West African Power Pool

WAPP/NorthCore/ESIA/11-2014

330 KV WAPP NORTH CORE PROJECT NIGERIA - NIGER - BURKINA FASO - BENIN\TOGO

UPDATE LINE ROUTE AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

May 2018

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY NIGERIA

TRANSMISSION COMPANY OF NIGERIA

TCN

WSP

330 KV NORTH CORE PROJECT - NIGERIA - NIGER - BURKINA FASO - BENIN/TOGO

WEST AFRICAN POWER POOL (WAPP)

UPDATE LINE ROUTE AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT - NIGERIA

Final Report

Date: May 2018

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NON-TECHNICAL SUMMARY

PROJECT CONTEXT AND JUSTIFICATION

The West African Power Pool (WAPP) is a specialized institution of the Economic Community of West African States (ECOWAS) which ensures regional power system integration and the realization of a regional electricity market. The WAPP is made up of public and private generation, transmission and distribution companies involved in the operation of the electricity in West Africa.

The 330 kV WAPP North Core Project, between Nigeria, Niger, Burkina Faso and Benin is a step forward in the integration of national power systems in West Africa.

PROJECT DESCRIPTION

The project is under the auspices of the WAPP. This institution is supported by each of the companies responsible for electricity production and / or distribution of electrical energy, whether the TCN in Nigeria, the NIGELEC in Niger, the SONABEL in Burkina Faso or the CEB in Benin.

The project consists in the construction of a 330 kV transmission line on steel pylons with a total length of 880 km linking Nigeria to Burkina Faso through Niger, with a derivation toward Benin, as shown on the figure below.

The existing Birnin Kebbi substation in Nigeria will be modified to accept a new bay for the 330 kV line. The 330 kV line runs from the Birnin Kebbi substation to the border with Niger, with the following characteristics:

→ Extends over a total length of 62 km with a right-of-way of 50 m.

→ Exits the Birnin Kebbi station from the north following the corridor of the existing Kanji-Birnin Kebbi 330 kV line, by-passes the city and links with the existing 132 kV line.

→ Crosses the floodplain of the Sokoto River on a distance of 8 km following the existing 132 kV line.

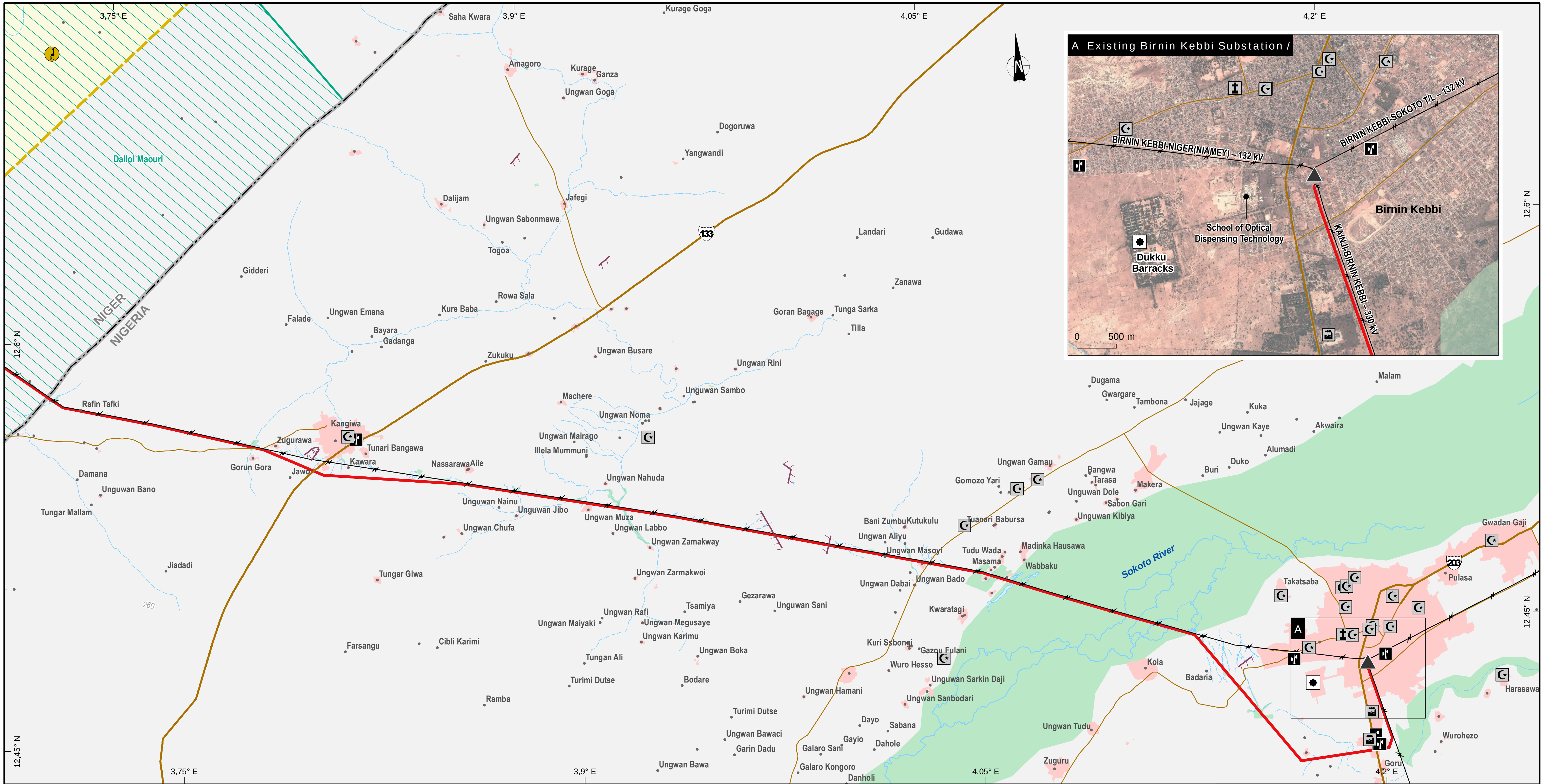
→ Mainly follows the existing 132 kV transmission line to the border with Niger over a distance of 48 km.

Self-supporting lattice towers are used in western Africa and are foreseen for this interconnection. It can be estimated that there will be about 140 to 150 tower structures in Nigeria considering dead-end and angle structures. These structures have usually a lifespan of more than 60 years, with possibilities to increase the performance by means of refurbishment works.

It is planned that the 330 kV North Core project, from the overhead ground wire or other appropriate technologies, will supply electricity to all communities / villages / towns within a radius of 10 km from the center line, including a total of in between 500 to 2,500 inhabitants. This rural electrification projects are not covered by the current ESIA. However, this aspect was considered as an indirect positive impact of the project in the impact assessment.

To achieve the project's expected results, multiple alternatives were identified based on environmental, social, economic and technical criteria. The design of the line route options and the mapping of environmental components were carried out simultaneously to maximize feedback between the two processes. An option was selected and then optimized based on constraint analysis, a field mission to review constraint areas and meetings with stakeholders.

Map 1 presents the selected line route in Nigeria, which is the object of the ESIA.



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Mosque

Church

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Floodplain

Erosion

Infrastructure

National Road

Secondary Road

Telecommunication Tower

Military Base

Factory

Substations and Transmission Lines

Existing Line

Existing Substation

Project Component

Draft Final Line

Boundary

International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report

Draft Final Line Route in Nigeria

0 1,65 3,3 4,95 km

UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c3_1_Nigeria_160606.mxd

Map
1

June 2016

WSP

DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE

Description of the Project Area

Baseline characterization has focused on various environmental and social components. In order to get the best portrait of the studied components, the study area varies in terms of extend. For the bio-physical components, the study area is made from a 10 km-width corridor, 5 km from the central axis of the line on each side. The study area covers the Birnin-Kebbi substation occupying land area of approximately 11ha, with a total perimeter length of about 135m. The study area for the human environment characterization cover the Kebbi state that includes emirates of Gwandu, Argungu, Yauri and Zuru. However, socio-economic surveys have been focussed on communities and households located inside the project ROW.

Physical Environment

The study area is characterized with a tropical continental type of climate. Though much of the rain in the study area falls between June and September in the north and April to October in other parts, the rainy (wet) season starts around April and lasts until early October, with a peak in July (366 mm). Saharan air, which accompanies dry season in the area, is characterized by low relative humidity and intense aridity that creates dusty atmosphere. Mean relative humidity is between 12.9 and 62.5% with mean minimum air temperatures of 21.2 °C - 23.9 °C and mean maximum temperatures of 29.3 - 39.3 °C.

The zone along the study area is characterized, in the northern part, by low-lying dissected plains with risers of old stabilized dunes from aeolian deposits, flat-topped remnants of older landscapes with ironstone sheets or boulders and low rock-outcrops (Ojanuga, 2006). The Sokoto River runs through the study area and drains into the Niger River. The soils are situated on relatively flat to gently undulating undulated terrains, in the northern part of the zone.

Geologically speaking, Kebbi State lies within the Sokoto basin, which is characterized by many geological formations. The study area lies completely within the Gwandu formation. The sediments of this formation are of terrestrial origin and made up of interbedded semi consolidated sands and clays.

Soils along line route belong to three major soil mapping units; S1, S2 and S3:

→ S1: very deep, well drained, reddish yellow to brownish yellow, sandy loam and loamy sand soils on level to gentle slope, associated with upland topography.

→ S2: very deep, very poorly drained, pale brown to grayish brown, sandy loam and loamy sand soils on floodplains.

→ S3: very deep, well drained, yellowish brown to strong brown, sandy loam and sandy loam over loamy sand soils, on degraded hills with lateritic gravels and caps.

Four main aquiferous zones, separated from each other by various thicknesses of clays, are found in Kebbi State. They are designated as upper zone I, upper zone II, middle zone and lower zone (Oteze, 1971). The recharge areas, for all the aquifers, are in the eastern side of Birnin-Kebbi. Generally, the depth of the water table ranges between 7 m and 30 m below ground level. The aquifer extends to depths of about 220 m below ground level with yields of up to 6,480 L/hr/m. Its quality is generally good.

The entire project area is drained by the Sokoto River, which is the main river in the region. It is a tributary of the Niger River. At the source areas in the east, the Sokoto River system is only seasonal. However, in the western parts of the basin, the river becomes perennial as it begins to receive substantial ground water contribution to its flow. The study area crosses the Sokoto River, and it is expected that up to 8km of the line route could be under water during the wet season, which shrinks to 3 to 4 km during the dry season. The surface water quality is generally good.

Biological Environment

In Nigeria, the study area is exclusively located in the west sudanian savanna ecoregion. The study area is mainly characterized by human presence leading to a relatively important level of natural habitat degradation, with intensive cultivation and agricultural mozaics. The environment at the substation is mainly degraded and composed of a few planted trees; *Azadirachta indica* (Neem tree), *Mangifera indica*

(Mango tree), *Anarcadium occidentalis* (Cashew nut tree) and an important community of *Sida cordifolia*. The only natural terrestrial habitat is the tiger bush which is mainly located close to the Niger border. Tiger bush is a patterned vegetation community consisting of alternating bands of trees or shrubs, separated by bare ground or low herb cover, that run roughly parallel to contour lines of equal elevation. In terms of aquatic environments, the study area crosses the Sokoto River and its associated floodplains and wetlands.

A total of 41 different species were recorded inside the study area with the grasses having the highest abundance and diversity. The region has scattered trees; *Hermathria altissima*, *Sida cordifolia* and *Mitrocarpus hirtus* were noted to be the most widely distributed. Human disturbances, in terms of exploitation of tree species, may negatively affect their abundance.

In terms of herpetofauna, a total of 41 amphibians of three different species were surveyed in the rainy season; while 104 reptiles of 5 different species were recorded. The numbers decreased in the dry season, during which only 14 individuals of amphibians and 82 reptiles were recorded. *Rana temporaria* has the highest relative density among the species identified (57.14) during the dry season, but it was present at only one site. During the rainy season, a total of 19 individuals of *Rana temporaria* were observed at three of the five survey sites. For reptiles, *Agama agama* was the most abundant species and it was observed at the five survey sites during both the rainy and the dry season. None of the species observed are on the IUCN red list of threatened species.

Fourteen (14) species belonging to eleven (11) families were identified. Birds were the most abundant fauna observed during the field surveys. There was clear indication that the diversity of these birds was favoured due to available water and a variety of foods, mostly in rainy season compared to dry season, where their number of occurrence decreased. In the rainy season, a total of 317 individuals were identified compared to 165 individuals during the dry season. The species densities have shown that *Zenaida auriculata* has the highest density of any other species in both rainy season (29, 02%) and dry season (30, 30%). Based on a list of taxa susceptible to collisions, there are 5 species of birds surveyed inside the study area that are more susceptible to collision with the powerline, these are *Streptopelia roseogrisea, Cyanocitta cristata, Petronia xanthocollis, Egretta alba and Zenaida auriculata.*

The Palaearctic-African flyways constitute collectively the world's largest bird migration system. Over 2 billion passerines and near-passerines, 2.5 million ducks and two million raptors migrate from their breeding grounds in Europe and central and western Asia to winter in tropical Africa. Only two surveyed species inside the study area, *Anthus trivialis* and *Streptopelia roseogrisea* are migratory. They have been surveyed in both rainy and dry seasons.

The only species of mammals observed during the field survey were domestic animals, including cattle, sheep, horses, goats, camels, cats, dogs, and donkeys. According to the Global Biodiversity Information Facility, this region of Nigeria could potentially host 25 mammal species (table below). None of these potential species are listed in the IUCN red list of threatened species. Most of the potential mammal species that have been identified in Kebbi State are either small mammals or bats.

Nineteen fish species, found inside the study area, were reported from the interview conducted in a structured questionnaire. During the rainy season, 18 species were reported to be available in the river. However, in the dry season, only five (5) species were reported to be available. Out of these five species, Clarias Gariepinus and Synodontis Clarias are present in abundance compared to other species. This is likely due to the reduction in water volume and frequent fishing by fishermen. Fishermen also reported that the river had an important diversity of fish species, but their availability decreased as the volume of water decreased during the dry season.

In terms of plankton, 31 taxons and 20 taxa were surveyed in surface water, respectively, during the wet and the dry season. The Mycobiota recorded was dominated by species of Penicillium, Trichoderma, and Aspergillus, in both wet and dry seasons.

Ecosystem services inside the study area have been briefly described. ES are grouped into three categories: supply services, regulating services and supporting services. No cultural services are provided inside the study area. The benefits that local communities obtain from local natural and modified habitats are crucial in their well-being.

Social Environment

The study area is located inside Kebbi state. Using the 1991 population census and based on 2.83% growth rate, the projected population of Kebbi State for the year 1999 is 2.587 million (NPC, 1992). This increase is the result of improved medical care, better nutritional standards and internal migration, since the creation of the state in 1991. Further projections, from a more recent census, show that the population of the state stood at 3,630,931 by 2011, with a population density of 56/km2 (150/sq mi) ranking 22nd out of the 36 states that make up Nigeria. In general terms, the rural population, which accounts for 78% of the state total, lives in small and highly dispersed settlements.

Arewa and Dandi Local Government Area are among the four LGAs crossed by the study area and shares a boundary with the Niger Republic. Their headquarters are in the town of Arewa and Kamba respectively. They have together an area of 3,901km² and a population of 184,030 at the 2006 census. Thirdly, Kalgo LGA was created in 1996 out of Bunza LGA with its headquarters in the town of Kalgo. It shares a west border with Bunza LGA and had an area of 1,173 km² and a population of 85,403 at the 2006 census. The fourth LGA that is traversed by the line is Birnin Kebbi LGA, which also serves as the state’s capital city. From the 2007 numbers, the city has an estimated population of 268,420 and accounts for eight % of all the urban population (Online Nigeria, 2015).

Kebbi state hosts diverse ethnic groups, among which Hausas, Fulanis, Kabawa, Dakarkaris, Kambaris, Gungawa, Dandawa, Zabarmawa, Dukawa, Fakkawa and Bangawa are dominant. These ethnic groups speak diverse languages and dialects, with the Hausa language spoken all over the state. The majority of the people in Kebbi state are muslim following the 1804 Fulani jihad. However, there are minority groups of Christians and traditional worshippers, particularly in the south of the state.

The vast majority of households are headed by men. Of the 498 households that are affected by the project, (98.8%) are headed by men. Most of them (93.4 %) are married with either one (46.2 %) or many women (47.6 %). In total, these 498 households have 3 054 members almost equally divided between male (49.8 %) and female (50.2 %).

With over 75 % of the state population residing in rural areas, farming is the major occupation in Kebbi state. Among the affected households, the main occupation of the majority of the heads of households is farming (79.5 %). Only 8.4 % are employees of a private (1.6 %) or public (6.8 %) organization. Rainfall is seasonal; most farming is carried out during the wet season and on the upland, during which food and cash crops, such as millet, sorghum, maize, rice, beans, cassava, cotton, and tobacco, are cultivated. The affected households generally have a roof made of corrugated iron sheets (80.9 %), walls made of mud brick (45.8 %) or mud (28.3 %), and dirt, sand (55 %) or smoothed mud (26.1 %) floors. The vast majority (91.2 %) of them use wood as cooking fuel.

In terms of public infrastructures, most of the Kebbi state population uses unprotected or protected springs and wells. Treated pipe water is provided to 5.4 % of the population and 11.3% use bore hole or hand pump. The results, from the 498 affected households surveyed, show that the vast majority (88.8 %) get their domestic water from a well. Only a third (37.3%) of the 498 affected households is connected to the electricity’s main network. Wood is the main type of cooking fuel, used by 64% of households (38% of urban households and 83% of rural households). In addition to wood, kerosene is an important type of cooking fuel in urban areas as it is used by 48% of urban households (National Population Commission, 2014).

Many services, stores and enterprise are available in the communities crossed by the project in the four LGA. Materials such as sand, stones, cement and wood, petrol for machinery, and services (food, lodging) for the construction work can be bought in the villages when the project is being executed.

The health system of Kebbi state remains overstretched by a burgeoning population; physical facilities are decaying, equipment is obsolete and there is scarcity of skilled health professionals. In addition, the roles of stakeholders are misaligned and coordination systems are weak. Many of the public primary health care (PHC) facilities serve only 5 to 10% of their capacities or potential patient loads due to loss of confidence in public PHC facilities, as such, the secondary and tertiary facilities are used more or less as primary health care facilities.

Recent surveys revealed that the state has a total of 303 primary schools and 29 post primary schools. It also has the Federal University of Birnin Kebbi as well as three higher institutions; Kebbi State Polytechnic (Birnin-Kebbi), College of Agriculture (Zuru), and School of Health Technology (Jega).

Despite continued efforts, the state’s educational standards are well below the national average. The percentage of females in school is one of the lowest in the country, reflecting limited educational opportunities for girls until very recently. The 2013 NDHS Nigerian report also shows that men are much more likely than women to be literate (75% versus 53%).

Among the 498 affected households, some are vulnerable for different reasons, for example, if the head of household is a widow or child, etc. The following table shows that among the project’s affected households, 45 are headed by a person that is handicapped or chronically sick and 51 have to take care of a chronically sick or handicapped member.

The other potential source of vulnerability is related to the fact that for a lot of households the affected parcel is the only one that they use. In the vast majority of these cases the 20% or more of the parcel is occupied by the project ROW. This poses a risk to the PAP since TCN policy does not allow the PAP to use the ROW for cultivation. A replacement land must be provided to these households.

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

An Environmental Impact Assessment (EIA) for the North Core project is required in conformity to the EIA Act No. 86 of 1992 / EIA Act Cap E12 LFN of 2004. The EIA approach for the project follows the specific EIA National Procedural Guidelines as well as the Sectoral Guideline on Electricity Transmission Lines.

The other applicable legislation includes the Electric Power Sector Reform No. 6 (2005), the Nigerian Urban and Regional Planning Act CAP N138 (LFN 2004), the Harmful Waste (Special Criminal Provisions) ACT CAP H1, (LFN 2004), the Endangered Species Act, CAP E9 (LFN 2004), the Inland Fisheries Act, Cap I10 (LFN 2004), the River Basins Development Authority Act, CAP R9 (LFN 2004), the National Commission for Museums and Monuments Act, the Factory Act cap 126, LFN (1990), the Labour Act, the Wages Board and Industrial Council Act (1974) and the Workers’ Compensation Act. Additionally, it exposes the applicable environmental standards and regulations. International legislation including the applicable conventions for which Nigeria is signatory.

The relevant institutions involved in the overall implementation of this project include the Federal Government of Nigeria (FGN), the Federal Ministry of Power, the Transmission Company of Nigeria (TCN), the Federal Ministry of Environment, the Nigerian Electricity Regulatory Agency, the National Environmental Standards and Regulatory Enforcement Agency, the Kebbi State Government and relevant ministries, the Local Government Authorities (LGA) and the Customary District Councils.

The implementation of the project, in addition to be subject to national requirements relatively to the environmental and social protection, must conform to international best practices. Safeguard policies of the World Bank (WB) and the African Development Bank (AfDB) should be fed into the project cycles. It is also the case for the different requirements of co-financing agencies, notably the European Union (EU) who has its own environmental guidelines and policies.

SUMMARY OF POTENTIAL AND RESIDUAL IMPACTS

This impact analysis is based on a cause/effect matrix between project-related impact sources and valued environmental and social components. This matrix is displayed in chapter 7 (Figure 7-1).

Impacts are defined by their intensity (low, medium, major), their extent (regional, local, limited) and their duration (long, medium, short). The method used to identify, analyze and mitigate environmental and social impacts, or to improve positive impacts, places the project in a sustainable development perspective. The mitigation of potential negative impacts and the enhancement of positive impacts allow its environmental and social acceptability by stakeholders. Intensity of potential and residual impacts, as well as impact probability of occurrence, based on an environmental and social impact assessment report, regarding the North Core project, are shown in tables A and B.

Table A Summary of Potential and Residual Impacts during Pre-Construction/Construction Phases

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical environment VESC				
Air quality and climate change	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Temporary deterioration of air quality related to exhaust gas and dust generated by vehicle traffic. Construction activities could generate low emissions of GHG	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Local increase of noise levels anticipated during works. – Emissions of noise from construction works with associated machinery (roller, grader, concrete mixer, generators, trucks, etc.) could reach maximum noise emissions of approximately 100 dB	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agricultural potential	– site preparation – construction activities – management of hazardous products and residual materials – transport and traffic	– Foundation works for pylons, as well as the construction of access roads and camps will lead to soil erosion and compaction in erosion-prone areas such as strong slopes and wetlands. – Changes in soil chemical properties and risk of soil contamination are foreseen in case of an accidental spill of petrol or fuel oil.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Water resources	– site preparation – implementation of construction sites – construction activities – management of hazardous products and residual materials – transport and traffic	– In-water works and poor management of hazardous material could result in local changes in hydrology and in modifications to surface water and groundwater quality resulting in contamination. – Areas most at risk are the Sokoto River and its floodplain, as well as the intermittent watercourses crossed by the line route	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Biological environment VESC				
Terrestrial habitats, flora and fauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– Most of the power line ROW consists of agricultural areas including Agricultural-Shrubby Vegetation Mosaic, Cultivated Land and Intensive Cultivation which cover together 66,9 % of the right of way. – A total of 29.1 ha of tiger bush will need to be cut and constitutes permanent loss of natural habitat. – Habitat fragmentation and degradation will result in modification of species composition in flora and fauna communities and the introduction and risk of spread if invasive species.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Avifauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – labor	– Construction activities will lead to habitat losses, modification and fragmentation for some terrestrial and water birds, notably of conservation interest and water birds. – Habitats of higher ecological importance for birds in the study area are the Sokoto floodplain and areas close to the Niger border (not far from the dallol Maouri Ramsar site).	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Aquatic and semi-aquatic habitats and fauna	– site preparation – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– During the construction phase, access road construction, vegetation clearing, and pylon construction will cause wetland and riparian habitat loss and could lead to local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances. Sokoto river, its associated floodplain and intermittent watercourses may be affected.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Human Environment VESC				
Land planning and use	– site preparation – population resettlement – construction activities	– Loss of land, crops, trees and pastoral zones outside the ROW – 498 households will lose a piece of land entirely or partially. – 537 trees belonging to project affected people (PAPs) will need to be cut down	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Existing infrastructures	– population resettlement – site preparation – construction activities – transport and traffic	– A total of 25 houses, 11 secondary structures, six commercial structures and three community structures will need to be demolished or displaced before construction begin. – On main roads, the presence of vehicles and building materials can lead to an increase in traffic and damage risks. To the extent possible, existing roads will be used as access roads. New access roads (permanent or temporary) could be built only if clearly needed.	Nature: Negative Importance: **Major** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– Purchase of materials, goods and services – Labor	– Construction activities will lead to the creation of short-term jobs. – Stimulation of local economy by the purchase of local goods and services.	Nature: Positive Importance: **Minor** Probability of impact occurrence: Medium	Nature: Positive Importance: **Minor** Probability of impact occurrence: High
Economy, employment and livelihoods	– presence and operation of the line and substations – wayleave maintenance – population resettlement – construction activities – transport and traffic	– Construction works will lead to the creation of short term jobs and will stimulate local economy by the purchase of local goods and services. This demand can however lead to risks of inflation. – Project implementation will also lead to permanent loss of crops. – Tourism and leisure activities could temporarily be disturbed by noise, dust, traffic and construction works.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Quality of life, health and security	– population resettlement – construction activities – management of hazardous products and residual materials – transport and traffic – labor	– The influx of foreign workers can lead to increased pressure on community health services in the region. Their presence can also increase STD transmission risks, including HIV/AIDS. – The increase in heavy vehicle traffic can increase risk of accidents and physical injuries involving local workers and residents. Construction sites can generate curiosity, especially among children. – Noise, dust, air pollution and risk of accidents can generate stress and disturbances in generally calm rural areas – Environment disruption caused by workers' camps	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Social cohesion and gender	– land acquisition – population resettlement – labor	– Compensation assessment and transfer could lead to conflicts and revive old quarrels. – Tensions with outside workers could also arise because of different value systems. – Also, there is a risk of marginalization of women from the compensation process if they are not implicated in all project steps. – Works can also disturb women subsistence activities.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups	– land acquisition – population resettlement	– Increased marginalization of vulnerable groups (e.g.: women heads of households, disabled or elderly, etc.)	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Cultural and archeological heritage	– site preparation – exploitation of borrow pits – construction activities	– Potential disturbance or destruction of archaeological sites and / or objects, and of burial and / or sacred sites. No grave or cemetery were identified in the ROW.	Nature: Negative Importance: **Major** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Landscape	– site preparation – construction activities – exploitation of borrow pits	– Aesthetic impacts during the construction phase will be limited to work zones. Deforestation of the ROW will change the landscape	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

Table B Summary of Potential and Residual Impacts during Operation and Maintenance Phase

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical Environment VESC				
Air quality and climate change	– presence and operation of line and substations – facilities maintenance – ROW management	– Slight degradation or air quality felt locally due to maintenance activities, particularly ROM maintenance and vegetation clearing activities. – Transport and traffic associated with maintenance activities are also likely to generate dust, especially during dry periods – Emissions of greenhouse gases from machinery in very small quantities.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– presence and operation of line and substations – facilities maintenance – ROW management – transport and circulation	– Maintenance activities conducted near pylons, substations, transmission line or ROW could lead to an increase in noise levels – Operating transmission lines and substations emit a permanent background sound which is audible and which also may also disturb communities in the vicinity to the line or substation . Noise propagation is generally higher during rainfall and be especially noticeable during nighttime.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agriculture	– presence and operation of line and substations – facilities maintenance – ROW maintenance – transport and circulation – management of residual/hazardous material	– Maintenance activities will be limited during the operation phase, but are more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to soil contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Water resources	– presence and operation of line and substations – facilities of maintenance – ROW management – transport and circulation – management of residual/hazardous material	– Maintenance activities of the powerline will be limited during the operation phase, but could be more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to ground water and surface contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Biological Environment VESC				
Terrestrial habitats, flora and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– 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 within the ROW. This continuous alteration of natural habitats will maintain ROW habitats in earlier vegetation development stages, leading to habitat loss for some terrestrial fauna species and causing a barrier effect for small fauna, limiting their movements or making them more vulnerable to predation. – There are risks of collisions and electrocution with bats – Presence of the access road in previously inaccessible areas could lead to an increase in natural resources exploitation and a reduction of species communities with a higher use value.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Avifauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– Collision risks of birds with the ground wires are high and can cause injuries or death. Risk are greater for waterbirds near wetland or rivers, and for large birds. No species susceptible to collision surveyed inside the study area are threatened. – The Sokoto floodplain is certainly an area prone to bird collisions, as it is a wetland in proximity to the Niger river where birds are known to concentrate.Modification and disturbance of bird habitats, with associated changes in bird communities	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium
Aquatic and semi-aquatic habitats and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – transport and circulation – presence of workers	– Hydrological conditions modifications that could potentially be caused by the presence of pylons in the floodplain and of access roads could cause modifications in aquatic habitats and its associated fauna – Potential introduction of invasive alien species	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Low	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Low

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
		Human Environment VESC		
Land planning and use		– No negative impact on land use, and planning is expected during the Operation Phase since the PAPs will have been displaced before construction	n/a	n/a
Existing infrastructures	– presence and operation of line and substation	– Transmission lines do not usually interfere with television and radio signals. In some cases, interference can occur very close to the ROW due to low broadcast signals or poor reception of the equipment.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– presence and operation of line and substations – facilities maintenance – ROW management	– Potential for economic development associated with electricity access originating from the project – Jobs will be created	Nature: Positive Importance: **Major** Probability of impact occurrence: Medium	Nature: Positive Importance: **Major** Probability of impact occurrence: High
Quality of life, health and security	– presence and operation of the line and substations	– The project can lead to electrocution risks caused by equipment failure, illegal connections, steel theft and any other forms of dangerous contacts. – Based on a recent comprehensive review of scientific literature, there is no evidence to date concluding that an exposure to electromagnetic fields (EMF) of low intensity is harmful to human health. However, – perceptions of risk remain.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Social cohesion and gender	– presence of workers – ROW maintenance	– The loss of crops (annual and perennial) due to maintenance activities can affect women more than men. In fact, women are usually in charge of subsistence activities and struggle to provide their household when crops are limited.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups		– No negative impact on vulnerable groups is expected in the Operation Phase	n/a	n/a
Cultural and archeological heritage		– No negative impact on the cultural and archaeological heritage is expected during the Operation Phase	n/a	n/a
Landscape	– presence and operation of line and substation	– The overall aesthetic effect of a transmission line is likely to be negative for some people, especially where the proposed lines cross natural landscapes. The tall steel structures may seem out of proportion and not compatible with agricultural landscapes. The consultations conducted with the local populations have not raised the visual aspect as a negative impact	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

RISK ANALYSIS OF TECHNOLOGICAL ACCIDENTS AND EMERGENCY RESPONSE PLAN

TCN's objective, in terms of risk management, consists of reducing risks to the lowest levels, as much as is reasonably possible. They strictly implement their Corporate Policy on Occupational Health and Safety needed during all project phases.

Natural risks, associated to the current project, are mostly associated to lightning, which could short circuit the system, cause erosion phenomena, in particular in flooding zones or in areas which are prone to erosion, and bush fires which could start in areas close to the lines or stations. However, these risks are managed at a technical level via the use of specific components during the conceptualization of the project (earthing cable, appropriate choice of tower location, foundation composition, adequate clearing zone, etc.).

The risk analysis relies mostly on the technological risks associated to the use of the power line and the stations on the North Ridge project.

There are potential risks associated with the storage and use of petroleum products such as, diesel, light crude oils, fuel, lubrication oils and grease. The hazards, which can lead to identified major accidents, are spills of petroleum products, fires and/or explosions involving petroleum products or spills of oils and grease.

There are also potential risks associated to the presence of electric transformers. The hazards which can lead to identified major accidents are spills of dielectric oils or fire, explosions involving an electrical transformer.

For each identified risk, preventative and mitigation measures are proposed in order to reduce the risk of accidents as well as their consequences in an emergency situation. An Emergency Response Plan framework is also proposed.

STAKEHOLDER ENGAGEMENT

Four stakeholder information and consultation rounds were conducted, through the development of the ESIA study and RAP, for this project. Those were planned according to key stages, or decision moments, throughout the study where the informed participation of stakeholders was likely to make the most significant contribution to the on-going analysis, namely the environmental and social scoping stage (1st round), the preliminary route assessment stage (2nd round), the documentation of the affected communities and displaced households (3rd round) and the disclosure of the ESIA, ESMP and RAP preliminary results (4th round).

