.2 Islam
2.19.3 Christianity
2.19.4 Worship God
2.19.5 Atheist

2.20 Of what use are the water bodies in your area?
2.20.1 Fisheries
2.20.2 Irrigation
2.20.3 Domestic
2.20.4 Transportation
2.20.5 Recreation
2.20.6 None
2.20.7 Others (specify)

3. RESPONDENS' ECONOMIC DATA

3.1 Annual Income (Naira)
2.8.1 1,000 - 10,000
2.8.2 11,000 - 20,000
2.8.3 21,000 - 30,000
2.8.4 31,000 - 40,000
2.8.5 41,000 - 50,000
2.8.6 51,000 - 60,000
2.8.7 61,000 - 70,000
2.8.8 71,000 - 80,000
2.8.9 Above 80,000

3.2 What type of house do you (own /live in)
3.2.1 Thatched
3.2.2 Thatched/wooden
3.2.3 Thatched/mud
3.2.4 Zinc roof/wooden
3.2.5 Zinc roof/mud
3.2.6 Zinc roof/block

3.3 How many sleep in one room
3.3.1 1
3.3.2 2
3.3.3 4
3.3.4 6
3.3.5 8
3.3.6 >8

3.4 Do you own
3.4.1 Canoe
3.4.2 Bicycle
3.4.3 Motor – Cycle
3.4.4 Car / Lorry
3.4.5 Engine boat
3.4.6 Fish pond
3.4.7 House
3.4.8 Other (specify)

3.5 What other properties do you own ?
3.5.1 Rubber plantation
3.5.2 Palm plantation
3.5.3 Cocoa plantation

3.5.4 Forestry / Raffia palm
3.5.5 Farm land
3.5.6 Poultry (specify)
3.5.7 None
3.5.8 Others (specify)

3.6 Rank order pattern of land ownership
3.6.1 Inheritance
3.6.2 Tenant / lease
3.6.3 Family
3.6.4 Outright purchase
3.6.5 Communal
3.6.6 Others (Specify)

3.7 What is the total size of your land in hectares?
3.7.1 0 - 5 (1 = football field)
3.7.2 2 - 3
3.7.3 4 - 5
3.7.4 6 - 7
3.7.5 Above 7
3.7.6 None

3.8 Which are the farming methods in your area?
3.8.1 Garden
3.8.2 Fallow
3.8.3 Shifting cultivation
3.8.4 Rotational bush fallow
3.8.5 No idea

3.9 What cropping system is common here ?
3.9.1 Mono - Cropping
3.9.2 Mixed - Cropping
3.9.3 Inter - Cropping
3.9.4 Others (specify)
3.9.5 No idea

3.10 What has been the nature of Agricultural yield?
3.10.1 Increasing
3.10.2 Decreasing
3.10.3 The same

3.11 Form of Fish farming
3.11.1 Net (canoe)
3.11.2 Net (Motorized Boat)
3.11.3 Hook
3.11.4 Trap/Basket
3.11.5 Any other (specify)
3.13.7 ……………………………….

3.12 What has been the nature of fish yield in the past five years
3.12.1 Increasing
3.12.2 Decreasing
3.12.3 Constant

3.13 What is your usual means of Transportation?.
3.13.1 Canoe
3.13.2 Engine Boat
3.13.3 Motorcycle
3.13.4 Car
3.13.5 Bicycle

3.14 Name Sacred sites in your community
3.14.1 ……………………………….
3.14.2 ……………………………….
3.14.3 ……………………………….
3.14.4 ……………………………….
3.14.5 ……………………………….
3.14.6 ……………………………….

4 RESPONDENTS ATTITUDE TO COMPANY /ENVIRONMENT

4.1 Name the companies in this area and state the benefits you have derived from them.....……………………………..?

4.1.1 Employment
4.1.2 Scholarship
4.1.3 Community Project (specify)
4.1.4 Skills Acquisition
4.1.5 None
4.1.6 Negative
4.1.7 Name negative effects

4.2 Are you aware of any intended project in the Community? (Yes / No) If yes, What is it?

4.2.1 Cement factory
4.2.2 Power Transmission Line
4.2.3 Development project (specify)
4.2.4 No idea

4.3 What benefit do you expect from this Road project?

4.3.1 Employment opportunity
4.3.2 Economic boom
4.3.3 Infrastructural development
4.3.4 Scholarship
4.3.5 Housing
4.3.6 Hospital
4.3.7 Others (specify)

4.4 What is your attitude to this project?

4.4.1 Support the project
4.4.2 Resist the project
4.4.3 No idea
4.4.4 Demand compensation

4.5 What pipeline related social-problems do you have in your area ?

4.5.1 Youth / Juvenile delinquency
4.5.2 Land dispute
4.5.3 Chieftaincy tussle
4.5.4 Inter-family problem
4.5.5 Inter-village / Tribal conflict
4.5.6 Acute unemployment
4.5.7 Child abuse/ Infant pregnancy
4.5.8 Alcoholism, Prostitution
4.5.8 Other (specify)

4.6 What are your fears on the proposed Road Rehab project in order of importance

4.6.1 Loss of land (acquisition/deforestation)
4.6.2 Damage to farmland
4.6.3 Pollution of air/waterways
4.6.4 Health problems
4.6.5 Socio-cultural interference
4.6.6 High cost of living
4.6.7 Increased population
4.6.8 Soil infertility
4.6.9 Social disorder
4.6.10 Frequent death
4.6.11 Others (specify)
4.6.12 Explain your fears in details
4.6.13 ……………………….
4.6.14 ……………………….
4.6.15 ……………………….

4.7 Give general comment on activities of FMW or any other company in this community ?

4.7.1 ....
4.7.2 ....
4.7.3 ....
4.7.4 ………………………………………

4.7.5 ………………………………………

4.8 What Power Transmission Line induced problem have you experienced, when and where ?

4.8.1 ....
4.8.2 ....
4.8.3 ....
4.8.4 ……………………………………….
4.8.5 ……………………………………….

4.9 Type of waste discharge system

4.9.1 Water System
4.9.2 Pit system
4.9.3 Bucket system
4.9.4 River
4.9.5 Bush/swamp
4.9.6 Others (specify).......................................

4.10 Source of water supply

4.10.1 ....
4.10.3 ....
4.10.3 ....

4.11 Do you have the following in the river/creek ?

4.11.1 Shrimps/prawns
4.11.2 Oysters
4.11.3 Thias
4.11.4 Periwinkles
4.11.5 Scallops
4.11.6 Crabs
4.11.7 Others (specify).........................
4.12 Types of wild life in the area
4.12.1 ....
4.12.2 ....
4.12.3 ....

4.13 List in order of importance what you expect from FMW

4.13.1 ……………………………………
4.13.2 ……………………………………
4.13.3 ……………………………………
4.13.4 ……………………………………
4.13.5 ……………………………………
4.13.6 ……………………………………

4.14 Which group(s) in your community suffers most from industrial activities

4.14.1 …………………………………..
4.14.2 …………………………………..
4.14.3 …………………………………..
4.14.4 …………………………………..
4.14.5 …………………………………..

QUESTIONNAIRE FOR HEALTH IMPACT ASSESSMENT (HIA)

A) **SOCIO-DEMOGRAPHIC VARIABLES**

1. Name of Town/village________________________________
2. House Hold No. (District/settlement/house no.)__________
3. Age (Last birthday)__________________________________
4. Sex: (a) Male (b) Female
5. Marital Status: (a) Married (b) Single (c) Divorced (d) Separated
6. What is the highest level of education you attained?
7 Occupation __________________________________
8. Income per Month (for Adults only): _________________
9. Ethnic Group: _________________________________

B) **LIFE STYLE / HABITS**

1. Common food/preparations taken in the community

____

____

2. During the last 4 weeks how often have you had drinks containing alcohol? Would you say:
□□Every day
□□At least once a week
□□Less than once a week
□□None at all (don't take alcohol)
3. Smoking (Yes / No)
If yes, how many sticks per day?………….
4. Use of Tobacco (Yes / No)
5. Exercise (Yes / No)
Type …………………. (b) How often ……………….

C) **COMMON HEALTH HAZARDS IN THE COMMUNITY**

1. During the last 12 months have you been admitted into a hospital on account of ill health? (Yes / No)
2. If yes for which condition?
3. List all illness episodes in the last 12 months:

____

____

4. Which disease conditions in your opinion poses the greatest health threat to the community: (in order of priority)

5. How many people on the average died in your community within the last 12 months: Adults --------------
Under 5 --------------- Less than one year -------------
6. What in your opinion is the most important cause of death in the community?
(a) Amongst children under one year ______________________________
(b) Amongst children under 5 years ______________________________
(c) Amongst adults ____

D) **IMMUNISATION STATUS (CHILDREN)**

Have you received any of the following vaccines?
(i) DPT (Yes / No)
(ii) BCG (Yes / No)
(iii) Oral Polio Vaccine (OPV) (Yes / No)
(iv) Typhoid
(v) Yellow Fever
(vi) Tetanus Toxoid
(vii) Small Pox
(viii) Hepatitis Vaccine
(ix) Others (Specify)

E) **KAP REGARDING SEXUALLY TRANSMITTED INFECTIONS**

1. Have you ever heard of diseases that can be transmitted through sexual intercourse?
2. Can you describe any symptoms of sexually transmitted diseases in women?
1. Abdominal pains
□□Genital discharge
□□Burning pain on urination
□□Genital ulcers/sores
□□Itching
□□Swelling in the groin+-
□□Others
3. Can you describe any symptoms of sexually transmitted disease in men?
□□Genital discharge
□□Burning pain on urination
□□Genital ulcers/sores
□□Itching
□□Swelling in the groin
□□Others
4 Have you heard of HIV/AIDS
5 Do you have a close friend or close relative who is infected with HIV or who has died of AIDS?
□□Yes a close relative
□□Yes a close friend
□□No
□□No response
6 In your opinion, can people protect themselves from contracting sexually transmitted diseases or HIV/AIDS?
Yes No
Yes No
If yes by what means ____
7 Do you think this project will increase or decrease the chances of people contracting sexually transmitted diseases and HIV/AIDS?
o Yes will increase chances
o Yes will decrease chances
o No difference
o Don't know
8 If yes, how ____
9 What do you think can be done to prevent people from contracting sexually transmitted diseases and HIV/AIDS during this project? ________________

F **COMMUNITY HEALTH NEEDS**
1 What in your opinion are the most important health needs of your Community. (Score in order of priority 1 – 5)
□□Safe drinking water
□□Food
□□Health services / clinics
□□Electricity
□□Good toilet system
□□Waste disposal
□□Others (Specify)
2 In order of preference, what do think should be done to improve the Health Services in your community?
(i) ____
(ii) ____
(iii) ____
3 What Health problems do you think may arise because of this project in your Community?
(i) ____
(ii) ____
(iii) ____
(iv) ____
4. In order of preference what do you think should be done to minimize these anticipated health problems?
(i) ____

(ii) ____

(iii) ____

(iv) ____

G) **ENVIRONMENTAL HEALTH**
1. What is the source of your drinking water?
□□Tap
□□Well
□□Stream
□□Other (Specify)
2. How do you dispose your faeces?
(a) Bucket System
(b) Pit latrine
(c) Water System
(d) Bush
(e) Into River/Stream
(f) others (specify)
3. How do you dispose your house refuse?
(a) Dustbin
(b) Open dumping on land / creeks
(c) Composting
(d) Incineration
YES No
(e) Others (specify).

(H) **OCCUPATIONAL EXPOSURES**
(a) Have you been exposed to any of the following (Explain possible sources)
□□Asbestos
□□Lead
□□Benzene
□□Coal dust
□□Loud noise (over a long period of time)
□□Others (name them)
(b) Have you had any of the following occupational illnesses: (Explain symptoms)
□□Respiratory diseases
□□Skin diseases
□□Upper limb and neck disorder
□□Cancer and malignant blood disease
□□Poisoning
□□Noise induced hearing loss
□□Infectious diseases
□□Mental ill-health

APPENDIX 2

(ENVIRONMENTAL STANDARDS)

ENVIRONMENTAL STANDARDS

Inorganic constituents for drinking water quality (Source: WHO, 1993)

Characteristic	**Health-based guideline**
Antimony (mg/l)	0.005
Arsenic mg/l	0.01
Barium mg/l	0.7
Boron mg/l	0.3
Cadmium mg/l	0.003
Chromium mg/l	0.05
Copper mg/l	2
Cyanide mg/l	0.07
Fluoride mg/l	1.5
Lead mg/l	0.01
Manganese mg/l	0.5
Mercury mg/l	0.001
Molybdenum mg/l	0.07
Nickel mg/l	0.02
Nitrate mg/l	50
Nitrite mg/l	3
Selenium mg/l	0.01
Uranium μg/l	140
Consumer acceptability level	
Aluminium mg/l	0.2
Chloride mg/l	250
Hardness as $CaCO_3$ mg/l	500
Hydrogen sulphide mg/l	0.05
Iron mg/l	0.3
Manganese mg/l	0.1
PH	6.5-9.5
Sodium mg/l	200
Sulphate mg/l	250
Total dissolved solids mg/l	1200
Zinc mg/l	4

EMISSION STANDARDS, ENVIRONMENTAL REGULATIONS 1987 (ENVIRONMENTAL QUALITY ACT 1974).

Item	Category of Vehicle	Maximum Sound Level Permitted (dBA)
3	Used for the carriage of goods. Permitted maximum weight does not exceed 3.5 tons. Engine is less than 200 hp DIN	81
6	Used for the carriage of goods. Permitted maximum weight exceeds 3.5 tons. Engine is less than 200 hp DIN	86
7	Used for the carriage of goods. Permitted maximum weight foes not exceed 3.5 tons. Engine is 200 hp DIN or more.	88

Source: Environmental Quality Act 1974 and Regulations

NIGERIA AMBIENT AIR QUALITY STANDARD (FEPA, 1991)

Pollutants	Time of Average	Limit
Particuclates Sulphur Oxides Sulphur Dioxide Non-Methane Hydrocarbon Carbon Monoxide Nitrogen Oxides (Nitrogen Dioxide) Photochemical Oxidants	Daily Average of hourly values (1 hour) Daily Average of hourly values (1 hour) Daily Average of hourly values (1 hour) Daily Average of hourly values (3 hourly averages) Daily Average of hourly values (8 hourly average) Daily Average of hourly values (range) Hourly Values	250ug/m^3 600ug/m^3 0.01ppm 160ug/m^3 10ppm (20ppm) 0.04-0.06ppm 0.06

NOISE EXPOSURE LIMITS FOR NIGERIA (FEPA, 1991)

Duration/Day-Hours	**Permissible Exposure Limit dB(A)**
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼	115
Impulsive or Impact Noise	< 140 dB, Peak

EFFLUENT LIMITATION/GUIDELINES IN NIGERIA FOR ALL CATEGORIES OF INDUSTRIES (FEPA, 1991)

Parameters	Units in Milligram per litre (mg/l) Unless Otherwise Stated	
	Limit for Discharge into Surface Water	**Limit for Land Application**
Temperature	Less than 40°C within 15 minutes of out fall	Less than 40°C
Colour (Lovibond Units)	7	-
pH	6 – 9	6 – 9
BOD_5 at 20°C	50	500
Total Suspended Solids	30	-
Total Dissolve Solids	2,000	2,000
Chloride (as CI)	600	600
Sulphate (as SO_4^{2-})	500	1,000
Sulphide (as S^{2-})	0.2	-
Cyanide (as CN^-)	0.1	-
Detergents (linear alkylated suphonate as methylene blue active substance)	15	15
Oil and Grease	10	30
Nitrate (as NO_3)	20	-
Phosphate (as PO_4^{3-})	5	10
Arsenic (as As)	0.1	-
Barium (as Ba)	5	5
Manganese (as Mn)	5	-
Phenolic Compounds (as phenol)	0.2	-
Chlorine (free)	1.0	-
Cadmium, Cd	Less than 1	-
Chromium (trivalent and hexavalent)	Less than 1	-
Copper	Less than 1	-
Lead	Less than 1	-
Tin (as Sn)	10	10
Iron (as Fe)	20	-
Mercury	0.05	-
Nickel	Less than 1	-
Selenium	Less than 1	-
Silver	0.1	-
Zinc	Less than 1	-
Total Metals	3	-
Calcium (as Ca^{2+})	200	-
Magnesium (as Mg^{2+})	200	-
Boron (as B)	5	5
Alkyl Mercury Compounds	Not detectable	Not detectable
Polychlorinated Biphenyls (PCBs)	0.003	0.003
Pesticides (Total)	Less than 0.01	Less than 0.01
Alpha Emitter, uc/ml	10^{-7}	-
Beta Emitters, uc/ml	10^{-6}	-

Coliforms (daily average)	400MP/100ml	500MP/100ml
Suspended Fibre	-	-

INTERNATIONAL FINANCE CORPORATION (IFC) /WORLD BANK POLICIES AND GUIDELINES

Ambient Air

Concentrations of contaminants, measured outside the project boundary, should not exceed the following limits:

Particulate Matter (<10µm)	
Annual Arithmetic Mean	100 µg/m^3
Maximum 24 hour Average	500 µg/m^3
Nitrogen Oxides, as NO_2	
Annual Arithmetic Mean	100 µg/m^3
Maximum 24 hour Average	200 µg/m^3
Sulfur Dioxide	
Annual Arithmetic Mean	100 µg/m^3
Maximum 24 hour Average	500 µg/m^3

Workplace Air Quality

threshold limit values (TLVs):

Arsenic	0.5 mg/m^3
Carbon Monoxide	29 mg/m^3
Copper	1 mg/m^3
Free Silica	5.0 mg/m^3
Hydrogen Cyanide	11 mg/m^3
Hydrogen Sulfide	14 mg/m^3
Lead, Dusts & Fumes, as Pb	0.15 mg/m^3
Nitrogen Dioxide	6 mg/m^3
Particulate (Inert or Nuisance Dusts)	10 mg/m^3
Sulfur Dioxide	5 mg/m^3

Workplace Noise

Ambient Noise levels should not exceed 85dBA

Liquid Effluents

pH	6 to 9
BOD_5	50 mg/l
Oil and Grease	20 mg/l
Total Suspended Solids	50 mg/l
Temperature – at the edge of	Max 5^{o}C above ambient temperature

A designated mixing zone receiving waters – max 3^{o}C if receiving waters>28^{o}C

Residual Heavy Metals

Arsenic	1.0 mg/l
Cadmium	0.1 mg/l
Chromium, Hexavalent	0.05 mg/l
Chromium, Total	1.0 mg/l
Copper	0.3 mg/l
Iron, Total	2.0 mg/l
Lead	0.6 mg/l
Mercury	0.002 mg/l
Nickel	0.5 mg/l
Zinc	1.0 mg/l

Cyanide

In no case should the concentration in the receiving water outside of a designated mixing zone exceed 0.022mg/l

Free Cyanide	0.1 mg/l
Total Cyanide	1.0 mg/l
Week Acid Dissociable	0.5 mg/l

Measures to prevent access by wildlife and livestock are required for all open waters (examples tailings impoundments and pregnant leach ponds) where WAD cyanide is in excess of 50 mg/l.

Ambient Noise

Receptor	**Maximum Allowable L_{eq} (hourly), in dB(A)** Day time 07:00 – 22:00	Night time 22:00 – 07:00
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

APPENDIX 3

(FEDERAL MINISTRY OF ENVIRONMENT FEEDBACK LETTER)

FEDERAL MINISTRY OF ENVIRONMENT

Environment House
Independence Way South, Central Business District, Abuja - FCT.
Tel: 09-2911 337 www.environment.gov.ng, ea-environment.org

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMENV/EA/EIA/4318/Vol.1/93
11th July, 2017

The Managing Director,
Transmission Company of Nigeria,
Plot 14, Zambezi Crescent,
Maitama, Abuja

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED OGUN STATE TRANSMISSION LINES AND ASSOCIATED SUBSTATIONS PROJECT (LOT 2)

Please refer to your letter dated 10th May, 2017 and the Ministry's letter Ref:FMEnv/EA/EIA/4318/Vol.1/76 dated 30th May, 2017 on the above project.

2. Following the successful conclusion of site verification exercise, the Ministry has placed the project in **Category One (1)** requiring EIA mandatory studies and a panel review process. Please be informed that Ministry approval for the Terms of Reference is subject to the satisfactory inclusion of significant issues identified relevant to the project during the scoping workshop.

3. The field data gathering, laboratory analyses of the environmental components of the study which will be One (1) season and should be augmented with relevant approved EIA data generated within 5km radius of the project site with the underlisted as minimum. The sampling point should be geo-referenced with coordinates in UTM format and tables in spread sheet (excel).

S/N	ENVIRONMENTAL. COMPONENT	ENV /LCOMPONENTS DETAILS	NUMBER OF SAMPLES/ DISTRIBUTION	PARAMETERS TO BE MONITORED.
1	**Climate/ Meteorology**	Microclimate/Regional Climatic features	In-situ measurement, secondary data	Temperature, Rainfall; Relative humidity, Wind direction and speed, visibility, cloud cover and their local effects.
2	**Surface water**	Physico-Chemical & Microbial, fisheries and plankton	3 Nos. at each river/stream crossings + control sample	Heavy metals – (Mn, Cr, Cd, Ni, V, Zn, Hg, Cu, Pb, Fe etc), Colour, Temp, pH, turbidity, Salinity, hardness, DO, BOD, COD, THC, Electrical conductivity, Phosphate, SO_4, NO_3, TSS.

				coliform, total plate), water body depth and width, flow direction and flow rate, fisheries and fish spawning areas, planktons, benthos, aquatic macrophyte and hydrodynamics.
3	**Ground water,**	Physico-chemical & Microbial.	1 No. at each substation + control sample	Depth to and thickness, hydraulics, recharge and, uses. Colour, pH, turbidity, Salinity, hardness, heavy metals - Cu, Pb, Fe, K, Ba, DO, BOD, COD, THC, Electrical conductivity, Phosphate, SO_4, NO_3, TSS, PCB
4	**Soil**	Physical	30 Nos. + controls Samples	Profile (depth, type) colour, permeability, porosity, bulk density, texture (grain size).
		Chemical	30 Nos + controls samples	Heavy metals – (Mn, Cr, Cd, Ni, V, Zn, Hg, Cu, Pb, Fe etc), Colour, pH, turbidity, Salinity, hardness, DO, BOD, COD, THC, PCB
		Soil Microbiology	30 Nos. + controls samples	Total heterogenic bacteria (total hydrocarbon, T. fungi, total hydrocarbon bacteria (THB), faecal coliform.
5	**Land Use**	Land cover	-	Approved Land Use types: Recreational, agricultural, forestry, industrial, residential, institutional, commercial. Trends etc
6	**Ambient Air Quality**		3 Nos. each substation (in-situ @ different elevations of both sites) and 1sampling unit at 5km distance along TL RoW.	Suspended particulate matter, NO_x, SO_x, CO_2, CO, VOCs, H_2S.
7	**EMF**		At the edge of RoW/at regular intervals and around substations	
8	**Noise**	Noise level	3 Nos. each substation (in-situ @ different elevations of both sites) and 1sampling unit at 5km distance along TL RoW.	Db
7	**Ecology**	Vegetation		Flora and fauna, Habitat status, floral composition, density and distribution, vegetation structure, plant pathology
10	**Geology**	Local and regional		Stratigraphy, structure, fractures patterns, flow direction, aquifer level, Regional geology, Stratigraphic/Lithologic properties

11	**Socio-Economic**			Education, culture, distribution of livelihood, land use, etc. with structured questionnaire administration.
12	**Health Impact Assessment**			Health status and prevalent diseases within and around the project area and host community.

4. The sampling is based on the location contained in the ToR submitted. However, if the rout changes significantly from the area sampled, additional sampling to cover the new area will be required.

5. You are to facilitate the participation of Ministry officials and also ensure full quality assurance/quality control (QA/QC) measures for the laboratory analyses in line with standard practices which should be referenced. You should notify the Ministry in good time to enable us plan our participation in the field work/laboratory analysis.

6. You are also, requested to conduct a scoping workshop and to ensure the participation of regulators, community representatives and other relevant stakeholders for lot 2.

7. The following should be forwarded to the FMEnv before submission of the **draft** EIA report;
   - Evidence of laboratory accreditation with the FMEnv where the samples are analyzed.
   - Chain of custody form
   - Certificate of analysis duly stamped and signed by the laboratory manager.
   - Evidence of laboratory witnessing by the FMEnv.

8. I am further directed to request you to pay the sum of Five Hundred Thousand Naira (500,000:00) only into the Ministry's Treasury Single Account (TSA) as the Initial processing fee. Upon completion of the EIA studies, you are to submit ten (5) hard copies and One (1) soft copies of the draft EIA report to the Ministry and review, consideration and approval.

9. Thank you for your co-operation.

K. A. Ihebinike
For: Honourable Minister

APPENDIX 4

(FIELD DATA)

Geophysical Survey

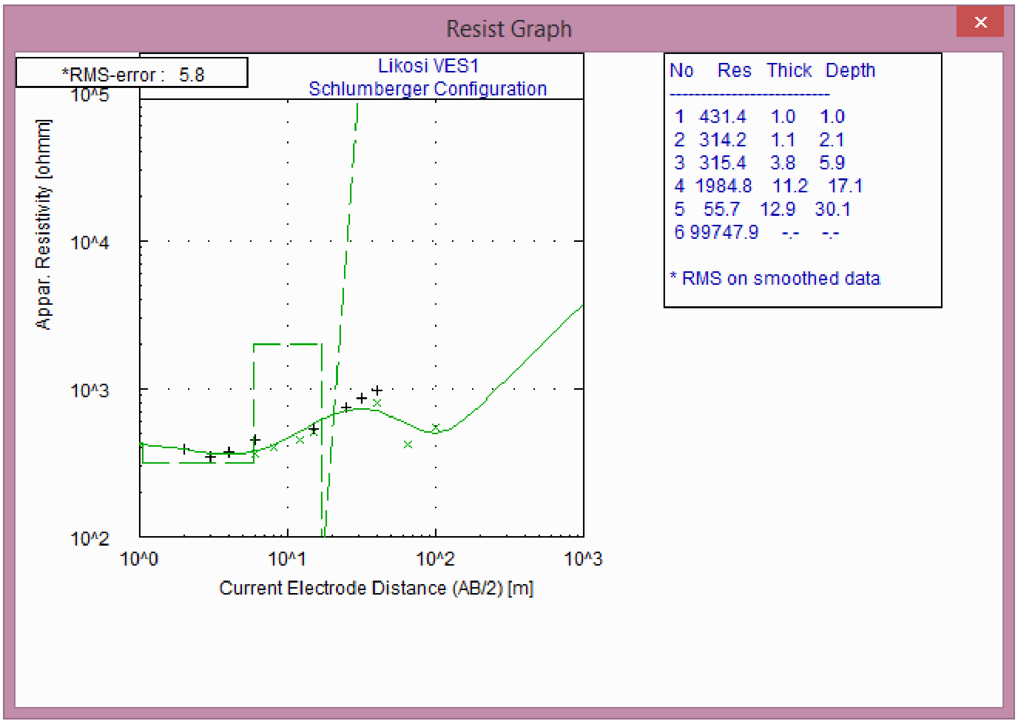
Vertical Electrical Sounding (VES) Data

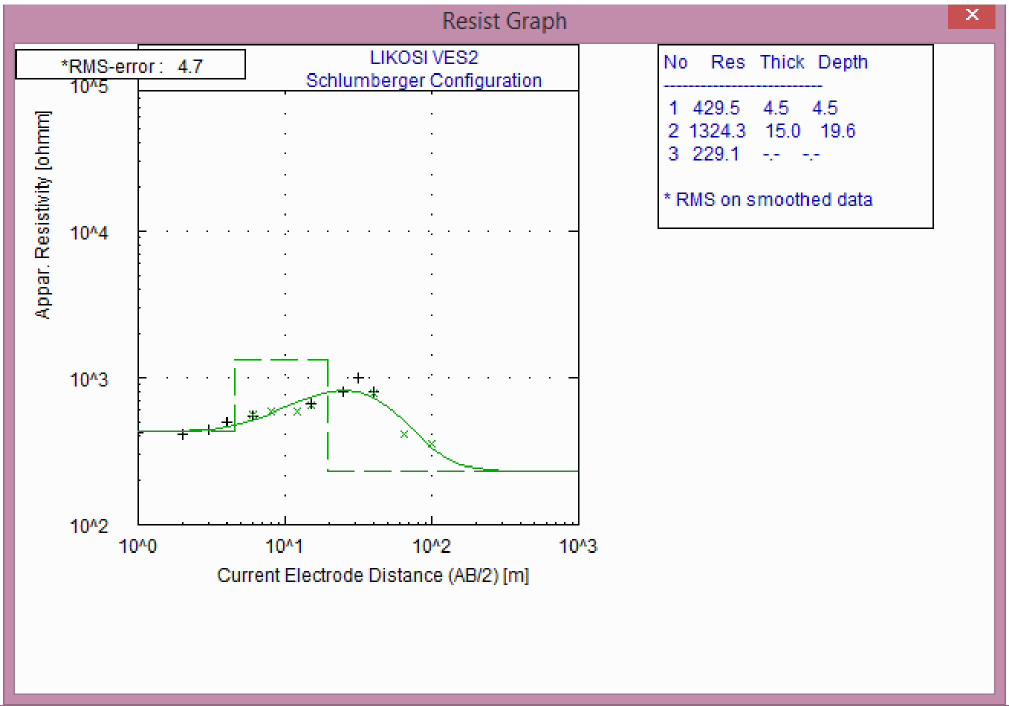
AB/2 (m)	Apparent Resistivity (ohm-m)					
	VES 1 E -558867 N -748537	VES 2 E -558851 N-748622	V ES 3 E-558840 N-748689	VES 4 E-561235 N-748642	VES 5 E-558737 N-754147	VES 6 E-556825 N-748204
1	424	417	247	181	312	162
2	392	412	337	201	224	236
3	351	449	418	215	204	283
4	372	493	503	241	191	322
6	452	543	633	266	122	396
6	362	566	633	249	136	362
8	402	583	764	315	74	442
12	452	588	735	338	19	475
15	505	651	680	344	11	519
15	530	672	699	382	11	523
25	756	813	632	426	11	625
32	858	997	650	445	48	757
40	967	808	643	532	57	916
40	805	789	643	486	74	946
65	419	413	763	763	75	1223
100	548	359	1093	1189	104	1880