Target stakeholder groups, for the stakeholder engagement process, have included:

→ Concerned ministries and national agencies
→ State-level (Kebbi) and LGA-level (Birnin Kebbi, Arewa, Dandi and Kalgo) authorities and technical services
→ Customary authorities
→ Communities and households affected by the line route
→ Industrial and commercial actors affected by the line, if any
→ NGOs and other civil society organizations in the fields of nature conservation, community development and human rights

First round of consultation was held in both Birnin Kebbi to meet with state and local authorities from the January 7 2015. During the second round, state and local authorities and organizations were met in Birnin Kebbi the April 18 and 19 2015 and a meeting with TCN was held in Maitama Abuja on April 20 2015. For the third round of consultations, Federal authorities were met in Abuja on October 9 2015 and the Kebbi state authorities and Sokoto-Rima River Basin Development Authority were met in Birnin Kebbi on September 17 2015. Local government authorities, local organisations, women groups, traditional chiefs, Media Houses and Argungu Emirate Council were met in Bernin Kebbi, Kangiwa, Agungu and along the line route from September 17 to 19 2015 and October 13 to 15 2015. The activities carried out as part of the fourth stakeholder engagement round were:

→ One national meeting in Abuja with concerned ministries and national agencies (March 17, 2016)

→ One State-level meeting in Birnin Kebbi with State authorities and technical services (March 14, 2016)

→ Group meetings in Birnin Kebbi and Arewa with LGA-level authorities and technical services and representatives from affected communities (March 14, 2016)

Main comments, raised issues or recommendations were associated to the following components:

→ fair and equitable compensation for any loss, including fallow lands, of project affected persons;

→ risk of erosion in some areas;

→ impacts on ecologically sensitive habitats (aquatic habitats (river, floodplain and wetland), forest reserves);

→ communities health and safety aspects during both construction and operation phases;

→ impact on traffic during construction works because of road crossing;

→ importance of public enlightenment;

→ benefits to communities in terms of access to electricity.

MANAGEMENT MEASURES

The mitigation impact hierarchy has been applied as part of the project. A comprehensive set of impact management measures applicable to site activities has been prepared. These measures are designed to minimize impacts on air, noise environment, water and soil and protect environmental components from the pollution caused by works. Other measures are aimed at avoiding, reducing or offsetting impacts on wildlife, flora and the socio-economic environment. These measures respect international best practices and national regulations.

Among the wide range of measures proposed, a number are presented in the following table.

Table C Management Measures identified for Valued Environmental and Social Components

Valued Environmental and Social Components	Management Measures
Air quality and climate change	Stockpiles of fine materials will be covered during of high wind periods. Non-stabilized stockpiles and exposed soil will be sprayed with water regularly if dust generation is visible. Develop and apply a proper waste management strategy. Burning of solid wastes will not be permitted. Generators, vehicles and machinery will be shut down when not in use. Maintain equipment and machinery in good running conditions. Restrict speed on loose surface roads to 25 km/h during dry or dusty conditions. Cover loads of brittle material during transport.
Noise Levels	Follow national noise standards. Provide all internal combustion equipment with properly functioning silencers or mufflers.
Water Quality Protection	Where stream crossing is unavoidable, install suitable culvert. Under no circumstances will water bodies be blocked to provide access. Store hazardous material and vehicles minimally 100m away from wetlands and floodplains Set and implement strict procedures for in-water works. Conduct activities during the dry season to minimize disturbance of sensitive shoreline and wetland areas. Do not refuel or service equipment within 100 m of any watercourse or surface water drainage installations. Install silt barriers (e.g., fencing) when working in steep riparian areas and along wetlands to minimize potential sediment transport to aquatic habitats. Prepare and implement an Emergency Response Plan.
Soils and agricultural potential	Prepare and implement erosion and sediment control plans, particularly in areas identified as having high erosion potential.

Valued Environmental and Social Components	Management Measures
	Identify and rehabilitate exposed soils immediately after the end of construction activities. Hazardous materials (mainly used oil and gas) must be stored in a manner that avoids interaction with each other or with the environment and prevents them from being tampered accidentally. De-compact soils following construction with appropriate equipment. Keep a Spill Containment Kit readily accessible onsite in the event of an accidental spill and ensure on-site staff is trained in spill response. Characterize, remove and dispose of contaminated soils at sites authorized by relevant authorities. Ensure that all stationary equipment and machinery are installed in permanent spill containment installations of sufficient capacity Revegetate areas of bare and disturbed soils as soon as possible with native species
Fauna and Flora	Establish a Compensation and Revegetation Plan for lost natural habitats during construction phase. Clearly mark the extent of vegetation clearing in the ROW with stakes at intervals of 50 m or less. Identify and mark the vegetation to be preserved along sections of the ROW. Conserve all vegetation under 4 meters (trees, shrubs, herbaceous plants, crops) present at the edge of watercourses and on steep slopes.
Birds	Where a threatened bird species is nesting, do not undertake tree clearing within a radius of 1 km. Wait until the nest is deserted. Compensate any loss of breeding/nesting sites by the creation of suitable habitats elsewhere. Place “bird diverters” on the top (ground) wire to make the lines more visible to birds if the collision potential is high (especially where the powerline crosses the Sokoto river floodplain). Complete tree and/or brush cutting prior to or after the core nesting season.
Economy, employment and livelihoods	Implement a Resettlement Action Plan. Provide compensations to affected households and landowners. Involve traditional leaders in the resettlement process. Provide compensation measures to affected tourism and recreation activities, if any. Adopt procurement policies promoting local products and services, when available. Undertake revegetation with agroforestry trees that increase availability of fodder or fruit trees, to maximize livelihood benefits for local population. Implement an accessible grievance mechanism for PAPs to address complaints at the local level.
Health	Design and build the transmission line as to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits. Restrict transport and circulation activities on public roads to the period between 6 a.m. and 6 p.m. Control speed of transport vehicles. Limit speed to 20 km/h inside villages and install signposts where relevant. Require all contractors and sub-contractors to comply with relevant World Bank (WB) health and safety requirements, including specific provisions. Develop and Implement a Hygiene, Health and Safety Management Plan. Prepare and implement a STDs/HIV/AIDS prevention program for both communities and workers.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The environmental and social management plan (ESMP) sets the implementation of proposed mitigation measures and management plans in order to insure project sustainability. It identifies the objectives to be achieved and the management measures to be implemented to ensure optimal integration of the project into its environment, according to national regulations, but also according to international best practices for similar projects.

In addition to the elements presented below, the ESMP also describes supplementary initiatives, such as the detailed ESMP, including Vegetation Management Plan, Revegetation and Erosion Control Plan, Waste Management Plan, Physical Cultural Resources Management Plan and Emergency Management Plan, as well as the Resettlement Action Plan (RAP). It also includes a Stakeholder Engagement Plan (SEP) for project operation, including goals regarding resources and institutional organization for the SEP implementation.

IMPLEMENTATION INDICATORS AND ENVIRONMENTAL SURVEILLANCE AND MONITORING

An environmental and social surveillance and monitoring program is proposed to ensure that commitments regarding environmental and social measures, included in the ESIA and the ESMP, are fully respected at the implementation phase and to evaluate the environmental performance during the project's operation phase. Essentially, this exercise should provide ongoing information on actual changes occurring in natural and socio-economic systems as a result of the project implementation. For both environmental and social surveillance and monitoring, associated methods, standards and targets, location and responsibility, are exposed.

Main environmental and social components included in the surveillance and monitoring program are air quality, water quality, noise levels, fauna protection, local and regional economy, employee and community health and safety.

The PGES identifies many indicators for implementation of management measures, for example:

- Intensity of suspended particles in water and signs and intensity of water contamination
- Noise levels (dBA)
- Type of nuisance reported through complaints and measures implemented to solve the problem
- Species involved in bird or bat morality, location of the carcasses, period, number of threatened species individuals involved
- Number of locals involved in works
- Number and rate of electrified communities
- Number of development projects
- Cause and type of workers' injuries/accidents

GRIEVANCE MECHANISM

Regarding the disputes/disagreements that could potentially occur between the project developer and the PAPs or other stakeholder, a structure dedicated to complaints management will be established and will include two stages according to the Nigeria LUA of 1978, namely customary mediation and judiciary hearings.

The first stage includes a series of customary avenues to deal with dispute resolutions. These aim to provide an amicable grievance procedure that will facilitate formal and/or informal grievance resolution. A Customary Grievance Redress Committee shall be set up by the Project Implementation Unit (PIU) in each LGA to address complaints related to RAP or ESMP implementation. This committee will be assisted by the PIU who will act as a TCN representative.

The second stage is to follow the judicial process in accordance with applicable laws, where the law courts will pass binding judgment on the matter.

ROLES AND RESPONSIBILITIES

In summary, a Project Management Unit (PMU), consisting in a Technical Committee and an Environmental and Social Management Committee, will be set up for the project implementation by TCN. The PMU will create a Technical Committee and an Environmental and Social Management Committee.

The Technical Committee should be composed of engineers and technical experts able to ensure compliance with the construction standards provided in the plans and specifications, bidding documents and contracts. It will oversee the Supervising Engineer who will supervise the Contractor responsible for the project construction. The Supervising Engineer will ensure that the Contractor (and its subcontractors) successfully implement the environmental and social clauses included in the contracts, the ESMP and Health and Safety aspects. The Supervising Engineer will have to recruit an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007 as well as a senior environmental specialist and a senior social specialist, which must have experience at the international level. The Supervising Engineer will also make sure that the Contractor recruits an Environmental expert and a Health and Safety expert with an OHSAS Certificate 18001: 2007 with experience at the international level as well as a liaison officers which will provide support for communications with local communities.

The Environmental and Social Management Committee should be composed of an environmental expert, a resettlement expert as well as an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007. The different specialists will be located in the project area, especially during the pre-construction / construction phase. These specialists will be supported by one or more liaison officers with the local communities and will have to master the local language (s).The Environmental and Social Management Committee will also comprise experts from the professional TCN staff, and from departmental and local authorities that need to supervise the ESMP and RAP implementation.

In addition, the Environmental and Social Management Comittee will work closely with the Project Implementation Unit (PIU) created for the RAP implementation. The PIU will be in charge of the followings activities: estimation and delivery of compensation packages; livelihood restoration and vulnerable group assistance measures to affected households; reconstruction of community affected structures; implementation of the Community Compensation Fund's (CCF) funded measures.

SCHEDULE AND BUDGET

The ESMP proposes a timetable for the implementation of the project during the preparatory phase (a year before the pre-construction), as well as the pre-construction (6 months), construction (18 months) and operation phases. Many of the proposed management measures and specific management plans to be implemented during the construction phase are to be under the responsibility of the contractor(s) who will build the project, so those costs will be integrated with other construction costs. It should be mentioned that the present ESMP imperatively needs to be appended to the construction tender documents to be published in order to ensure that those costs are placed under the responsibility of the project contractor(s). Indeed, the bidder shall propose:

→ an activity implementation plan
→ measures that will be taken to protect the environment
→ rehabilitation work and a methodological presentation, describing how negative effects will be avoided and unavoidable effects minimized

In addition, the bidders shall present, upon submission of their bid, the detailed program for environmental and social management essentially inspired from the environmental and social management plan (ESMP)

Table below shows a summary of the main costs for the implementation of plans, programs and management measures which require additional costs.

Table D ESMP Budget Estimate

Activities	Costs (USD) (5 years)	Cost NGN (5 years)*
Phase 1: Pre-construction		
Capacity Building and Training Program	270,000	85,050,000
Survey of sensitive areas for bird populations and nests surveys	50,000	15,750,000
Involvement of a botanist for clearing activities	10,000	3,150,000
Stakeholder Engagement Activities during preconstruction/construction phase	60,000	18,900,000
Sub-total Pre-construction Phase	**390,000**	**122,850,000**
Phase 2: Purchase and Construction		
Install warning signs and anti-climbing devices	10,000	3,150,000
Document and report all spills to the FM Env	5,000	1,575,000
Development of local and regional emergency plans in case of infrastructure breakdowns	50,000	15,750,000
Revegetation and Erosion Control Plan	25,000	7,875,000
Environmental and social surveillance	80,000	25,200,000
Sub-total Purchase and Construction Phase	**170,000**	**53,550,000**
Phase 3: Operation		
Prepare and implement an Emergency Response Plan	20,000	6,300,000
Spill Containment Kits and spill response training of on-site staff	10,000	3,150,000
Document and report all spills	5,000	1,575,000
Grade ground surface at each tower site to keep drainage water away from tower base	6,000	1,890,000
Implementation of the Vegetation management plan, including invasive alien species monitoring program in identified sensitive areas	15,000	4,725,000
Involvement of a botanist in maintenance activities to implement selective vegetation clearing	15,000	4,725,000
Invasive alien species control program	20,000	6,300,000
Implement an awareness program to educate and raise local communities' awareness on the protection of natural resources	15,000	4,725,000
PAP compensation for any damage to their crops or assets during maintenance activities	10,000	3,150,000
Minimize the number of permanent access roads to and in the ROW. When possible, proceed to early closing and rehabilitation of temporary access roads nearby sensitive scenic areas	25,000	7,875,000
Stakeholder Engagement activities during Operation phase	80,000	25,200,000
Monitoring of environmental and social performance, including the development of adapted mitigation measures (notably for birds)	100,000	31,500,000
Environmental Audit	20,000	6,300,000
Supervision of environmental and social monitoring by designated people	45,000	14,175,000
Prepare and implement a Vegetation Management Plan	60,000	18,900,000
Prepare and implement a Waste Management Plan	40,000	12,600,000
Prepare and implement a Hygiene, Health and Safety Plan	100,000	31,500,000
Sub-Total Operation Phase	**586,000**	**184,590,000**
Implementation of the ESMP	**1,146,000**	**360,990,000**
Implementation of the RAP	**4,398,850**	**1,385,637,783**
TOTAL	**5,544,850**	**1,746,627,750**

Exchange rate: 315 NGN = 1 USD
The cost was estimated for deflectors at the level of the Sokoto River floodplain. Deflectors will be marked every 10 m on 60% of the area between two pylons at the level of the two earthing cables.

A K N O W L E D G E M E N T S

This report is a collaboration of a various number of national and international experts, who have worked together, to successfully provide the input required to ensure the most optimal line route is selected, the conclusions of the impact assessments are supported by reliable data and profound knowledge, and to ensure a proper environmental and social management strategy is proposed for the North Core project implementation. Thank you for your great sense of professionalism. Special thanks to the national project coordinator, Mamoud Bello, for his involvement and precious collaboration during the entire ESIA process.

We also want to thank all the stakeholders that have collaborated and shared information with the consultant team, and who have also expressed their thoughts about the project. First they were required to identify the issues, but then they considerably enriched the content of this report. A great thanks to the national, Kebbi state, Birnin Kebbi LGA, Kalgo LGA and Arewa and Dandi LGA authorities who participated to the meetings and workshops throughout the process.

Finally, we want to show our profound appreciation to TCN and the WAPP who allowed us to undertake this assignment. Your collaboration was vital to the success of this mandate.

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1 INTRODUCTION

After the presentation of the context and objective of the project, this chapter exposes the Policy, Legal and Institutional framework. Main environmental and social requirements of the Funding agencies that the project needs to comply are also described.

1.1 PROJECT CONTEXT AND OBJECTIVE

1.1.1 PROJECT CONTEXT

The West African Power Pool (WAPP) is a specialized institution of the Economic Community of West African States (ECOWAS) which ensures regional power system integration and the realization of a regional electricity market. The WAPP is made up of public and private generation, transmission and distribution companies involved in the operation of the electricity in West Africa. Some projects are currently in the planning phase or in execution.

The 330 kV North Core Power Line project- that will provide electrical interconnection between Nigeria, Niger, Burkina Faso and Benin- is part of this large network and is a new step toward national networks integration. This project inserts into a sustainable development perspective. Environmental and social issues were considered when selecting the electric line route and electric power stations locations. This type of project must undergo an environmental and social impact assessment and because of its cross-border nature, it is covered by four different legislative schemes. An Environmental Impact Assessment (EIA) for the North Core project is required in conformity to the EIA Act No. 86 of 1992 which states that no industrial plan, development or activity falling under the mandatory list can be executed without prior consideration of the environmental consequences of such a proposed action, in the form of an environmental impact assessment. The EIA Act made it compulsory for EIA to be conducted for projects which are likely to have significant effects on the environment. Such projects are listed in Category 1, which includes infrastructure projects like the North Core project. The EIA process consists in the various stages a project undergoes from proposal to approval for implementation, resulting in the issuing of an Environmental Impact Statement (EIS) and certificate. The EIA approach for the project follows the specific EIA National Procedural Guidelines as well as the Sectoral Guideline on Electricity Transmission Lines. This EIA must also comply with international best practices, in particular the World Bank Safeguard Policies, African Development Banks Safeguard Systems and European Union Policies. The content of the Environmental and Social Impact Assessment (ESIA) report complies with the Terms of reference submitted to the Minister in charge of Environment in 2013 and the comments of the Federal Ministry of Environment received on January 2014 (Appendix 1).

WSP has been mandated to perform the impact assessment study. WSP conducted the line route study allowing the integration of environmental and social concerns into the project concept. This integrative method implies an analysis of social and environmental stakes at the planning phase, hence enabling source reduction of potential impacts, while respecting economic considerations. This study analyzes environmental and social impacts expected to occur from the project, including the chosen route and associated management measures of anticipated impacts.

After the Technical Review of this report by the Federal Ministry of Environment (FME), the ESIA of the 330 kV North Core Interconnection Project was adjudged satisfactory for disclosure. In this context, it is presented to the "ESIA Panel Review Exercise" scheduled to hold amongst the relevant stakeholders, project affected persons, identified project host community as well as Environmental regulators at State and Local Government levels and community, in the State of Kebbi from August 1st to 4th (Appendix 8).

1.1.2 OBJECTIVES

In respect with Nigeria legislation and International best practices, the 330 kV North Core project is subjected to a complete environmental study, along with a Reinstallation Action Plan (RAP) and an Environmental and Social Management Plan (ESMP). The present document is actually the EISA report, whose objectives are:

- → Ensure compliance to national by-laws, international conventions signed by the country and international best practices endorsed by money lenders to protect the environment and the quality of life of communities.
- → Identify and manage impacts related to the project implementation in each of its phases.
- → Elaborate a robust management framework used to mitigate the project's negative aspects and improve the positive ones and identify ways to achieve its execution.

1.2 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. Relevant sections are:

- → 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.

About 62km of the transmission line will pass through Nigerian territory as result policies, laws and regulations instituted by Nigerian Government pursuant to this constitutional requirement and relevant to the project will be complied with. These are discussed in the following sections.

1.2.1 POLICY FRAMEWORK

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.

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.

1. Energy Sources: Oil and Gas and Other Conventional (Coal & Tar Sands) Energy Sources such as Nuclear Renewable Energy.
2. Energy Utilization: Electricity, Industry, Agriculture and Transport.

3. Energy Issues: Environment, Energy Efficiency and Conservation, Research, Development and Training, Energy Manpower Development; Bilateral, Regional and International Cooperation, Energy Databank.
4. Energy Financing: Indigenous participation. Financing.
5. Planning and Policy Implementation: Energy Planning, Policy Implementation, prioritization of Strategies into Short, Medium and Long term, Monitoring and Evaluation.

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.

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 labour-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:

I. 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
II. the health fee waiver for pregnant women and children under five (financed through the DRG fund)

III. 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.

National Policy on Climate Change

Given Nigeria's status as a fossil-fuel dependent economy with a large climate sensitive agricultural sector, the development of a climate change policy and response strategy is critical; as climate change portends a serious threat to poverty eradication and sustainable development in general. One of the key pillars of the Vision 20:2020 is investment in low carbon fuels and renewable energy. Achieving the goal of low carbon, high growth and resilient socio-economic system for equitable and sustainable socio-economic and environmental development faces some challenges which include stability and sustainability of enabling environment, adequate institutional and human resources capacity and availability of adequate resources to address mitigation and adaptation initiatives to address climate change. Thus Government need to ensure that economic growth, resource management and climate change mitigation and adaptation can all happen simultaneously if this will be done effectively (Department of Climate Change, 2017).

1.2.2 LEGAL FRAMEWORK

1.2.2.1 NATIONAL LEGISLATION

The Environmental Impact Assessment Act No. 86, 1992/Environmental Impact Assessment Act Cap E12 LFN 2004

The EIA Act 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 considered to be 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 drives from this Act and the project proponents shall conduct their activities in conformance with these guidelines.

Land Use Act of 1978 and Resettlement Procedures

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.

Again 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.

Electric Power Sector Reform 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 licences 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".

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.

The expansion of the Birnin-Kebbi Substation as well as other relevant construction works for this project shall be implemented in line with requirements of this Act.

Section 72 provides for the preservation and planting of trees for environmental conservation.

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 WAPP 330KV North Core project will generate waste transformer oil and other harmful wastes. These wastes shall be handled, treated and disposed of in accordance with the relevant requirements of this Act.

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.

Most of the 62km line route of this project, within Nigerian territory, will pass through bushy 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.

Inland Fisheries Act, Cap I10, LFN 2004

Focused on the protection of the water habitat and its species, the following sections are instructive:

- **Section 1** prohibits unlicensed operations of motor fishing boats within the inland waters of Nigeria.
- **Section 6** prohibits the taking or destruction of fish by harmful means. This offence is punishable with a fine of N3, 000 or an imprisonment term of 2 years, or both.

River Basins Development Authority Act, CAP R9, LFN 2004

This Act establishes and regulates all river basin authorities in Nigeria. The Act lists their functions as agriculture, irrigation, fisheries, forestry and veterinary institute. The Act also establishes the 12 river basin authorities one which is the Sokoto-Rima River Basin Authority, within whose jurisdiction Kebbi State is. The line route for this project crosses River Sokoto on the outskirts of Birnin Kebbi. Hence, the River Basin Authority shall be consulted at both planning and implementation stages of the project.

National Commission for Museums and Monuments Act

The Act provides for the dissolution of both the Antiquities Commission and the Federal Department of Antiquities and to create a National Commission for Museums and Monuments, with the responsibilities to establish and administer national museums, antiquities and monuments; including, antiquities, science and technology, warfare, African, Black and other antiquities, arts and crafts, architecture, natural history and educational services among others. Sections 12 to 18 provide the process/steps for the declaration of antiquities as national monuments, while section 19 deals with restriction of excavations or the purpose finding antiquities as well as issuance of permits and 20 deals with accidental discoveries. In case of any accidental find, the Commission shall be notified within seven days.

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 WAPP 330KV North Core Project. Hence, the occupational 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.

Labour Act

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.

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.

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.

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, in order to ensure that the project is implemented with maximum consideration for environment. This EIA study was conducted in compliance with this guideline.

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.

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, replaced 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:

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

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 various environmental components and sectors of development. The regulations relevant to the project are as follows:

- National Environmental (Wetlands, River Banks and Lake Shores) Regulations, 2009. S. I. No. 26.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Watershed, Mountainous, Hilly and Catchments Areas) Regulations, 2009. S. I. No. 27.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35.
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010. S. I. No. 12.
- National Environmental (Surface and Groundwater Quality Control) Regulations, 2010. S. I. No. 22.
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, 2010. S. I. No. 20.

1.2.2.2 INTERNATIONAL LEGISLATION

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)
- Framework Convention on Climate Change (1992)
- Convention to Combat Desertification (1994)
- 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

1.2.3 INSTITUTIONAL FRAMEWORK

This section highlights the relevant institutions through which planning and implementation of the project will be affected. A number of institutions have been identified and will be involved in the overall implementation of this project. These include:

- The Federal Government of Nigeria (FGN)
- Federal Ministry Of Power
- Transmission Company of Nigeria (TCN)
- Federal Ministry of Environment
- Nigerian Electricity Regulatory Agency
- National Environmental Standards and Regulatory Enforcement Agency
- Kebbi State Government
- Kebbi State Ministry of Environment
- Kebbi State Ministry of Lands, Housing and Urban Development
- Kebbi State Ministry of Agriculture
- Kebbi State Environmental Protection Agency (KESEPA)
- Kebbi State Rural Electrification Board
- Local Government Authority (LGA):
  - Birnin Kebbi Local Government Area
  - Kalgo Local Government Area
  - Arewa Local Government Area
- The Customary District Councils
- Emir of Gwandu
- Emir of Argungu
- Village Chiefs of Affected Communities

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

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.

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. 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.

Transmission Company of Nigeria (TCN)

TCN is responsible for supervising the contractors engaged in construction of facilities and ensures strict adherence to project design specifications and land acquisition. ***Health Safety and Environment Unit of TCN*****,** is responsible for Environmental and Social Safeguards. Headed by a General Manager , the unit 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.

Kebbi State Ministry of Environment

Kebbi State Ministry of Environment is responsible for the overall environmental policy of Kebbi state, enforcement of state environment laws, establishing regulations, sanitation and waste management. Since, environment is on the concurrent list in the Nigerian Constitution, the State Ministry of Environment has a role in the EIA process. The state undertakes joint site verifications with the Federal Ministry of Environment, receives a copy of the report, appoints a member on the review panel as well as participates in impact mitigation monitoring. The State can also impose additional requirements based on the nature of the local environment.

Kebbi State Ministry of Lands, Housing and Urban Development

Kebbi State Ministry of Lands, Housing and Urban Development has the responsibility for the formulation of policies and implementation pursuant to the provisions of the Land Use Act, 1978 as amended under the 1990 Laws of the Federation of Federal Republic of Nigeria.

It also has the primary responsibility for land management in the state. Part of its agencies includes the Land Use Advisory and Allocation Committee. Its functions and powers include advising the Governor on how to grant right of way for the line route to be constructed. The Ministry is also the primary Government agency with respect to payment of compensation.

Local Government Authority

Three Local Government Areas (LGAs) are involved in this project - Birnin Kebbi, Kalgo and Arewa. These LGAs are involved in the ESIA approval process, because environment is on the concurrent list in the Nigerian Constitution, which means all three tiers of Government can legislate. Each LGA will have representatives of 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.

1.2.4 STEPS TO OBTAIN THE ENVIRONMENTAL CERTIFICATE

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 shall follow the following steps sequentially as outlined in the procedural guideline.

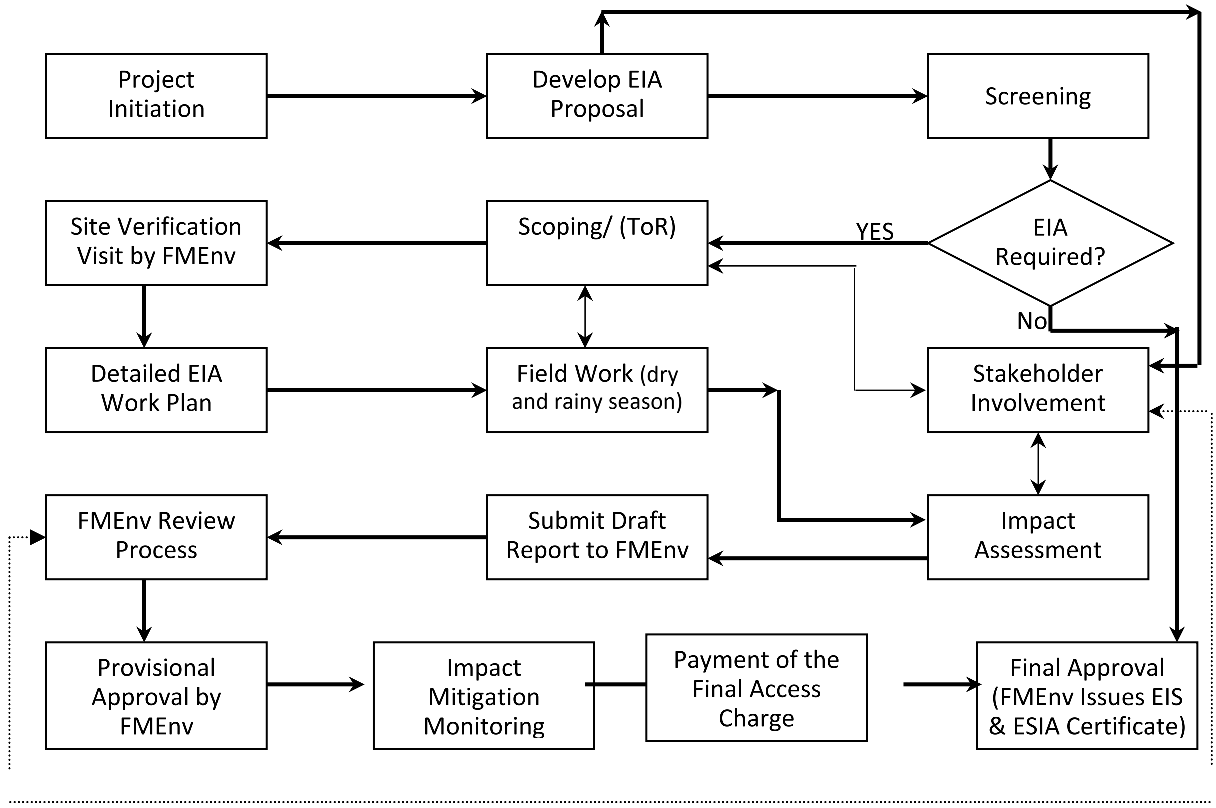


Figure 1-1 *The EIA Process*

Project Proposal: As soon as a proponent decides to embark on any development project (for which EIA is mandatory), a project proposal shall be submitted to FMEnv along with completed “EIA Notification Form” for registration.

Screening: FMEnv shall carry out Initial Environmental Examination and assign the project to a category, and provide screening reports to the proponent.

A screening is a systematic approach to documenting the environmental effects of a proposed project and determining needs to eliminate or minimize (mitigate) the adverse effects, to modify the project plan or to recommend further assessment through mediation or an assessment by a review panel.

Screenings will vary in time, length and depth of analysis, depending on the circumstances of the proposed project, the existing environment, and the likely environmental effects. Some screenings may require only a brief analysis of the available information and a brief report; others may need new background studies and will be more thorough and rigorous. This may involve site verification visits by the officers of the Ministry, and the expenses transferred to the proponent.

The responsible authority must prepare or ensure the preparation of a report which summarizes the findings of the screening.

A responsible authority must determine the significance of the environmental effects of the project. This in turn governs whether the responsible authority can take action that will enable the project to proceed (i.e., whether to proceed with the project itself when it is the proponent, or otherwise to provide the funding, land, permit or other authorization).

If the screening has identified the need for further review, the responsible authority must ask the Minister of the Environment to refer the project to a mediator or a review panel.

Further review is necessary when:

- → it is uncertain whether the project is likely to cause significant adverse environmental effects
- → the project is likely to cause significant adverse environmental effects and it is uncertain whether these effects are justified in the circumstances
- → public concerns warrants it

However, the responsible authority cannot take any **action that enables the project to proceed**, if the project is likely to cause significant adverse environmental effects (taking into account any appropriate mitigation measures) that cannot be justified in the circumstances.

Scoping: After receipt of screening report, the proponent shall carry out scoping exercises to ensure all significant impacts and reasonable alternatives are addressed in the EIA. The scoping exercises normally involve stakeholders, particularly people affected by the project. The proponent shall submit Terms of Reference (TOR) to the Ministry indicating scope of the proposed EIA study as well as evidence of consultation.

Commencement of EIA: The proponent shall undertake the EIA study according to the TOR agreed with the Ministry. Field work may be conducted twice (during dry and rainy seasons) as will be stated in the approved TOR.

Submission of the Draft Reports: After their completion, 5 copies of the ESIA, ESMP and RAP are submitted to the Federal Ministry of Environment (FMEnv) for review.

Review Process: The ministry shall evaluate the form of review of the report, which may be in-house, panel sitting in public, public display or mediation. The method of review shall be communicated to the proponent and the review comments shall be furnished to the proponent to address issues raised in the final report. A provisional approval may be granted at this stage, if the Ministry is satisfied that the report presented is acceptable except for minor corrections, which shall be corrected and final report submitted within stipulated time frame.

- → **Public Display:** The reports will be displayed at various centers including Abuja, Lagos, Kebbi State Ministry of Environment and LGA Offices for 21 working days for members of the general public to review and submit comments. The display centers and dates will be advertised by radio jingles and newspapers through 2 national dailies and one local. Associated costs will be paid by the proponent.
- → **Panel Review:** A review panel is a group of experts selected on the basis of their knowledge and expertise and appointed by the Minister of the Environment. The regulatory agencies at all three levels of Government (Federal, State and Local Government) are also represented on the panel, because environmental protection is on the concurrent list of the Nigerian Constitution. The Minister also appoints one of the panel members as chairperson. The panel review reports and assesses the project including a visit to the project site. The proponent will be required to make presentations to the panel and the panel presents its findings during the public meeting, in the presence of all stakeholders. After completing the public hearings and its analysis, the panel prepares a report which summarizes its rationale, conclusions and recommendations, and includes a summary of comments received from the public display center as well as those presented during the public meeting. This report is submitted to the Minister of the Environment, who will use it to guide decisions on the project. Associated costs are paid by the project proponent and depend on the number of participants.