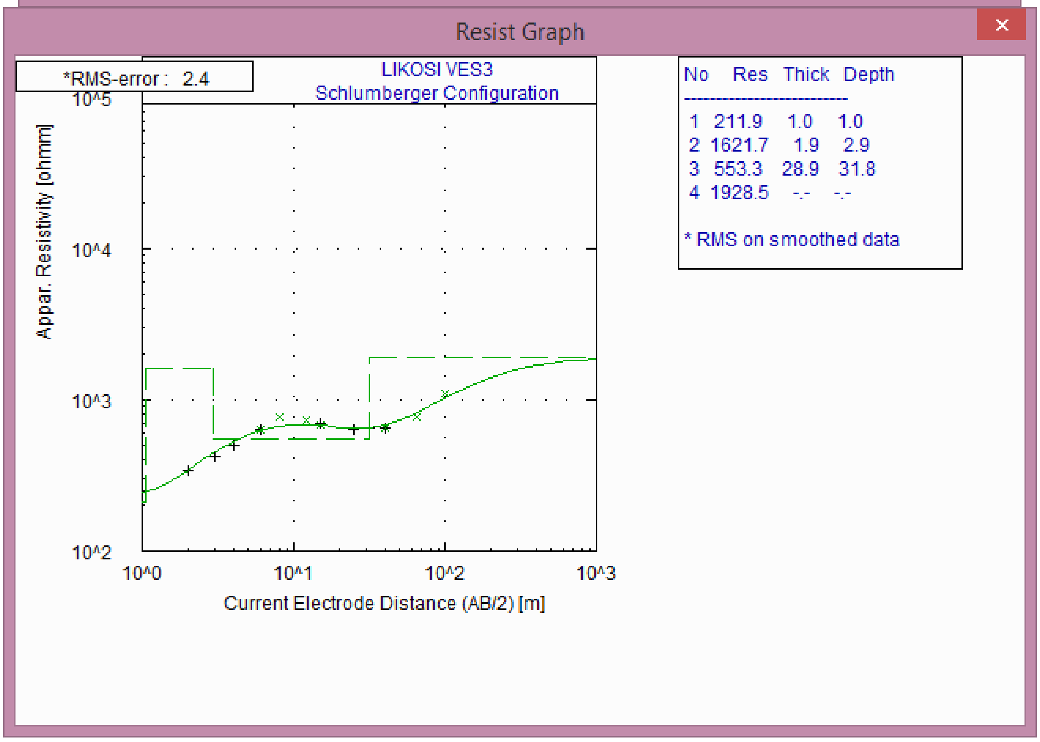
AB/2 (m)	Apparent Resistivity (ohm-m)					
	VES 7 E – 554040 N - 746885	VES 8 E – 542453 N – 741256	VES 9 E – 542647 N – 746246	VES 10 E – 542659 N – 746323	VES 11 E – 541962 N – 743081	VES 12 E – 556825 N – 748204
1	417	351	30	12	13	206
2	472	289	10	8	9	271
3	498	277	8	6	11	373
4	563	271	8	6	13	382
6	543	249	8	6	17	498
6	543	249	8	7	18	633
8	383	221	10	7	21	724
12	211	160	52	10	21	844
15	91	126	15	11	31	817
15	102	137	17	11	32	1130
25	108	65	22	15	32	1194
32	18	46	24	16	27	1239
40	9	41	27	17	22	1374
40	18	34	23	21	20	1702
65	34	18	21	18	13	1393
100	99	17	18	16	9	1171
100		12			10	
150					7	

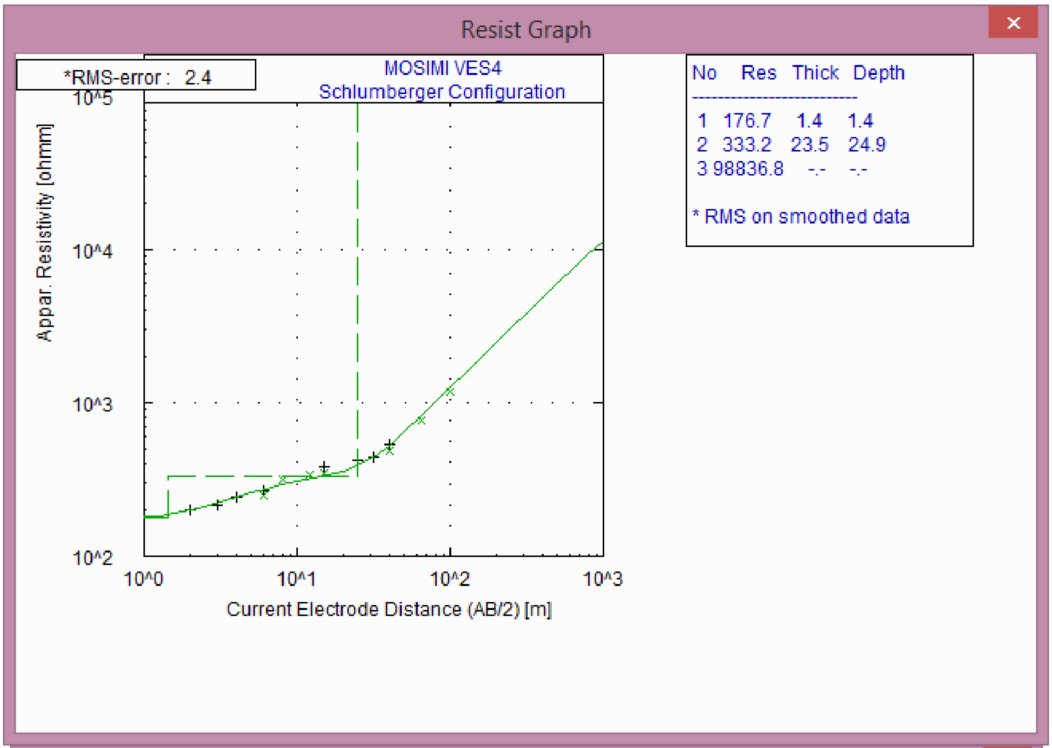
AB/2 (m)	Apparent Resistivity (ohm-m)					
	VES 13 E – 550495 N – 760276	VES 14 E – 541696 N – 758501	VES 15 E – 543751 N – 759799	VES 16 E – 533499 N – 757317	VES 17 E – 525306 N – 757140	VES 18 E – 523334 N – 757117
1	95	69	715	869	167	134
2	75	60	269	739	181	211

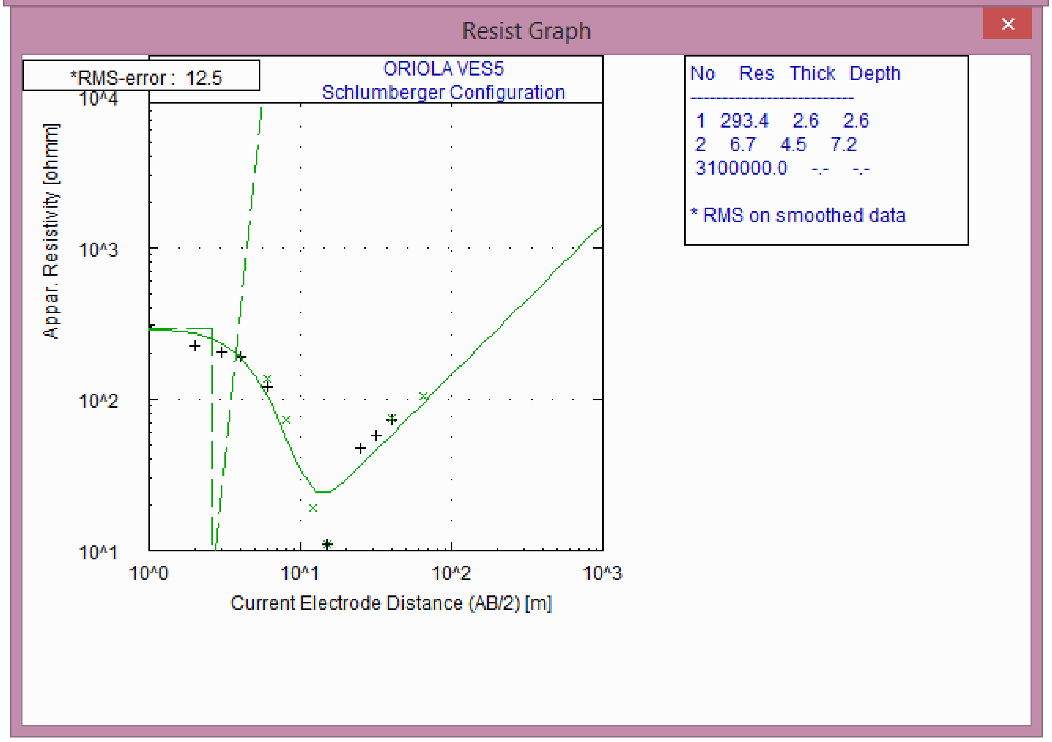
3	84	41	209	611	192	260
4	100	32	181	553	165	302
6	113	16	139	339	95	382
6	120	21	147	351	108	362
8	139	9	149	201	60	402
12	136	8	138	64	17	492
15	110	9	132	42	11	497
15	109	7	148	41	9	516
25	144	8	133	34	6	635
32	158	11	120	38	6	672
40	183	14	157	38	8	753
40	200	11	69	35	5	753
65	195	19	48	39	10	832
100	231	30	42	35	15	108
100			42	34		
150			119	31		

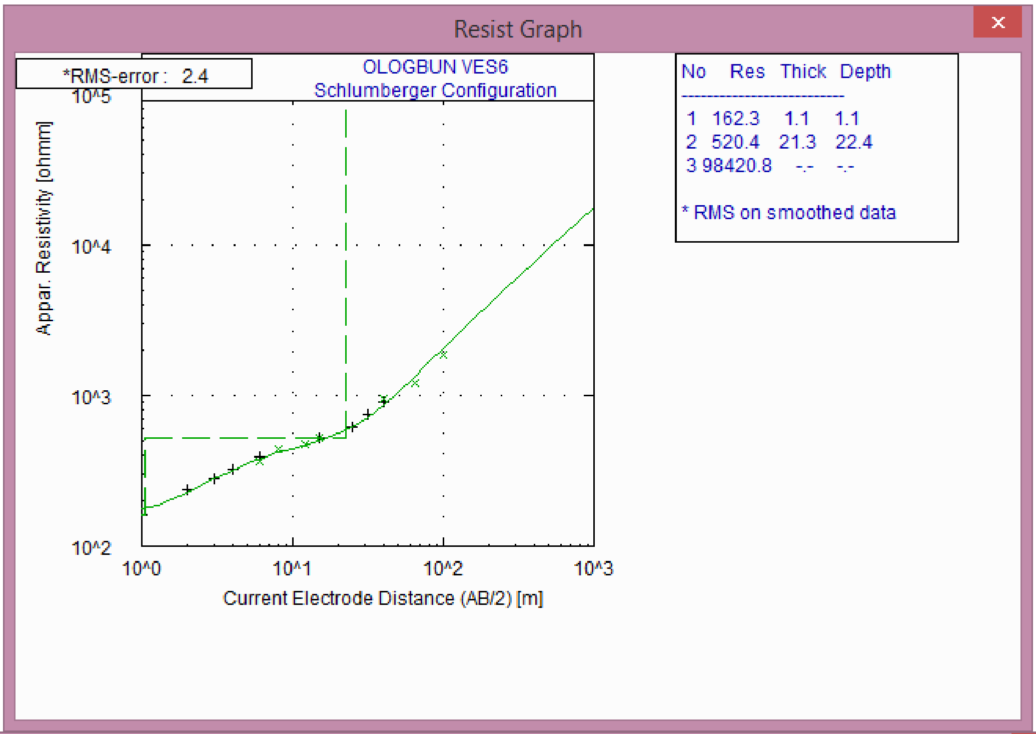


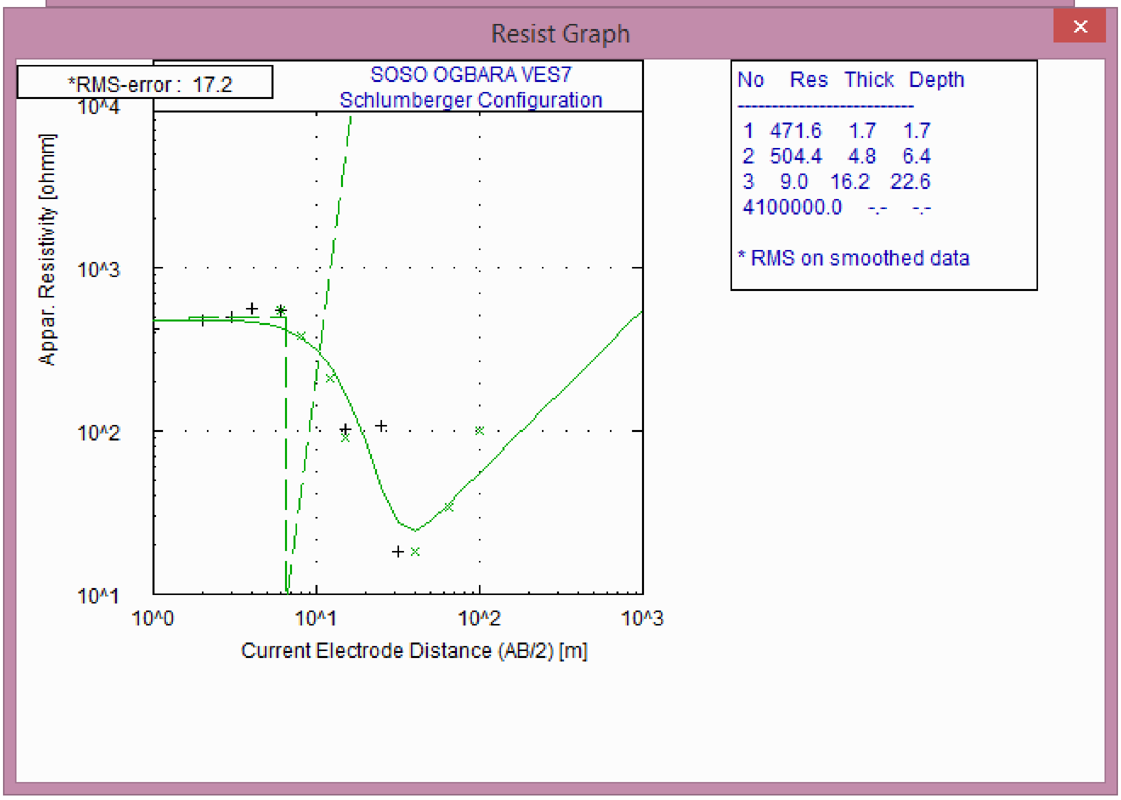

Resist Graph
*RMS-error : 4.7
LIKOSI VES2
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 429.5 4.5 4.5
2 1324.3 15.0 19.6
3 229.1 -.- -.-
* RMS on smoothed data

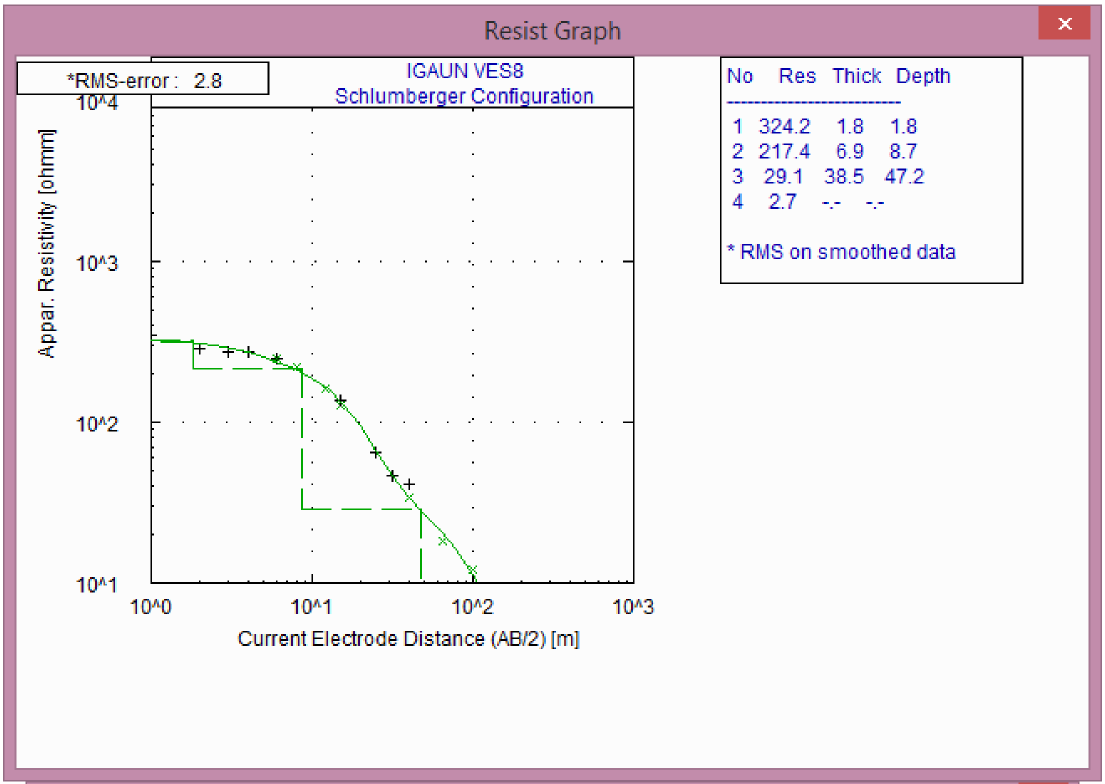

Resist Graph
*RMS-error : 2.4
LIKOSI VES3
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 211.9 1.0 1.0
2 1621.7 1.9 2.9
3 553.3 28.9 31.8
4 1928.5 -.- -.-
* RMS on smoothed data