  Final Report: The proponent incorporates Panel Review comments on ESIA, ESMP and RAP. Once the reports are modified accordingly, the 5 to 10 hard copies and a soft copy of the final reports are submitted to the FMEnv. The FMEnv issues a provisional ESIA approval and the proponent can start project implementation. The FMEnv will then undertake Impact Mitigation Monitoring (IMM) activities. If it is satisfactory, the proponent will pay a final access charge and the final ESIA report will be approved. The FMEnv will issue the EIS and the ESIA certificate.

1.2.5 FUNDING AGENCIES REQUIREMENTS

In addition to national requirements in terms of environment and society protection, the Project implementation needs to comply with international best practices. Both World Bank and African Development Bank safeguard systems will need to be integrated inside the project cycle as well as other requirements from the European Union. Main environmental and social requirements that the project needs to comply with are described in the following sections.

1.2.5.1 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. The potentially triggered safeguard policies which will be considered in the study are the following:

- → OP/BP 4.01 Environmental Assessment, including public participation
- → OP/BP 4.04 Natural Habitats
- → OP/BP 4.11 Physical Cultural Resources
- → OP/BP 4.12 Involuntary Resettlement

OP 4.01 ENVIRONMENTAL ASSESSMENT

The purpose of OP 4.01 is to ensure that projects funded by the Bank are environmentally feasible and viable, and that decision making is improved through appropriate analysis of actions and their probable environmental impacts (OP 4.01, para 1).

This policy is triggered if the project is likely to cause potential (negative) environmental risks and impacts in its zone of influence.

OP 4.01 covers:

- → Impacts on the physical environment (air, water and land)
- → Life environment, health and safety of populations
- → Cultural and physical resources
- → Environmental concerns at the transboundary and world levels

Social aspects (involuntary resettlement, indigenous populations) as well as natural habitats, pest control, forestry and safety of dams are addressed by separate policies with their own requirements and procedures.

The Bank undertakes environmental screening to determine the appropriate extent and type of environmental assessment to be conducted. The Bank classifies the proposed projects into categories, depending on the type, location, sensitivity, scale of the projects and the nature and magnitude of their potential environmental impacts.

In the present case, the project has been classified in category A. Projects considered as category A have potential adverse environmental impacts on human populations or environmentally important areas that could be significant. These impacts may affect an area broader than the sites or facilities subject to physical works. The environmental assessment will thus have to examine the project's potential negative and positive environmental impacts and recommend any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

For all Category A and B projects, during the environmental assessment process, project-affected groups and local NGOs have to be consulted about the project's environmental aspects and their views must be taken into account. The consultations must be initiated as early as possible. These groups should be consulted shortly after environmental screening, before the terms of reference for the Environmental Asessment (EA) are finalized and once a draft EA report is prepared. Consultations can also be conducted throughout project implementation to address related issues that affect them.

For meaningful consultations, all relevant material was provided in a timely manner prior to consultation, in a form and language that was understandable and accessible to the groups being consulted.

OP 4.04 NATURAL HABITATS

The conservation policy 4.04 aims at protecting natural habitats and their biodiversity and ensuring sustainability of services and products that natural habitats supply to human societies. In principle, the WB refuses to finance what may be perceived as causing significant damages in whichever Critical Natural Habitat (CNH).

It seeks as much as possible to avoid financing, through projects, conversions or degradations of natural habitats (non-critical). These impacts should be avoided by reconsidering the project, even in its size or its extension, and/or putting in place acceptable mitigation measures, such as establishing a protected area or strengthening effective protection of CNHs. Should the project involve the significant conversion or degradation of natural habitats that are not considered as critical, and if there is no alternative solution for the project and its location, and if the complete analysis clearly shows that the project's overall benefits are significantly higher than the environmental costs, then the WB can finance the project on condition that it includes appropriate mitigation measures.

The WB defines natural habitats as land or water zones where biological communities sheltered by ecosystems are in majority made of indigenous plant and animal species, and where human activity did not fundamentally modify the zone's main ecological functions.

CNHs are defined as:

→ Existing protected areas and areas officially proposed by governments to be classified among ''protected areas'' e.g. reserves that meet the criteria of the International Union for Conservation of Nature (IUCN) classifications

→ Areas traditionally recognized as protected by traditional local communities

→ Sites maintaining vital conditions for the viability of such protected areas

OP/BP 4.11 PHYSICAL CULTURAL RESOURCES (PCR)

This policy assists in preserving PCRs and helps reduce chances of their destruction or damage. The policy considers PCRs to be resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites) and aesthetic or other cultural significance.

According to this policy, an investigation and inventory of PCRs likely to be affected by the project have to be conducted. This investigation should document the significance of such PCRs, and assess the nature and extent of potential impacts on them. Since many cultural resources are generally not well documented or protected by law, consultation is an important means of identifying PCRs. Such consultations include meetings with project-affected groups, concerned government authorities and relevant non-governmental organizations.

If PCRs are found during the inventory, a management plan must be prepared. This management plan must include measures to avoid or mitigate any adverse impacts on PCR, provisions for managing chance finds, any necessary measures for strengthening institutional capacity for the management of PCR and monitoring systems to track the progress of these activities.

Finally, if a PCR is found at the inventory phase, provisions for managing chance finds must be implemented to ensure that PCR that may be discovered be properly handled.

OP. 4.12

INVOLUNTARY RESETTLEMENT

The main objectives of the WB Resettlement Policy (OP 4.12) are to:

- → Avoid or minimize involuntary resettlement whenever feasible
- → Develop resettlement activities as sustainable development programs, providing sufficient investment resources to enable the displaced persons to share in project benefits
- → Meaningfully consult displaced persons and give them opportunities to participate in planning and implementing resettlement programs
- → Assist displaced persons in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher

This policy is usually applied for projects that require international financing. The World Bank OP 4.12, Annex A (Paragraphs 17-31), describes the scope (level of detail) and the elements that a resettlement plan should include.

These include objectives, potential impacts, socioeconomic studies, legal and institutional framework, eligibility, valuation and compensation of losses, resettlement measures, relocation planning, community participation, grievance management procedures, implementation schedule, costs and budgets, and monitoring and evaluation.

WB OP 4.12.(6a) requires that the resettlement plan includes measures to ensure that displaced persons are (i) informed about their options and rights, (ii) consulted and offered choices among technically and economically feasible resettlement alternatives, and (iii) provided prompt and effective compensation of full resettlement costs.

WB OP 4.12 (8) requires that attention should be paid to the needs of vulnerable groups among those displaced such as: those below the poverty line, landless, elderly, women and children, indigenous populations, ethnic minorities.

WB.OP 4.12 (13 a) stipulates that any displaced persons and their communities and any host communities receiving them should be provided with timely and relevant information. They also should be consulted on resettlement options and offered opportunities to participate in planning, implementing and monitoring the resettlement.

WB OP4.12 (12a) states that payment of cash compensation for lost assets may be appropriate where livelihoods are land-based but only when the land taken for the project is a small fraction (less than 20%) of the affected asset and the residual is economically viable.

WB OP4.12 Para (6 b & c) state that in case of physical relocation, displaced persons should be (i) provided assistance (such as moving allowances) during relocation; and (ii) provided with residential housing, or housing sites, and, if required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site.

In addition, displaced persons should be offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living. This development assistance comes in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities.

WB OP4.12 Para 13 (a) requires that appropriate and accessible grievance mechanisms are established to sort out any issues arising.

OP 4.36 FORESTS

The Operational Policy 4.36 is about forest protection. The major objectives of the policy are:

- Sustainable management of forests;
- Conservation of wet forest zones;
- Communities' rights respect in their traditional use of forest zones in a sustainable manner.

The Bank does not finance projects that, according to it, would involve significant conversion or degradation of critical sections of forests or essential (critical) natural habitats attached to them.

Should the project involve the significant conversion or degradation of natural forests or associated natural habitats that are not considered as critical, and if there is no alternative solution for the project and its location, and if the complete analysis clearly shows that the project's overall benefits are significantly higher than the environmental costs, then the WB can finance the project on condition that it includes appropriate mitigation measures. OP 4.36 is triggered by the project as some forest habitats are located along the projected line route.

WORLD BANK APPLICABLE GUIDELINES

ENVIRONMENTAL, HEALTH AND SAFETY GENERAL GUIDELINES

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. The areas covered are:

- Environmental standards, which are related to emissions and air quality, wastewater and water quality, noise, energy and water conservation principles, management of hazardous materials, waste, contaminated sites and soils.
- Occupational health and safety
- Community health and safety
- Management of the construction and decommissioning phases, in terms of environmental management, occupational health and safety and community health and safety

ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES FOR ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

The EHS Guidelines for Electric Power Transmission and Distribution analyze the environmental, health and safety problems associated with the transmission and distribution of electricity in the various phases of the project, from construction to closure. They include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas.

They expose in details:

- description and management of the impacts specific to the associated activities
- environmental performance monitoring and indicators

1.2.5.2 AFRICAN DEVELOPMENT BANK

ENVIRONMENTAL AND SOCIAL SAFEGUARDS

To better articulate its safeguard policies while improving their clarity, coherence and consistency, the Bank has developed an Integrated Safeguards System (ISS). The ISS consists of four interrelated components: the Integrated Safeguards Policy Statement, the Operational Safeguards (OSs), the Environmental and Social Assessment Procedures (ESAPs) and the Integrated Environmental and Social Impact Assessment (IESIA). The Integrated Environmental and Social Safeguards of the African Development Bank (AfDB, or the Bank) are a cornerstone of the Bank's support for inclusive economic growth and environmental sustainability in Africa. They are a set of five safeguard requirements that Bank clients are expected to meet when addressing social and environmental impacts and risks:

- Operational Safeguard 1: Environmental and social assessment
- Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation
- Operational Safeguard 3: Biodiversity and ecosystem services
- Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency
- Operational Safeguard 5: Labour conditions, health and safety

Operational Safeguard 1: Environmental and social assessment – This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.

Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation – This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.

Operational Safeguard 3: Biodiversity and ecosystem services – This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements.

Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency – This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.

Operational Safeguard 5: Labour conditions, health and safety – This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It also ensures greater harmonisation with most other multilateral development banks.

AFDB APPLICABLE POLICIES AND STRATEGIES

The AfDB has developed various policies and strategies to integrate environmental and social considerations into the projects it finances. Some of these are:

- Energy Sector Policy of the AfDB Group: The energy sector policy provides a general framework for Bank Group operations in the energy sector. It aims to support the efforts of the Regional Member Countries (RMCs) to provide access to modern, reliable and affordable energy infrastructure and services for all their populations and productive sectors, and help RMCs develop a socially, economically and environmentally sustainable energy sector. It advocates sustainable development and the Bank is committed to helping RMCs move progressively towards environmentally-friendly production and supply of energy.
- Policy on Poverty Reduction: This policy aims to reduce poverty in Africa through strategies that promote national ownership and participation as well as actions to improve welfare including the achievement of the Millennium Development Goals (MDGs).
- Involuntary resettlement Policy: It regulates the involuntary resettlement of persons caused by the institution-funded operations for the public and private sectors. The policy applies when a project financed by the AfDB results in relocation or loss of shelter by the persons residing in the project area, assets being lost or livelihoods being affected. The borrower will have to prepare a comprehensive resettlement action plan for any project involving the displacement of large numbers of people (200 or more) who would need to be displaced with a loss of assets, or access to assets or reduction in their livelihood.

- AfDB’s Policy on the Environment: The policy sets out sets out the broad strategic and policy framework under which all Bank lending and non-lending operations will henceforth be made in Africa. The overall objectives of the policy are to help improve the quality of life of African people and to preserve and improve ecological capital and ecosystems across the African continent.
- Gender Policy: This policy defines the AfDB's commitment to promote gender mainstreaming as a means of promoting poverty reduction, economic development and gender equality on the continent. It develops key concepts and approaches that support gender and development issues and seeks to provide, inter alia, a framework for action that will ensure equal access to women and men to all resources and opportunities of the bank.
- Disclosure and access to information Policy: It aims to (i) maximize the disclosure of information held by the Bank Group and to limit the list of exceptions; (Ii) facilitate access to information on the Group's operations and its sharing with a broad spectrum of stakeholders; (Iii) promote good governance, transparency and accountability; (Iv) improve the effectiveness of implementation and better coordinating information disclosure processes; (V) raise awareness of the AfDB's overall mission, strategies and activities; (Vi) support the consultative process; and (vii) strengthen harmonization with other development finance institutions in the area of information dissemination.
- Climate risk management and adaptation strategy: Its main objective is to promote the eradication of poverty and contribute to the sustainable improvement of people's livelihoods. Specifically, it aims to: (i) reduce the vulnerability within the RMCs to climate variability and promote climate resilience in past and future development projects financed by the Bank making them more effective; (Ii) build the capacity and knowledge within the RMCs to address the challenges of climate change and ensure sustainability through policy and regulatory reforms.

1.2.5.3 EUROPEAN UNION

Integration of environmental protection requirements into European Community (EC) policies is a fundamental obligation under the Treaty of Amsterdam. Promotion of sustainable development is also a central objective of EC development co-operation. European environment policy rests on the principles of precaution, prevention and rectifying pollution at source, and on the ‘polluter pays’ principle. Multiannual environmental action programmes set the framework for future action in all areas of environment policy. They are embedded in horizontal strategies and integrated in international environmental negotiations. It also identifies the role of environmental impact assessment in environmental and social protection in each project’s cycle. Environmental preoccupations are organized in seven main domains:

- Climate change and the environment
- Biodiversity, nature and soil
- Water protection and management
- Air and noise pollution
- Resources efficiency and waste
- Sustainable consumption and production
- Chemicals

European Employment and social policy has the objective to increase employment and worker mobility, improve the quality of jobs and working conditions, inform and consult workers, combat poverty and social exclusion, promote equal opportunities and combat discrimination, as well as modernise social protection systems.

The European Union has a specific policy concerning the importance of environmental protection in their economic and development cooperation activities in which they are involved with developing countries: Integrating environment and sustainable development into economic and development co-operation policy. The success and sustainability of development programmes and projects implemented by EC and members is influenced by how they interact with and depend on environmental resources. A preliminary environmental screening of all projects helps to determine the extent of environmental actions needed. For those projects requiring further action, EIA address the integration of environmental concerns throughout the project cycle.

2 PROJECT JUSTIFICATION

This second chapter exposes the elements that justify the need for the project. The value of the project is exposed as well as the factors that will contribute to reach project's sustainability.

2.1 NEED FOR THE PROJECT

The WAPP is a specialized institution of the Economic Community of West African States (ECOWAS). It covers 14 of the 15 countries of the regional economic community. These countries show a very unevenly distributed population within this economic area. The growth rate of urban population (3.81%/year) is much higher than the overall rate for the population of the region. The main energy resources of West Africa (hydro-electricity, oil, natural gas, coal and renewable energy sources) are also unevenly distributed in the territory of the region.

The WAPP aims to ensure regional power system integration and realization of a regional electricity market. WAPP is made up of public and private generations, transmission and distribution companies involved in the operation of the electricity in West Africa. The WAPP mission is to ensure the promotion and development of power generation and transmission facilities, as well as the coordination of power trade between ECOWAS state members. Currently, the electricity sector in the countries of the WAPP serves only 30% of the population. The maximum load for the region exceeded 6,500 MW for a total consumption of about 40,000 GWh.

In this context, the objective of the WAPP is to establish a regional electricity market in West Africa through the development of key infrastructures that would permit the accessibility to economic energy resources to all state members of the ECOWAS. Already, a number of priority interconnection projects are underway:

→ 225 kV Bolgatanga (Ghana) – Ouagadougou (Burkina Faso)

→ 330 kV Volta (Ghana) – Lome C (Togo) – Sakété (Benin)

→ 330 kV Han (Ghana) – Bobo (Burkina Faso) – Sikasso-Bamako (Mali)

The 330 kV WAPP North Core project, consisting of a transmission line from Birnin Kebbi (Nigeria) to Ouagadougou (Burkina Faso) through Zabori (Niger), Niamey (Niger) and Malanville (Benin), is part of this wide network. The introduction of this interconnection line between Nigeria, Niger, Burkina Faso and Benin contributes crucially to the backbone interconnector between the power systems of several Western African countries, which is intended to be completed in the mid-term future. Map 2-1 presents regional interconnections.

The updated ECOWAS revised master plan, for generation and transmission of electrical energy adopted by ECOWAS, has re-affirmed the project as a priority necessary to further integrate and reinforce the WAPP's interconnected system.

The result of the economic analysis is that, the project is economically justified as it offers a cost-effective solution for supplying the off taking countries with the electric energy required in the future. The project very high economic internal rates of return, because the substitution of electricity which otherwise has to be generated at very high cost of diesel gensets between 0.26 and 0.34 USD/kWh with relatively cheap imported power from Nigeria could be a very advantageous deal for the participating parties. In the same way it could be very advantageous to use cheap imported energy, mainly from Nigeria, instead of very expensive diesel generation to connect new customers in order to reduce the high levels of suppressed demand as presented in the following table.

Table 2-1 Benefits from reduced suppressed demand

	Current generation cost (USD/kWh)	Generation cost in Nigeria (USD/kWh)	Benefit of imported energy (USD/kWh)
Nigeria	0.29	0.07	0.22
Niger	0.34	0.07	0.27
Burkina Faso	0.26	0.07	0.19
Benin	0.27	0.07	0.20

Reference: Fichtner,2016

Currently the producing company would be the Power Holding Company of Nigeria, but in the future an exchange of power between the countries, probably from Niger, might be envisaged too. The Nigeria had an internal power production of 30,915 GWh and it is expected to rise to 109,753 GWh in 2025 (Tractebel Engineering, GDF SUEZ, 2011).

2.2 VALUE OF THE PROJECT

The project will be supported by international funders as well as other development partners. According to Fichtner 2016, the total cost of the project is US$ 421,282,539. In Nigeria, the total cost of the project is US $ 26,133,834 (8,232,158,000 NGN). The detailed project costs are presented in section 3.6.2.

2.3 TECHNOLOGICAL, ENVIRONMENTAL, SOCIAL AND ECONOMIC SUSTAINABILITY

Some factors are important to consider in order 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.

In terms of technical resources, Nigeria has abundant human resources that are capable of supplying the skilled and non-skilled labor required for sustaining the project. TCN staff is used to this kind of project in the Nigerian environment. Also, project implementation is based on an integrated approach including a proper capacity building and formation program. Project success relies on stakeholders' enhanced understanding of their responsibilities and individual implications regarding technical, environmental and social components that will be possible by an institutional support and capabilities building program.

On the other side, sustainability invariably involved the respect of the environment and society. Sub-Saharan Africa is rich in energy resources, but very poor in energy supply. Making reliable and affordable energy widely available is critical to the development of a region that accounts for 13% of the world's population, but only 4% of its energy demand (International Energy Agency, 2014). Improving infrastructures, particularly access to electricity, is critical when looking at barriers to business opportunities and job growth in these countries. Since 2000, sub-Saharan Africa has seen rapid economic growth and energy use has risen by 45%. Many governments are now intensifying their efforts to tackle the numerous regulatory and political barriers that are holding back investment in domestic energy supply, but inadequate energy infrastructure risks, putting a brake on urgently needed improvements in living standards.

Access to electricity is an important factor that could significantly contribute to meeting the Millennium Development Goals (MDGs). The electricity provision and improvement of its reliability is widely believed to be a stimulus to increased agricultural productivity and output through irrigation and mechanization, to the growth of rural industries, to the improvement of public services and to raising the living standards of people. The energy targets for Nigeria is to make reliable electricity available to 75% of the population by 2020 and 100% by 2030 (45% today) as well as to connect an average of 1.5 million households per year (International Energy Agency, 2014).


MAURITANIE
MALI
NIGER
SENEGAL
THE GAMBIA
GUINÉ-BISSAU
GUINÉE
SIERRA LEONE
LIBERIA
IVORY COAST
COTE D'IVOIRE
BURKINA FASO
GHANA
TOGO
BENIN
NIGERIA
CAMEROUN
ATLANTIC OCEAN
OCÉAN ATLANTIQUE
Dagana
Sakal
Matam
Tobene
Kounoune
Cap des biches
Belair
Sendou
Birkelane
Kaolack
Tambacounda
Kayes
Albatros
Félou
Gouina
Badoumbé
Markala
Segou
Brikama
Soma
Tanaf
Ziguinchor
Mansoa
Kambangalou
Manantali
Bamako
Kénié
Sotuba
BAMAKO
Koutiala
Sikasso
Bobo Dioulasso
Ouagadougou
OUAGADOUGOU
Kandadji
Salkadamna
Niamey
NIAMEY
Dosso
Birnin Kebbi
Dyodyonga
Malanville
Sokoto
Katsina
Kano
Maiduguri
Kaduna
Jos
Gombe
Yola
Jalingo
Zungeru
Shiroro
Kainji
Jebba
ABUJA
Makurdi
Mambilla
Oshogbo
Ajaokuta
Geregu
Aiyede
Benin City
Eyaen
Ethiope
Sapele
Okpai
Omoku
Onitsha
Alaoji
New Haven
Afam
Ikot-Abasi
Calabar
Delta
Gbaran
Egbema
Egbin
Erunkan
Lagos
Ikeja
Sakete
PORTO-NOVO
Papalanto
Contour Global
Kétou
Bembereke
Nangbeto
Tetetou
LOME
Kpong
Akossombo
Volta
Tema
ACCRA
Kumasi
Bui
Kintampo
Techiman
Yendi
Daboya
Noumbiel / Koulibie
Kulpawn
Pwalugu
Bolgatanga
Juale
Cape Coast
Prestea
Takoradi
Aboadze
Domini
Elubo
Abidjan
ABIDJAN
Vridi / Azito
Aboisso Comoe
Tiassalé
Taabo
Kossou
Bouake
Ferkessedougou
Boundiala
Laboa
Man
Buyo
Soubré
Boutoubre
Gribo-Popoli
San-Pedro
Tiboto
Louga
Buchanan
Cestos
Monrovia
Saint Paul - 1B
Saint Paul - 2
Mano River
Lofa
Yekepa
Nzébéla
Gozoguézia
Bumbuna
Benkongor
Bitmai
Kuse II
Kambatibo
Kogbédou
Diaragela
Tinkisso
Fomi
Morisakano
Kassa
Garafiri
Souapiti
Kinkon
Grand Kinkon
Kaleta
Linsan
Amaria
Tombo
CONAKRY
Maneah
FREETOWN
Koukoutamba
Boureya
Digan
Kouravel
Koukoutamba
Fetore
Binkon
Poudalde
Tiopo
Saltinho
Fello Sounga
Kouya
Moussala
Bindougou
Diaoya
Missoula
Mpoaza
MALABO
YAOUNDE
LEGEND / LÉGENDE
Interconnection 330 kV existing / existante
Interconnexion 330 kV project / en projet
Interconnection 330 kV under study / à l'étude
Interconnection 225 kV existing / existante
Interconnection 225 kV project / en projet
Interconnection 225 kV under study / à l'étude
Super Grid 760 kV
Hydropowerplant existing / Centrale hydroélectrique existante
Hydropowerplant project / Projet de centrale hydroélectrique
Thermal power plant existing / Unité thermique existante
Thermal power plant project / Unité thermique en projet
Existing sub-station / Sous-station existante
Sub-station project / Projet de sous-station
NATIONAL CAPITAL/ CAPITALE NATIONALE
0
200
400 kilometers / kilomètres
West African Power Pool
330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report
Current and Projected Electricity
Interconnections of the WAPP
0
7,65
15,3
22,95 km
UTM, WGS 84, Zone 31N
Sources :
Tractebel Engineering GDF Suez,
September 2011
File: 141_24307_EIE_NG_c2_1_Inter_Elec_160606.mxd
Map
2-1
June 2016
141-24307-00
WSP

Sustainable development means to also increase development without compromising environment. The recent move towards power sector privatization in Nigeria is assumed to help to mobilize investment for power generation projects. Even with its considerable oil production, more than two-thirds of the investment in generation capacity is for renewables. Nigeria is developing its hydropower potential (Mambilla and Zunguru projects) and is expected to continue to do so to help meet rapidly rising electricity demand. Nigeria's solar capacity increases to 12 GW in 2040, nearly one-quarter of peak electricity demand at that time (International Energy Agency, 2014).

Regional cooperation is a major component of Africa's vision for its future. Regional power pools aim to strengthen integration through co-operative planning and improved physical linkages, and have been playing a larger role in the recent expansion of generation capacity. The WAPP has integrated the reinforcement of clean and renewable energy in its master plan. The electrical generation will evolve towards an energetic mix that integrates, more and more, clean or cleaner energy sources (Tractebel Engineering, GDF SUEZ, 2011). The improvement in terms of environmental protection comprises notably, the development of the region aims at interconnecting the isolated country and/or zones.

These isolated areas presently produce their electricity mainly using diesel groups, whose efficiency and ecological impact can only improve when using other technologies such as hydro and natural gas. The regional cooperation makes production synergies possible between countries allowing to better valorize the resources and to build projects that would be too big for only one country. These synergies are also synonyms of better efficiency.

3 PROJECT DESCRIPTION

This chapter presents the promoter of the project including TCN in Nigeria. It describes also the selected line route as a whole with emphasis on selected the line route in Nigeria, which has been the subject of Environmental and Social Impact Assessment. Substations and technical components are then presented in order to understand the characteristics that may influence the identification and analysis of the impacts of the project.

3.1 PROMOTER PRESENTATION

The project is under the auspices of the WAPP. This institution is supported by each of the companies responsible for electricity production and / or distribution of electrical energy, whether the TCN in Nigeria, the NIGELEC in Niger, the SONABEL in Burkina Faso or the CEB in Benin.

3.1.1 WAPP

The WAPP is the institution of the ECOWAS in charge of the integration of the regional energy system and the creation of a regional electricity market through various public and private companies involved in the production, transmission and distribution of electricity in West Africa.

The WAPP has a structure enabling it to fulfill the responsibilities entrusted to it, including a General Secretariat, which is the administrative body responsible for the daily management of the WAPP activities. The General Secretariat has three branches, the Planning Department, Investment Programming and Safeguarding the Environment (PIPES) that is composed of a team of professionals responsible for performing daily tasks necessary for the fulfillment of environmental and social aspects of the mission of the WAPP.

3.1.2 TCN (TRANSMISSION COMPANY OF NIGERIA)

The Transmission Company of Nigeria (TCN) is responsible for activities related to the transportation of electric power across Nigeria. According to Fichtner (2016) the total production capacity in Nigeria is 12,318.9 MW while the available capacity is 9,990.3 MW and consists of the following primary sources:

Table 3-1 Types and Electricity Production Capacity in Nigeria

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	1,900	15	1,340	13
Thermal	10,418.9	85	8,650.3	87

In terms of the network, it consists mainly of:

- → 6,000 km of 330 kV power lines and 38 substations (330 kV)
- → 8,000 km of 132 kV power lines and 133 substations (132 kV)

In addition, Nigeria has interconnected transmission lines with the neighboring countries:

- → a 260 km 132 kV power line between Birnin Kebbi and Niamey (Niger)
- → a 103 km 132 kV power line between Katsina and Gazaoua (Niger)
- → a 70 km 330 kV power line between Lagos and Sakete (Benin)

Nigeria has a National control center located in the city of Osogbo, in addition to three regional control centers.

3.1.3 NIGELEC

The Nigerian Electricity Society (NIGELEC) was established in September 1968 as a public corporation to take over from the African Electricity Company (AEC). The company is overseen by the Ministry of Energy and Petrol.

It is responsible for the generation, transmission and distribution of electricity, under a renewable 50-year concession signed with the State of Niger on March 3, 1993 and follows the first concession ratified on May 22, 1956.

According to the concession, the state transferred the monopoly to the NIGELEC while allowing the use of public facilities directly related to the generation, transmission and distribution of electric energy. The NIGELEC has the responsibility to maintain and improve facilities to ensure the best quality service at the best price.

The NIGELEC is governed by a legal and regulatory framework by the electrical energy sub-sector. In 2003, a new electrical code was adopted (No. 2003-004), enabling production by independent companies, ending the monopoly of the NIGELEC.

The energy requirements of the NIGELEC are met through domestic production, imports, and independent producers. Total production and importation in 2015 reached a 1026.63 GWh of which 212.51 GWh was produced by NIGELEC, 52.70 GWh by SONICHAR and 781.99 GWh was imported from Power Holding Company of Nigeria (PHCN) (BOAD, 2016). National production is provided via:

- The facilities of the NIGELEC, composed of 53 thermal centrals including more than a hundred power units generating between 50 and 16,000 kVA (BOAD, 2016), offers an approximate total capacity of 113.2 MW and available capacity of 73.2 MW (Fichtner, 2016).
- The energy production of the Nigerian Society of Anou Araren Coal (SONICHAR), a state company that produces just over 36 MW thanks to a coal power plant. The transmission of electricity for the mining companies COMINAK and SOMAIR is provided through a 132 kV line. The transmission line and associated substations are leased to the SONICHAR but nevertheless belong to the NIGELEC. Part of this production is sold to the NIGELEC needed for the towns of Agadez, Arlit and Tchirozerine.

Imports from Nigeria are ensured by the PHCN and represented approximately 87% of electricity transiting on the NIGELEC distribution network in 2011. The PHCN has been selling electricity to the NIGELEC since 1976 when the first 132 kV interconnection line became operational between Birnin Kebbi (Nigeria) and Niamey, via Dosso. In 1994, a second interconnection line, of 330 kV, was built between Katsina in Nigeria and Gazaoua, Maradi and Zinder in Niger.

The network in Niger is established in six zones:

- The River Zone, via the 264 km 132 kV interconnection line linking Birnin Kebbi (Nigeria) to Niamey (Niger) with a capacity of 120 MV and a diesel plant of 57,6 MW
- The Central East Zone, which includes the provinces of Zinder, Maradi and Tahoua, via a 302 km 132 kV line linking Katsina (Nigeria) to Gazaoua (Niger) with a capacity of 40 MW and a diesel plant of 13,8 MW
- The North Zone, which includes the communities of Agadez, Arlit and Tchirozerine, in addition to the mining companies, via a 155 km 132 kV line supplied by SONICHAR, the coal plant, with a power of 37,6 MW
- The East Zone, which includes the province of Diffa, connected to the network of Nigeria by 33 kV interconnection linking Damask, with a power of 5 MW
- The Gaya – Malanville Zone, supplied by the interconnection of Kamba in Niger, with a power of 7 MW
- The Thermal Zone, comprising isolated load centers, provided by thermal power plants of a 6 MW capacity

This network is linked through the following type of substations:

- 6 substations at 132 kV
- 15 substations at 66 kV
- 4 substations at 33 kV
- 19 substations at 20 kV

The Government of Niger is currently undertaking an extensive program of energy production by developing their national resources.

Several projects have been initiated, including the construction of Kandadji dam with a power of 130 MW, coal power plants Salkadamna with 200 MW and Anou Araren with 50 MW and the 100 MW Gourou-Banda diesel power plant, for which financing has been obtained for the first 80 MW, is currently under construction. 330 kV transmission line construction projects are also planned, including the North Core Project of the WAPP.

3.1.4 SONABEL

The national electricity company of Burkina Faso, The *Société Nationale d'Électricité du Burkina Faso* (SONABEL), is a company managed by the State under Decree (No. 97-599 / PRES / PM / MEM / CEC) approved on 31 December, 1997. Several changes have occurred since the creation of the company which was then a private company (AOF Energy) founded in 1954, and was responsible for the production and distribution of electricity in Ouagadougou. The SONABEL is currently responsible for the production, importation, transmission and distribution of electricity to the localities in the sectors it serves.

National production is essentially from thermal power plants and from a small amount of hydropower through 24 thermal power plants and 4 hydropower plants. According to Fichtner (2016), the total firm capacity of these facilities is 271.5 MW while the total available capacity is 147.5 MW distributed as follows:

Table 3-2 Types and Electricity Production Capacity in Burkina Faso

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	36	13	16	11
Thermal	235.5	87	131.5	89

The SONABEL also meets some of the needs by the importation of electricity from the Ivory Coast, Ghana and Togo. Imports accounted for 48% of production in late 2011.

The main transmission lines are 132 kV lines connecting the hydroelectric facilities of Bagre and Kompienga to Ouagadougou and a 225 kV line, connecting Ferkessedougou (Ivory Coast) to Bobo Dioulasso and Ouagadougou. The total length of transmission lines is about 1370 km, including the interconnection transmission line of 225 kV linking Bobo Dioulasso and Ouagadougou completed in 2008 at a length of 350 km. The 225 kV interconnection line project between Bolgatanga (Ghana) and Ouagadougou is under construction and is expected to be completed in 2015.

With regards to the electrical substations, the following installations are present:

- 4 substations at 225 kV
- 4 substations at 132 kV
- 7 substations at 90 kV
- 25 substations at 33 kV

In 2011, 172 localities were served. The electrification rate of the country was 20% in 2003, with a 60% objective to be reached by 2015.

3.1.5 CEB

The Electric Community of Benin (CEB) is a public organization established by an international agreement ratified on July 27, 1968. Under this agreement, the CEB has the monopoly on the production and transportation of energy and also possesses a monopoly for the development of structures connected to Benin and Togo.