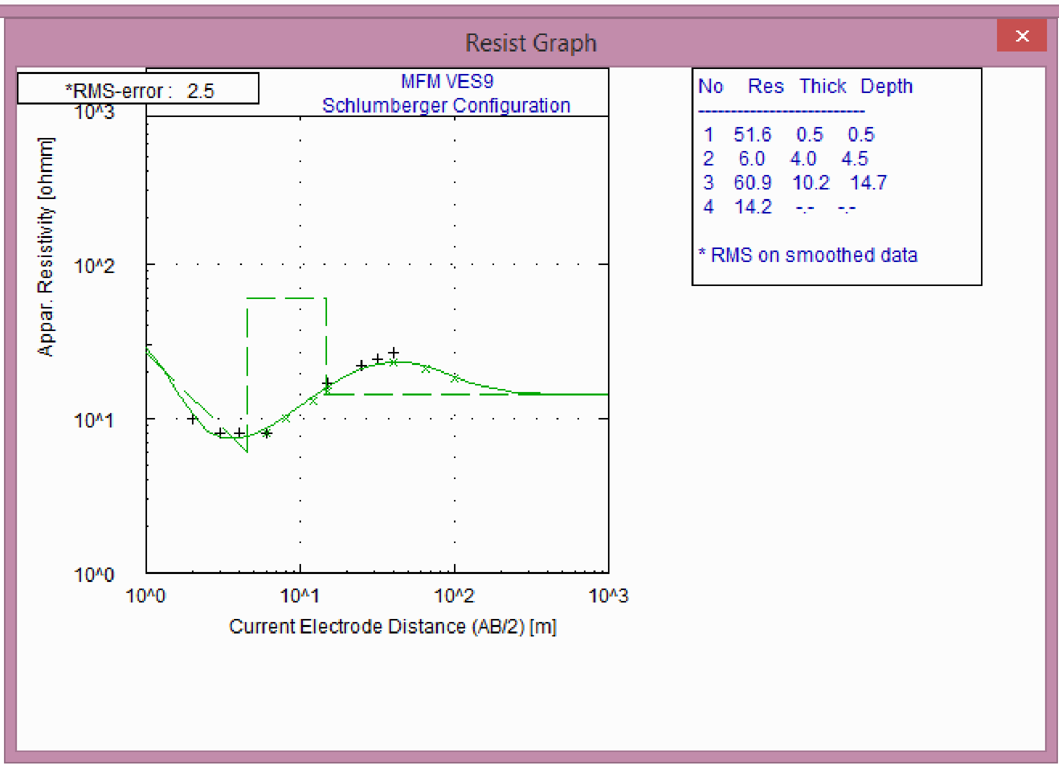

Resist Graph
*RMS-error : 2.4
MOSIMI VES4
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 176.7 1.4 1.4
2 333.2 23.5 24.9
3 98836.8 -.- -.-
* RMS on smoothed data

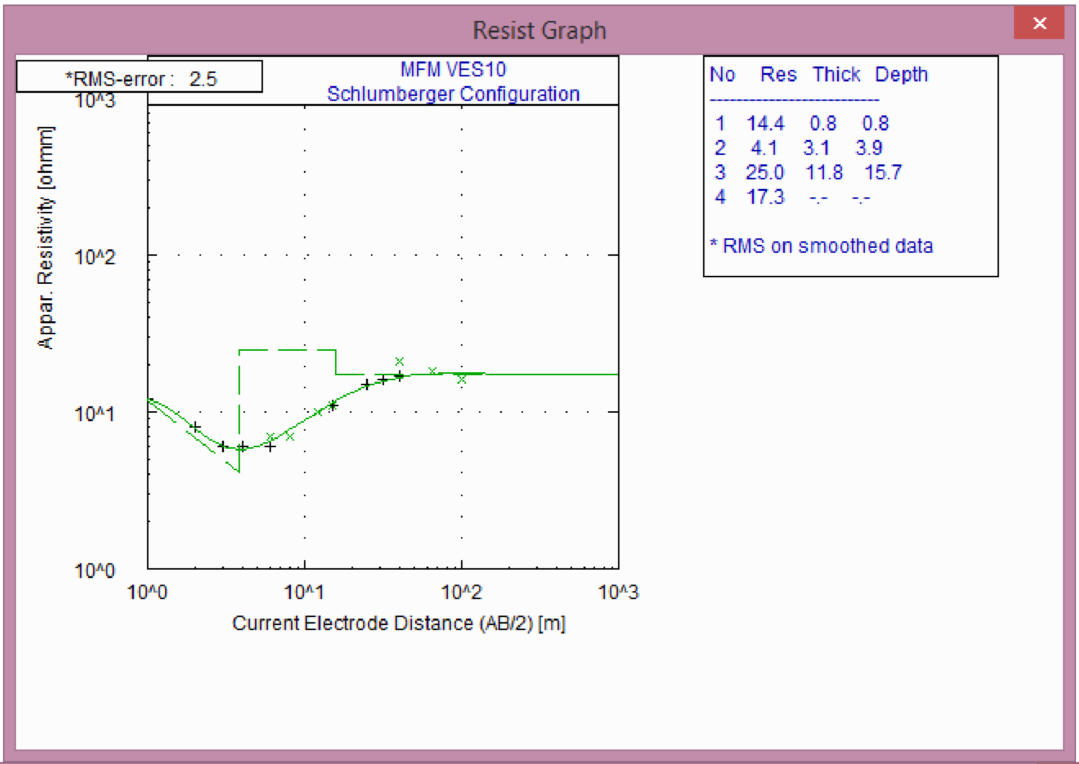

Resist Graph
*RMS-error : 12.5
ORIOLA VES5
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^4
10^3
10^2
10^1
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 293.4 2.6 2.6
2 6.7 4.5 7.2
3100000.0 -.- -.-
* RMS on smoothed data

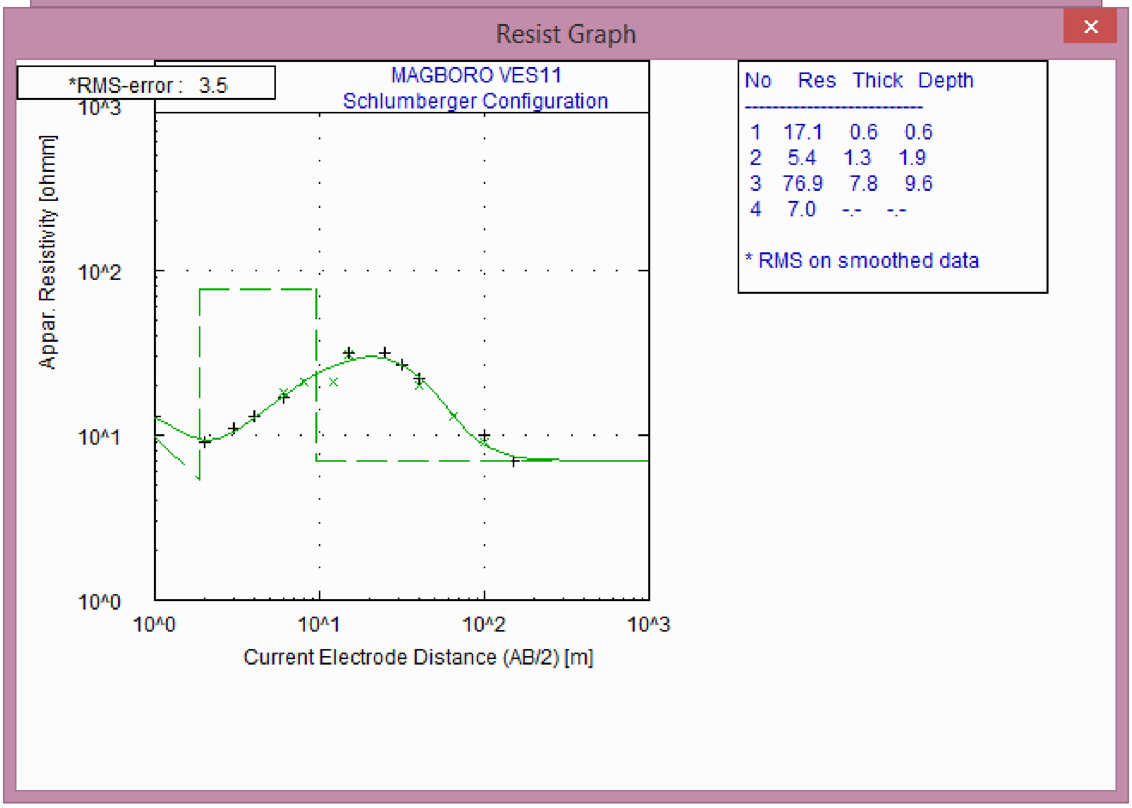

Resist Graph
*RMS-error : 2.4
OLOGBUN VES6
Schlumberger Configuration
No Res Thick Depth
1 162.3 1.1 1.1
2 520.4 21.3 22.4
3 98420.8 -.- -.-
* RMS on smoothed data
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]

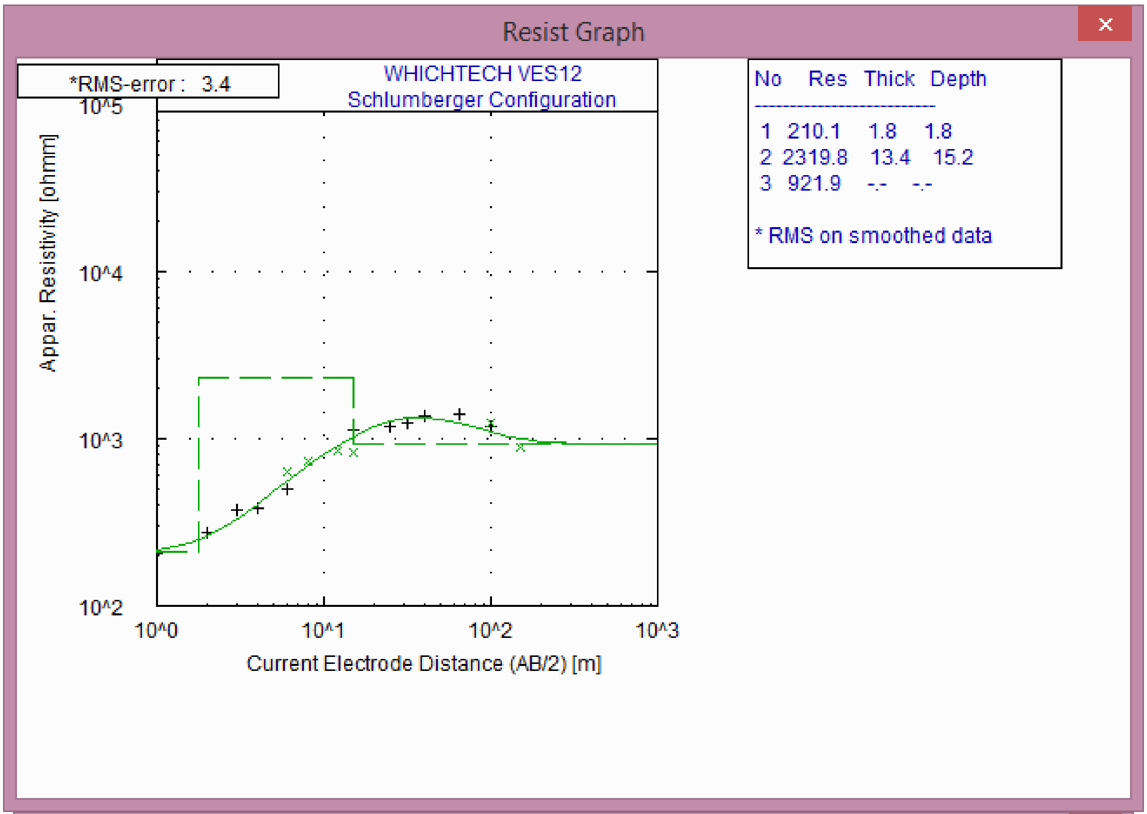

Resist Graph
*RMS-error : 17.2
SOSO OGBARA VES7
Schlumberger Configuration
No Res Thick Depth
1 471.6 1.7 1.7
2 504.4 4.8 6.4
3 9.0 16.2 22.6
4100000.0 -.- -.-
* RMS on smoothed data
Appar. Resistivity [ohmm]
10^4
10^3
10^2
10^1
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]

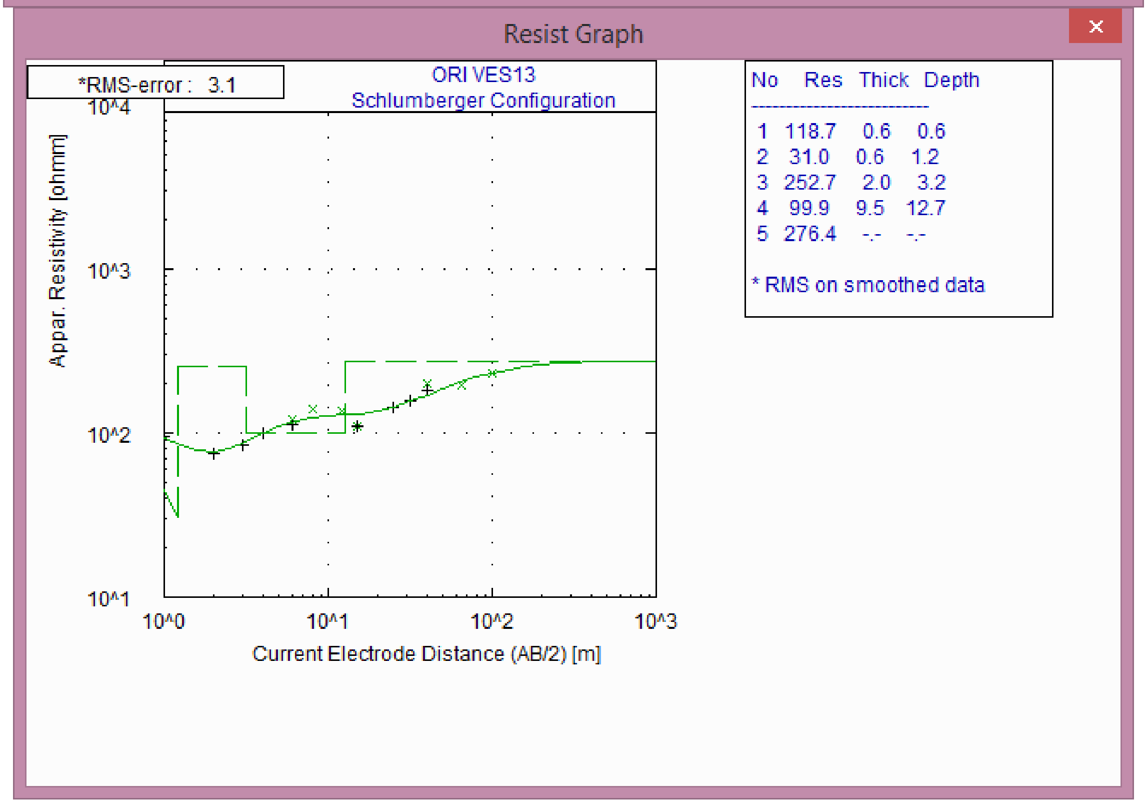

Resist Graph
*RMS-error : 2.8
IGAUN VES8
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^4
10^3
10^2
10^1
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 324.2 1.8 1.8
2 217.4 6.9 8.7
3 29.1 38.5 47.2
4 2.7 -.- -.-
* RMS on smoothed data

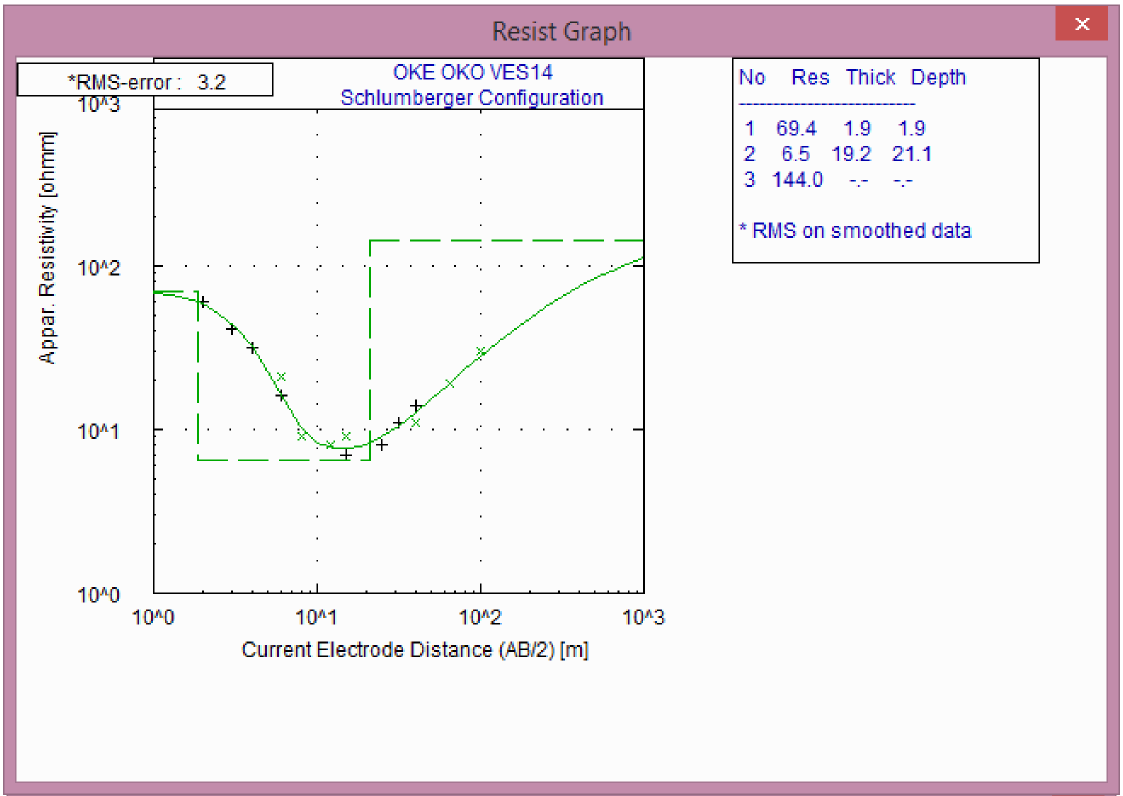

Resist Graph
*RMS-error : 2.5
MFM VES9
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^3
10^2
10^1
10^0
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 51.6 0.5 0.5
2 6.0 4.0 4.5
3 60.9 10.2 14.7
4 14.2 -.- -.-
* RMS on smoothed data

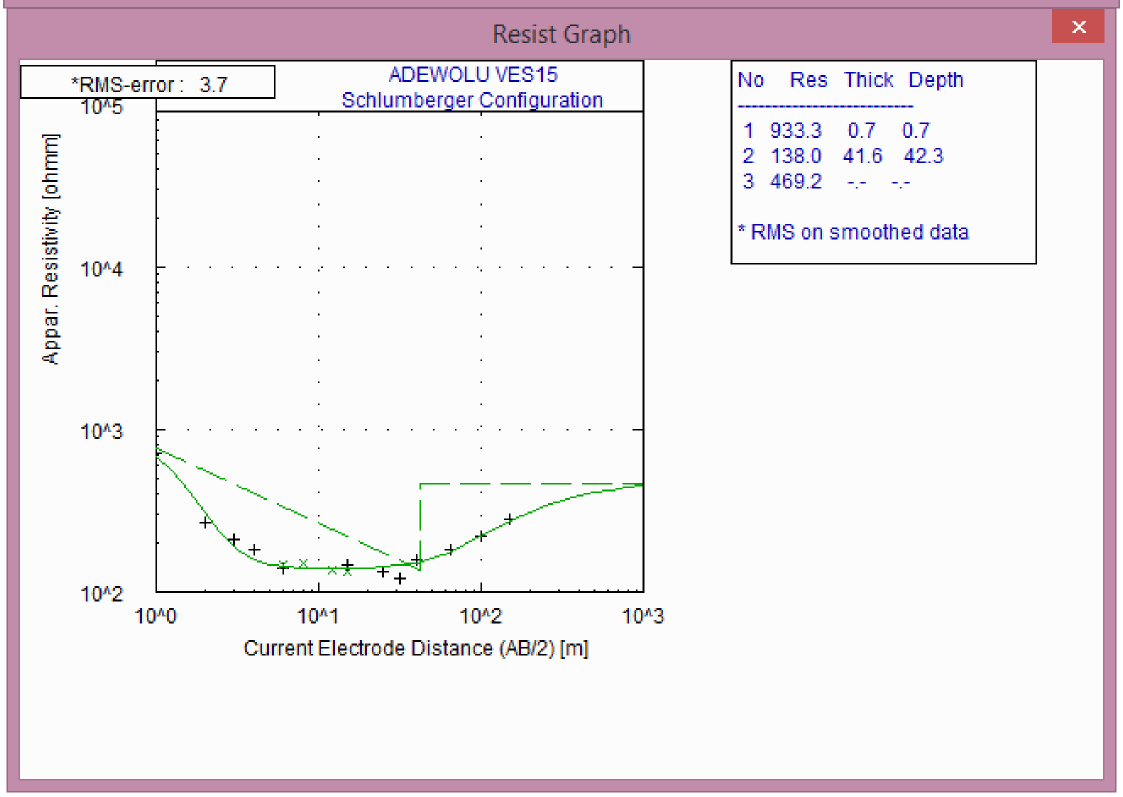

Resist Graph
*RMS-error : 2.5
MFM VES10
Schlumberger Configuration
No Res Thick Depth
1 14.4 0.8 0.8
2 4.1 3.1 3.9
3 25.0 11.8 15.7
4 17.3 -.- -.-
* RMS on smoothed data
Appar. Resistivity [ohmm]
10^3
10^2
10^1
10^0
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]

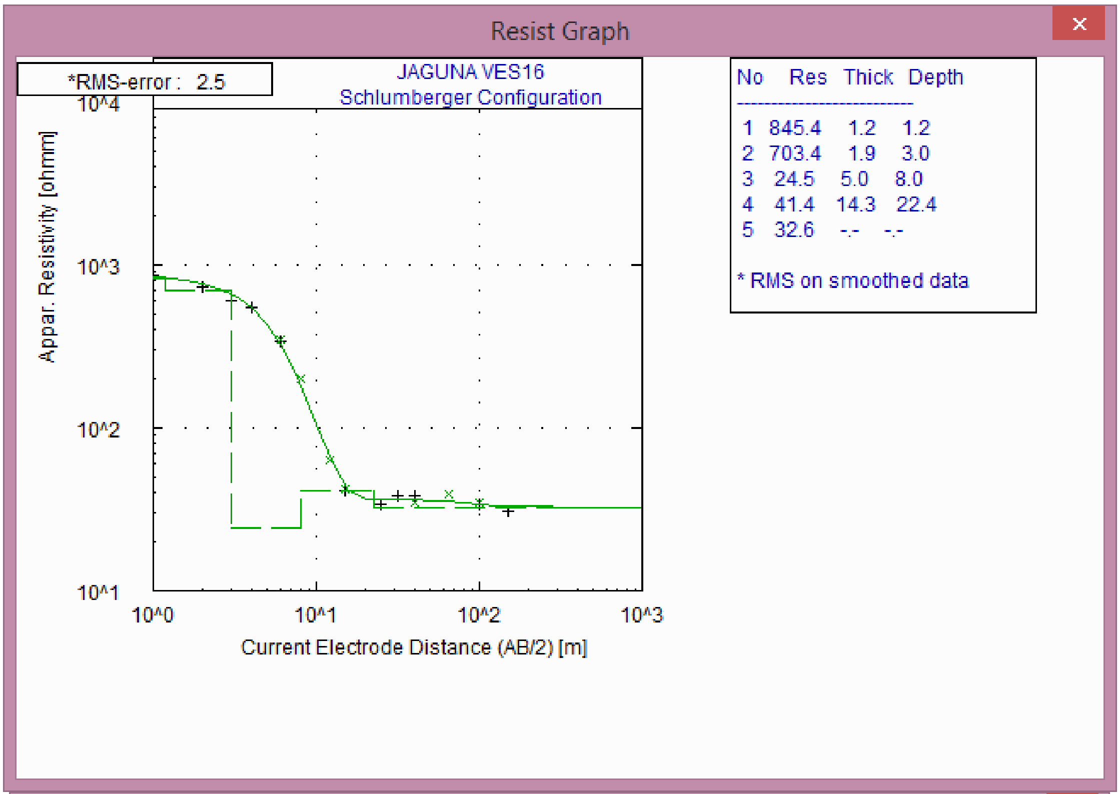

Resist Graph
*RMS-error : 3.5
MAGBORO VES11
Schlumberger Configuration
No Res Thick Depth
1 17.1 0.6 0.6
2 5.4 1.3 1.9
3 76.9 7.8 9.6
4 7.0 -.- -.-
* RMS on smoothed data
Appar. Resistivity [ohmm]
10^3
10^2
10^1
10^0
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]

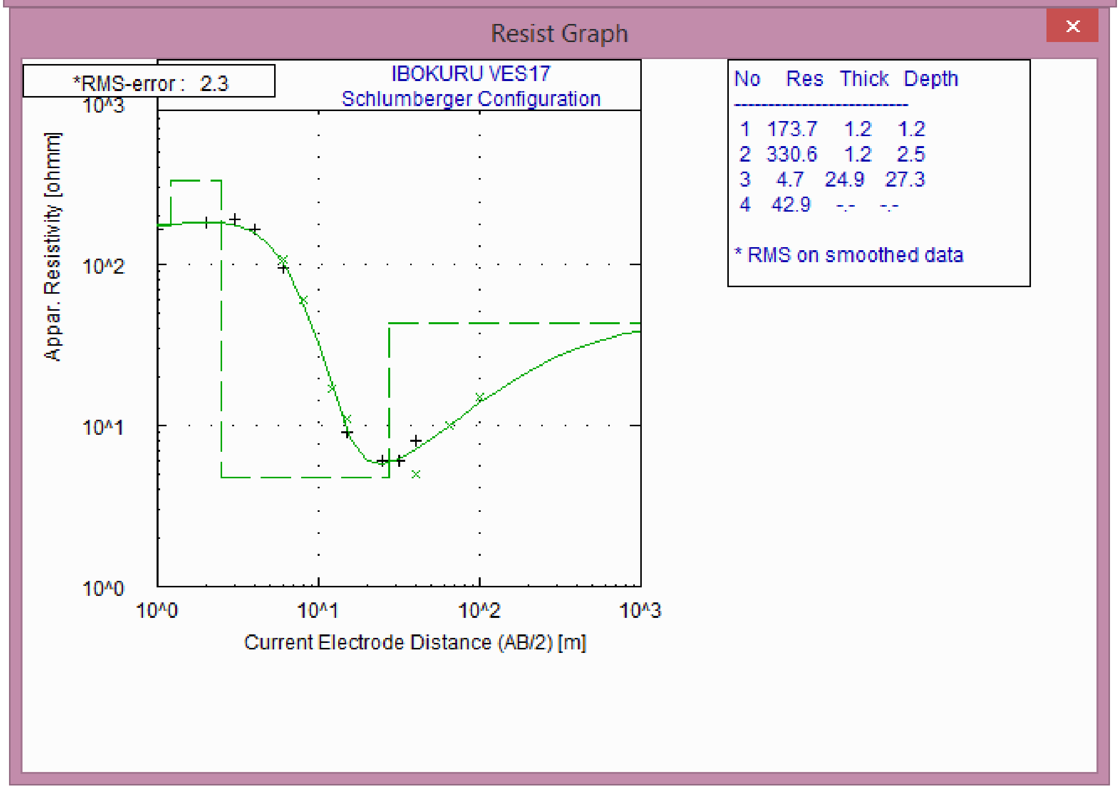

Resist Graph
*RMS-error : 3.4
WHICHTECH VES12
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 210.1 1.8 1.8
2 2319.8 13.4 15.2
3 921.9 -.- -.-
* RMS on smoothed data


Resist Graph
*RMS-error : 3.1
ORI VES13
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^4
10^3
10^2
10^1
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 118.7 0.6 0.6
2 31.0 0.6 1.2
3 252.7 2.0 3.2
4 99.9 9.5 12.7
5 276.4 -.- -.-
* RMS on smoothed data


Resist Graph
*RMS-error : 3.2
OKE OKO VES14
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^3
10^2
10^1
10^0
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 69.4 1.9 1.9
2 6.5 19.2 21.1
3 144.0 -.- -.-
* RMS on smoothed data


Resist Graph
*RMS-error : 3.7
ADEWOLU VES15
Schlumberger Configuration
Appar. Resistivity [ohmm]
10^5
10^4
10^3
10^2
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 933.3 0.7 0.7
2 138.0 41.6 42.3
3 469.2 -.- -.-
* RMS on smoothed data

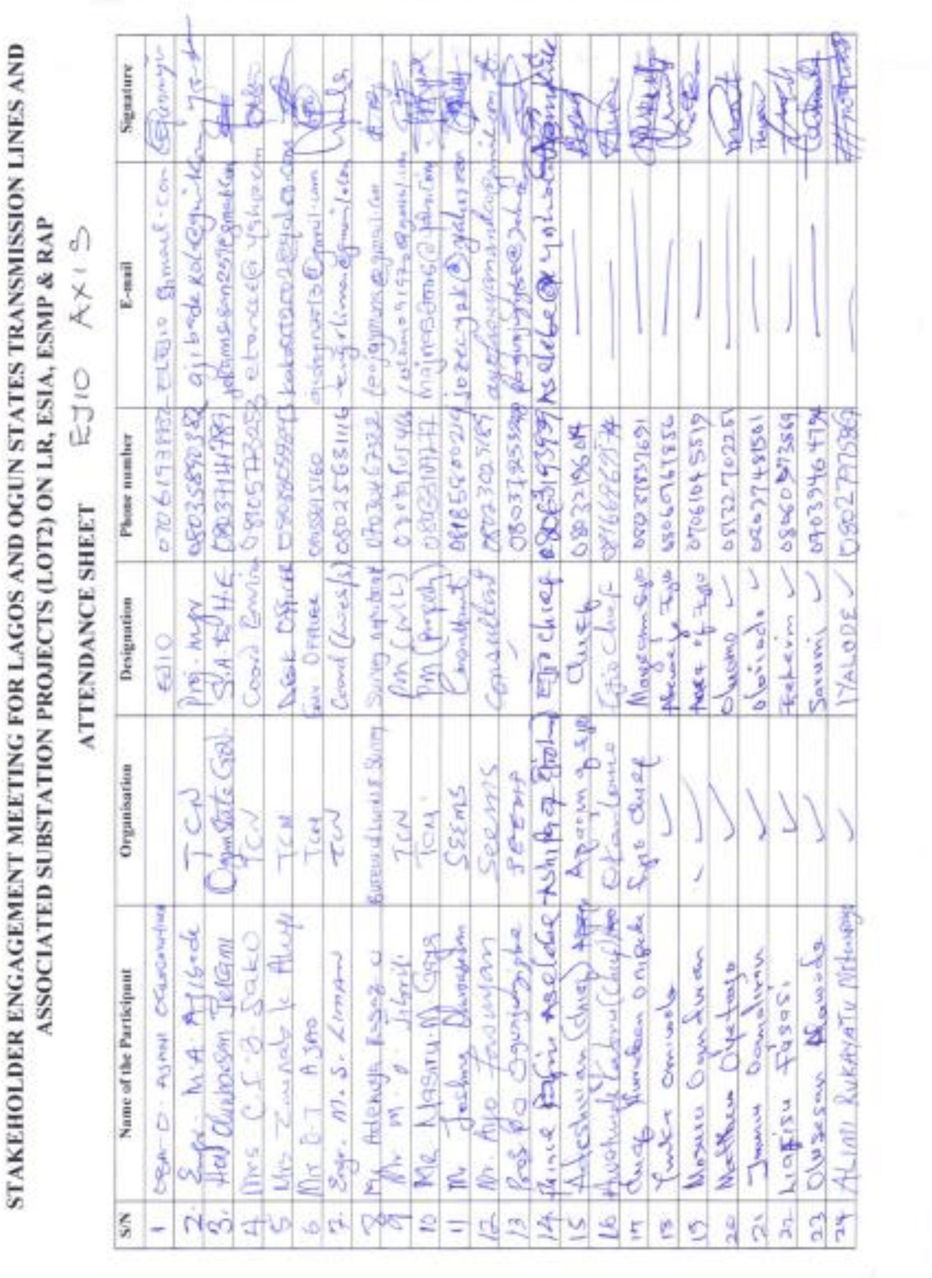

Resist Graph
*RMS-error : 2.5
JAGUNA VES16
Schlumberger Configuration
10^4
10^3
10^2
10^1
Appar. Resistivity [ohmm]
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 845.4 1.2 1.2
2 703.4 1.9 3.0
3 24.5 5.0 8.0
4 41.4 14.3 22.4
5 32.6 -.- -.-
* RMS on smoothed data