The revision of the Beninese–Togolese Electrical Code assigned the CEB exclusive rights to transport, import and sell to the unique buyers of these two countries. This revision also opens the market to independent power producers (IPP).

The main mission of the CEB is to provide ongoing energy electric in quantity, quality, at lower cost and eco-friendly. According to the Beninese Togolese Code of electricity (revised in 2003) which dedicated the opening of the segment of the production to independent producers (IPP), the CEB has for essential missions:

→ to realize and operate according to the rules applied by industrial and commercial companies, facilities for the production of electric energy for the needs of both States

→ to realize and operate according to the rules applied by industrial and commercial, facilities for transport of electric power throughout the territories of the two States as the exclusive carrier. In addition, CEB receives the privileges of a single buyer for the needs of both States

→ to conclude, when necessary, with the neighbouring countries of the two States, agreements for the import of electricity, each of the two States committing to no agreement separate import of electric energy; agreements

→ to conclude, if necessary, export excess electric energy agreements with the neighbouring countries of the two States

→ to conclude, if necessary, with the neighbouring countries of the two States transit agreements of electric energy

→ to provide, through its Centre of professional training and development, selection, training and development for the benefit of companies in the two States without exception;

→ to plan the production and transport of electric energy in conjunction with the ministries responsible for electrical energy for the needs of both States

→ to assume, for the benefit of both States, centre of repair and maintenance missions, central purchasing of materials and equipment and engineering firms, being understood that these missions do not have a binding for the electricity community of Benin (CEB).

The vision of the CEB is to be the engine of sustainable socio-economic development of Benin and Togo.

The CEB is the only energy supplier to distribution companies located in Benin, via the Beninese Electric Power Corporation (SBEE), and in Togo, via the Electric Power Company of Togo (CEET).

The CEB's activities began in 1973, following the construction of a 161 kV transmission line interconnected between the two countries and Ghana. In 2007, a 330 kV network was built to interconnect the CEB network to the network of Nigeria. In 2010, the importation of electricity totaled 88.6% of consumption in Benin and Togo. These imports came from Ghana (30.2%) via The Volta River Authority, The Ivory Coast (4%) via the *la Compagnie Ivoirienne d'Électricité de Côte d'Ivoire* and Nigeria (51.5%) via the Transmission Company of Nigeria.

According to Fichtner (2016), this network is linked through the following substations:

→ 1 substation at 330 kV

→ 17 substations at 161 kV

→ 6 substations at 63 kV

→ 2 substations at 34.5 kV

→ 2 substations at 33 kV

→ 4 substations at 20 kV

The CEB currently operates the hydroelectric plant of Nangbeto located 210 km northeast of Lome. Its installed capacity is about 65 MW for an average annual production of about 172 GWh. This resource is however characterized by a high sensitivity to climatic events. The CEB also occasionally operates two thermal power plants of 20 MW, one in the city of Lome in Togo and the other in Cotonou, Benin. They function as equally well with natural gas as with A1 jet fuel and each have a generation capacity of 150 GWh per year. *Contour Global*, an independent producer located in Togo, currently operates a 100 MW thermal power plant.

According to Fichtner (2016), the total firm capacity of the CEB power generation plants is 285,6 MW, while its total available capacity is 90 MW, and consists of the following primary sources:

Table 3-3 Types and Electricity Production Capacity in Benin

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	65.6	23	20	22
Thermal	220	77	70	78

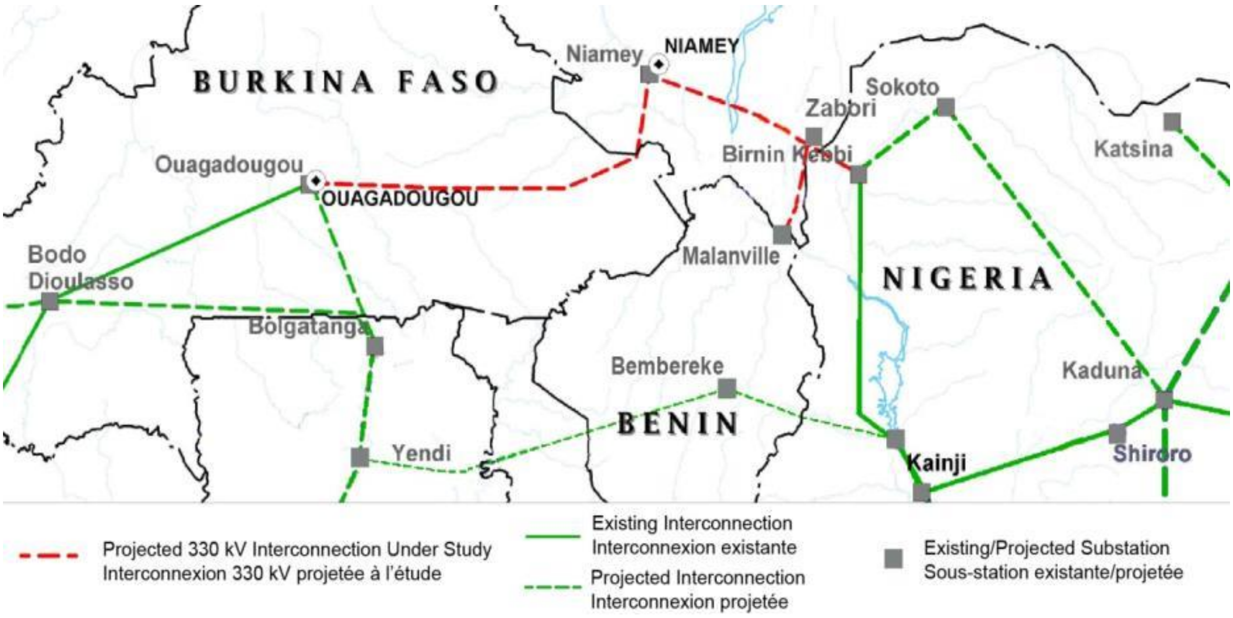
The interconnected network of the CEB mainly covers the coastal area, where the population density is high, and where the majority of economic and industrial activities are concentrated. Faced with a growing demand resulting from the development and expansion of new cities in both countries, the CEB has undertaken a series of studies aimed at:

- → The potential of hydroelectricity development in the two countries.
- → The possible diversification of energy sources, via transmission lines interconnected with Nigeria, which is part of the WAPP. The extension of the electricity transport systems in the two countries via the interconnection of the northern regions to the southern coastal network.

On January 22nd, 2011, the Government of Benin received funding from the West African Development Bank (WADB) to finance the preparation and construction of a 161 kV line linking Malanville, Kandi and Bembereke in Benin.

3.2 TYPE OF PROJECT

The project consists in the construction of a 330 kV transmission line on steel pylons with a total length of 880 km linking Nigeria to Burkina Faso through Niger, with a derivation toward Benin, as shown on the figure below.



Reference: WAPP, 2011

Figure 3-1 Projected Interconnection between Burkina Faso, Niger, Nigeria and Benin

Five new substations will be constructed: two in Niger (not that the Gorou Banda substation is in its final stages of construction), two in Burkina Faso, and one in Benin. The existing Birnin Kebbi substation in Nigeria will be modified to accept a new bay for the 330 kV line.

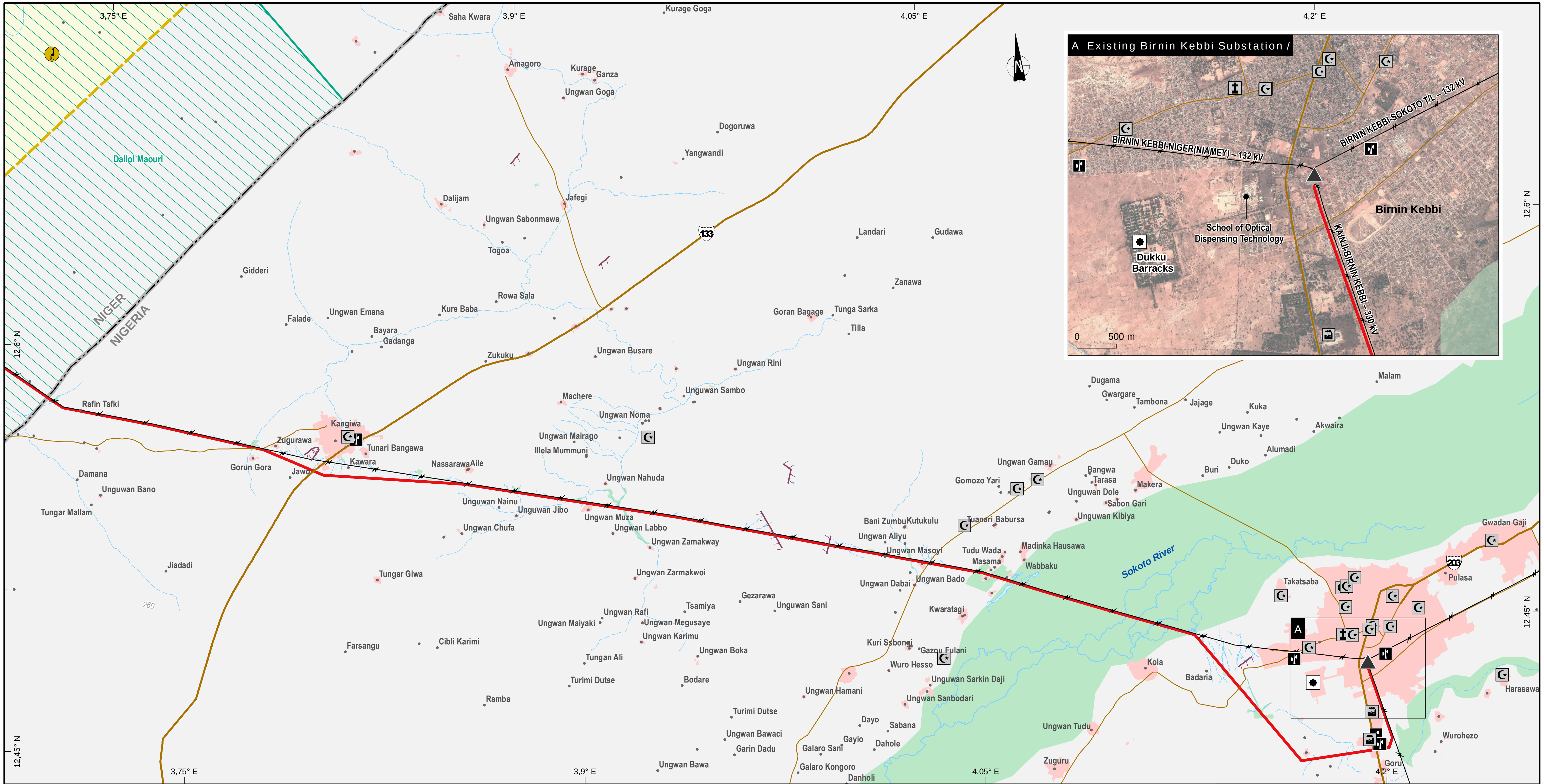
This interconnection between Nigeria, Niger, Burkina Faso and Benin will enable efficient transfer of electrical energy within the sub region and will help satisfy energy demand from appropriate production points.

It is planned that the 330 kV North Core project, from the overhead ground wire or other appropriate technologies, will supply electricity to all communities / villages / towns within a radius of 10 km from the center line, including a total of in between 500 to 2,500 inhabitants. In this context, WSP presented this list in the line route study (WSP 2015) to enable the consultant in charge of updating the feasibility study to make an appropriate proposal for rural electrification (Fichtner 2016). This list is presented in Appendix 9. This component of the project is not comprised in this ESIA.

3.3 LOCATION AND CHARACTERISTICS OF THE LINE ROUTE

The final provisional line route (WSP 2015) takes into account the comments made during the meeting to review and adopt the provisional preliminary line route. This line route is presented below, from Nigeria to Burkina Faso through Niger and Benin. The following guidelines were followed to design an optimal line route:

→ Follow existing roads as much as possible to ease maintenance
→ avoid the proximity of rivers and, as much as possible, paddy fields, to decrease pylon foundation costs
→ select normal river crossing spans to avoid using high towers
→ minimize the number of angle points
→ avoid restricted areas, like villages, airfields and nature reserves
→ consider technical and economic criteria for final optimization



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Mosque

Church

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Floodplain

Erosion

Infrastructure

National Road

Secondary Road

Telecommunication Tower

Military Base

Factory

Substations and Transmission Lines

Existing Line

Existing Substation

Project Component

Draft Final Line

Boundary

International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report

Draft Final Line Route in Nigeria

0 1,65 3,3 4,95 km

UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c3_1_Nigeria_160606.mxd

Map 3-1

June 2016

WSP

3.3.1 NIGERIA

The 330 kV line runs from the Birnin Kebbi substation to the border with Niger, with the following characteristics:

→ extends over a total length of 62 km with a 50 m right-of-way

→ exits the Birnin Kebbi Station from the north following the corridor of the existing Kanji-Birnin Kebbi 330 kV line, by-passes the city and links with the existing 132 kV line

→ crosses the floodplain of the Sokoto River on a distance of 8 km following the existing 132 kV line

→ mainly follows the existing 132 kV transmission line to the border with Niger over a distance of 48 km

3.3.2 NIGER

There are three 330 kV line sections in Niger that are between the Niger/Nigeria border and the future Gorou Banda substation in Niamey, between the Gorou Banda substation and the Niger/Burkina Faso border and between the projected Zabori substation and the Niger/Benin border.

The first section, from the border with Nigeria to the projected Gorou Banda substation in Niamey presents the following characteristics:

→ extends over a length of 208 km with a 50 m right-of-way

→ from the border with Nigeria to the future site of the projected Zabori substation, crosses the Dallol Maouri Ramsar site for 24 km

→ east of Dosso, crosses the Dallol Bosso Ramsar site for 37 km parallel to the National 1 road and the existing 132 kV line

→ crosses the floodplain of the Niger River near Tahirou Koira

→ reaches the projected Gorou Banda substation site located to the south of Niamey

The second section, from Gorou Banda to Niger/Burkina Faso border, is characterized by the following:

→ extends over a length of 104 km with a 50 m right-of-way

→ exits the Gorou Banda substation towards the south-west

→ meets with the Niger NR6 and follows it to the Burkina Faso border

→ crosses the bird and biodiversity area of Makalondi for approximately 50 km

The third section, future site of the Zabori substation to Niger/Benin border, shows the following characteristics:

→ extends for a length of 108 km with a 50 m right-of-way

→ exits the future Zabori substation towards the south-west

→ touches a small section of the north-west limit of the Dallol Maouri Ramsar site

→ curves slightly towards the south to meet with Niger NR7 at the level of Gonga Innza, and follows this road on its western side for approximately 10 km

→ leaves the NR7 and pursues south through an area of classified forests

→ passes less than 2 km west of the Gourou Bassounga National Park and reaches the Niger River floodplain and the border with Benin

3.3.3 BENIN

The line runs from the border with Niger to the Malanville substation, with the following characteristics:

→ extends over a distance of 12 km with a 50 m right-of-way

→ enters in Benin at the frontier with Niger at the west of Malanville and crosses the Niger river and its floodplain

- → bypasses the suburban area of Malanville on the west side
- → bypasses the hilly area southwest of Malanville
- → crosses the NR2 to reach the Malanville substation by the north-west

3.3.4 BURKINA FASO

The original project, in Burkina Faso, consisted in one 330 kV line running from the border with Niger to the Ouaga-east substation in Burkina Faso, with the following characteristics:

- → extends over a distance of 381 km with a 50 m right-of-way
- → follows the south-west side of the NR4 at a distance of approximately 5 km and crosses the NR19 at the level of Kantchari
- → curves towards the west and continues following the NR4 on its southern side
- → crosses the NR4 at the level of Nalougou and continues to follow this road on its other side thus avoiding the agropastoral and pastoral area of Tapoa-Boopo
- → reaching the periphery of Fada N'Gouma, the line leaves the NR4's side to bypass the city on its northern side and then crosses the National road on the western side of the city
- → it pursues on the south side of the NR4 towards the west up to the level of the city of Koupéla which it bypasses on its southern side crossing, in the doing, the RN16
- → the line curves slightly towards the north-west following the southern side of the NR4 and passing north of Silmiougou pastoral area, a military base and the Boromé gold mine
- → approximately 13 km after passing the town of Rapadama, the line follows the RN4 with which crosses the Volta Valleys zone for approximately 22 km and crosses twice the NR4 that is once at the level of Kougri and then again as it exits the Volta Valley zone
- → when crossing the NR4 at the level of Kougri, the line is near the southern limit of the Wayen National Park
- → after leaving the Volta Valley zone, the line, still following the RN4, gradually curves towards the south-west, slightly touching the limits of the Gonsé National Park and finally reaching the Ouaga-east substation from the north

However, the WAPP introduced two other line sections to be constructed at the periphery of Ouagadougou, which are:

- → A 225 kV line originating from the Ouaga-east substation, connecting to the future Ouaga-south-east substation and pursuing up to an anchor pylon to the south-west of the future substation.
- → A 90 kV line originating from the Ouaga-east substation and reaching the Kossodo (KOS) substation to the north-west.

The new 225 kV line originating from the Ouaga-east substation shows the following characteristics:

- → extends towards the south for a length of 24 km and a 75 m right-of-way, bypassing on its eastern side the urban area of Ouagadougou
- → reaches the future location of the Ouaga-south-east substation some 2 km to the north-east of the NR6 after bypassing the western limits of the Ouassoudi community
- → leaving the Ouaga-south-east substation, the line crosses the NR6 and extends towards the south-west and reaches the PA5 pylon approximately 800 m after crossing a water course

The new 90 kV transmission line originating from the Ouaga-east substation presents the following characteristics:

- → extends for approximately 17 km with a 50 m right-of-way
- → the line stretches towards the north-west for 12 km crossing the NR4, the Ouaga 3 dam outlet and the NR3
- → almost 4 km after crossing the NR3, the line changes direction towards the south-west to finally reach the Kossodo substation.

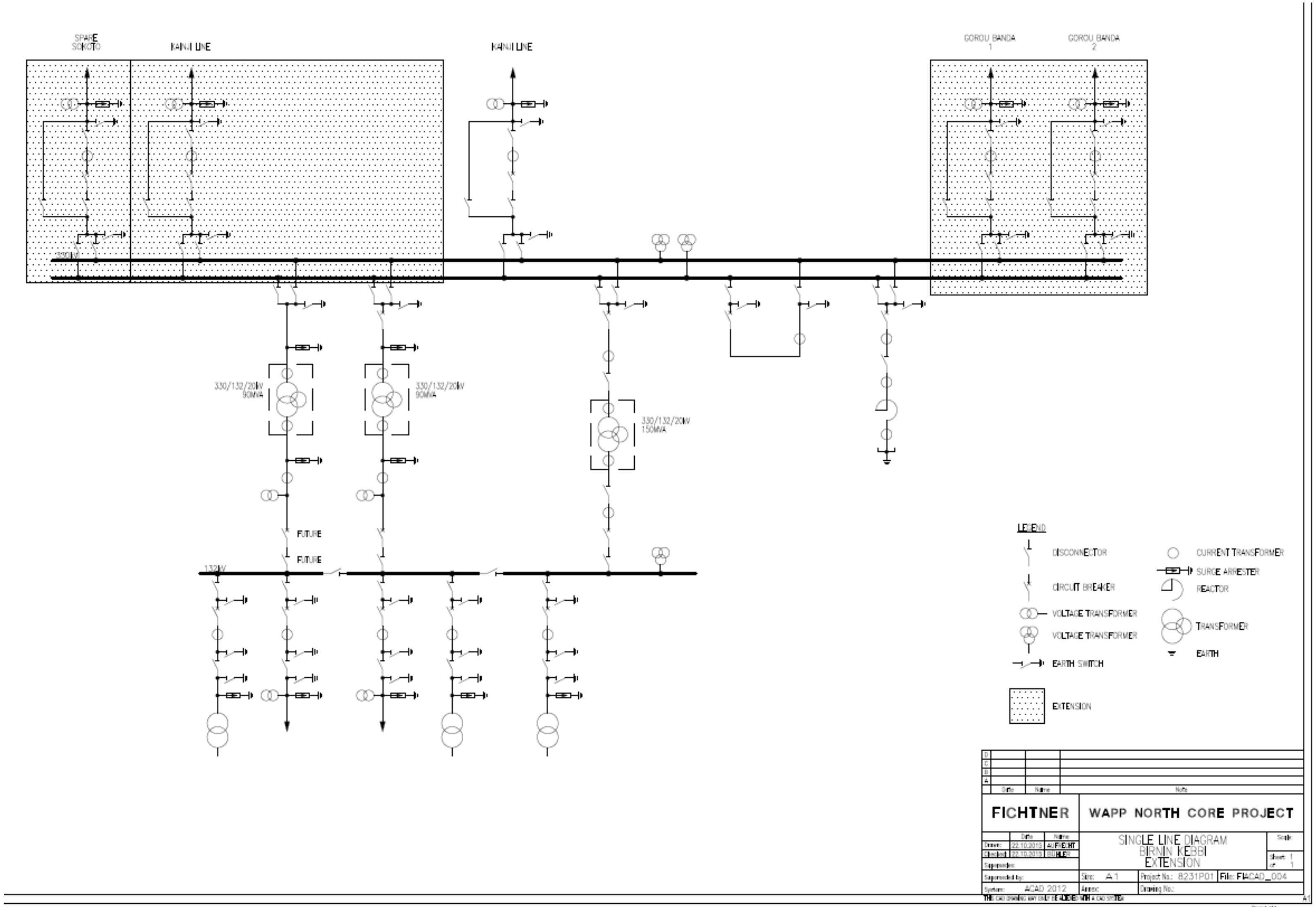
3.4 LOCATION AND CHARACTERISTICS OF THE SUBSTATIONS

3.4.1 NIGERIA

The existing Birnin Kebbi substation is located in the heart of the city (12.437° N, 4.197° E). When completed with the new 330 kV bay for the present interconnection, the substation will occupy a surface of 110,000 m². According to Fichtner (2016), two development variants are considered for the extension of the substation, which would include the following components:

- extension of air insulated double busbar
- extension of the substation with 1 or 2 line feeders
- extension of auxiliary power supply (AC/DC Panels)
- connection of two existing transformers to the double busbar
- construction of the incoming gantry for the existing Kainji line
- removal of T-OFF of existing Kainji line

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).



Source: Fichtner, 2016

Figure 3-2 Birnin Kebbi extension scheme

3.4.2 NIGER

The new Gourou Banda substation (13.426° N 2.116° E) is located 10 km south of Niamey and 2 km from highway 27. The substation is located 300 m from the Gourou Banda diesel power plant, on a hill at an elevation above sea level of 20 m. The substation occupies an area of 90,000 m². According to Fichtner 2016, this new substation is in fact an expansion of an existing 132 kV substation with two transformer feeders 161/330 kV in hybrid technology. Although initial recommendations were for an air insulated system (AIS) with double busbar for the extension, it seems that potential space limitation could prohibit this type of system and favor a gas insulated system (GIS). Two development variants have been considered which would include the following components:

- **2 or 4** line feeders
- **2 or 4** shunt reactor feeders
- bus coupler
- two 330/132, 80 MVA power transformer feeders
- an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

The new Zabori switchyard (12.769°N 3.473°E) is located 3 km southeast of Baba Dey and 3.3 km northwest of Zabori. It occupies an area of 90,000 m² and according to Fichtner (2016), it will be an air insulated double busbar arrangement with or without power transformer. Two development variants have been considered which would include the following components:

- **3 or 5** line feeders
- one 330/132/33 kV, 20 MVA power transformer feeder
- 1 or 2 shunt reactor feeders
- bus coupler
- an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

3.4.3 BENIN

The new Malanville substation (11.782° N 3.374° E) is located 3 km south of Badjekali and is accessible by a tertiary road linking the National Route E2. The substation occupies an area of approximately 70,000 m². According to Fichtner (2016), this substation will be built in two stages. First a 161 kV substation using air insulated double busbar will be built and later, the 330 kV section will be added. The required area to build both stages has already been reserved. The final station will include the following components:

- 1 line feeder
- bus coupler
- 1 shunt reactor feeder
- two 330/161 kV, 50 MVA power transformer feeders
- an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

3.4.4 BURKINA FASO

Two new substations will be constructed at the periphery of Ouagadougou that is Ouaga-east and Ouaga-south-east.

The new 330/225/90 kV Ouaga-east substation near Ouagadougou (12.401° N 1.381° E) is located 1 km from an existing secondary road and accessible by NR4. The substation will occupy an area of 100,000 m². This substation is at a distance of 16.5 km from the city center of Ouagadougou. According to Fichtner (2016), two development variants are considered for this substation and will include the following component:

- new air insulated double busbar substation with transfer busbar
- **1 or 2** 330 kV Line feeders
- **1 or 2** Shunt reactor feeders
- three 330/225 kV power transformer feeders
- 330 kV bus coupler
- 225 kV bus coupler
- two 225 kV Line feeders
- two 225/90 kV power transformer feeders
- 90 kV bus coupler
- two 90 kV Line feeders
- auxiliary power supply (transformer, Battery, UPS, auxiliary transformers, diesel generator)

The new 225/132/33 kV Ouaga-south-east substation (12.287º N, 1.400º E) is located 2 km to the north-east of the NR6 and the Kouba community. The substation will occupy approximately 20,000 m^2 and it is located at a distance of 14.8 km from Ouagadougou's city center. According to Fichtner (2016), the station will include the following components:

- new air insulated double busbar substation
- three 225 kV line feeders
- two 225/132 kV power transformer feeders
- 225 kV bus coupler
- two 132 kV line feeders
- one 132/33 kV power transformer feeder
- 132 kV bus coupler
- four 33 kV outgoing feeders
- auxiliary power supply (transformer, Battery, UPS, auxiliary transformers, diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

3.5 PROJECT COMPONENTS

3.5.1 VOLTAGE LEVEL

A 330 kV voltage level was selected for this interconnection, which is part of a wide network foreseen by the WAPP in ECOWAS member states.

As for the two existing lines, the Ouaga-east substation toward the south-west and north-west will respectively have a voltage of 225 kV and 90 kV.

3.5.2 NUMBER OF CIRCUITS

Fichtner (2016) defined the configuration of the 330 kV line as well as its number of circuits. The number of circuits considered is defined as follow:

- → SCL: Single Circuit Overhead Line
- → DCL: Double Circuit Overhead Line
- → DSL: Double Circuit Overhead Line which is erected with one circuit only

Four distinct sections were considered for this analysis:

- → Birnin Kebbi – Zabori: 90 km
- → Zabori – Gorou Banda (Niamey): 180 km
- → Zabori – Malanville: 120 km
- → Gorou Banda – Ouagadougou: 490 km

Three variants were studied by the FS consultant for the configuration and number of circuits:

Variant 1:

- → Birnin Kebbi – Zabori: SCL
- → Zabori – Gorou Banda: SCL
- → Zabori – Malanville: SCL
- → Gorou Banda – Ouagadougou: SCL

Variant 2:

- → Birnin Kebbi – Zabori: DCL
- → Zabori – Gorou Banda: DCL
- → Zabori – Malanville: DSL
- → Gorou Banda – Ouagadougou: DCL

Variant 3:

- → Birnin Kebbi – Zabori: DSL
- → Zabori – Gorou Banda: DSL
- → Zabori – Malanville: DSL
- → Gorou Banda – Ouagadougou: DSL

Fichtner (2016) proposes to retain both variants 2 and 3 for network analysis and economic calculations. Variant 1, although it is the lowest investment cost option (see section 1.7), is not recommended as it does not allow the network to meet the n-1 criterion which is the ability to withstand the loss of any single component.

As for the 225 kV line to be implemented between the Ouaga-east substation and the PA5 pylon, it is recommended by Fichtner (2016) that the first 9 km to the Ouaga-south-east substation be DCL while the last 15 km to the PA5 pylon be SCL.

Finally, with regards to the 90 kV line which will link the Ouaga-east and Kossodo substations, it is recommended that the line be SCL.

3.5.3 PHASE CONDUCTORS AND SHIELD WIRES

According to the Fichtner (2016), the diameter, area and number of sub-conductors per phase should ensure:

- → provision of satisfactory radio interference (RI), audible noise (AN) and corona loss performances
- → transfer of a maximum design power at 330 kV nominal voltage
- → transfer of a maximum design power at 330 kV nominal voltage, in cases of emergency on one circuit where there is a double circuit system
- → provision of satisfactory safety to the line (considering the loads from wind pressure)

The existing 330 kV lines are equipped with two Aluminum Conductor Steel Reinforced (ACSR) Bison per phase, one classical ground wire (shield wire) and one Optical Ground Wire (OPGW). This type of conductor is suitable for power transfer at 330 kV nominal voltage and thus, no further investigations were made for the conductor size. The recommendation for the OPGW cables are the 48 fibers type G.652d.

Investigations focused on conductor materials in respect of the latest technological developments to determine the possibilities of:

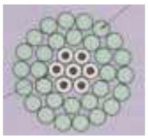
- → selecting an alternative conductor
- → solutions to upgrade the line in the future, if necessary

In order to ensure that the same types of towers and insulator strings could be maintained for an alternative conductor, the following restrictions were observed:

- → The alternative conductor shall have a diameter less than or equal to and breaking loads higher than or equal to the ACSR Bison.
- → The ground clearance and clearances to the other lines and structures shall be the same.

The following table summarizes the main characteristics of the existing conductor and of the alternative conductors considered.

Table 3-4 Key Features of the Existing Conductor and Alternative Conductors Considered

Conductor Type	Stranding	View	Characteristics	
			Temperature	Power Transfer at Max. Current
			ºC	% of ACSR
ACSR	Al + Steel		80ºC	100%
ACSR/ACS	Al + ACS		80ºC	107%
SLAC/ACS	Al + SBAl + ACS		80ºC	113%
TCASR/AS	TAl + ACS		150ºC	150%
60% ZTACIR/ACS	ZTAl + IR(ACS)		230ºC	200%
58% ZTACIR/ACS				
XTACIR/ACS	XTAl + IR(AS)			
60% ZTACEIR/ACS	SB ZTAl/IR(AS)		230ºC	200%
58% ZTACEIR/ACS				
XTACEIR/ACS	SB XTAl / IR(AS)			
GTACSR	TAl + TZ + EST		150ºC	150%
GZTACSR	ZTAl + TZ + EST		210ºC	180%

The conclusion of Fichtner's (2016) completed investigation was that for both single circuit and double circuit lines, the conductor should be two-bundle ACSR Bison with one steel conductor as classical ground wire (shield wire) and one OPGW. They also recommend that all inner layers of conductors and the ground wire's steel core, be greased for protection against corrosion.

As an alternative, Fichtner (2016) proposes a conductor with aluminum clad steel wires of ACSR/ACS Bison type that have the same size and strength as the ACSR, based on the following technical performance:

→ an electrical resistance approximately 7% lower than that of the ACSR (consequently power losses should be less)

→ favorable corrosion behavior, as all wire-to-wire contacts are aluminum-to-aluminum

→ reasonable extra costs, comparable to the savings resulting from low losses

→ favorable corona phenomenon performance (the grease on the ACSR conductor collects dust, so corona losses increase over time)

→ low weight compared to ACSR, since no grease is needed, sagging is then less than for the ACSR

The FS consultant will also select the number of optical fibres in the OPGW.

For the 225 kV line linking the Ouaga-east and Ouaga-south-east substations, the conductor type will be an almelec, model ASTER 570. These conductors are an alloy of aluminum with some magnesium and silicon. This type of cable is composed of 61 strands of 3.45 mm in diameters for a total exterior diameter of 31.05 mm.

Finally, the 90 kV line linking the Ouaga-east and Kossodo substations, the conductor type will also be an almelec, model ASTER 228. This type of cable is composed of 37 strands of 2.9 mm for a total exterior diameter of 19.6 mm.

3.5.4 TOWER TYPES

Typically, self-supporting lattice towers, as illustrated in figures 3-2 and 3-3, are used in western Africa and are foreseen for this interconnection. In its 2016 feasibility study, Fichtner proposes the following specifications for the towers:

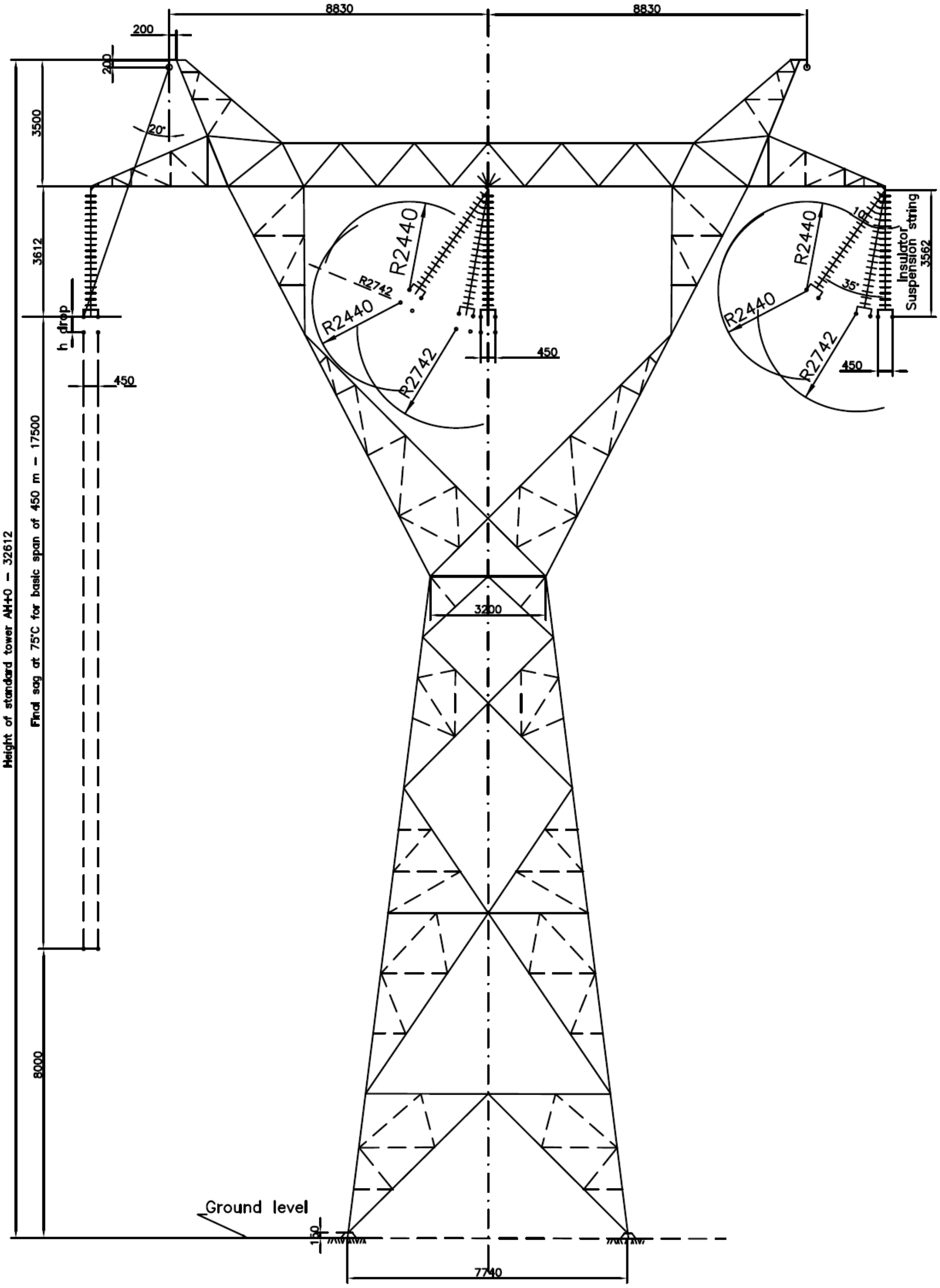
- → Tower types will be made under conventional basis but it should be made clear to the tenderers that, if found economical, it would be acceptable to combine one or more designs into a single type.
- → Suspension towers should be designed for the maximum height and maximum characteristic spans and provide with adequate body extensions.
- → Tension towers will include 30º, 60º, 90º and terminal angle towers.
- → Tower span considered is 450 m for both single-circuit and double-circuit tower configurations.
- → Average height of the single-circuit structure will be 33 m and 47 m for the double-circuit structure.

These structures have usually a lifespan of more than 60 years, with possibilities to increase the performance by means of refurbishment works.

The information related to minimum clearance to ground is currently not available for the 330 kV line. However, it will be necessary to consider the presence of giraffes in Niger during the feasibility study to ensure sufficient clearance, if required.

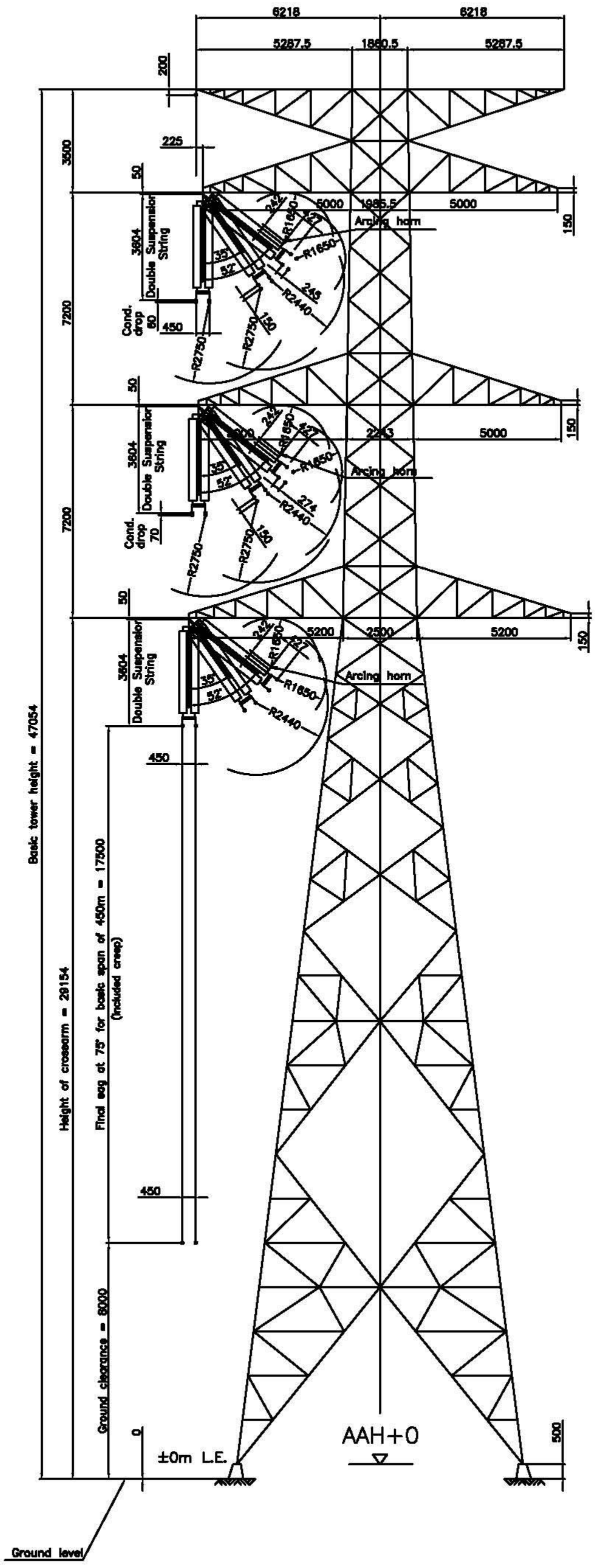
The specification for the selection of the 225 kV towers will be described in the call for tender file and thus, are not available at this time. Nonetheless, figures 3-4 and 3-5 respectively present the typical aspect of the DCL and SCL tower types to be used for this line. Typical span between two DCL towers will be 350 m and 300 m between two SCL towers.

The 90 kV line, also located in Burkina Faso, should be composed of tetrapod metal lattice towers equipped with composite isolators. The height of the structures will be calculated to ensure a minimal ground clearance of 6.5 m at conductor’s maximum temperature. Figure 3-5 shows the typical aspect of the SCL towers to be used for this line. Typical span between two towers will be 300 m.



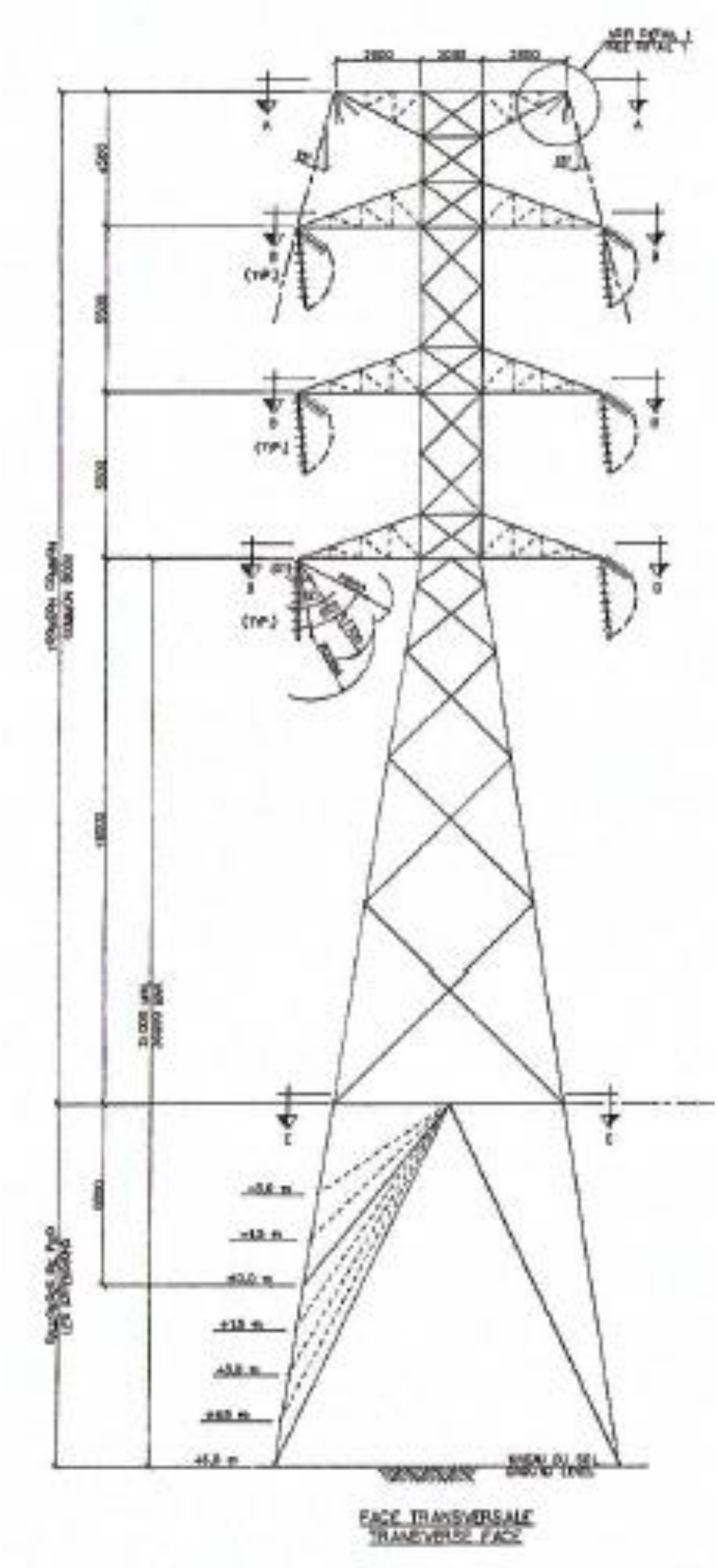
Reference: Fichtner, January, 2016

Figure 3-3 330 kV Single Circuit Suspension Tower Type



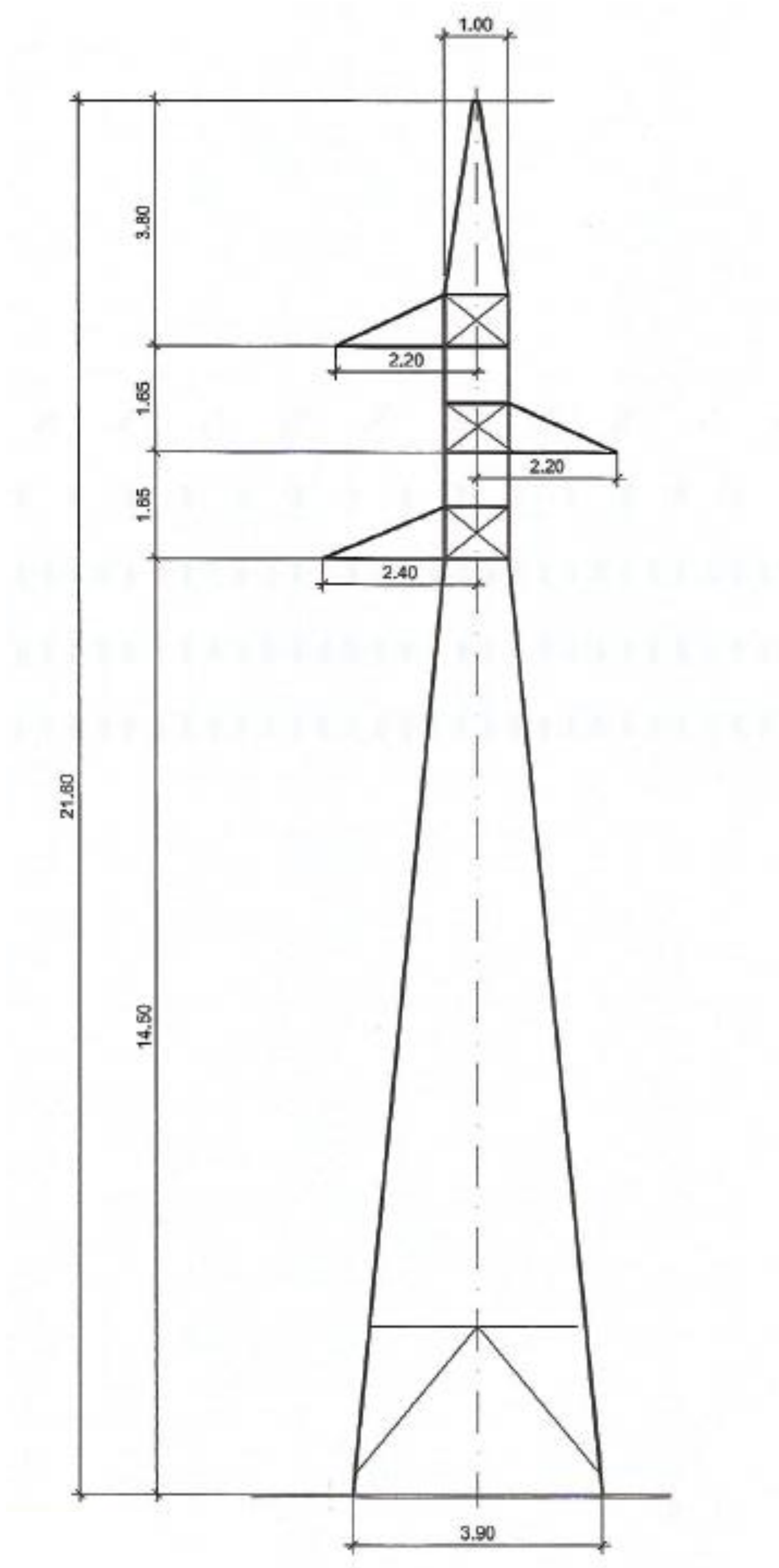
Reference: Fichtner, January, 2016

Figure 3-4 330 kV Double Circuit Suspension Tower Type



Reference : Sonabel

Figure 3-5 Typical Representation of a DCL Tower for the 225 kV Line



Reference : Sonabel

Figure 3-6 Typical Representation of a SCL Tower for the 225 and the 90 kV Lines

3.5.5 TOWER FOUNDATIONS

The 2016 feasibility study (Fichtner, 2016) specifies the following characteristics for the towers' foundations:

- → rock foundations for sound rock with a bearing capacity of at least 1,000 kN/m^2
- → rock foundations for weathered rock with a bearing capacity of 600-1,000 kN/m^2
- → pad and chimney foundations for heavily weathered / fractured rocks with a bearing capacity of 300-600 kN/m^2
- → pad and chimney foundations for normal / good soil conditions with a bearing capacity of 150-300 kN/m^2
- → pile foundations for poor / very poor soil conditions

The FS contractor has indicated that the footprint for a single-circuit tower, with an average height of 33 m, is about 60 m^2. With a 15 m base extension, the footprint would increase to 163 m^2 and 200 m^2 with a supplementary leg extension of 15 m.

For a double-circuit tower with an average height of 47 m, the footprint is about 52 m^2. With a 12 m base extension, the footprint would increase to 100 m^2 and 118 m^2 with a supplementary leg extension of 4 m.

The typical area occupied by the proposed 225 kV line DCL towers will be 8.5 X 8.5 m (mean value) and 10 X 10 (maximum value). The typical area occupied by the proposed 225 and 90 kV line SCL towers will be 5 X 5 m (mean value) and 7 X 7 m (maximum value).

The 90 kV line tower foundation will be in concrete/armed concrete and composed of 4 distinct bases located at each corner of the towers.

3.5.6 NUMBER OF TOWERS

Nigeria

The line route study (WSP 2015) indicates that there will be 17 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 140 to 150 structures in Nigeria considering dead-end and angle structures.

Niger

The line route study (WSP 2015) indicates that there will be 84 angle structures. Considering that the FS consultant has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 935 to 950 structures in Niger considering dead-end and angle structures.

Benin

The line route study (WSP 2015) indicates that there will be 9 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 30 to 35 structures in Benin considering dead-end and angle structures.

Burkina Faso

The line route study (WSP 2015) indicates that there will be 63 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 850 to 865 structures in Burkina Faso considering dead-end and angle structures.

For the 225 kV line linking the Ouaga-east and Ouaga-south-east substations in Burkina Faso and considering that the first 9 km will be composed of DCL towers while the last 15 km will be composed of SCL towers, the respective number of towers required has been estimated at 26 and 50, for a total of 76.

For the 90 kV line linking the Ouaga-east and Kossodo substations in Burkina Faso, the estimated number of towers required for its length of 17 km was estimated at 57.

3.5.7 RIGHT-OF-WAY

A width of right-of-way (RoW) of 50 m has been preselected in the four countries for the line route study and final selection. It is expected that this 50 m RoW is enough to satisfy the following technical requirements to which the 330 kV transmission lines must comply:

→ audible and radio noises

→ electric and magnetic fields

→ conductor swing clearance under high wind conditions

→ security clearance for tower collapsing scenario

For the 225 kV line, the basic RoW between the Ouaga-east substation and the PA5 pylon is 50 m. However, an additional width of 25 m has been reserved for the section between the Ouaga-east and the future Ouaga-south-east substations for a total RoW of 75 m.

The RoW for the 90 kV line between the Ouaga-east and the Kossodo substations is 50 m. This RoW will be adapted to the existing roads in the Kossodo industrial area as the line approaches the Kossodo substation.

3.6 PROJECT SCHEDULE AND COST

3.6.1 PROJECT SCHEDULE

According to Fichtner (2016), implementation schedule for the construction of the transmission lines and substations would imply the following duration which are presented per project phase.

Table 3-5 Project Implementation Schedule

Transmission Lines			**Substations**			
Phase 1: Pre-Construction	Phase 2: Supply and Construction	Phase 3: Commissioning, Project Closure	Phase 1: Design and Approval	Phase 2: Procurement and Manufacturing	Phase 3: Construction	Phase 4: Commissioning, Project Closure
6 months	18 months	3 months	5 months	9 months	14 months (6 months in parallel of Phase 2)	5 months

Based on the above, and allowing 10% for contingencies, the overall transmission line construction duration for each of the transmission line sections will be around 2.5 years. However, it would be possible to implement certain sections in parallel in the same period.

As for the substations, the total duration will be 27 months. Allowing a contingency of 10% for implementation, the total construction duration is 2.5 years. It is assumed that work may be undertaken in parallel at the various substation locations so the implementation period for all substation work will likewise be 2.5 years.

With regards to the 90 kV line linking the Ouaga-east and Kossodo substations, its construction will be realized in parallel with the other components of the project and thus, should not exceed the total duration of 2.5 years.

3.6.2 PROJECT COST

The total cost estimated by Fichtner (2016) included all work for the 330 kV and 225 kV lines as well as for the associated new substations or expansions of existing substations. The estimate was calculated comparing the three line variants presented in section 3.5.2. The following table summarizes the total cost estimates.

Table 3-6 Estimates of Project Costs

Country	Variant 1		Variant 2		Variant 3	
	Lines*	Substations*	Lines*	Substations*	Lines*	Substations*
Nigeria	13,190,289	4,383,425	20,460,659	5,673,175	16,240,807	4,383,425
Total*	**17,573,714**		**26,133,834**		**20,624,232**	
Niger	89,353,572	39,594,200	131,253,757	51,705,200	110,018,370	39,594,200
Total*	**128,947,772**		**182,958,957**		**149,612,570**	
Burkina Faso	85,254,177	58,924,450	129,931,775	63,903,950	104,000,101	58,924,450
Total*	**144,178,627**		**193,835,725**		**162,924,551**	
Benin	2,552,959	13,794,150	3,143,382	13,794,150	3,143,382	13,794,150
Total*	**16,347,109**		**16,937,532**		**16,937,532**	
Total Lines and Substations	**307,047,222**		**419,866,048**		**350,098,885**	

* US $

Fichtner (2016), specifies that variant 2 is the most expensive but more profitable in the viewing time, by 2035, while variant 1, is the cheapest option, but not stable for the future.

With regards to the 90 kV line linking the Ouaga-east and Kossodo substations in Burkina Faso, its construction costs should amount to US $ 83,323 /km (€ 74,000/km) for a total of US $ 1,416,491 (€ 1,258,000) for 17 km of line.

The total cost of the project is thus US $ 421,282,539.

In Nigeria, the total cost of the project is US $ 26,133,834.

4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE

After presenting the areas being investigated as part of the environmental and social impact study, this chapter describes then each environment crossed by the line route: physical, biological and human.

4.1 DESCRIPTION OF THE PROJECT'S AREA

Baseline characterization has focused on various environmental and social components. In order to get the best portrait of the studied components, the study area varies in terms of extend. For the bio-physical components, the study area is made from a 5 km buffer from the central axis of the line route. The study area covers the Birnin-Kebbi substation occupying land area of approximately 11ha, with a total perimeter length of about 135m with the following as the corner coordinates.

Table 4-1 Coordinates of the Birnin Kebbi study area

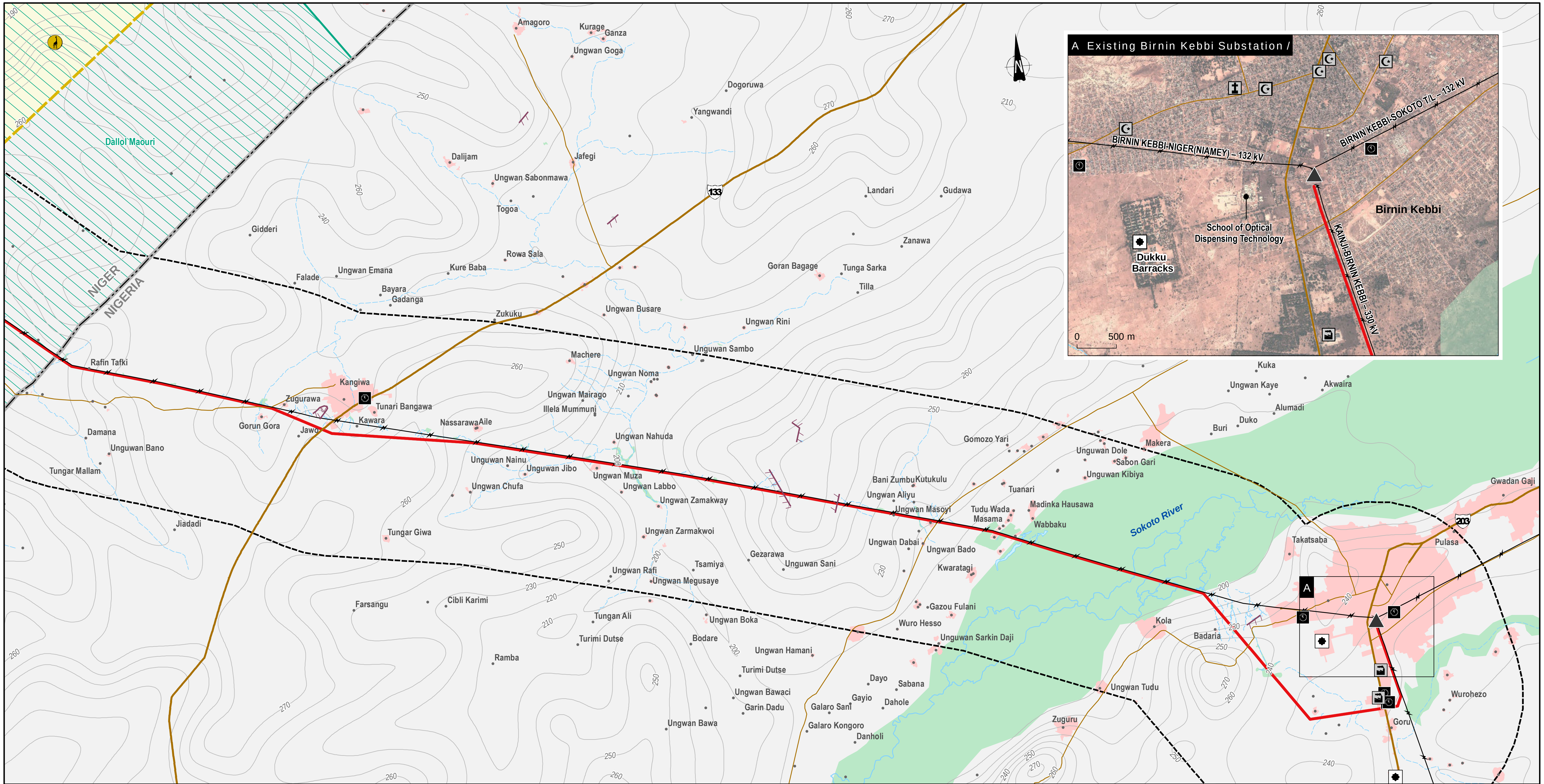
Beacon	Latitude	Longitude
A	12.4389	4.19868
B	12.4362	4.19856
C	12.4359	4.19549
D	12.4385	4.19508
E	12.4385	4.19572
F	12.4388	4.19573

The land use area is mixed commercial and residential and located in the Birnin Kebbi Local Government Area. Accessibility to the station is through the Abuja road, which is approximately 150m from the gate.

The study area stretches from the substation (Lat 12.43627, Long 4.1990) and runs to the south parallel of the existing 330kV line from Kainji to Birnin Kebbi for about 5km. It takes a turn to the right at Lat 12.40515, Long 4.20208 just outside Goru Village and crosses the Binin Kebbi to Jega Road at Lat 12.40485, Long 4.19723 and then, it takes another right turn at Lat 12.40331, Long 4.16890 just outside Unguwan Mairago Village. The line then joins the existing 132kV line by the Sokoto River bank and runs parallel to it, to the Niger Boarder.

The vegetation is dominated by shrubs and open grassland, owing to human activities such as bush burning and land clearing for cultivation. The main land-use types include agricultural crop (rain fed and irrigation) and animal production, forest reserves, few settlements, etc. Crops under cultivation are millet (gero and maiwa), sorghum, cowpea and groundnut. The crops are grown in mixture of millet+ sorghum, millet/ cowpea and sorghum/millet/cowpea in the upland of the sandy plains. Swampy rice is the main crop grown in the floodplain.

The study area for the human environment characterization covers the Kebbi state that includes emirates of Gwandu, Argungu, Yauri and Zuru. However, socio-economic surveys have been focussed on communities and households located inside the project ROW.



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Mosque

Church

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Floodplain

Erosion

Infrastructure

National Road

Secondary Road

Telecommunication Tower

Military Base

Factory

Substations and Transmission Lines

Existing Line

Existing Substation

Project Component

Draft Final Line

Boundary

International Border

Study Area (5 km buffer)

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report

Study Area

0 1,6 3,2 4,8 km

UTM, Zone 31N, WGS 84
Contour Interval : 10m

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c4_1_StudyArea_160606.mxd

Map 4-1

June 2016

WSP

4.1.1 CLIMATE AND METEOROLOGY

The study area is characterized with a Tropical Continental type of climate largely controlled by two air masses including the Tropical Maritime and Tropical Continental blowing from the Atlantic and the Sahara Desert respectively. These give the area the rainy and dry seasons like any other part of Nigeria.

Rainfall: Based on monthly average precipitations calculated from 1915 and 2007 in Bernin Kebbi, though much of the rain in the study area falls between June and September, its rainy (wet) season starts around April and lasts until early October with a peak in July (Figure 4-1). From November the long dry season starts and lasts in March. The mean maximum monthly rainfall comes around July and can be as high as 366 mm though there can be months without rain especially around December.

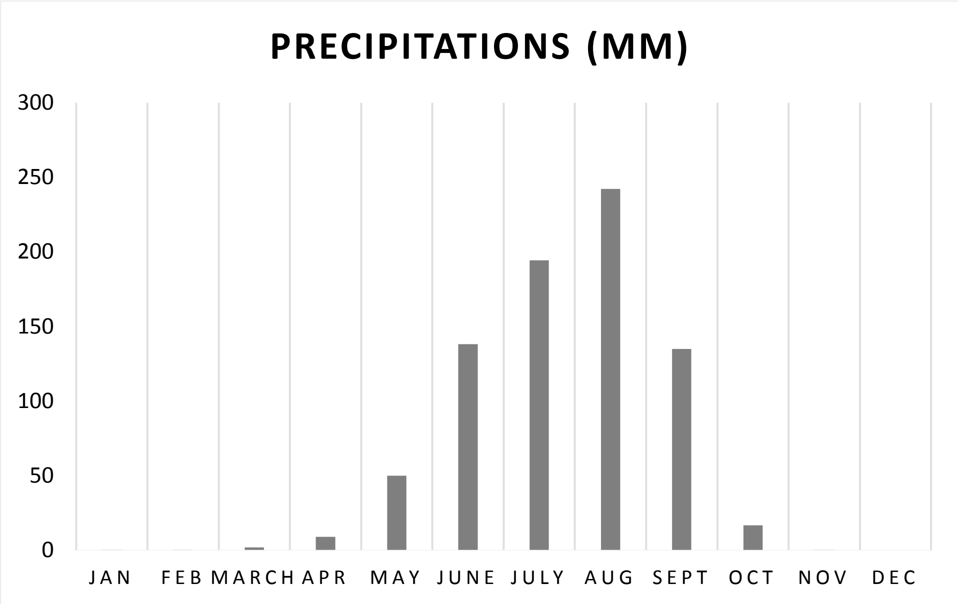


Figure 4-1 Monthly Rainfall Distribution in the Study Area (1915-2007) (Ismail and Oka, 2012)

Relative Humidity: Saharan air that accompanies dry season in the area is characterized by low relative humidity and intense aridity that creates dusty atmosphere. Its mean relative humidity is 12.9 – 62.5% (Figure 4-2) with mean minimum air temperatures of 21.2 °C - 23.9 °C with the mean maximum of 29.3 - 39.3 °C (Figure 4-3) using the ten-year period (2005 – 2014) data from NIMET (2015). The daily sunshine period in Kebbi is 6.7 - 8.3 hours with an average of 7.5 hours (Figure 4-4). Its mean surface wind speed is 2.6 – 7.3 m/s with the minimum and maximum in December and February respectively (Table 4-1). This is characterized by south-westerly, easterly and north-easterly prevailing wind directions (Figure 4-5).