Resist Graph
*RMS-error : 2.3
IBOKURU VES17
Schlumberger Configuration
10^3
10^2
10^1
10^0
Appar. Resistivity [ohmm]
10^0
10^1
10^2
10^3
Current Electrode Distance (AB/2) [m]
No Res Thick Depth
1 173.7 1.2 1.2
2 330.6 1.2 2.5
3 4.7 24.9 27.3
4 42.9 -.- -.-
* RMS on smoothed data

APPENDIX 5

(ATTENDANCE SHEETS AND MINUTE OF MEETINGS)

EJIO AXIS



STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET EJIO AXIS

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
1	OBA O. AJANI [illegible]		EJIO	07061938932	ELEJIO @gmail.com	
2	Engr. M.A. Ajibade	TCN	Proj. Mgr	08035890382	ajibade.kol@[illegible]	
3	Hon [illegible]	Ogun State Govt.	S.A to H.E	08037141789	[illegible]	
4	Mrs C.S.B. Sako	TCN	Coord Envir	[illegible]	[illegible]@yahoo.com	
5	Mrs Zainab K. Aliyu	TCN	Desk Officer	[illegible]	[illegible]@yahoo.com	
6	Mr B.T. Ajao	TCN	[illegible] Officer	[illegible]	[illegible]@gmail.com	
7	Engr. M.S. Liman	TCN	Coord (Lines/S)	08025681116	engrliman@gmail.com	
8	Mr Adenuga Razaq O.	Bureau of Lands & Survey	Survey [illegible]	0703[illegible]	[illegible]@gmail.com	
9	Mr M. B. Jibril	TCN	PM (W/L)	[illegible]	[illegible]@gmail.com	
10	Mr Nasiru M. Gaya	TCN	PM (Project)	[illegible]	[illegible]@yahoo.com	
11	Mr Joshua [illegible]	SSEMS	Consultant	[illegible]	[illegible]	
12	Mr Ayo Fasunyan	SEEMS	Consultant	08023025189	[illegible]	
13	Prof. P.O. [illegible]	PEEMS		0803[illegible]	[illegible]	
14	Prince [illegible] Aselebe	Ashipa of Ejio	Ejio chief	[illegible]	Aselebe@yahoo[illegible]	
15	Adeshina (chief)	[illegible]	Chief	08032196014	—	
16	Awotunde Kabiru (Chief)	[illegible]	Ejio Chief	[illegible]	—	
17	Chief [illegible] Onigbede	Egbe Chief	[illegible]	08037837691	—	
18	[illegible] Omiwole	—	[illegible]	[illegible]	—	
19	Mosuru Ogundiran	✓	[illegible]	07061045519	—	
20	Matthew Oyetoyo	✓	[illegible] ✓	08132702251	—	
21	[illegible]	✓	[illegible] ✓	[illegible]	—	
22	Liadisu Fasasi	✓	Ekerin ✓	[illegible]	—	
23	Olusesan [illegible]	✓	Sarumi ✓	07039464794	—	
24	ALIMI RUKAYATU [illegible]	✓	IYALODE ✓	[illegible]	—	

EJIO AXIS (Cont.)

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
25	Kamorudeen I. Onifade	Ejio chief	Baale Ejio	08033278036	—	
27	Alh. S. A. Ayelean	✓	Lukotun ✓	08032946331	—	
28	Sunday Adedeji	✓	Asipa	08032344700	—	
29	Chief Olawale Akere	~~Baale~~ Abese	Baale Abese	08038427233	—	
30	Chief Bamidele L.J	Ikija	Baale Ikija	08167830133	—	
31	Chief Abdullah Akeeyem	Odogunmi ounde	Baale ounde	08112686049	—	
	~~Taj/ILUDIPE~~	~~ABEOKUTA~~	~~BAALE ABEOKUTA~~			
32	Tajudeen Kuraisi	Abeokuta	Baale	08052989110	—	
	Chief Idowu Obasa	Sowunmi village	Balogun	08039746497	—	
34	Chief George B.A Oladipupo	Ogunmola	BAALE	07068802193	—	
35	Chief Adekunjo	Aleogbata	Magajegun	08160612958	—	
36	Chief Sunmonu	Eleggbata	BALE	08025753162	✓	
37	Chief KAYODE ADESINA	OMOLAJA	BAALE	08033416257	✓	
38	Chief - Sotipe Sunday	Orile-Ibaegun	BAALE	07031824555	✓	
39	Chief Ayoade Olusegun	Oreke Village	Baale	07035895779	✓	
40	Chief Mutiu Omolabi	Abese	Baale	08055088865	—	
41	Pst Dennis Okedigwe	Iludun Ejio	Community leader	08052535403	chidmek@gmail.com	
42	Ajibola Michael	Iludun Ejio	C	08036267015		
43	SAIRU ODUN	ALULO EJIO		08062139155		
44	Sobola Oluyemisi	REP. ABESE	REP.	08064624050	—	
45	Solomon Olusoji - Fagoola	Iludun Ejio	Community member	08035631546	olusoji4me@yahoo.com	
46	Adeshina Rafiu	Iludun Ejio	✓ Otun Baale	09065881551	—	
47	Adelani Kareem	Oreke	Balogun	07036668978	—	
48	Adenbigbe Saheed A.	Iludun Ejio	Vice Chairman	08051318567	mesah554@yahoo.com	

EJIO AXIS (Cont.)

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
49	PST Kolawole Taiwo	Iludun Ejio	CDA Chairman	07054942880	Kolatemmy@gmail	
50	Orimolofe - Gbolega	Iludun Ejio	Rep	08113559729		
51	Abatomi - Oripede	Iludun Ejio	LANDLORD	08162133721		
52	R. Alabamu	Ilu Adeniyi Ejio	Ref-11	08022417899		
53	CYRIL IMAFIDON	ILUDUN Ejio	Landlord	07064969040	Imafidonc@yahoo	
54	Dai Moses Ba Adebayo	ABESE Village	Resident	08035859125		
	Satimeli Blessing	Seminar	Survivor	08032279817		S. @...
	Salawu Clement		Farmer	08164735574		
	Fesinke Adetohe		Farmer.			
	Orotosho Grenga B	ILUDUN, EJIO		08035857999	orotoshofungayi@yahoo.com	
	ESTHER ABI	EJIO	FEMALE.			
	Bankole Oluwafunmilola	Iludun	Male	07086791517		
	MOSES AYODEJI	Iludun	08169037476			
	Sunday Eje	Iludun		07038302470		
	Alawiye Sina	—	—	08170065...		
	AZEEZ NURUDEEN	Iludun		09060788832		
	OLADEJINMBA	FEMMI		08147358630		
	Abiodun Felix Adebora	Iludun Ejio		08148714257		
	Ajayi Babatunde	Ejio	—	08061382851		

LIKOSI/REDEEM AXIS (Cont.)

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET LIKOSI/REDEEM AXIS

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
1.	Barr. Gbenga Hassan	Sagamu South LCDA	Chairman	0803333[illegible]	[illegible]hassan@yahoo.co.uk	
2	Idowu Fagun	Gov. office	SSA	07030001001	[illegible]@aol.com	
3	Oluwaseun Jetomi	Gov. Rep.	SA & H.E.	08037141789	[illegible]@gmail.com	
4	Ogunmuyiwa Joseph Oluwafemi	Sec. Sagamu West LCDA	S.L.G (Sagamu)	08061476193	[illegible]	
5	[illegible] D. Samsdee-1	Sagamu South LCDA, CDC Chair	[illegible] CDC	08023267256	[illegible]	
6	Joshua Oluwaseun	SEEMS	Consultant	08067530933	[illegible]@yahoo.com	
7.	Engr. M.S. Liman	TCN	Coord. (Lines, SS)	08025631116	engrliman@gmail.com	
8.	Mr M.O. Tiamiyu	TCN	PM (HSE)	08079505886	[illegible]@gmail.com	
9	Mr N.M. Gata	TCN	PM (property)	08031092[illegible]	mgata52006@yahoo.com	
10	Mr Adekoya Rasaq .O	Bureau of lands/survey (ABJ)	[illegible]	07036467782	[illegible]@gmail.com	
11	E.E. Aleyu (Mrs)	TCN	SM (RESU)	08033005589 [illegible]	[illegible]@yahoo.com	
12	D.T. Ajayi (Mrs)	TCN	Mgr (FKSU)	0803[illegible]5160	[illegible]@gmail.com	
13	Ayo Famoyin	SEEMS	Est. Valuer	08027329185	[illegible]	
14	Ogunsanwo [illegible] P.O.	SEEMS	Consultant	[illegible]	[illegible]	
15	Sako, C.J.B. (Mrs)	TCN	Coord. Environ	08705713253	[illegible]@yahoo.com	
16	Engr. M.A. Ajibade	TCN	Proj. Mgr	08035850322	ajibadekole@gmail.com	
17	Engr. Kasumu T.T	Sagamu South LCDA	Secretary	08023096116	[illegible]@gmail.com	
18	Okesowo Taiwo	Sagamu [illegible]		08084929241		
19	Baale Jubril Amodu	Community leader	Baale	08030646997		
20	Baale Ishola Abayomi	Community lead	Baale	08023266649		
21	Baale [illegible] F. Adesiyan	community leader	Baale	0802497227[illegible]		
22	Baale Lasisi, Fatola Olugbenga	Community leader	Baale	08055676191		
23	Chief Adenuga Marzaquil	"	"	07011002[illegible]		
24	Wasiu Adesegun	"	Sec.	07037071594		

16/12/2017

LIKOSI/REDEEM AXIS

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
25	OTUNBA ABDULRASAQ OLUSOTE	Sagamu-West LCDA	Political Leader	08034006690	[illegible]	
26	OTUNBA OGUNLESI KAMILU	SAG WEST LCDA	Leaders	08182195014	[illegible]	
27	OLATUNDE ABIOYE	Likosi Sagamu	Osi	[illegible]	olatunde.com	
28	Oluseyon Ogunlona	Likosi Alado	member	08026150953	[illegible]	
29	Olumba [illegible] Ewuemi	ALADO	Member	[illegible]	[illegible]	
30	Quomo Idowu Oyenade	Community Leader	Alado Leader	08033624162	[illegible]	
31	Prince O.O. Otambalo	Alado Community	Secretary	08185779797		
32	Fasola - Balogun	MOSU Sag.	Secretary	08068614664		
33	Ghaniy Shakiru	[illegible]	Treasurer	08025906134		
34	KEHINDE GBENGA SEGUN	Youth Secretary	LIKOSI	[illegible]	[illegible]	
35	Murinat Sonni	member	Dijuwado	[illegible]		
36	Taiwo Ogunnowo	Alado Indigene	Alado	08035695224		
37	Oni Ogunnowo	Alado Indigene	Alado	09032263693		
38	Isiaka - Ogunnowo	Alado Indigene	Alado	08032020927		
39	Adebayo Arowolo	Dijuwagbo CDA	Dijuwagbo	08055841301	[illegible]	
40	Adenuga Kehinde O	Dijuwagbo CDA	Dijuwagbo	08032440023	[illegible]	
41	Mustapha Rozi	Likosi Dejuwagbo	Dejuwagbo	08126747234		
42	HASSAN MUMSON K.	DEJUWOGBO CDA	FACE 2	08091971399		
43	Akinyemi - Azeez	Alado Indigene	Alado	08028927064		
44	Akinyemi - Gani			[illegible]		
45	Akinyemi - Dare			08153321986		
46	TUNDE		Alado	[illegible]		
47	Mrs Shopitan Omidaya	Ijebadu CDA	Social sec	08052397597		
48	Mrs Ogibo Olabisi	Ijebadu CDA	Tresurer	08058552103		

16/12/2017

LIKOSI/REDEEM AXIS

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
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50	[illegible]	ALDO	KEMADIT	08184512[illegible]	—	
51	Yinka Kayode	[illegible]	[illegible]	0[illegible]829189	Tkca2012@gmail.c[illegible]	
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53	Aminu Olawale A	Dejuwoogbo	member	08060079494	[illegible]	
54	Oludeyi Julius	Dejuwoogbo	Secretary	0814778[illegible]		
59	MRS Jumoke Ajayi	Dejuwoogbo	[illegible]	[illegible]	[illegible]	
56	Aro Nurudeen	Dejuwoogbo	Chairman	08122603215		
57	Aliyu Durumoye	Dejuwoogbo	member	07062371424	-	
58	Oluwale Julius	Dejuwoogbo	member	09027497481		
59	Oladunni Sherif	Dejuwoogbo II	Secy	08136 07169	[illegible]	
60	ESEGBOBO MICHEAL	Dejuwoogbo II	[illegible]	[illegible]	— —	
61	BALE IFATUNBOKE	MADE ABIGBABU		08038838605	— —	
62	Chief [illegible] Adekoya	Alado	Member	0705803[illegible]	— —	
63	ANJORIN RICHARD OLUBUNMI	TCN	PM(WAYLEAVE)	08033257796	olubunmianjorin@yahoo.com	

16/12/2017

MFM AXIS

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET MFM AXIS

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16	Adio Ogunyika	Abule Ayetoro	Bale Ayetoro	08035156600	—	
17	CHIEF	Oluseyi	Ogunwede	Bale Atisi [illegible] 08064409778		
18	CHIEF	BALE	MOSADOM	08060642	0024	
19	Prince Isunmade	Olua Bale	Oluwo Ogun	08032457217		
20	Prince Dauda Kilani	Bale Ropo	Ropo village	09038285373		
21	Sobukola Sogunde	Asaju Bale Sodele	Bale Sodele	0806[illegible]	—	
22	Otunba M A Shitta	Community Leader	Leader	08043434955	alanshitta@gmail.com	
23	Lawalstun Tunde	Adeson Olu leader	—	08167861120	otedolor[illegible]@yahoo.com	

16/12/17

MFM AXIS

STAKEHOLDER ENGAGEMENT MEETING FOR LAGOS AND OGUN STATES TRANSMISSION LINES AND ASSOCIATED SUBSTATION PROJECTS (LOT2) ON LR, ESIA, ESMP & RAP

ATTENDANCE SHEET

S/N	Name of the Participant	Organisation	Designation	Phone number	E-mail	Signature
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25	Dr Abiodun Sonuke	OM-LCDA	HOLGA	09031603537	asorunke@gmail.com	[illegible]

16/2/17

RECENT MONTHLY PROGRESS MEETING

Line Route, ESIA, ESMP and RAP Studies for the Proposed Lagos and Ogun States Transmission Lines and Associated Substation Projects