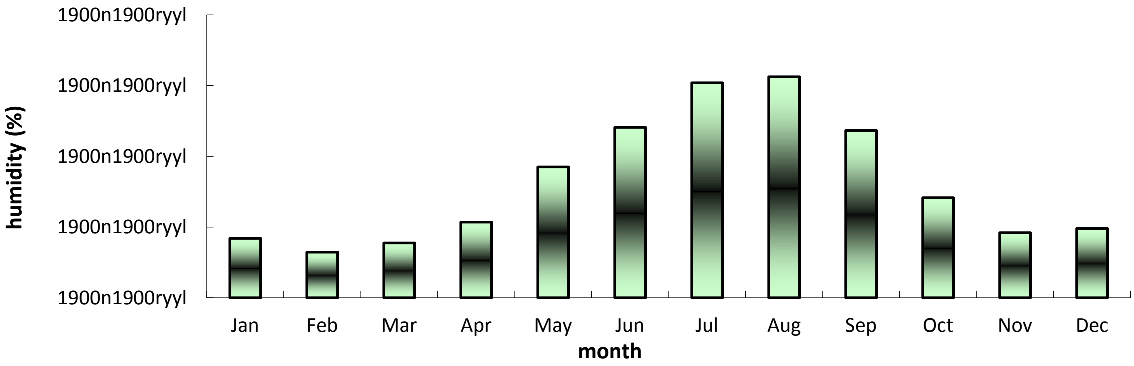


Figure 4-2 Ten Year Monthly Relative Humidity Distribution in the Area (NIMET, 2015)

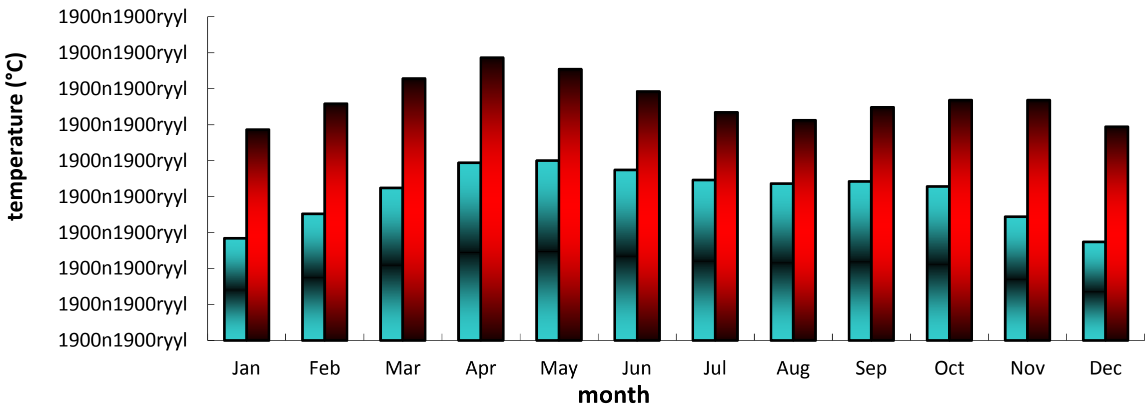


Figure 4-3 Ten Year Monthly Air Temperature Distribution in the Area (NIMET, 2015)

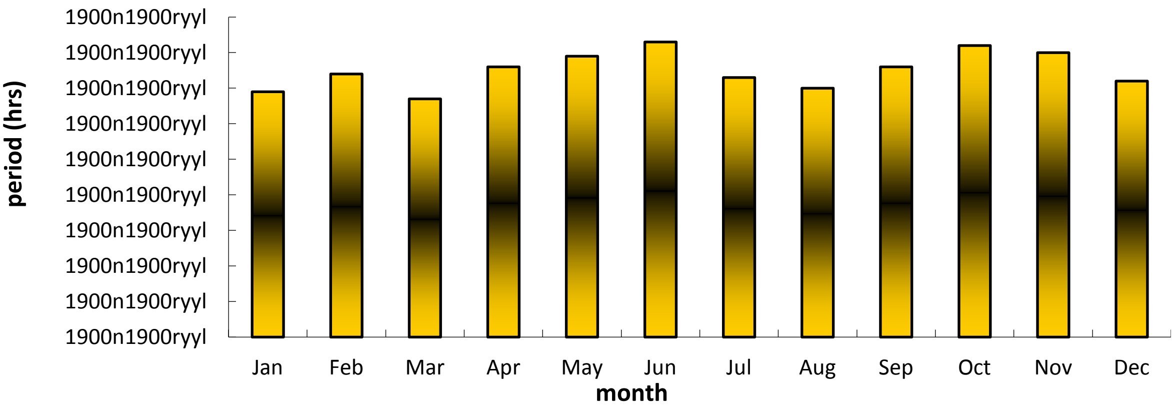


Figure 4-4 Ten Year Monthly Sunshine Hours Distribution in the Area (NIMET, 2015)

Table 4-2 Monthly Wind Speed Variation in the Study Area (2005 – 2014)*

Month	Wind speed (knots)		
	Minimum	Maximum	Mean
January	4.1	6.5	4.9
February	3.9	7.3	5.4
March	4.1	7.0	5.2
April	4.2	6.2	5.2
May	3.8	6.4	5.2
June	3.9	6.8	5.7
July	3.9	6.1	5.1
August	3.5	5.3	4.5
September	3.2	5.5	4.3
October	3.1	4.6	3.8
November	2.8	5.3	3.9
December	2.6	6.5	4.5

*Source: NIMET (2015)

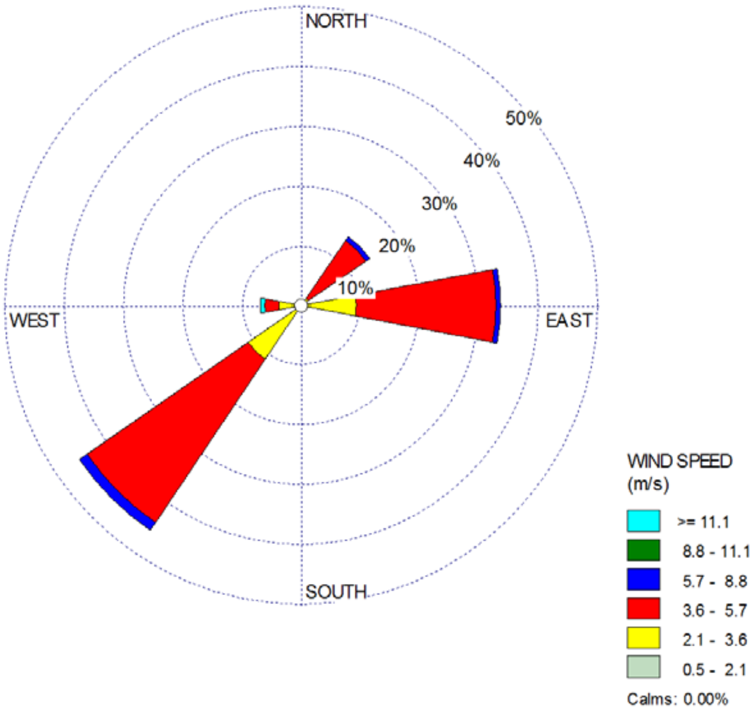
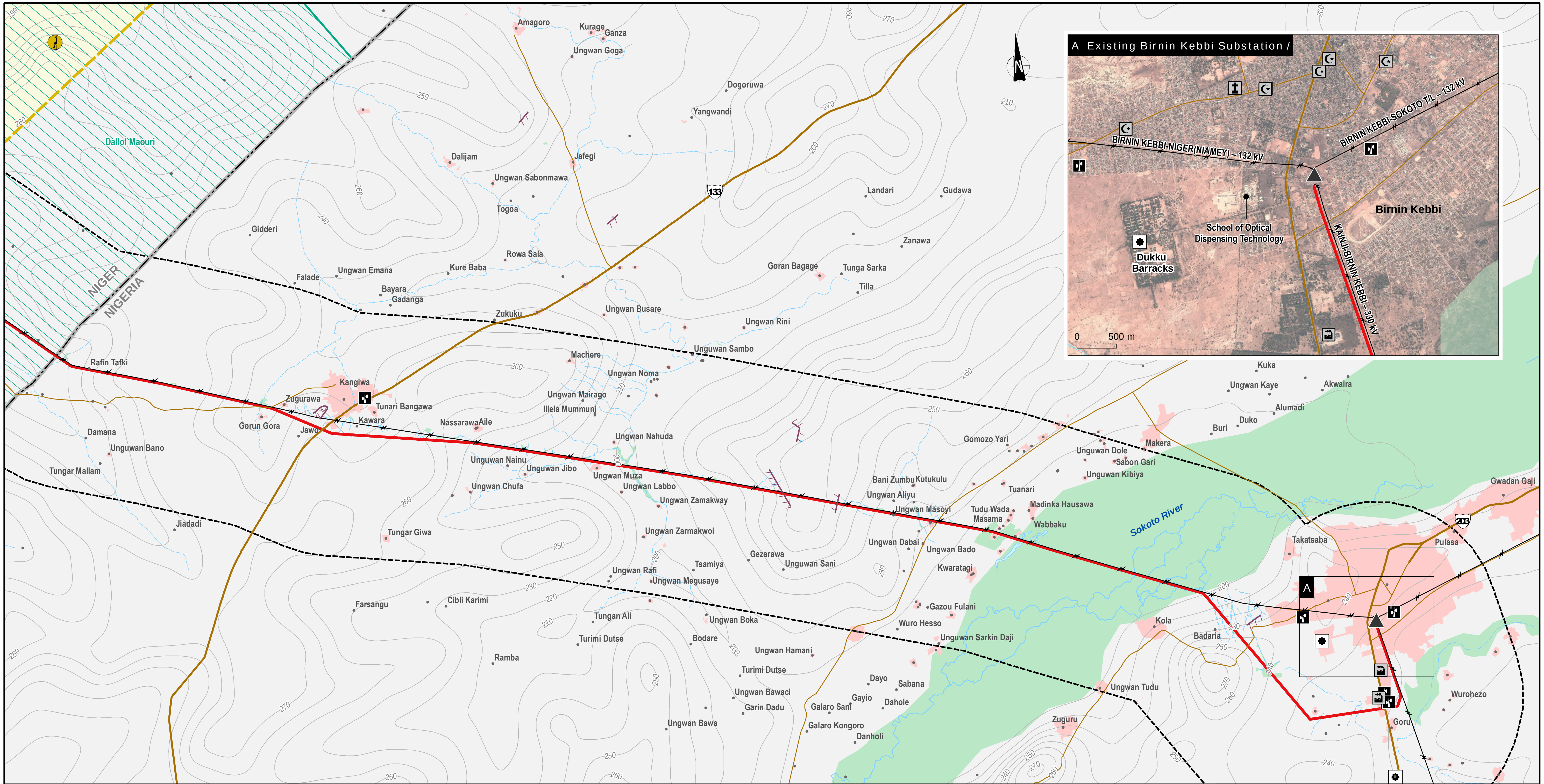


Figure 4-5 Windrose of the Proposed Project Area (NIMET, 2015)

4.1.2 TOPOGRAPHY

Kebbi State hosts three relief regions: the high plains in the south and south east, the plain landscape in the north and the riverine lowland of the Niger and lower Rima valleys. The high plains are characterized by dissected crystalline rocks with hill ranges and domical rises (inselbergs) and are approximately 700 m above sea level. The plain landscape forms part of the vast Sokoto plains which is an end tertiary plantation surface (Davis, 1982). It is monotonous lowland, sedimentary in origin, with an average height of about 300 m above sea level. The riverine lowlands are mainly the flood plains of the Sokoto River which is very wide, up to 8 km in many areas. Along the proposed power line corridor, the topography varies from 194 to 269 m above the sea level. The lowest elevation is encountered in the valley of the Sokoto River. Slopes are usually gentle along the proposed corridor and are comprised between 2.5 to 5.1%.

The area along the study area is characterized by low-lying dissected plains with risers of old stabilized dunes in the northern part from aeolian deposits, flat-topped remnants of older landscapes with ironstone sheets or boulders and low rock-outcrops (Ojanuga, 2006). The Sokoto River runs through the study area and drains into the Niger River. The soils are situated on relatively flat to gently undulated terrains in the northern part of the zone (see next Map).



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Mosque

Church

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Floodplain

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Topography

0 1,6 3,2 4,8 km
UTM, Zone 31N, WGS 84
Contour Interval 10 m

Sources :
see Appendix A
Mapping: WSP, 2015
File: 141_24307_EIE_NG_cT_Topo_160606.mxd

Map 4-2

June 2016

WSP

Upland Areas: A large portion of the upland soil surface was not characterized by any form of erosion. However, slight sheet was observed around Kwamawa Village -12.40419 ON, 4.18959 OE, with nearly level slope (2-3O) and well drained soils. Similar sheet erosion was also observed around Ungwan Musa -12.52304 ON, 003.90528 OE with gentle to moderate slope (4-7O) and moderately drained soil. The slight erosion observed could be attributed to increase in slope gradient from level to gentle slope. Gullies and rills forms of erosion were also observed between Sabon Gari -12.42327ON, 4.15434OE and Kola Village around coordinates 12.45311 ON, 4.13339 OE. The gradients are nearly level-gentle slopes (2-4O) with well drained soils and level (0-2O) with very poorly drained soil respectively. These gullies serve as drains into the Sokoto River, and area could be a difficult terrain for construction works.

Flood Plain: The soils within floodplain along the route line of the power project were very deep (>150cm) situated on level to nearly level (0 – 2%) ground on lower slope to floodplain. They are very poorly to moderately drained with weak massive over single grain materials on the Kola side of the Sokoto River around 12.47720^{O}N, 4.07039^{O}E towards Ungwan Dodo around 12.52304^{O}N, 3.90528^{O}E. Construction of pylons in this area may require deep or pile foundation.

Plate 1 Flood Plain Along the Line Route (Kola Side of Sokoto River)

Plate 2 Sand Dunes Around Unguwan Dodo

Hilly Areas: This region has crests of degraded hills with lateritic gravels and caps in many areas. The hills were level (0-2%) with edges that were gentle to moderate slopes (4 – 7%) contributing to rill and gully erosions observed between Sandare -12.48509°N, 4.03759°E and Ungwan Masoyi, -12.49974°N, 003.99419°E and surrounding areas. Similar occurrences were also observed around Zukuku and surroundings. Strong to steep slopes are also observed at the boundary, which are associated with gullies (Plate 3). The soils are generally well drained with fine crumb, structureless material that ranged between yellowish brown and strong brown.

Plate 3 Gully Erosion long the Line Route

4.1.3 GEOLOGY

4.1.3.1 REGIONAL GEOLOGY

Geologically speaking, Kebbi State lies within the Sokoto Basin, which is part of an extensive elongated sedimentary basin underlying most of north-west Nigeria and the eastern part of Niger Republic. The Sokoto basin is characterized by many geological formations which include, Dukamaje, Kalambaina, Taloka, Illo, Gundumi, Dange, Wurno, and Gwandu formations (Fig. below). The sediment ages range from the Cretaceous to the Eocene. The study area lies completely within the Gwandu formation.

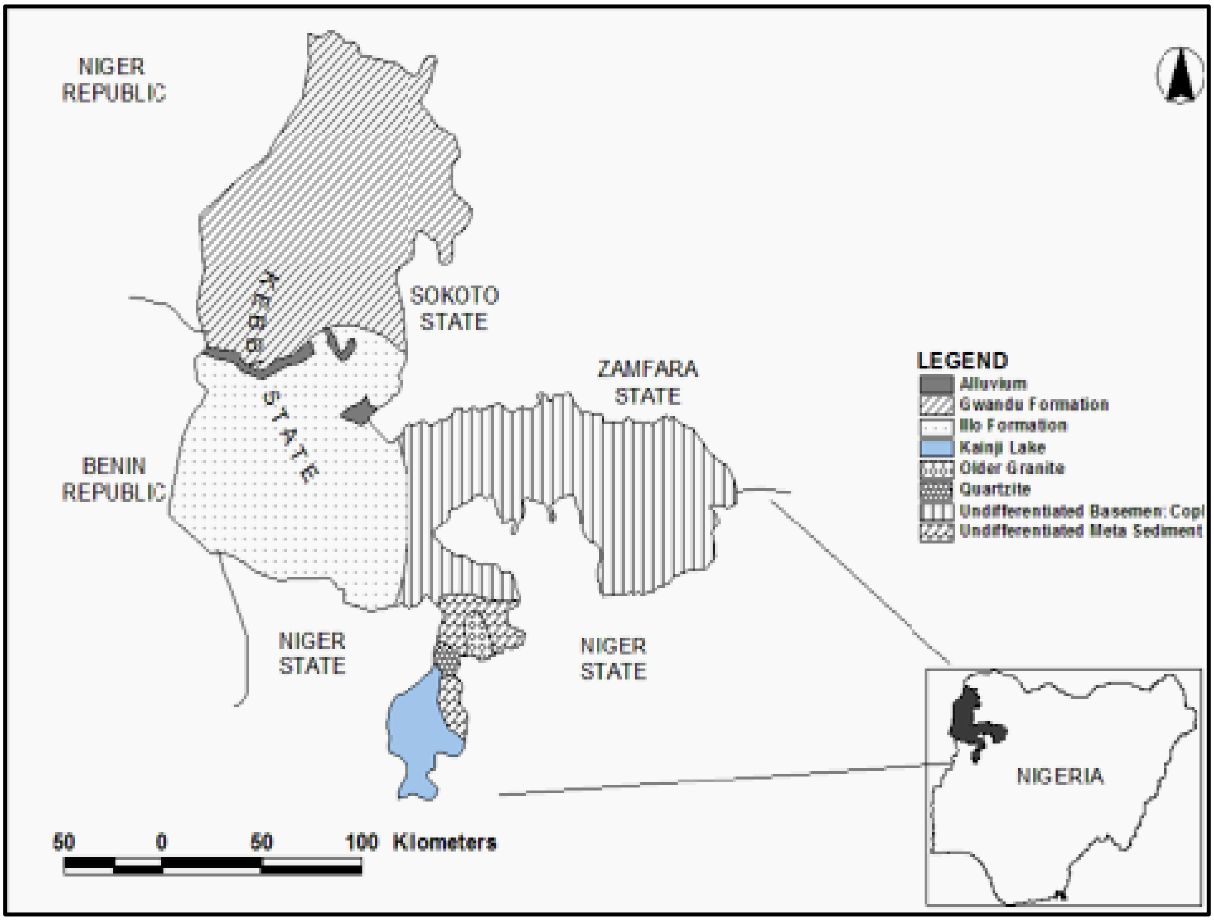


Figure 4-6 Main Geological Units of Kebbi State (Yakubu, 2006)

The sediments of Gwandu formation also extend into neighbouring Niger Republic and Republic of Benin, where they were referred to by Hubbert (1908) as the “Grès du Niger” and by Urvey (1936) as “Grès du Moyen Niger”. They have been correlated with deposits of Miocene-Pliocene age in the Central African Republic and in Mauritania, where they are known as the “Continental Intercalaire”. The sediments of terrestrial origin are made up of interbedded semi consolidated sands and clays. The clay beds are commonly thick, massive and white, red, or grey brown to black colours.

Texturally, the sand beds are fine to very coarse, predominantly quartz containing some limonite nodules, cemented in places by limonite. Characteristically, sand beds underlie the low plains, and resistant clay beds from the tabular-shaped hills capped with residual ironstone.

4.1.3.2 GEOLOGY OF THE STUDY AREA

STRATIGRAPHY

The sediments of Gwandu formation consist of massive white clays interbedded with coarse and medium grained red sandstones and mudstones with occasional peat bands. The type section shows the typical lithologic characteristics of the formation.

Beneath the lateritic capping is a hard ferruginous sandstone layer which is easily eroded into a network of dendritic gullies. These are underlain by red sandy clays and white massive mudstones, which show pale brown or pink colors. The mudstones with sandstones intercalation extend monotonously throughout the sections. Similar sections of Gwandu formation occurs at Makera at the outskirt of Birnin- Kebbi near the bridge (Plate 4). The sand at the surface is quite red in colour, often showing colour banding and poor stratification. The mudstones often show a nodular structure with noodles suggestive of local turbulences in the depositional environment.

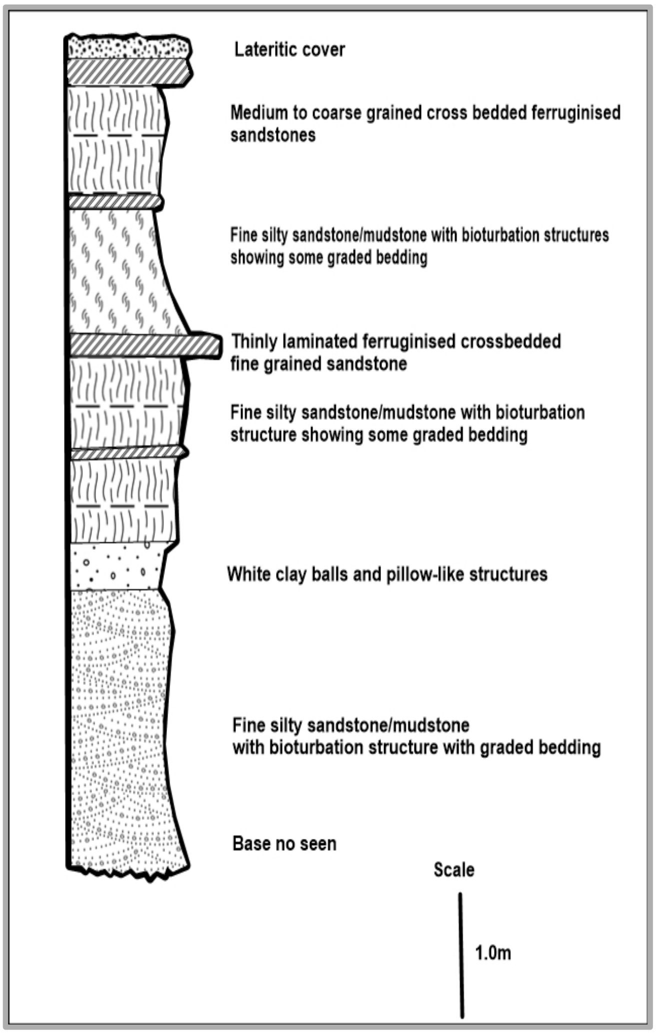


Figure 4-7 Section of Gwandu Formation Exposed Along Birnin-Kebbi to Gwandu Road (Kogbe 1978)

Plate 4 Exposure of a Section of Gwandu Formation at Makera, Birnin Kebbi

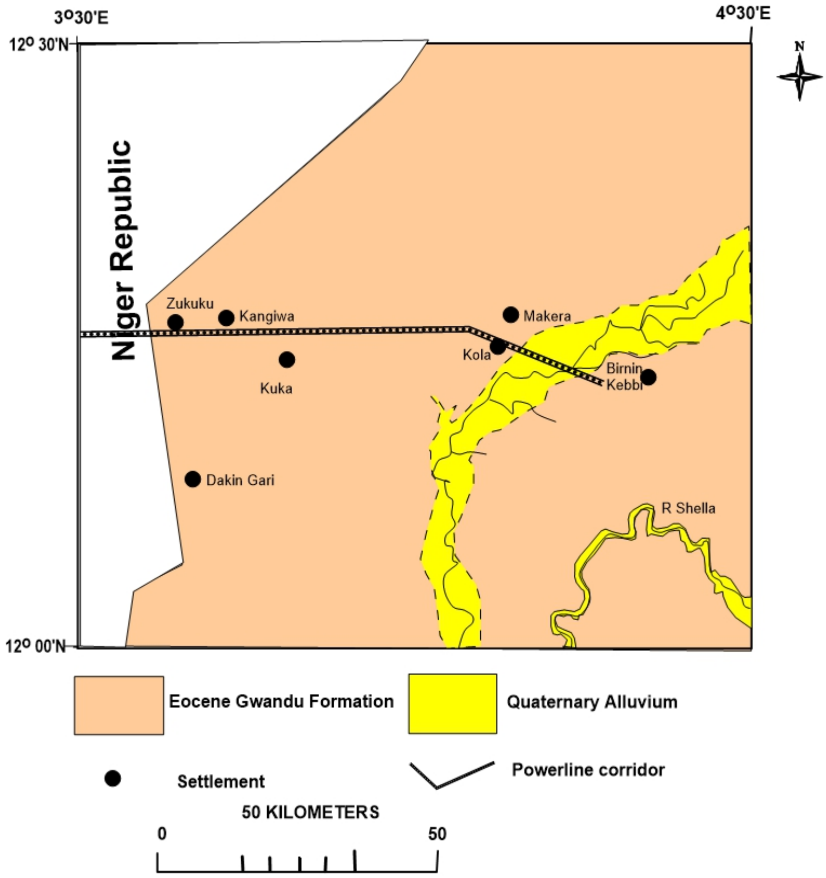


Figure 4-8 Simplified Geological Map of the Study Area (compiled from results of fieldwork and NGSA (2007)

ROCK TYPES

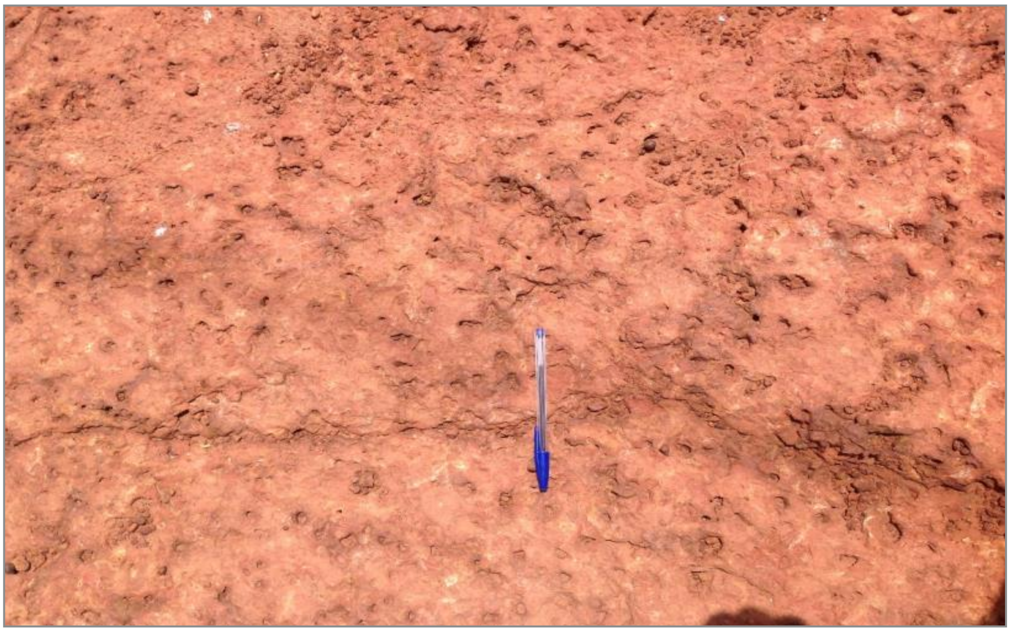
Three types of rock have been observed inside the study area which are the followings:

Lateritic Ironstones

Pisolitic and oolitic ironstones are frequently documented in the study area. Thicknesses of up to 13.5 m have been recorded and the best exposures were observed south of Birnin Kebbi (see Plate 5). They are exposed along the Valley of Dangwaremi River from Yamama to Kalgo. The iron content of the oolitic ironstone from Kalgo varies from 47 to 53% while P_2O_5 content is about 2.6% (Adeleye 1970).

The lateritic ironstones are distinguished into two petrographically distinct types. The first is indurated and the second is not. The indurated variety consists of a fairly large nucleus, surrounded by a small number of envelops (see plate 5). The nucleus ore core is often made up of an oolite fragment. The component grains do not portray any oolitic structure and most of the oolites are fractured. The mineral component of the oolites consists predominantly of goethite with some traces of hematite.

Plate 5 Oolitic Lateritic Ironstones Commonly Observed in the Project Area



Clays

The clays are white in colour and often occur as nodules or roundish “balls” suggesting local turbulence in the depositional environment. The clay which outcrops at Makera, at the outskirt of Birnin Kebbi, forms a bed over 2 m thick, overlain by a thick layer of ferruginised sandstone (see Plate 4). At Kuhau, about 6km southwest of Sokoto on the road to Gumbi, samples of white clay, often stained with iron oxides, belonging to the basal bed of Gwandu formation, were analyzed by the Geological Survey of Nigeria. They were found to be purely kaolinitic (Kogbe 1978).

Ferruginised sandstones

These are primary deposits which have been consolidated by a ferruginised matrix. The cementing material is mostly goethite and hematite. These ferruginised sandstones attained several metres in thickness in the study area. The sandstone consists predominantly of fairly sorted randomly oriented angular to sub angular quartz grains, usually fine to slightly medium in size. The sandstone shows primary sedimentary structures like cross beddings, bioturbation and ripple marks.

STRUCTURES

Analysis of lineaments for the study area indicates that the direction of lineaments tends to lie in NE-SW direction. The lineaments were identified to be of different lengths ranging from 1.7km to 6.2 km. Also when the lineaments were compared with the drainage map of the area, the result shows that the direction of lineaments is inclined towards the direction of the tributaries and valleys.

The sedimentary structures commonly found within the Gwandu formation were documented in the study area (Plate 6). The following structures occur frequently:

1. Outcrops
2. Ripple marks
3. Cross-beddings
4. Graded bedding
5. Bioturbations

Plate 6 Some Sedimentary Structures Associated with Gwandu Formation Observed in the Study Area

Current ripple marks frequently occur at the top of Gwandu formation which is predominantly sandy. The ripple marks are due to unidirectional flow of current. They are elongated transversely along the flow, with regular spaced crests alternating with troughs. With the erosion and denudation of the upper cross bedded outcrops, huge boulders can be observed on the slopes of the hills. Most of these hills show ripple marks which are between 40 and 50 cm in length. The height varies between 0.3 and 0.4 cm. The ripple marks confirm the deposition of non-cohesive small to medium grained sandstone at the terminal stages of the sedimentation of the Gwandu formation. The current was more energetic than those that deposited the predominant silt stones and clays typical to the formation. The sandstones were later ferruginised during post depositional changes.

The rock samples obtained were subjected to sieve analyses at the sedimentology laboratory of the Department of geology Ahmadu Bello University, Zaria. The size fractions of the sediment were determined and subjected to statistical analyses before they were interpreted.

4.1.4 SOILS

4.1.4.1 METHODOLOGY

Literature Review

The literature review was aimed to gather information on soils in the study as well as other components that can influence soils as geology, geomorphology, climate, vegetation, etc. Maps from the Federal Ministry of Agriculture and Land Resources (1990) were exploited.

Preparation of Base Map

Landsat Imageries covering the route line from Birnin Kebbi to the border with Niger were acquired. In addition Digital Elevation Models (DEM) of 10m resolution was also acquired.

Using the DEM in a Geographical Information Service (GIS), environment landform boundaries were identified and drawn for primary units of hills, degraded land, low plains and flood plains. The maps have been digitized and geo-referenced at a scale of 1:25,000.

Contour maps were also derived from the DEM. The maps were digitized and geo-referenced. Similarly, geological maps covering the study area were superimposed on the area.

Land use and land cover maps were produced from Landsat satellite image to include the following:

- → Land use
- → Settlements
- → Drainage Networks (Rivers, Streams)
- → Communication network (roads)

These maps have been digitized and geo-referenced.

From the landform map that was produced from the DEM, Way points were marked (Wp) at 5km interval from the PHCN Sub-station at Birnin Kebbi to the border with Niger following through the proposed new route line for the power line project covering a distance of about 62km. The base maps were produced at a scale of 1:25,000. All the maps were digitized and geo-referenced. The base maps with the way points were transferred to a geographical positioning system (GPS) for detailed field work. The base map is presented as Map 4-3.

Field Studies

The field works were carried out between the 13th and 17th of October, 2015 for the wet season and between December 19th and 20th, 2015 for the dry season. Soil physiographic and morphological properties were determined on-site and soil samples collected for physical, chemical and microbiology analyses in the laboratory.

Soil physiographic and morphological properties, are not easily altered properties that their features may be expected to change within a single wet and dry season cycle. These properties remained the same for both dry and wet seasons.

Soil Mapping

The study area, focusing on the line route, was traversed and mini profile pits were dug at an interval of 5km. At every 10km interval a control mini-profile pit was dug at a distance of 300m away from the line route. Thirteen (13) mini-profile pits were dug along the line route and six (6) control mini-pits off the line route. All the sampling points have been geo-referenced with a geographic positioning system (GPS) and pictures of the surrounding environment.

Soil mapping units corresponding to the way point locations were plotted along the line route on the base map of the study area. On the basis of the geo referenced sampling points, approximate soil boundaries were drawn to fix soil units. The concept of the soil mapping unit is based on soils which share similar morphological, topographical and physical characteristics for the depth, drainage, colour of soil matrix and mottles, texture and structure identified to the soil series. The soil mapping units are not completely homogenous but show some variations with respect to depth, textures and horizon arrangement. A total of three soil units were delineated.

Mini- Profile Pit Description

Mini profile pits were dug to the depth of 30cm. Soils were sampled using systematic horizons at 0 - 15 cm and 15-30 cm depths to establish baseline soil properties data. Soil descriptions were made at both surface and subsurface horizons at 15 cm depth intervals and selected soil morphological characteristics were recorded. The environmental features (local relief in terms of slope, erosion hazard, land use, and extent of vegetation, etc.) at each sampling site were recorded. The soil morphological characteristics recorded included soil depth, colour of soil matrix and mottles (if present), texture, and drainage conditions (FAO, 2006).

Soil Sampling

Two types of soil samples were collected on the field.

- → Disturbed soil samples were collected for laboratory analyses of both physical and chemical properties.

- Undisturbed soil samples were collected using core samplers for bulk density, total porosity and permeability test.

LABORATORY ANALYSIS

Soil Physical and chemical properties

Soil samples collected for dry and wet seasons were analyzed for physical and chemical properties Mifor Consult Laboratory, No. 55, Marian Road, Calabar.

The following parameters were analyzed according to standard procedures recorded in laboratory manuals (IITA, 1979, Page et al., 1982, Klute, 1986).

- Bulk density: The core soil samples were oven dried at 105^{0}C for 24 hours and the bulk density calculated as the weight of soil divided by the volume of the core sampler.
- Total porosity: The total porosity was calculated mathematically from the bulk density values using the formula:

$$T.P\ (\%) = 100\left(1 - \frac{Db}{2.65}\right)$$

Where TP = Total porosity
Db = Bulk density

- Soil permeability was determined using laboratory hydraulic conductivity tests.
- Particle size distribution was determined by hydrometer method and texture was identified using USDA Textural Triangle.
- Soil pH was determined from soil reaction in water and 0.01M $CaCl_2$ solution at 1:1 soil solution ratio.
- Available sulphur using method described in IITA laboratory manual and was determined using spectronic 20 to read the concentrations.
- Total nitrogen by Microkjldahl technique using potassium sulphate as catalyst.
- Available micronutrients (Zn, Fe and Cu) and heavy metals (Ni and Pb) were determined and read by atomic adsorption spectrophotometer (AAS).

4.1.4.2 RESULTS

The study area along the route line is characterized by low-lying dissected plains with risers of old stabilized dunes from aeolian deposits in northern part, flat-topped remnants of older landscapes with ironstone sheets or boulders and low rock-outcrops (Ojanuga, 2006). The Argungu River runs through the study area and drains into Niger River. The soils are situated on relatively flat to gently undulating terrains in the northern part of the zone.

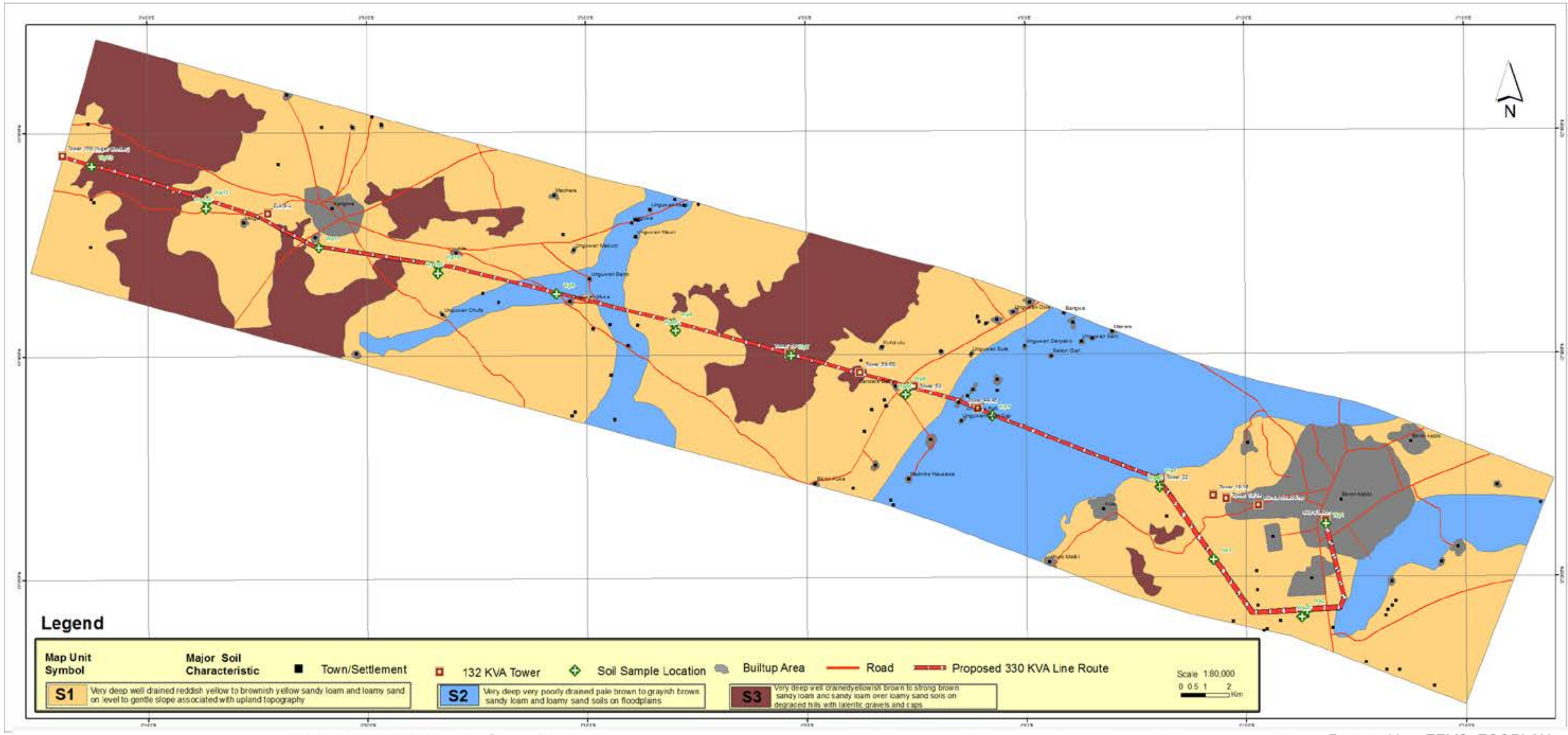
The descriptions of soil mapping unit considers soil mapping unit as a group of closely interrelated soils with similar physiographic and soil morphological properties.

Soils along line route belong to three major soil mapping units namely S1, S2 and S3 which are on (Map 4-3):

- S1: very deep well drained reddish yellow to brownish yellow sandy loam and loamy sand soils on level to gentle slope associated with upland topography.
- S2: very deep very poorly drained pale brown to grayish brown sandy loam and loamy sand soils on floodplains.
- S3: very deep well drained yellowish brown to strong brown sandy loam and sandy loam over loamy sand soils on degraded hills with lateritic gravels and caps.

Three soil mapping units were identified which is more than the earlier study of the Federal Ministry of Agriculture and Land Resources (1990) that grouped the soils along the line route into only two (2) soil mapping units and may be due to the small scale (1:250,000) used in the earlier study by the Federal Ministry of Agriculture and Land Resources. The detailed soil physiographic, morphological, physical and chemical properties are presented in Tables 4-2, 4-3, 4-4 and 4-5 respectively.

Map 4-3 Types of Soils



West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Impact Assessment
Draft Report

Map 4-3 Types of Soils

Prepared by : EEMS, ECOPLAN
Source : EEMS, ECOPLAN

File: Map_4_3_160616

June 2016

Table 4-3 Environmental Characteristics of Sampling Sites

Location Description	Way Point	Coordinate		Topography		Drainage	Erosion	Land Use
		Latitude (º)	Longitude (º)	Position	Gradient (%)			
PHCN Sub-Station B/Kebbi	Wp 1	12.43633	004.19691	Upper - Crest slope	Level (0-2)	Well drained	None	Fallow
Kwamawa	Wp 2C	12.40165	004.18777	Middle slope	Level –nearly level (1-3)	Well drained	None	Millet (maiwa)+ Cowpea
Kwamawa	Wp 2	12.40419	004.18959	Crest	Nearly level (2-3)	Well drained	Slight sheet	Millet – Cowpea
Sabon Gari	Wp 3	12.42327	004.15434	Middle slope	Nearly level – gently slope (2-4)	Well drained	Slight sheet	Fallow + shrubs
Kola	Wp 4	12.45311	004.13339	Floodplain	Level (0-2)	Very poorly dr.	Deposition	Rice
Kola	Wp 4C	12.45037	004.13395	Lower slope	Level (0-2)	Well drained	Deposition	Sorghum + cowpea + millet
Ungwan Dodo	Wp 5	12.47720	004.07039	Floodplain	Level (0-2)	Very poorly dr.	Deposition	Fallow
Sandare	Wp 6	12.48764	004.03852	Middle slope	Level (0-2)	Well drained	None	Sorghum+ Cowpea
Sandare	Wp 6C	12.48509	004.03759	Middle slope	Level (0-2)	Well drained	None	Millet (gero-maiwa)
Ungwan Masoyi	Wp 7	12.49974	003.99419	Crest	Level (0-2)	Well drained	Gullies at edge of crest	Fallow + shrubs
East of U/Musa	Wp 8	12.51191	003.94988	Middle slope	Level (0-2)	Well drained	None	Groundnut + millet + rosselle
East of U/Musa	Wp 8C	12.50924	003.95041	Middle slope	Level (0-2)	Well drained	None	Millet + Cowpea
Ungwan Musa	Wp 9	12.52304	003.90528	Floodplain	Gentle to moderate slope (4-7)	Moderately drained	Sheet	Millet (gero)
Eri	Wp 10	12.53359	003.86055	Crest	Nearly level (1-2)	Well drained	None	Millet – Cowpea+ sorghum
Eri	Wp 10C	12.53090	003.86032	Lower slope	Nearly level (1-2)	Well drained	None	Millet+– Cowpea+ rosselle
Kangiwa	Wp 11	12.54061	003.81509	Upper slope	Undulating (2-4)	Well drained	Slight sheet	Sorghum+ Millet+ Cowpea
Zukuku	Wp 12	12.55796	003.77286	Middle slope	Gentle (2-4)	Well drained	None	Hungry rice
Zukuku	Wp 12C	12.55533	003.77227	Middle- lower slope	Gentle (2-4)	Well drained	None	Fallow, sparse shrubs
Zukuku	Wp 13	12.57112	003.72884	Crest	Level (0-2)	Well drained	Gullies at edge of crest	Dense shrubs

Table 4-4 Morphological Properties of Sampled Soils

Location description	Way point	Sampling depth	Co-ordinate		Structure	Soil colour
			Latitude (º)	Latitude (º)		
PHCN Sub-Station B/Kebbi	Wp 1	0-15	12.43633	004.19691	SG	7.5 YR 6/8 Reddish yellow
PHCN B/Kebbi	Wp 1	15-30	12.43633	004.19691	SG	7.5 YR 6/8 Reddish yellow
Kwamawa	Wp 2C	0-15	12.40165	004.18777	WM	7.5 YR 6/6 Reddish yellow
Kwamawa	Wp 2C	15-30	12.40165	004.18777	SG	7.5 YR 6/6 Reddish yellow
Kwamawa	Wp 2	0-15	12.40419	004.18959	WM	7.5 YR 5/6 Strong brown
Kwamawa	Wp 2	15-30	12.40419	004.18959	SG	7.5 YR 5/6 Strong brown
Sabon Gari	Wp 3	0-15	12.42327	004.15434	WM	7.5 YR 6/6 Reddish yellow
Sabon Gari	Wp 3	15-30	12.42327	004.15434	WM	7.5 YR 6/6 Reddish yellow
Kola	Wp 4	0-15	12.45311	004.13339	WM	10 YR 6/3 Pale brown
Kola	Wp 4	15-30	12.45311	004.13339	WM	10 YR 6/2 Light brownish gray
Kola	Wp 4C	0-15	12.45037	004.13395	WM	10 YR 6/8 Brownish yellow
Kola	Wp 4C	15-30	12.45037	004.13395	SG	10 YR 6/4 Yellowish brown
Ungwan Dodo	Wp 5	0-15	12.47720	004.07039	WM	10 YR 5/2 Grayish brown
Ungwan Dodo	Wp 5	15-30	12.47720	004.07039	SG	10 YR 5/2 Grayish brown with many coarse yellowish red mottles (5 YR 5/6)
Sandare	Wp 6	0-15	12.48764	004.03852	WM	10 YR 6/6 Brownish yellow
Sandare	Wp 6	15-30	12.48764	004.03852	WM	10 YR 6/6 Brownish yellow
Sandare	Wp 6C	0-15	12.48509	004.03759	WM	10 YR 6/6 Brownish yellow
Sandare	Wp 6C	15-30	12.48509	004.03759	WM	10 YR 6/6 Brownish yellow
Ungwan Masoyi	Wp 7	0-15	12.49974	003.99419	FC	10 YR 5/6 Yellowish brown
Ungwan Masoyi	Wp 7	15-30	12.49974	003.99419	FC	7.5 YR 5/6 Strong brown

SG = single grained, WM = weak massive, FC = fine crumbs, WSBK = weak sub angular blocky and M= massive

Table 4-3 Morphological Properties of Sampled Soils (cont'd)

Location description	Way point	Sampling depth	Co-ordinate		Structure	Soil colour
			Latitude (º)	Latitude (º)		
East of U/Musa	Wp 8	0-15	12.51191	003.94988	WM	10 YR 6/6 Brownish yellow
East of U/Musa	Wp 8	15-30	12.51191	003.94988	SG	10 YR 5/8 Yellowish brown
East of U/Musa	Wp 8C	0-15	12.50924	003.95041	WM	10 YR 6/8 Reddish yellow
East of U/Musa	Wp 8C	15-30	12.50924	003.95041	SG	10 YR 5/6 Strong brown
Ungwan Musa	Wp 9	0-15	12.52304	003.90528	WM	10 YR 6/6 Brownish yellow
Ungwan Musa	Wp 9	15-30	12.52304	003.90528	SG	10 YR 5/8 Yellowish brown
Eri	Wp 10	0-15	12.53359	003.86055	WSBK	10 YR 5/4 Yellowish brown
Eri	Wp 10	15-30	12.53359	003.86055	WSBK	10 YR 5/6 Yellowish brown
Eri	Wp 10C	0-15	12.53090	003.86032	WSBK	10 YR 6/6 Brownish yellow
Eri	Wp 10C	15-30	12.53090	003.86032	WSBK-M	10 YR 5/6 Yellowish brown
Kangiwa	Wp 11	0-15	12.54061	003.81509	WM-SG	10 YR 6/8 Brownish yellow
Kangiwa	Wp 11	15-30	12.54061	003.81509	WM	10 YR 5/6 Yellowish brown
Zukuku	Wp 12	0-15	12.55796	003.77286	WM	10 YR 6/6 Brownish yellow
Zukuku	Wp 12	15-30	12.55796	003.77286	SG	10 YR 5/8 Yellowish brown
Zukuku	Wp 12C	0-15	12.55533	003.77227	WM	10 YR 6/6 Brownish yellow
Zukuku	Wp 12C	15-30	12.55533	003.77227	WM	10 YR 5/8 Yellowish brown
Zukuku	Wp 13	0-15	12.57112	003.72884	FC	10 YR 6/4 Light yellowish brown
Zukuku	Wp 13	15-30	12.57112	003.72884	FC	10 YR 5/8 Yellowish brown

SG = single grained, WM = weak massive, FC = fine crumbs, WSBK = weak sub angular blocky and M= massive

Table 4-5 Physical Properties of Sampled Soils

Way point	Depth (cm)	Soil sampling Co-ordinate		Particle size distribution (g kg^{-1})			Soil texture	Bulk density (g kg^{-1})	TP (%)	Wet season mc (%)	Dry season mc (%)	Permeability (cm sec^{-1})
		Latitude (º)	Latitude (º)	Sand	Silt	Clay						
Wp 1	0-15	12.43633	004.19691	780	40	180	SL	1.65	37.7	16.6	3.40	0.04
Wp 1	15-30	12.43633	004.19691	680	120	200	SL	1.63	38.5	16.9	4.20	
Wp 2C	0-15	12.40165	004.18777	620	160	220	SCL	1.62	38.9	4.0	4.70	0.02
Wp 2C	15-30	12.40165	004.18777	600	160	240	SCL	1.48	44.2	5.2	5.60	
Wp 2	0-15	12.40419	004.18959	660	160	180	SL	1.68	36.6	6.4	4.70	
Wp 2	15-30	12.40419	004.18959	700	140	160	SL	1.59	40.0	6.8	5.60	
Wp 3	0-15	12.42327	004.15434	740	120	140	SL	1.72	35.1	5.6	2.40	
Wp 3	15-30	12.42327	004.15434	720	120	160	SL	1.59	40.0	6.4	4.10	
Wp 4	0-15	12.45311	004.13339	780	120	100	SL	1.75	34.0	14.4	10.4	0.03
Wp 4	15-30	12.45311	004.13339	740	120	140	SL	1.67	37.0	18.8	12.6	
Wp 4C	0-15	12.45037	004.13395	700	180	120	SL	1.52	42.6	8.7	4.60	0.01
Wp 4C	15-30	12.45037	004.13395	680	220	100	SL	1.48	44.7	9.2	5.30	
Wp 5	0-15	12.47720	004.07039	680	200	120	SL	1.45	45.3	16.8	7.30	
Wp 5	15-30	12.47720	004.07039	660	220	120	SL	1.61	39.2	18.6	8.50	
Wp 6	0-15	12.48764	004.03852	760	140	100	SL	1.02	61.5	12.7	3.80	0.34
Wp 6	15-30	12.48764	004.03852	720	200	80	SL	1.52	42.6	13.5	6.80	
Wp 6C	0-15	12.48509	004.03759	780	120	100	SL	1.57	40.8	11.4	6.90	
Wp 6C	15-30	12.48509	004.03759	760	120	120	SL	1.49	43.8	12.8	5.70	
Wp 7	0-15	12.49974	003.99419	800	60	140	SL	1.71	35.5	5.8	2.60	
Wp 7	15-30	12.49974	003.99419	820	80	100	LS	1.49	43.8	6.9	1.60	

TP = Total Porosity, MC = Moisture content, Perm. = Permeability, LS = Loamy sand, SL = Sandy loam, SCL = Sandy clay loam.

Note: only moisture content is different for wet and dry season, other properties are the same

Table 4-4 Physical Properties of Sampled Soils (cont'd)

Way point	Depth (cm)	Soil sampling Co-ordinate		Particle size distribution ($g\ kg^{-1}$)			Soil texture	Bulk density ($g\ kg^{-1}$)	TP (%)	Wet season mc (%)	Dry season mc (%)	Permeability ($cm\ sec^{-1}$)
		Latitude (º)	Latitude (º)	Sand	Silt	Clay						
Wp 8	0-15	12.51191	003.94988	820	60	120	LS	1.61	39.2	4.2	3.40	0.01
Wp 8	15-30	12.51191	003.94988	860	60	80	LS	1.45	45.3	6.4	3.60	
Wp 8C	0-15	12.50924	003.95041	800	100	100	SL	1.67	37.0	13.1	3.70	0.24
Wp 8C	15-30	12.50924	003.95041	840	80	80	LS	1.58	40.4	14.3	3.90	
Wp 9	0-15	12.52304	003.90528	820	80	100	LS	1.57	40.8	14.4	6.90	
Wp 9	15-30	12.52304	003.90528	880	40	80	LS	1.55	41.5	14.8	9.60	
Wp 10	0-15	12.53359	003.86055	840	80	80	LS	1.59	40.0	11.8	2.80	0.14
Wp 10	15-30	12.53359	003.86055	800	80	120	SL	1.56	41.1	14.2	3.20	
Wp 10C	0-15	12.53090	003.86032	820	100	80	LS	1.73	34.7	11.3	3.70	0.05
Wp 10C	15-30	12.53090	003.86032	680	180	140	SL	1.12	38.9	13.6	4.20	
Wp 11	0-15	12.54061	003.81509	840	80	80	LS	1.60	39.6	7.4	2.60	
Wp 11	15-30	12.54061	003.81509	820	80	100	LS	1.68	36.6	8.2	3.10	
Wp 12	0-15	12.55796	003.77286	860	60	80	LS	1.54	41.9	4.2	3.40	0.11
Wp 12	15-30	12.55796	003.77286	820	80	100	LS	1.57	40.8	5.4	3.80	
Wp 12C	0-15	12.55533	003.77227	820	100	80	LS	1.68	36.6	4.4	3.20	0.16
Wp 12C	15-30	12.55533	003.77227	860	60	80	LS	1.52	42.6	6.8	3.50	
Wp 13	0-15	12.57112	003.72884	740	120	140	SL	1.83	30.9	4.2	3.20	0.05
Wp 13	15-30	12.57112	003.72884	780	100	120	SL	1.69	36.2	5.7	3.40	

TP = Total Porosity, MC = Moisture content, Perm. = Permeability, LS = Loamy sand, SL = Sandy loam.

Table 4-6 Chemical Properties of Sampled Soils - Wet Season

Way point	Sample code	Depth (cm)	Co-ordinate Latitude (º)	Co-ordinate Latitude (º)	pH H_2O	pH cacl₂	N (g kg^{-1})	S (mgkg⁻¹)	Cu (mgkg⁻¹)	Ni (mgkg⁻¹)	Zn (mgkg⁻¹)	Pb (mgkg⁻¹)	Fe (mgkg⁻¹)
Wp 1	SS-1310-BRK-01	0-15	12.43633	004.19691	6.4	5.2	0.175	2.174	0.231	0.00	6.987	6.154	40.682
Wp 1	SS-1310-BRK-02	15-30	12.43633	004.19691	6.3	5.4	0.175	1.630	0.615	0.00	5.705	6.154	38.409
Wp 2C	SS-1310-BRK-03	0-15	12.40165	004.18777	6.2	5.3	0.175	1.872	0.231	0.00	4.423	6.154	40.682
Wp 2C	SS-1310-BRK-04	15-30	12.40165	004.18777	6.5	5.6	0.140	2.294	0.231	0.00	2.500	6.154	45.227
Wp 2	SS-1310-BRK-05	0-15	12.40419	004.18959	6.3	5.4	1.050	2.113	0.615	0.00	3.141	6.154	63.409
Wp 2	SS-1310-BRK-06	15-30	12.40419	004.18959	6.6	5.5	0.210	3.441	0.615	0.00	3.782	6.154	61.136
Wp 3	SS-1310-BRK-07	0-15	12.42327	004.15434	6.7	5.6	0.210	22.64	0.231	0.00	3.782	6.154	36.136
Wp 3	SS-1310-BRK-08	15-30	12.42327	004.15434	6.4	5.7	0.210	2.958	0.231	0.00	1.859	6.154	31.591
Wp 4	SS-1310-BRK-09	0-15	12.45311	004.13339	6.3	5.4	0.170	3.623	0.615	0.00	3.782	6.154	152.05
Wp 4	SS-1310-BRK-10	15-30	12.45311	004.13339	6.5	5.6	0.070	4.468	0.615	0.00	3.782	6.154	95.227
Wp 4C	SS-1310-BRK-11	0-15	12.45037	004.13395	6.4	5.5	0.105	7.909	0.231	0.00	4.423	6.154	47.50
Wp 4C	SS-1310-BRK-12	15-30	12.45037	004.13395	6.7	5.6	0.035	5.796	0.231	0.00	5.064	6.154	49.773
Wp 5	SS-1410-KLG-01	0-15	12.47720	004.07039	6.8	5.7	0.245	3.804	1.000	0.00	5.064	6.154	197.50
Wp 5	SS-1410-KLG-02	15-30	12.47720	004.07039	6.5	5.4	0.245	17.75	0.615	0.00	3.782	6.154	167.96
Wp 6	SS-1410-KLG-03	0-15	12.48764	004.03852	6.6	5.3	0.140	3.140	0.231	0.00	3.141	2.308	31.591
Wp 6	SS-1410-KLG-04	15-30	12.48764	004.03852	6.4	5.7	0.140	3.264	0.615	0.00	3.782	2.308	45.227
Wp 6C	SS-1410-KLG-05	0-15	12.48509	004.03759	6.5	5.4	0.350	3.140	0.615	0.00	5.064	2.308	56.591
Wp 6C	SS-1410-KLG-06	15-30	12.48509	004.03759	6.3	5.2	0.140	3.502	0.231	0.00	3.141	6.154	40.682
Wp 7	SS-1410-KLG-07	0-15	12.49974	003.99419	6.2	5.1	0.070	5.313	0.231	0.00	3.050	6.154	38.409
Wp 7	SS-1410-KLG-08	15-30	12.49974	003.99419	6.4	5.3	0.105	3.562	0.231	0.00	3.050	6.154	36.136

N: Nitrogen, S: Sulphur, Cu: Copper, Ni: Nickel, Zn: Zinc, Pb: Lead, Fe: Iron.

Table 4-5 Chemical Properties of Sampled Soils – Wet Season (cont'd)

Way point	Sample code	Depth (cm)	Co-ordinate		pH H_2O	pH $cacl_2$	N (g kg^{-1})	S	Cu	Ni	Zn	Pb	Fe
			Latitude (°)	Latitude (°)				(mgkg^{-1})					
Wp 8	SS-1410- KLG-09	0-15	12.51191	003.94988	6.3	5.5	0.105	3.502	0.231	0.00	3.050	6.154	36.136
Wp 8	SS-1410- KLG-10	15-30	12.51191	003.94988	6.1	5.0	0.105	3.743	0.231	0.00	5.064	6.154	61.136
Wp 8C	SS-1410- KLG-11	0-15	12.50924	003.95041	6.2	5.1	0.035	4.045	0.231	0.00	3.782	6.154	63.409
Wp 8C	SS-1410- KLG-12	15-30	12.50924	003.95041	6.4	5.3	0.070	3.985	0.615	0.00	10.08	2.308	70.682
Wp 9	SS-1410- KLG-13	0-15	12.52304	003.90528	6.5	5.4	0.070	5.313	2.154	0.00	9.551	2.308	90.682
Wp 9	SS-1410- KLG-14	15-30	12.52304	003.90528	6.3	5.2	0.035	4.347	0.615	0.00	1.559	2.308	77.045
Wp 10	SS-1510-ARW-01	0-15	12.53359	003.86055	6.2	5.3	0.070	6.097	0.615	0.00	12.15	2.308	49.773
Wp 10	SS-1510-ARW-02	15-30	12.53359	003.86055	6.6	5.5	0.105	4.045	0.615	0.00	4.423	6.154	52.045
Wp 10C	SS-1510-ARW-03	0-15	12.53090	003.86032	6.7	5.6	0.070	3.804	0.231	0.00	3.782	2.308	45.227
Wp 10C	SS-1510-ARW-04	15-30	12.53090	003.86032	6.4	5.3	0.070	4.528	0.231	0.00	3.141	2.308	52.045
Wp 11	SS-1510-ARW-05	0-15	12.54061	003.81509	6.5	5.2	0.070	5.373	0.615	0.00	13.40	6.154	54.318
Wp 11	SS-1510-ARW-06	15-30	12.54061	003.81509	6.3	5.1	0.070	4.287	0.615	0.00	28.14	6.154	56.591
Wp 12	SS-1510-ARW-07	0-15	12.55796	003.77286	6.2	5.3	0.070	3.502	0.615	0.00	3.782	2.308	49.773
Wp 12	SS-1510-ARW-08	15-30	12.55796	003.77286	6.0	5.2	0.105	3.864	0.231	0.00	1.859	6.154	52.050
Wp 12C	SS-1510-ARW-09	0-15	12.55533	003.77227	6.1	5.4	0.070	3.683	0.231	0.00	3.782	2.308	40.682
Wp 12C	SS-1510-ARW-10	15-30	12.55533	003.77227	6.3	5.2	0.105	6.822	0.615	0.00	3.141	6.154	38.410
Wp 13	SS-1510-ARW-11	0-15	12.57112	003.72884	6.2	5.3	0.105	4.106	1.000	0.00	8.629	6.154	127.04
Wp 13	SS-1510-ARW-12	15-30	12.57112	003.72884	6.1	5.2	0.070	4.106	0.615	0.00	3.782	6.154	86.136

N: Nitrogen, S: Sulphur, Cu: Copper, Ni: Nickel, Zn: Zinc, Pb: Lead, Fe: Iron.

Table 4-7 Chemical Properties of Sampled Soils – Dry Season

Way point	Depth (cm)	Co-ordinate		pH	pH	N	S	Cu	Ni	Zn	Pb	Fe
		Latitude (º)	Latitude (º)	H_2O	$cacl_2$	(g kg^{-1})	←		(mgkg^{-1})			→
Wp 1	0-15	12.43633	004.19691	6.4	5.3	0.070	0.121	0.86	0.00	3.18	0.00	14.04
Wp 1	15-30	12.43633	004.19691	6.4	5.2	0.070	0.060	0.94	0.00	2.73	0.00	14.04
Wp 2C	0-15	12.40165	004.18777	6.5	5.4	0.175	0.060	0.86	0.00	3.66	0.00	9.64
Wp 2C	15-30	12.40165	004.18777	6.4	5.3	0.070	0.060	0.86	0.00	3.18	0.00	12.66
Wp 2	0-15	12.40419	004.18959	6.2	5.1	0.175	0.060	0.77	0.00	2.73	0.00	19.53
Wp 2	15-30	12.40419	004.18959	6.5	5.3	0.070	0.060	0.77	0.00	2.73	0.00	16.76
Wp 3	0-15	12.42327	004.15434	6.4	5.3	0.175	0.060	0.87	0.00	2.73	0.00	14.04
Wp 3	15-30	12.42327	004.15434	6.3	5.1	0.070	0.060	0.77	0.00	2.31	0.00	8.76
Wp 4	0-15	12.45311	004.13339	6.5	5.3	0.105	1.650	0.77	0.00	2.73	0.00	101.31
Wp 4	15-30	12.45311	004.13339	6.6	5.4	0.105	2.600	0.77	0.00	2.73	0.00	31.12
Wp 4C	0-15	12.45037	004.13395	6.4	5.2	0.070	0.181	0.86	0.00	2.73	0.00	14.04
Wp 4C	15-30	12.45037	004.13395	6.3	5.1	0.070	0.363	0.86	0.00	3.18	0.00	14.04
Wp 5	0-15	12.47720	004.07039	6.4	5.3	0.070	5.190	0.77	0.00	2.73	0.00	117.8
Wp 5	15-30	12.47720	004.07039	6.3	5.2	0.070	2.900	0.77	0.00	2.73	0.00	113.6
Wp 6	0-15	12.48764	004.03852	6.3	5.2	0.035	0.084	0.77	0.00	2.73	0.00	14.04
Wp 6	15-30	12.48764	004.03852	6.2	5.1	0.105	0.483	0.77	0.00	2.31	0.00	14.04
Wp 6C	0-15	12.48509	004.03759	6.5	5.4	0.105	0.181	0.86	0.00	2.73	0.00	8.76
Wp 6C	15-30	12.48509	004.03759	6.4	5.2	0.070	0363	0.94	0.00	3.18	0.00	9.64
Wp 7	0-15	12.49974	003.99419	6.4	5.3	0.105	0.483	1.63	0.00	3.18	0.00	22.35
Wp 7	15-30	12.49974	003.99419	6.5	5.3	0.070	0.363	0.77	0.00	2.73	0.00	16.76

N: Nitrogen, S: Sulphur, Cu: Copper, Ni: Nickel, Zn: Zinc, Pb: Lead, Fe: Iron.

Table 4-6 Chemical Properties of Sampled Soils – Dry Season (cont'd)

WAY POINT	DEPTH (CM)	CO-ORDINATE Latitude (º)	Latitude (º)	PH H_2O	PH $CACL_2$	N (G KG^{-1})	S	CU	NI	ZN	PB	Fe
							←		(mgkg^{-1})		→	
Wp 8	0-15	12.51191	003.94988	6.5	5.3	0.105	1.423	0.86	0.00	2.73	0.00	8.76
Wp 8	15-30	12.51191	003.94988	6.5	5.2	0.105	1.423	0.86	0.00	3.18	0.00	23.24
Wp 8C	0-15	12.50924	003.95041	6.5	5.4	0.175	1.419	0.86	0.00	2.82	0.00	24.74
Wp 8C	15-30	12.50924	003.95041	6.4	5.2	0.070	1.419	0.94	0.00	3.34	0.00	29.58
Wp 9	0-15	12.52304	003.90528	6.5	5.6	0.105	5.310	1.23	0.00	3.30	0.00	42.88
Wp 9	15-30	12.52304	003.90528	6.4	5.4	0.105	4.350	0.94	0.00	2.64	0.00	33.82
Wp 10	0-15	12.53359	003.86055	6.5	5.3	0.070	1.400	0.94	0.00	3.52	0.00	15.68
Wp 10	15-30	12.53359	003.86055	6.4	5.1	0.070	1.418	0.94	0.00	2.88	0.00	17.20
Wp 10C	0-15	12.53090	003.86032	6.4	5.2	0.105	1.421	0.86	0.00	2.82	0.00	12.66
Wp 10C	15-30	12.53090	003.86032	6.4	5.3	0.175	1.414	0.86	0.00	2.77	0.00	17.20
Wp 11	0-15	12.54061	003.81509	6.5	5.2	0.105	0.163	0.77	0.00	6.63	0.00	14.04
Wp 11	15-30	12.54061	003.81509	6.5	5.4	0.105	0.121	0.77	0.00	3.66	0.00	14.04
Wp 12	0-15	12.55796	003.77286	6.4	5.3	0.210	0.483	0.77	0.00	2.73	0.00	16.76
Wp 12	15-30	12.55796	003.77286	6.6	5.4	0.105	0.181	0.77	0.00	2.73	0.00	11.38
Wp 12C	0-15	12.55533	003.77227	6.4	5.3	0.175	0.483	0.86	0.00	2.82	0.00	14.04
Wp 12C	15-30	12.55533	003.77227	6.4	5.4	0.105	0.181	0.94	0.00	2.73	0.00	11.38
Wp 13	0-15	12.57112	003.72884	6.6	5.7	0.175	0.363	1.63	0.00	3.18	0.00	34.14
Wp 13	15-30	12.57112	003.72884	6.3	5.5	0.175	0.363	1.63	0.00	2.31	0.00	25.22

N: Nitrogen, S: Sulphur, Cu: Copper, Ni: Nickel, Zn: Zinc, Pb: Lead, Fe: Iron.