CONSULTATION MEETING REGISTER OF SIGNATURE OCTOBER

S/N	NAME	ORGANISATION	DESIGNATION	PHONE NO	E-MAIL	SIGNATURE	DATE
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02	Balogun Femi	OGSG Power & Energy	S.A to the Govr	08033447788	femi.abag@gmail.com		26/10/17
03	Gbeleni Bolanle	OGSG Power & Energy	Consultant to Govr	0802 4615958	abogbelegi@gmail.com		26/10/17
04	Ifeoma A. Nwachukwu	TCN	Manager (ERSU)	08033261891	ifyangel77@gmail.Com		26/10/17.
05	Saaco, Comfort	TCN	Env. Coord JICA Proj	08105773253	ebancee@yahoo.com		26/10/17.
06	Gabriel Agidani	JICA	Consultant	08127778924	Agidani.gabriel.ng@jica.go.jp		
07	Takumi Koide	JICA	Project Formulation Advisor	08160213933	koide.takumi@jica.go.jp		26/10/17
08	Olatayo Olaseinde	EEMS	Consultant	08035960671	tayo@eemslimited.com		26/10/17
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10	Ogunjimi Gbenga Peter	SEEMS	Consultant	0803[illegible]	[illegible]		26/10/17

SHEET 1

Line Route, ESIA, ESMP and RAP Studies for the Proposed Lagos and Ogun States Transmission Lines and Associated Substation Projects

CONSULTATION MEETING REGISTER OF SIGNATURE

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04	Engr. Balogun I.O	MRD	DDRE	08055914607	[illegible]@gmail.com		26/10/17
05	Engr. R.O. Ojetola	MRD	DRE	08033237531	[illegible].ojetola@yahoo.com		26/10/17
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09	Ogunbajo A[illegible]	[illegible]	Surveyor	08066572[illegible]	adekitobanjo@gmail.com		26/10/2017
10	George Okhomina	GODIRRA	Field Officer	08028636941	babageorgie@yahoo.com		26/10/17

SHEET 1

Line Route, ESIA, ESMP and RAP Studies for the Proposed Lagos and Ogun States Transmission Lines and Associated Substation Projects

CONSULTATION MEETING REGISTER OF SIGNATURE

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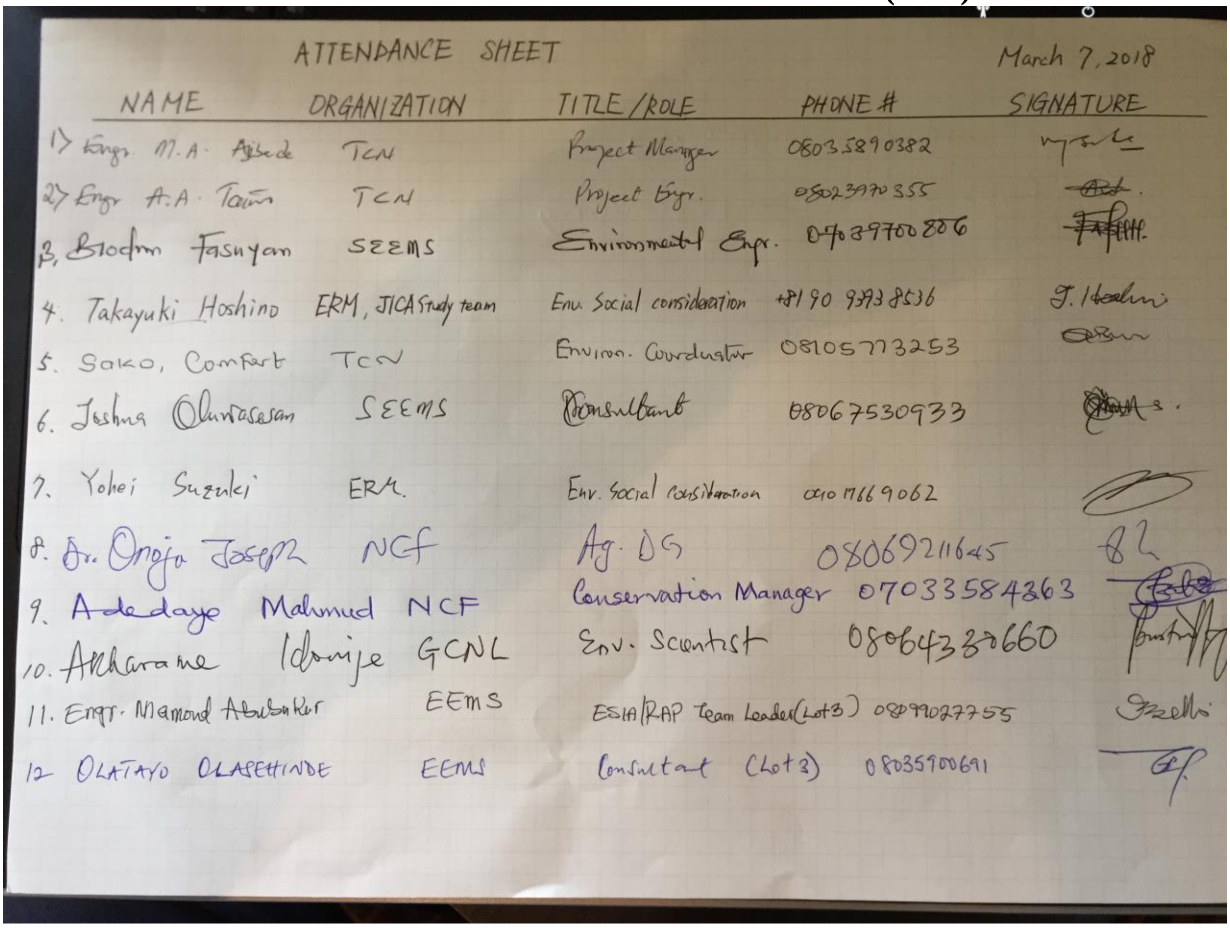
04	Efosa Okeke	Goldwire Chemicals Nig Ltd	Consultant	08068768987	okekeefosa@yahoo.com		26/10/17
05	Makinde C O	Director (SP) (OPIC)	Secretary to Director.	07026457872	[illegible]@gmail.com		26/10/17
06	Lawal Adebowale A.O. (Mrs)	Community Development Cooperative	CDO	08039504382	yemaga@yahoo.com		26/10/17
07	Saheed Olaniyi	SEEMS	Consultant	08028478266	sagasofts@yahoo.com		26/10/2017
08	Ajayi: Shakiru Akomi	Bureau of Lands & Survey ASK	Land Officer	08062106400	[illegible]		26/10/17
09	Ayotele Tijani	Energy office OGSG	Senior Admin. Officer	08082553667	ayotele.tijani55@gmail.com		—
10	ADESEUN A J	Min of Housing	Director, Engineering Services	08054118753	adeadesega@gmail		26/10/17

SHEET 1

NIGERIA CONSERVATION FOUNDATION (NCF)



ATTENDANCE SHEET

March 7, 2018

NAME	ORGANIZATION	TITLE / ROLE	PHONE #	SIGNATURE
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2) Engr. A.A. Taiwo	TCN	Project Engr.	08023970355	
3. Biodun Fasuyan	SEEMS	Environmental Engr.	07039700806	
4. Takayuki Hoshino	ERM, JICA Study team	Env. Social consideration	+81 90 9393 8536	T. Hoshino
5. Soko, Comfort	TCN	Environ. Coordinator	08105773253	
6. Joshua Oluwasesan	SEEMS	Consultant	08067530933	
7. Yohei Suzuki	ERM.	Env. Social consideration	090 7166 9062	
8. Dr. Onojo Joseph	NCF	Ag. DG	08069211645	
9. Adedaye Mahmud	NCF	Conservation Manager	07033584363	
10. Akharame Idonije	GCNL	Env. Scientist	08064330660	
11. Engr. Mamoud Abubakar	EEMS	ESIA/RAP Team Leader (Lot 3)	08099027755	
12 OLATAYO OLASEHINDE	EEMS	Consultant (Lot 3)	08035900691	

Minutes of the Consultation with Baale, Community Representatives and Stakeholders in Ejio Community on 15th December, 2017

1. **Opening**

The meeting commenced at 3.30pm with an opening prayer. At the meeting were the Elejio of Ejio Community, and members of his cabinet, Baale of most of the settlements along the Transmission Line and more than 100 other members of all the affected communities.

The Paramount ruler of Ejio community, the Baales (Head of villages and settlements along the Transmission line from Ejio to Likosi) and the key stakeholder were introduced.

2. **In Attendance (See the attached list above)**

3. **Meeting objectives**

i. To inform the community members and the stakeholders about the proposed Transmission Line project
ii. To explain the likely impacts of the project on portions falling within the Right of Way (RoW)
iii. To obtain their concerns with regards to the effects of the proposed project on their land, economic trees, structures (completed and uncompleted) and business
iv. To explain the likely effects of the project on existing utilities and what will be done to mitigate the effects
v. To inform the community members about the mode of valuation of compensation and how grievances will be addressed.

4. **Project Description**

The project team among whom are TCN representatives (including the Project Manager and Project Coordinator), Consultants from SEEMS Nigeria Limited (the firm handling the project) and representative of Ogun State Government were introduced.

After the introduction, the Project Manager gave an overview of the project and took time to explain the reason why the stakeholder engagement is necessary. He informed the participants about the various stages and phases of the projects. The participants were informed that the entire project is divided into three LOTs and that SEEMS has been given LOT2 under which Ejio community falls. The essence of ESIA was explained which include assessment of the likely impacts of the projects and suggestions on how any identified negative impacts arising from the project will be mitigated.

The Project Coordinator, reinforcing what the Project Manager told the participants requested for the cooperation and support of all affected communities and participants for the project. She informed them that in the next one week the consultants will be in the community for public consultation as part of Environmental and Social Impact Assessment (ESIA). This exercise according to her will involve interviewing some members of the community and conducting some tests.

The representative of Ogun State Government at the meeting reiterates the interest of the State Government in that project. He encouraged the community to give full support to TCN and all the consultants that will be working in the area. He appealed to Kabiyesi, the Elejio of

Ejio to ensure that the community members give necessary support to the project so that it can be executed successfully and without unnecessary interference.

5. Project Plan

An overview of various activities that will take place as from Monday 18th December, 2017 and about Resettlement Action Plan (RAP) coming up early next year (specifically from January 8, 2018) was given. The participants were informed that some members of the affected communities will definitely lose portions of their land within the right of way (ROW) and properties therein to the project. They were however asked not to entertain any fear as those that will be affected by the project will be duly compensated for their losses.

He said the consultants will be in the area as from Monday 18th December for ESIA and to establish a baseline of existing conditions in the project area and assess proactively the potential impacts as well as associated impacts of the project. This exercise involves quantitative measure and characterization of basic environmental baseline indicators such as air quality, noise level, geology and soil, and hydrogeology etc. The participants were further informed that the team will interact with the owners of affected area and some members of adjourning settlements and as well engage some individuals in the area in social consultation and socio-economic enumeration. Meeting will also be held with community leaders and some key stakeholders during the period.

The participants were further informed the participants that there will be RAP from January 8th, 2018 to identify the people that the project will affect, so as to advice the project proponent (TCN) on measures that must be taken to mitigate the recognized impacts and settle the affected individuals. He noted that the fundamental principle guiding this exercise is that the proposed project should not leave affected people worse than they were before the project. So, in order to achieve the set objectives for transmission line and the Substation (that will be handled by another firm), survey teams will be on ground to identify the rightful owners of the affected portions of the affected land and properties. The affected individuals will be interviewed using questionnaires. The records of these individuals and their properties will be taken and their pictures will be linked to their properties.

6. Reactions and Comments

The community leaders expressed their appreciation to the team for deeming it fit to acquaint them early enough about the proposed project. The participants requested to know the impact of the Substation and the Transmission Line on the community and how these impacts will be mitigated.

In response to this enquiry, Kabiyesi, the Elejio of Ejio informed the community members that SEEMS will only be handling the Transmission Line component of the project and urged all those that have properties in the site chosen for Substation not to worry as necessary dialogue is currently going on between the leaders of the community and the contractor handling the Substation project. The explanation of Kabiyesi, the Elejio concerning LOT2 (SEEMS) assignment in the area (coverage the route from Ejio to Likosi) was further highlighted by the team. They were reminded that the exercise is going to be in three phases – Line Route, ESIA and RAP. He said the consultants will be in the community as from Monday 18th for the EISA component of the project. However, he said RAP will take place early next year, specifically from January 8, 2018.

The Elejio then formally welcome the team to the community and asked the representative of the State Governor to extend the appreciation of the community to the government for their support and assistance to the community. He however expressed his concern for those that will be affected along the proposed line, especially those that will lose their properties. He therefore appealed to the project proponent to ensure that the affected properties are correctly evaluated and valued so that the affected individuals will not be surcharged. The Kabiyesi also used the opportunity to make some demands from the governments, most especially from the State government. He appealed to the government to fix the main road leading the community which is in bad shape.

One community member, Mr Julius Arigbabowo also expressed his appreciation to the government for the choice of their community for the project but requested that their leader, the Elejio of Ejio should be adequately carried along and be acquainted with all development pertaining to the projects.

Mr Oladipupo Odunayo wish to know how the youths of the community can be gainfully employed through the project. He also expressed the fear that their stream which is the main source of water in the community may be polluted during construction and so requested that the community be provided with pipe borne water.

Chief Olasode Oladokun expressed his appreciation to the team but asked if members of the community will be included among those that will be employed to execute the project. He requested that there should be memorandum of understanding (MOU) between the community and TCN.

To all the questions and issues raised, the spokesperson for the team reminded the participants that the essence of coming now was to inform the community about the project and get them acquainted with various activities involved in the execution the project. He informed them that the project has not reached the stage many of the participants are assuming. The next stage which will commence on Monday 18th December, 2018 will be to conduct ESIA and by early January to conduct RAP. He made them realize that there will still be series of consultations and meetings where some other important issues will be discussed. He reminded them that the government representative will take their request concerning the road, pipe borne water and other needs to His Excellency, the Governor of the State for consideration.

To the Mrs Oyebo question on know how the issue of compensation and property valuation will be handled, Professor informed the participants that the team that will be coming for RAP in January and will take adequate record of their land and properties. He told them that among the consultants coming for RAP are different professionals/experts including qualified Estate Surveyor, Land Surveyor, and Demographers/Socioeconomic experts. The Estate Surveyor will use appropriate measures based on existing standard to calculate whatever is due to each individual; each affected person will sign a form where the quantity and value of his/her properties will be recorded. His/her photograph will also be included in the form which will be countersigned by a witness and a recognized community leader.

The community youth leader asked question pertaining to the benefit the land owners who are not the owners of whatever is on the land will derive from the project. Professor Ogunjuyigbe answered this question by reminding the participants that records of whatever is on the land will be taken, affected persons will be identified and whatever is due to each of the affected persons will be calculated and recorded in the RAP.

Finally, the team expressed its appreciation to Kabiyesi and to members of the Ejio community and other settlements along the Transmission Line for honouring our invitation and for expressing their readiness to cooperate with consultants when they are in the community.

Closing: The meeting ended with closing prayer at 05.45pm, Nigerian time.

Minutes of the Consultation with Baale, Community Representatives and Stakeholders in Ogijo (Likosi) Community on 16th December, 2017

1. **Opening**

The meeting started with opening prayer from Chief Lasisi Fatoba Olugbenga, Baale of Kogberegbe Community at 4.15pm. At the meeting were the Chairman of Sagamu West LCDA, leaders of various communities along Likosi-Ikorodu/Sagamu route, Youth leader and CDC Chairman and a sizeable number of members of affected communities.

2. **In Attendance (see the List Attached above)**

3. **Introduction**

The team members including those from TCN, SEEMS and representatives of Ogun State Government were introduced. The Secretary of Sagamu West LCDA, who acted as the Master of Ceremony introduced the Local Government Officials, Baale of affected communities and the other key stakeholders in attendance.
Thereafter, the Project Manager gave the project overview and highlighted the benefits of the projects to the communities around the area and the companies operating in the area. The Project Manager elaborated on how important Ogijo (Likosi) is to the project. He informed the participants that consultants from SEEMS will be in the area as from Monday 18th December, 2017 to conduct ESIA and RAP which will start early next year. He also used the occasion to introduced SEEMS, the firm that will carry out the assignment to the community.
The Project Coordinator also made some remarks. She appreciated the participants for the warm reception and admonished them to give necessary support to all those that will be involved in the execution of the project. She also informed the participants that the consultants will be on ground as from Monday 8th, 2017 for consultation and come back in January 8, 2018 for RAP.
One of the Ogun State Government representatives conveyed the greetings of His Excellency, Governor Ibikunle Amosu to the participants. He highlighted how important the project is to the State Government and for the development of communities around the area. He, therefore solicited for the cooperation of all communities along the routes and affected communities.
The Chairman, Sagamu West LCDA in his welcome address expressed the appreciation of the Local Government to the State and Federal Governments for siting the project to their area. He also highlighted some of the benefits the project will bring to all communities around the area and therefore indicated the readiness of the Local Government to fully support the project. He gave an assurance that none of the affected communities will do anything to thwart the effort of government to develop the area by considering the area for the project. He however used the occasion to request for the assistance of governments in providing stable electricity and also to help fix the dilapidated roads within the LCDA most especially the main road that connects the LCDA to the major highway.

4. **Project Plan**

The relevance of the project to the affected communities, especially with the presence of so many companies that will need electricity was elaborated. He said apart from the companies, people living in the area, especially the artisans will benefit a lot from the project when fully operational. He however said there can be no development without some impact (both positive and negative). Therefore the essence of this stakeholder engagement is to inform the participants about the various activities that will soon commence in the area and explain how negative impacts as a result of the project will be mitigated. He informed the participants that

SEEMS consultants will be in the area as from Monday December 8th, 2017 for ESIA. The ESIA that will start on Monday will involve consultations with some key stakeholders along the routes, conduct study on the existing conditions in the project area and assess the potential impacts and associated impacts of the project. He also informed them that as from January 2018, RAP team will also be around to conduct census of people and properties of the affected persons along the Transmission Lines. He told them that during the exercise, some youths from communities along the Transmission Line will temporarily be engaged as labour to assist those that will be conducting the ESIA and RAP. To allay the fears of some properties owners in the area, the participants were informed that the Chairman of the LCDA will always be consulted each time the consultants are in the area for the project.

5. **Reactions and Comments**

Reacting to the question from Mrs Ajeh Gloria who wished to know if there is any opportunity for an independent Estate Surveyor to participate in the exercise, the team spokesperson said SEEMS Nigeria Limited which is a qualified firm that will execute the project will only work within the scope as provided by the project proponent. Fortunately, the firm has registered Estate Surveyor among the team that will conduct the RAP. So the question of independent Estate Surveyor may not arise. However, the consultants said any land owners who is interested in seeking for the assistance of independent Estate Surveyor can go ahead, but this is not known to the SEEMS and TCN.

One participants requested to know whether the affected persons will be allowed to ask questions when the exercise is ongoing regarding the boundary of the project and some other issues. To this question, our response was in affirmative. The properties owners are free to make enquiry and ask questions that are relevant to the project. However, the participants were informed that there are some questions that the Consultants may not be able to answer. Such question(s) will be referred to the project proponent. For instance, the consultants will not answer questions pertaining to ‘when compensation will be paid and how it will be paid’. But an assurance was given that all affected properties owners will be duly accounted for and the costing of their properties will be done by qualified Surveyor. This will be part of what will be in RAP report that will be submitted TCN.

Comrade Kehinde Segun and some members of the affected communities raised some issues pertaining to some exiting projects in the locality. Addressing this issue, the Project Manager advised them that in case of other time and to avoid unnecessary conflict, the community should endeavour to make enquiry about the company involved, type of project and seek for other necessary information.

The issue of location name was raised by Comrade Femi. He said the location name must be clearly specified to avoid confusion and crisis. He said three communities are claiming the ownership of the location where the substation will be sited – Dejuwogbo, Alado and Mosu communities. Mr Anjorin said at a particular time Alado was used as the name of the site. He therefore suggested that the name of community with larger portion in the affected site should be used. But this was opposed by some members of the affected communities. Chief Lasis Fatoba also suggested that the place should be called Jagba since Sagamu area is known as Jagba. This was vehemently opposed by the participants. The Project Coordinator therefore suggested that the three concerned communities (Dejuwogbo, Alado and Mosu) should meet to resolve the issue. However, up till when the matter is resolved, the location will be known as Likosi.

Both Alhaji Sani and Chief Lasis Fatoba expressed the appreciation of the people of the area to government for bringing the project to their vicinity and promised to fully support the project. On behalf of the affected communities, Chief Lasisi thanked the team for coming to clear some burning issues, provide necessary information and for carrying them along. Finally, the team thanked the participants for their patients, understanding and for expressing their readiness to support the project.

6. **Closing Remark**

The closing remark was given by Secretary, Sagamu West CDA and the meeting came to an end at 11.35 am with a closing prayer.

Minutes of the Consultation with Baale, Community Representatives and Stakeholders in Ofada Mokolojki LCDA on 16th December, 2017

1. **Opening**

The meeting started with opening prayer at 3.15pm. At the meeting were the Ofada/Mokoloki LCDA, the Baale and leaders of various communities along Likosi-Redeem/Sagamu route and some members of the LCDA in attendance.

2. **In Attendance (see the Attached List above)**

3. **Introduction**

The Chairpersons and all the key stakeholders in attendance were introduced. Thereafter, the visitors including those from TCN, SEEMS and representatives of Ogun State Government were introduced.

The Project Manager gave the project overview and specifically described the route and areas affected within the jurisdiction of the LCD. He solicited for the support of the LCDA for the project and the cooperation of members of affected communities for the SEEMS, the firm that will work on the MFM/Ofada axis of the project. He informed the participants that the consultants will be on ground as from Monday December 18, 2017 to conduct ESIA and will come back later in January 8, 2018 for RAP. Mrs Sako, the Project Coordinator in her remarks, highlighted the importance of the exercise to the community. She admonished the participants to give necessary support to all those that will be involved in the execution of the project.

The appreciation of Ogun State Government was conveyed to the people of the area for their support for government activities and programmes. He highlighted the relevance of the project to the State and for the development of communities around the area. He therefore solicited for the cooperation of the LCDA and all the affected communities for the project.

4. **Project Plan**

The relevance of the project was explained to the affected communities in the area especially with the presence of so many companies that will need electricity. He informed the participants that SEEMS consultants will as from Monday December 8th, 2017 commence ESIA which is one of the major aspects of the projects. The ESIA that will start on Monday will involve consultations with some key stakeholders along the routes, conduct study on the existing conditions in the project area and assess the potential impacts and associated impacts of the project. He also informed them that as from January 8, 2018, RAP team will visit the area to conduct census of people and properties that will be affected by the Transmission Lines. To allay the fears of some properties owners in the area, the team promised that the Chairman of the LCDA will always be consulted each time the consultants are in the area for the project.

5. **Reactions and Comments**

Virtually all the Baale and members of the various communities in attendance expressed their readiness to support the project by wish to be adequately compensated for any loss properties. Responding to the issues raised, the participants were promised that all individuals that may likely be affected by the Transmission Line will be accounted for and duly compensated.

The Chairman, Ofada/Mokoloki LCDA, Honourable Balogun in her remarks expressed the appreciation of the Local Government to the State and Federal Governments for counting the LCDA worthy and for the Transmission Line. She also highlighted some of the benefits the project will bring to the communities around the area and therefore indicated the readiness of the LCDA to give full support to the firm that handle the project. She allayed the fears of the people of the area by reiterating the readiness of government to adequately compensate those that will be affected by the project but warn the inhabitants not to put up any new structure along the RoW. She also used the occasion to solicit for government assistance in fixing the main road that pass through the LCDA and ensure adequate supply of electricity to the area. The Kabiyesi of Abisodun, one of the affected communities appreciated the team for coming and for carrying them along. He prayed that all will be well.

6. **Closing Remark**

The closing remark was given by Dr Abiodun Sorunke and the closing prayer was said by Mr Olaniyi Saheed. The meeting came to an end at 5.15 pm with a closing prayer by Mr Olaniyi Saheed.

MINUTES OF PROGRESS MEETING FOR LAGOS/OGUN STATES TRANSMISSION LINE AND SUBSTATIONS PROJECTS HELD ON 26TH OCTOBER, 2017

Venue: Ogun State Government Secretariat, Room 138, Block C, Oke-Mosan, Abeokuta

1. Attendance: Attached

2. Opening:

The Project Manager was unavoidably absent. In his absence, the meeting was coordinated by Consultant to Ogun State Government on Power and Energy who welcomed members to the meeting and prayed for a fruitful deliberation.

The meeting commenced at about 11.14 am with a short opening prayer from Consultant to Ogun State Government on Power and Energy. This was followed with the introduction of members. Thereafter, the minutes of last meeting held on 29th September, 2017 was presented by LOT 1 representative. Motion for adoption of the minutes was moved by Mr Fagbemi and seconded by Engineer Balogun.

3. Matters Arising

Before the adoption of the minutes, a number of amendments were made; among these are the following:

i. The attention of the meeting was drawn to a motion adopted at the last meeting where it was decided that names of members that move motion for adoption of minutes of any of the subsequent meetings should be mentioned.

ii. It was noted that the section on ‘matters arising’ was missing from the minutes

iii. On page 2, paragraphs 2 of the minutes, corrections were made on issue pertaining to Ejio Substation. The Environmental Coordinator reported that she had been mandated to inform those concerned about this matter that Ejio Substation will now be handled by LOT3 simply because substantial grounds had been covered by the team.

iv. The statement on page 3, paragraph 2, was corrected to indicate that ‘all letters that should have been forwarded to Ogun State Government had been written and sent as appropriate’.

The Coordinator thereafter requested each of the LOTs to give the updates on their activities starting with LOT1.

4. Consultants’ update

LOT1 Update

Corrections on the Line Route Survey have been concluded and physical assessment had been carried out by TCN, Ogun State Representative and the consultant. The inspection was carried out on the 25th of October, 2017. Necessary corrections had been effected. Some of the hotspots discovered were visited.

Based on the visitation, it was recommended that the line route should align with the same corridor with EEMS (LOT3). On the line coming from Olorunsogo Power Plant to Ejio Sub-Station, two hotspots were discovered; these are Oil Palm Plantation and a University that had already been surveyed. However, it was reported that necessary efforts will be made to meet with the Baale of the concerned community. Also, it was suggested that the clearance of 45m should be maintained and should not be reduced.

It was recommended that the angle on the line coming from Abeokuta Substation at Kobape to New Abeokuta should be removed and the steep along the line should be avoided.

The meeting solicited for the support of Ogun State Government to help identify the owners of those hotspots for further dialoging. And that all the issues pertaining to this line route should be taken together to resolve them at once.

LOT2 Update

As indicated in the outlook of LOT2 for the month of October, the map of Redeemed and MFM Substations had been submitted. Also, the major work on profiling and line route survey had been completed; the map of the line route was presented at the meeting. The meeting was informed that letter of rejection had been received from OPIC for approval of JICA line. The map presented showed the alternative route being proposed by LOT2 for OPIC approval. The request has been submitted to OPIC office while acknowledgement copy was given to OPIC representative for the follow-up.

The alternative route was proposed by LOT2 for Likosi – Redeem Transmission Line due to the future development plan of Redemption Camp, however, the meeting adopted the option. The meeting was informed that though the problem with Redeem axis had been resolved, but there are still some unresolved problems in Likosi area of the project. Ogun State government is therefore being called upon to intervene to avoid unnecessary disruption and delay in project execution.

LOT3 Update

As indicated in the outlook of LOT3 for October, 2017, the team had already submitted the line route. However, there are still some issues with the substation line route. The team has not been able to submit the substation line route draft report as proposed because the coordinates for Ejio substation has not been supplied. The team has tentatively fixed the training of participants for early December. Though the training work plan had been prepared but is yet to be submitted.

5. General Discussion

The Environmental coordinator would wish to know the latest about the inception reports; whether final inception reports had been submitted by the three LOTs. The meeting was informed that all necessary corrections have been effected but not submitted. It was mentioned that the basic for the delay in getting the final inception submitted and approved was due to lack of uniformity in the style of writing of the three groups. JICA representatives at the meeting observed that each of the LOTs used different format for their inception report; they said the format should be the same since the three groups are working on one project. The meeting therefore agreed that the same template should be adopted for the subsequent reports pertaining to the project.

Also, there were a lot of deliberations on which format to adopt for the ESIA report – whether the structure should align with the Ministry of Environment or to adopt the World Bank format. The consensus was that the same format should be used by the three groups. The expectation therefore was that the three groups should come up with one specific format that will be used for the report.

The meeting also deliberated on whether the project should be for 'Wet' and 'Dry' seasons. But it was reported that the Federal Ministry of Environment gave approval for one season. The Ministry will be satisfied with this one season provided reference can be made to previously approved EIA report in the area.

6. Outlook for November

LOT1

The outlook for LOT1 for November includes: Make necessary corrections on the adopted optional line and to resolve all issues pertaining to the names and other matter on the hotspots. It is expected that the preliminary line route map will be submitted and line route report will equally be submitted. The team hopes to commence ESIA report subject to approval of preliminary report.

LOT2

For LOT2, the outlook for November will include: Submission of preliminary line report, ESIA work plan and first training work plan. The stakeholders' engagement plan will also be submitted and the affected community will be identified.

LOT3

For LOT3, the outlook for next month include: Submission of line route after the issue with LOT1 might have been resolved. The team hopes to submit prepared work plan, plan for necessary training and conclude plan on ESIA data collection. The team also plans to embark on second round of community engagement.

7. AOB

It was proposed that the November meeting should be the last for the year. This was extensively deliberated upon and it was supported by most of the members. However, it was also suggested that necessary arrangement should be made for the December meeting that may not likely hold at the next meeting.

8. Closing and closing remarks

Motion for adjournment was moved by Mrs Nwachukwu, TCN representative for Lot 1 and seconded by Engineer Balogun, Government Official from Ministry of Rural Development. The meeting came to a close around 1.15pm. While giving closing remarks, the Coordinator expressed his appreciation to everybody present and thanked them for their contributions to issues. The date of next meeting was fixed for 30th November, 2017.

Signed

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For TCN	For JICA	For Ogun State Rep
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For LOT 1	For LOT 2	For LOT 3

Minutes of Meeting

Project	Lagos and Ogun states transmission lines and associated substation project
Date	March 07 2018, 11:00-12:00
Venue	Head quarter of NCF (Nigeria Conservation Foundation)
Participants	NCF TCN ESIA/RAP consultants (Lot 1 – 3) JICA study team See attendance sheet.
Agenda	ESIA study for the project

Discussion item

After explanation of the overall of proposed transmission line project by Mr. Ajibade of TCN, followings have been discussed.

- NCF is currently working on IWC (International Water bird Census), which is organized by Wetlands International, to monitor the migratory birds in Badagry area. IWC was also conducted in December 2017- January 2018 at Badagry area. The IWC report in 2017 is available and can be shared with the team.
- Some of the bird species listed as migratory bird is not migratory species, therefore, further review may be necessary. It is agreed that TCN will share the draft ESIA report to NCF to provide their feedback for the potential impact on ecosystem from the proposed project.
- There is no fact that the presence of transmission line causes bird strike around the project area. However, since no bird strike survey has been conducted, NCF has been planning to carry out such a survey to understand actual situation of bird strike.
- Migration route is not main concern for NCF since bird can fly over transmission lines; however NCF concerns place to stay in winter.
- December is a good timing for bird survey since many species of bird visit the area since the migratory birds fly from outside of Nigeria, e.g. Europe from December to February in general (the biodiversity survey in this ESIA study was conducted in December 2017).
- NCF has been working on several projects for local community to enhance their way of livelihood in sustainable manner. For example, NCF is educating local people to find alternative livelihood resource such as chicken farming, instead of hunting.
- NCF accommodates about 90 staffs and there are several project offices throughout Nigeria. The staff of NCF works as project officer for the community support project.
- NCF shows their interest for the collaboration of TCN`s project if there is any opportunity.