SOIL UNIT S1 PROPERTIES

Soil Physiographic and Morphological Properties

Soil unit S1 covered large portion of the line route within the upland study area. This soil unit was very deep with a soil depth without restrictions within the first 150 cm. The soil is well drained and occupies crest to lower slope position. The areas within this slope position were leveled to nearly leveled (0-2%) with some gentle slope (2-4%). The soils ranged between reddish yellow, strong brown and brownish yellow, with yellowish brown colour underlying most of the surface horizons. The soils consist of structureless materials that were single grain or weak massive with sandy loam and loamy sand textures.

Some parts of soil unit 1 that were characterized by less vegetation and were prone to the prevailing north east wind during the dry season resulted in some form of wind erosion.

Physical Properties

Sand dominated particles size fraction within soil unit S1 has a content values ranging from 600 to 860 g kg^{-1}, which slightly decreased from surface to subsurface horizon. Silt content varied between 40 and 220 g kg^{-1} and the values were mostly similar between surface and subsurface horizon. Clay content ranged between 80 and 240 g kg^{-1}in the soils and tended to increase slightly from surface to subsurface horizon.

The bulk density values ranged between 1.02 and 1.73Mg m^{-3}. The bulk density of the surface soils were mostly greater than the subsurface horizons, and rated low to high. The greater values observed in the surface horizon might be due to crust formation, human and animal traction causing soil compaction. Reciprocally, the total porosity of the soils was mostly greater in the surface horizons than in the subsurface horizons with values ranging between 34.7 and 61.5%.

Moisture content during the dry season decreased to a range between 2.4 and 6.8%. The sandy loam and loamy sand textured material contributed to the rapid drainage of moisture to deeper soil horizon as well as the emergence of the north east wind (dry Harmattan wind). Soil permeability was mostly high with values ranging from 0.01 to 0.34 cm sec^{-1}, and might be associated with the medium to coarse textural material of the soils.

Chemical Properties

The wet and dry season chemical properties of the soil are presented in Tables 4-5 and 4-6 respectively. Soil pH varied between slightly acid to neutral and the values ranged between 6.2 and 6.7. The soil pH is within range of most nutrient availability for crops. The soil reaction is within range reported for the rainy season. The soil of this unit may not likely develop salinity or sodicity as the pH values are quite low and well drained. The soil pH for both dry and wet seasons are within safe limits and therefore no toxicity associated with soil acidity or sodicity is expected within this soil unit.

Macronutrients nitrogen (NO_3-N) and sulphur content of the soils varied from 0.035 to 0.210 g kg^{-1} and 0.06 to 1.423 mg kg^{-1} respectively. The values were rated low or deficient for both nitrogen and sulphur. Both nitrogen and sulphur varied irregularly with increased soil depth. Agricultural crop productions contributed to the depletion of both nitrogen and sulphur as crops consume nutrients for their growth.

The heavy metals analyzed included copper (Cu), nickel (Ni), zinc (Zn), lead (Pd) and iron (Fe). Copper, zinc and iron are also considered as micronutrients as they are essentially required for crop growth and development. The content of Cu, Zn and Fe in soils from the soil unit 1 varied between 0.77 and 0.94 mg kg^{-1}, 2.31 and 6.63 mg kg^{-1} and 8.76 and 29.58 mg kg^{-1}respectively. The values of the micronutrients were rated as medium for Cu and high for Zn and Fe for the purpose of crop production. The toxicity or pollution values have not attained or exceeded the critical desirable limits for pollution within soil (Kabata-Pendias, 2011; Alloway, 1995). The values of nickel and lead were of 0.00 mg kg^{-1} for all the soils sampled within this unit and are considered to be very rare in the soils. This may be associated with the nature of parent materials from which the soil was formed and could be attributed to the high sand and low clay content that may affect retention of the trace amount of Ni and Pb on the exchange sites.

Land Use

Generally, land use within the upland areas along the line route was fallow land, extensively or intensively cultivated land. Few areas were used for community structures within Birnin Kebbi, Sandare and Ungwan Musa. The crops were either cultivated as single crop of hungry rice at Sandare (WP 6C) and Zukuku (WP 12). Mixed cropping includes the cultivation of millet (gero, maiwa), sorghum, cowpea, groundnut and rosselle, whereas multiple cropping involved millet (gero) and cowpea cultivation. However, during the dry season animals were notably grazed on the crop left-over.

SOIL UNIT S2 PROPERTIES

Soil Physiographic and Morphological Properties

The soil unit S2 (Floodplain) showed a significant surface change between rainy and dry seasons, as the soil unit is massively inundated during rainy season between Kola and Ungwan Dodo (WP 4 and WP 5) and drastically drained by December exposing the soils during the dry season (Plate 7a, 7b, 8a and 8b).

Plate 7a Soil Unit 2 (Floodplain soils) land surface around WP 4 showing rice and inundated portions patchesduring rainy season.

Plate 7b Soil Unit 2 (Floodplain soils) no longer submerged during dry season, but only of water within river bed around WP 4.

Plate 8a Soil Unit 2 (Floodplain soils) around WP 5 inundated during rainy season.

Plate 8b Soil Unit 2 (Floodplain soils) no longer submerged during dry season, but only patches of water within river bed around WP 5

The soils within floodplain (S2) along the line route were very deep (>150cm) situated on level to nearly level (0 – 2%) ground on lower slope to floodplain. The soil unit was, very poorly to moderately, drained with weak massive over single grain materials (WP 4 at Kola, WP 5 at Ungwan Dodo and WP 9 at Ungwan Musa). The soils were dominated by sandy loam and loamy sand textured materials. The soils varied from pale brown to grayish brown colours with many coarse yellowish red mottles in the subsoil horizons.

Physical Properties

The soils of unit S2 were enriched by deposited material eroded from the surrounding plains and sand values ranging between 660 to 880 g kg^{-1} in the soils which slightly decreased from surface to subsurface horizons. Silt varied between 40 and 200 g kg^{-1} and there was no clear trend of silt distribution between surface and subsurface horizons. Clay content ranged between 80 and 140 g kg^{-1}in the soils. There was no clear trend of distribution of clay material between surface and subsurface horizons. This might be attributed to continuous deposition of materials through colluvial and alluvial processes resulting in soil stratification.

The bulk density values ranged between 1.45 and 1.75Mg m^{-3} in the soil. The bulk density values varied inconsistently between the surface and subsurface horizons, and rated medium to high. Total porosity of the soils varied between 34.0 and 45.3%.

The dry season moisture content varied between 6.9 and 12.6% and the soil permeability value was found to be 0.03cm sec^{-1}. Moisture content of samples from the dry season slightly decreased compared to samples from the rainy season, and may be attributed to poorly drained status of the floodplain soils as well as irrigation practice.

Chemical Properties

Soils of unit S2 were slightly acid to neutral, and the values of pH between rainy season and dry season were similar ranging between 6.3 and 6.6 for the soils. The soil pH is within range of most nutrient availability for crops. The soils may not likely develop salinity or sodicity in the near future as the pH values were quite low and the sand content was high to permit leaching of any excess salt.

The contents of macronutrient nitrogen and sulphur in the soils during dry season respectively ranged from 0.070 to 0.105 g kg^{-1} and from 2.60 to 11.65 mg kg^{-1}. The values were rated low for nitrogen and sufficient for sulphur. The high sulphur content observed may be associated with interaction between reduced (soluble) Fe and S that usually occur under redoximorphic state (water-logging condition), though the values decreased with aeration during the dry season due to change from ferrous to ferric form.

The content of Cu, Zn and Fe in soils of unit S2 varied between 0.77 and 1.23 mg kg^{-1}, 2.31 and 3.30 mg kg^{-1} and 31.12 and 117.80 mg kg^{-1} respectively. The values of the micronutrients were rated as medium to high for Cu and high for Zn and Fe. The floodplain soil unit (S2) had the highest amount of Fe along the line route. This may be attributed to release soluble Fe under reduced condition. The soil unit is considered not toxic or polluted with regards to Cu, Zn and Fe as the values have not attained or exceeded the critical desirable limits within soils (Kabata-Pendias, 2011; Alloway, 1995). The dry season values of nickel and lead were determined as 0.00 mg kg^{-1} for all the soils and considered to be very rare. This may be associated with the nature of parent material from which the soil was formed. Therefore, at present there is no toxicity or pollution associated with Ni and Pb in soils of this unit. Lead content was observed to decrease drastically to virtually rare quantity during the dry season.

Land Use

Swampy rice is the main crop grown in the floodplain. Irrigation is practiced during dry season with cultivation of vegetables such as onion, tomato, sweet pepper and spinach along with wheat and rice (Plate 9). Some portions were left fallow or used for sand mining. Fishing activities were observed within the river bed portion containing water.

Plate 9 Soil Unit 2 (Floodplain soils) used for irrigated cultivation of wheat, sweet pepper and onion around WP 4

SOIL UNIT S3 PROPERTIES

Soil Physiographic and Morphological Properties

Soil unit S3 was located on the crest of degraded hills with lateritic gravels and caps. It did not show significant changes in its surface properties between the rainy and dry seasons. The hills were leveled (0-2%) with edges that show gentle to moderate slopes (4 – 7%) contributing to rill and gully erosions observed at Ungwan Masoyi (between WP 6 and WP 7, and surrounding WP 7) and west of Zukuku (west of WP 12 to west of WP 13) in the rainy season. Areas on level slope with bare surface were exposed to wind erosion during the dry season as the north east trade wind was prevalent during the period. Strong to steep slopes were observed at boundary between soil units S3 and S1, and were associated with gullies. The soil unit was found to be very deep (>150cm) well drained with fine crumb structureless material that ranged between yellowish brown and strong brown. The soils consist of gravelly sandy loam and sandy loam over loamy sand texture.

Physical Properties

The content of sand within soil unit S3 ranged between 740 and 820 g kg^{-1}. The content slightly increased from surface to subsurface horizons. Silt values ranged between 60 and 120 g kg^{-1} and there was no clear trend of silt distribution between surface and subsurface horizons. Clay content ranged between 100 and 140 g kg^{-1} and tended to decrease from surface to subsurface horizons.

The bulk density values ranged between 1.49 and 1.83 Mg m^{-3}. The bulk density of the surface soils were mostly greater than the subsurface horizons, and rated high. The greater values observed in the surface horizon might be due to petroplinthite formation and animal traction causing soil compaction. Reciprocally, the total porosity of the soils was greater in the subsurface horizons than the surface horizons with values ranging between 30.9 and 43.8%. The values of total porosity were considered low and may be attributed to the lateritic nature of the soil and animal traction observed on the soil unit during the soil sampling period.

The moisture content for samples, from dry season, slightly reduced compared to the ones from rainy season, with values ranging between 1.60 and 3.40% with soil permeability of 0.05 cm sec^{-1}. The low amount of moisture in S3 unit may be attributed to the seizure of rain.

Chemical Properties

The dry season pH of soil unit S3 slightly increased with values ranging between 6.3 and 6.6, indicating slightly acid to neutral reaction for the soils. The soil reaction is within range of most nutrient availability for crops. The slight increase in pH may be attributed to the decrease in Fe content which contributes to exchange acidity property of soils.

The content of macronutrients nitrogen and sulphur in the soils during the dry season varied from 0.07 to 0.175 g kg^{-1} and 0.363 to 0.483 mg kg^{-1} respectively. The values were rated low for both nitrogen and sulphur, thus indicating their deficiency in this unit for crop production. The values of sulphur were observed to decrease during the dry season and it may be associated with Fe reduction in the soils as iron and sulphur distribution trends were similar in the soils along the route line.

The content of Cu, Zn and Fe in soils of unit S3 varied between 0.77 and 1.63 mg kg^{-1}, 2.31 and 3.18mg kg^{-1} and 16.76 and 34.14 mg kg^{-1} respectively. The values of the micronutrients were rated as medium to high for Cu, and high for Zn and Fe as nutrients required for crop production. The slightly high amount of Fe in this unit compared to unit S1 is associated with the petroplinthite and was evident with scattered lateritic gravels and caps within the soil unit. The soil unit is considered not toxic or polluted with regards to Cu, Zn and Fe as the values have not attained or exceeded the critical desirable limits within soils (Kabata-Pendias, 2011; Alloway, 1995). The values of nickel and lead were determined as 0.00 mg kg^{-1} for all the soils and thus considered to be very rare. This may be associated with the nature of parent materials from which the soil was formed. Therefore, the soil unit is not currently polluted by nickel and lead. Lead was observed to decrease to rare content between the rainy to dry seasons and that may be attributed to moisture reduction.

Land Use

The land use within the hill areas (S3) along the line route were fallow and regenerated forests with shrubs in some areas and sparse shrubs in other areas. The fallow and regenerated forests might have contributed to the organic matter in to the soils and to stabilization of the soils within soil unit S3 against erosion within the level areas. Livestock rearing is an important activity of the people, especially Fulanis, on the soils of this unit. Some of the animals reared include cattle, goat, sheep and camel (Ojanuga, 2006).

4.1.5 GROUNDWATER

4.1.5.1 METHODOLOGY

The Council of Mining Engineers and Geoscientist (COMEG) guideline was employed during the study. This guideline ensured data and samples were collected in accordance with agreed requirements using the best available equipment, materials and personnel. The methodology used for conducting the study was broadly categorized into three i.e. literature review, fieldwork and laboratory studies.

LITERATURE REVIEW

Literature review pertaining to the study area was undertaken on relevant studies on the geological features of the area. Materials reviewed included textbooks, reports, survey maps, articles and journals. Outside sources of information used in this report consisted of geological and other reports available in the public record and from private corporate files. Where cited, references are referred to in the text.

FIELDWORK

Fieldwork was undertaken to verify information obtained from the literature review and also obtain samples of groundwater and other geological data for further studies. All sampling positions were referenced using the geographical coordinates captured with handheld GPS. Field sampling methods and laboratory procedures are consistent with established methodologies.

SAMPLING

Fifteen representative underground water samples were obtained for the laboratory analysis (the sampling locations are given in appendix 2). The distribution of sampling points was designed in such a way as to ensure a good characterization of all accessible groundwater. Four Local Government Areas, (LGA) of Arewa, Kalgo, Dandi and Birnin Kebbi within which the transmission line traversed, were covered during the sampling.

At each sampling point, 1 litre of water was sampled for major elements, and an additional 120 ml of water for trace element analyses were obtained (Plate 10). Before water sampling, the plastic water containers used were thoroughly washed and later rinsed with distilled water. Water samples for trace element analyses were acidified with a drop of 10% HNO3 to prevent absorption on the walls of the containers.

LABORATORY ANALYSIS

A total of fifteen water sampling points were selected for this study of determination of ground water quality (the details of the sampling locations are given in appendix 2). Groundwater was obtained from fifteen sampling points from existing boreholes and open wells in the following communities: Birnin Kebbi, Kola, Sandare, Kutu-Kullu, Kuka, Unguwan Muza, Mahuta, Eri, Kangiwa and Zukuku within Birnin Kebbi, Kalgo, and Arewa/Dandi Local Government Area of Kebbi State of Nigeria. In-situ measurements were taken for pH, Conductivity (C), Total Dissolved Solids (TDS) and temperature for each of the fifteen samples collected. Subsequently, laboratory groundwater analyses were undertaken at the laboratory of the Department of Water Resources Engineering, Usman Danfodio University, Sokoto, Nigeria. The groundwater quality parameters obtained are the cations; Pb, K, Na, Mg, Ca, Zn, etc. and anionic concentrations; carbonate (CO_3^{2}-), bicarbonate (HCO^{3-}) sulphate (SO_4^{2}-), nitrate (NO^{3-}), chloride (Cl-) etc. were also obtained. Additional physical water quality parameters such as hardness, biological oxygen demand were also obtained. Table 4-7 is a summary of the ground water quality parameters obtained and the detail results are given in appendix 2.

Plate 10 Groundwater Sampling at a Concrete Lined Well Along the Project Corridor at Eri, Kangiwa

4.1.5.2 RESULTS

AQUIFER CHARACTERISTICS

Four main aquiferous zones, separated from each other by various thicknesses of clays, are known in Kebbi State. They are designated as Upper Zone I, Upper Zone II, Middle Zone and Lower Zone (Oteze, 1971). The recharge areas for all the aquifers are in the eastern side of Birnin-Kebbi.

Upper Zone I is exposed to recharge over almost all its surface areas. The aquifers are the most important source of potable water in the northern part of Kebbi State. This is evidenced by the high ratio of successful boreholes drilled into the formation within Birnin- Kebbi.

Generally, the depth of the water table ranges between 7 m and 30 m below ground level (Offodile, 1992). The aquifer extends to depths of about 220 m below ground level with yields of up to 6,480 L/hr/m. This is attributed to the permeability of the soil in the study area, and the recharge of the aquifer by groundwater as it flows continuously in a seaward regional pattern (Offodile, 1992).

The most important part of the Gwandu formation in the study area with respect to ground water is a sandy zone in the basal section that, where traced at depth, forms the most extensive and productive artesian aquifer yet identified in the Sokoto basin. This sandy zone thickens from only 12m in Gwandu to several hundred meters at Balle. In outcrop, it forms a sandy blanket on the Kalambaina formation that underlies a wide plain from Sokoto to Illela. An exploited artesian aquifer was documented in Kutu-Kullu within the study area.

Recharge to the shallow groundwater in the Gwandu is by direct infiltration from precipitation as well as by seepage from the streams while in flood during the rainy season. Also, there is some upward leakage from the deeper Gwandu artesian aquifer.

During the rainy season, as the shallow groundwater is replenished, the water table rises, reaching a seasonal high between the months of September and January. Through the following dry season, the water table declines until the beginning of the rains in June. The seasonal fluctuations of the water table measured in 12 observation wells tapping shallow ground water in the Gwandu during 1965-66 ranged from 0.5 to 10m during the year, the average being 3.3m (Kogbe 1978).

GROUNDWATER QUALITY

The physico-chemical and heavy metals composition of the groundwater samples in the study area are presented in Table 4-7 and the detailed results are given in appendix 2.

pH

The pH is an important variable in water quality assessment as it influences many biological and chemical processes and all processes associated with water supply and treatment. In unpolluted waters, pH is principally controlled by the balance between the carbon dioxide, carbonate and bicarbonate ions.

The recorded pH values in groundwater samples from the study area ranged from 5.3 to 7.3 with a mean of 6.39 for the dry season while the wet season values range from 4.7 to 7.3 with a mean value of 6.25. These values are within established pH ranges for freshwaters. The pH values for the groundwater in the study area was mainly slightly acidic neutral and slightly alkaline pH values respectively. The pH of most natural groundwater is between 6.0 and 8.5, although lower can occur in dilute waters high in organic content, and high values in eutrophic waters, groundwater brines and salt lakes (Todd and Larry, 2005).The observed pH is within the WHO 2007 limits for drinking water and respects also the range of the National Environmental Regulations, S.I. No 22, 2011 in Nigeria.

Turbidity

Turbidity in water is caused by suspended particles or colloidal matter that obstructs light transmission through the water. It may be caused by inorganic or organic matter or a combination of both (WHO 2007). Turbidity in some groundwater sources is a consequence of inert clay or chalk particles or of the precipitation of non-soluble reduced iron and other oxides when water is pumped from anaerobic waters.

The groundwater turbidity values ranged from 0.4 to 0.80 NTU with an average of 0.52 NTU for dry season while values for wet season ranged from 0.40 to 0.80 NTU with an average of 0.53 NTU. This is relatively low and above the recommended limit of 5 NTU for freshwater. The mean groundwater turbidity values for both wet and dry seasons have turbidity levels far below maximum specifications of WHO (2007) being maximum of 5NTU. This suggests the presence of non-polluted ground water in the area.

Table 4-8 Summary of Groundwater Quality in the Study Area

S/n	Parameters	Dry			Wet			WHO 2007	National Environmental Regulations, S.I. No 22, 2011
		Mean	Min	Max	Mean	Min	Max		
1	Turbidity	0.52	0.4	0.8	0.53	0.4	0.8		
2	Hardness	48.13	40	65	48.13	40	65	5	
3	Cond	1034.27	755	1420	1021.93	750	1480	1000	
4	TDS (mg/L)	6.6	4	12	3.27	1	8		1500
5	COD	45.51	35.7	58.2	47.05	33	66.1		
6	pH	6.39	5.3	7.3	6.25	4.7	7.3	6.5-8.5	6.5-9.2
7	DO	9.29	6.7	14.5	9.29	6.5	14.5	500	
8	BOD	34.41	24.8	44.4	35.25	24.8	54.1		
9	Cu (mg/L)	0.12	0.08	0.15	0.12	0.1	0.15	1.0	1.5
10	Cr (mg/L)	0.03	0	0.07	0.03	0.02	0.1	0.05	
11	Pb (mg/L)	0.01	0	0.03	0.01	0.01	0.02		
12	Zn (mg/L)	0.11	0.09	0.14	0.11	0.1	0.12		15
13	Na (mg/L)	1.38	0.23	2.73	1.38	0.2	2.7	200	
14	K (mg/L)	3.12	0.12	9.78	3.12	0.1	9.8		
15	Ca (mg/L)	0.48	0.27	0.68	0.48	0.25	0.65	200	200
16	Mg (mg/L)	0.22	0.12	0.47	0.23	0.15	0.45		0.5
17	P (mg/L)	0.12	0.09	0.18	0.13	0.12	0.15		
18	Fe (mg/L)	0.34	0.21	0.55	0.35	0.22	0.58		1
19	THC	Nil	Nil	Nil	Nil	Nil	Nil	0.3	
20	SO4	24.27	18	35	23.47	20	30		400
21	CO_3	Nil	Nil	Nil	0.22	0.1	0.4		
22	HCO_3	0.83	0.3	3.1	0.83	0.3	3.1		
23	NO_3	6.52	4.4	11.2	6.52	4.4	11.2	50	50
24	Cl^-	1.07	0.5	1.8	1.07	0.5	1.8	250	600

Note WHO= World Health Organization Standards

Total Dissolved Solids (TDS)

Total dissolved solids are a measure of the amount of dissolved inorganic (salts) in an aquatic medium. TDS are the aggregate of inorganic salts that are dissolved in water. It is an indication of the quantity of salt and solids dissolved in water. Dry season salinity values ranged from 4.0 to 12.0 with a mean value of 6.6mg/L and wet season values ranged from 1.0 to 8.0 mg/L with a mean value of 3.27 mg/L. This suggests that the groundwater in the study area is uncontaminated. Also the TDS values were within the natural limits for freshwaters. The documented TDS falls within the National Environmental Regulations, S.I. No 22, 2011 limits for unpolluted water.

Conductivity

Conductivity is a measure of the ability of water to conduct an electric current. It is sensitive to variations in dissolved solids, mostly mineral salts. The degree these dissociate into ions, the amount of electrical charge on each ion, ion mobility and temperature of the solution all have an influence on conductivity. The conductivity of most freshwater ranges from 10 to 1,000 µS/cm but may exceed 1,000 µS cm-1, especially in waters, or those receiving large quantities of land run-off or aquifers recharged by rainfall. In addition to being a rough indicator of mineral content when other methods cannot easily be used, conductivity can be measured to establish a pollution zone, e.g. around an effluent discharge, or the extent of influence of run-off surface waters.

The conductivity of groundwater samples from the study area ranged from 755.00 to 1420.00µS/cm with a recorded mean of 1034.27 µS/cm during the dry season while in the wet season, values range from 750 to 1480.00 µS/cm with a mean value of 1021.93 µS/cm. Electrical conductivity values of groundwater in the study area were moderate with all values above the WHO 2007 upper limits of 1000 µS/cm for unpolluted water.

Dissolved Oxygen

Dissolved oxygen (DO) measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Dissolved oxygen ranges between 6.70 to 14.50 mg/L with a mean of 9.29 mg/L during the dry season, while wet season values range between 6.50 and 14.50 mg/L with a mean of 9.29 mg/L. These values compared well with natural limits expected for groundwater. Hence the DO is low.

Biochemical Oxygen Demand (BOD)

BOD is an indirect measure of the amount of biologically degradable organic materials in water and is an indicator of the amount of dissolved oxygen that will be depleted from water during natural biological assimilation of organic pollutants (USEPA 2002). Excess BOD in water therefore could adversely affect aquatic organisms and by extension humans. BOD levels in groundwater samples from the study area ranged from 24.8-44.40mg/l with a mean of 34.41mg/l for the wet season while the dry season values ranged from 24.80 to 54.10 with a mean value of 35.25mg/L. The BOD values of groundwater from the study area were low which simply indicates low levels of organic matter in the groundwater.

Chemical Oxygen Demand (COD)

Chemical Oxygen Demand (COD) was used as a measure of the oxygen equivalent of the organic matter content of the sample which was susceptible to oxidation by a strong chemical oxidant (WHO 2007). COD levels in groundwater samples from the study area ranged from 33.00 to 66.10mg/l with a mean of 44. 77mg/l for the dry season while values ranged from 33 to 66.1mg/l with a mean of 47.05, recorded for groundwater samples obtained during the wet season. The low COD values also signify low levels of organic matter in the groundwater.

Hardness

Water hardness values in groundwater samples from the study area ranged from 40.00 to 65.00mg/l with a mean of 48.13mg/l for dry season while the wet season values ranged from 40.00 to 65.00 with a mean value of 48.13mg/L. Values below 200 mg/l of water hardness do not have any associated adverse health related effects on humans but is an indication of deposits of Ca and/or Mg ions (WHO 2007). The values are also below the 500 mg/l allowed as a maximum permissible level per the National Environmental Regulations, S.I. No 22, 2011.

Calcium, Sodium and Potassium

Calcium concentration values in groundwater values ranged from 0.27 mg/L to 0.68 mg/L with an average of 0.48 mg/L for the dry season, while the wet season values ranged from 0.25 mg/L to 0.65 mg/L with a mean value of 0.48 mg/L. No significant seasonal variation in calcium concentrations was documented.

Similarly, sodium concentration values in groundwater ranged from 0.23 mg/L to 2.70 mg/L with an average of 1.38 mg/L for the wet season, while the dry season values ranged from 0.23 mg/L to 2.73 mg/L with a mean value of 1.38 mg/L. No significant seasonal variation in sodium concentrations was observed. USEPA (2002) drinking-water advisory taste threshold for sodium recommends that concentrations in drinking water must not exceed the range of 30 to 60 mg/L. The low values mean sodium concentrations observed for both dry and wet seasons implied absence of anthropogenic pollution in the study area.

In addition, potassium concentration values in groundwater values also ranged from 0.12 mg/L to 9.78 mg/L with an average of 3.12 mg/L for the dry season, while the wet season values ranged from 0.1 mg/L to 9.80 mg/L with an average of 3.12 mg/L. The relatively higher mean concentrations of potassium in both seasons suggest addition of potassium from fertilizers during farming activities. All concentrations of calcium andsodium were within the WHO (2007) limit of 200 mg/L for non-polluted water. Calcium concentrations are also within the maximum permissible level of 200 mg/L requested by the National Environmental Regulations, S.I. No 22, 2011.

Heavy Metals (Pb, Zn, Cr, Fe, Mg, Cu, P)

The WHO (2007) water quality guideline indicates that a range of values from 1 to 3 mg/ L- is permissible for iron metals in waters, above which an objectionable and sour taste in mouth is given. It was also remarked that the formation of blue baby syndrome in babies and goitre in adults were results of consumption of water with quantities of iron above the specified values (Hem 1985).

Lead concentrations in groundwater of the study area during the wet season ranged from 0.00 to 0.03 mg/ L with a mean of 0.01mg/L while dry season values ranged from 0.01 to 0.02 mg/ L with a mean of 0.01 mg/L. The low concentration of lead in the groundwater is a clear manifestation of absence of pollution.

Zinc concentrations in groundwater ranged from 0.09 to 0.14 mg/ L for the dry season with a mean of 0.34 mg/L while the wet season concentration values ranged from 0.22 to 0.58 mg/L with a mean of 0.11 mg/L. It is under the 15 mg/L maximum permissible level prescribed by the National Environmental Regulations, S.I. No 22, 2011.

Chromium concentrations in groundwater samples ranged from 0.00 to 0.07 mg/ L for the dry season with a mean of 0.03 mg/L while the wet season concentration values ranged from 0.02 to 0.1 mg/L with a mean of 0.03Mg/L.

Copper concentrations in groundwater samples for the dry season ranged from 0.08 to 0.15 mg/L with a mean of 0.12mg/L while wet season values ranged from 0.10 to 0.15mg/L with a mean of 0.12 mg/L. High concentrations of copper in water may cause acute gastrointestinal disturbances. The low value of copper in samples signifies the low level or absence of substances that liberate copper in water. Copper concentrations in groundwater for both dry and wet seasons are within accepted limits as recommended by the WHO (2007).

The mean concentrations of iron in groundwater samples ranged from 0.21 to 0.55 mg/L with a mean of 0.34 mg/L during the dry season while the wet season values ranged from 0.22 to 0.58 mg/L with a mean of 0.35mg/L. It is below the prescribed maximum permissible level of 1 mg/L from the National Environmental Regulations, S.I. No 22, 2011. High iron content in groundwater may be attributed to the geologic materials and geochemical conditions prevailing in the Gwandu Formation. The iron contents of the water samples in the study area should therefore not be of concern.

The phosphorus concentrations in groundwater samples are low, varying between 0.09 to 0.18 mg/L with a mean of 0.12 mg/L for dry season while the wet season values ranged from 0.12 to 0.15 with a mean of 0.13 mg/L. At this concentration, eutrophication potential in the groundwater is low.

Chloride

Chlorides, expectedly were the dominant anion in groundwater, amongst those analyzed at the study area. The concentrations ranged from 0.5 mg/L to 1.80 mg/L with an average of 1.07 mg/L during the dry season while wet season values ranged from 0.50 to 1.80 mg/L with a mean value of 1.23 mg/L. The values of chloride are lower than the WHO (2007) upper limits for drinking water and maximum permissible level of 600 mg/L for domestic use (National Environmental Regulations, S.I. No 22, 2011).

Sulphate

Sulphate is naturally present in groundwater as SO_4^{2-}. It rises from the leaching of sulphur compounds, either sulphate minerals such as gypsum or sulphide minerals such as pyrite from sedimentary rocks. It is a stable, oxidized form of sulphur and is readily soluble in water (with the exception of lead, barium and strontium sulphates which precipitate). Industrial discharges and atmospheric precipitations can also add significant amounts of sulphate to groundwater.

Sulphate concentrations in groundwater samples from the study area ranged from 18 to 35.0 mg/l with a mean of 24.27mg/L in the dry season while wet season values also ranged from 20 to 30.0 mg/L with a mean value of 23.47mg/L. These values are within reported values for natural waters (Hem 1985) and below the maximum permissible level by the National Environmental Regulations, S.I. No 22, 2011 (400 mg/L)

Nitrate

Nitrate, the most oxidized form of nitrogen compounds is commonly present in groundwater because it is the end product of the aerobic decomposition of organic nitrogenous matter. Unpolluted natural waters usually contain only minimal quantities of nitrate. Natural sources of nitrate to groundwater include igneous rocks, land drainage as well as plant and animal debris. Natural concentrations, which seldom exceed 0.1 mg/l NO_3, may be enhanced by municipal and industrial waste-waters. In rural and suburban areas, the use of inorganic nitrate fertilizers can be a significant source.

The nitrate concentrations in groundwater samples from the study area are 4.4 to 11.2 mg/l with a mean of 6.52mg/l for the dry season while the wet season values ranged from 4.40 to 11.20 with a mean of 5.90 mg/L. These values showed that samples from the groundwater body were free from pollution as at the time of survey. Results are compliant with maximum permissible level of the National Environmental Regulations, S.I. No 22, 2011 (50 mg/L for nitrate).

4.1.6 SURFACE WATER

4.1.6.1 HYDROLOGY

The entire project area is drained by the Sokoto River, which is the main river in the region. It is a tributary of the Niger River (Figure 4-9). The Sokoto River rises with its main tributaries, the Ka River, Zamfara River, and Rima River from the 600 to 900 meter high Mashika and Dunia highland areas bordering the eastern part of the basin, and flows down, rather sluggishly down a gentle slope toward the northwest, where around Sokoto town, it is joined by the Rima in the north, making a southward swing, collecting the Zamfara and Ka before entering in to the Niger River. The river systems, thus effectively drain the whole basin. At the source areas in the east, the Sokoto River system is only seasonal. However, in the western parts of the basin, the river becomes perennial as it begins to receive substantial groundwater contribution to its flow (Abdullahi, 2014).

These rivers are sources of water for irrigation, domestic use, fishing and transportation. The study area crosses the Sokoto River, and it is expected that up to 8km of the line route could be under water during the wet season, which shrinks to 3 to 4 km during the dry season (Map 4-4). The flood plain is used for dry season farming after the water has receded during the dry season. The flood could be devastating sometimes due to release of water from the dams during periods of high flows. This affected crops, structures and animals significantly in recent years (Obeta C.M, 2014).

The substation is located on a relatively high ground area, which is well drained and not susceptible to flooding or erosion. Drainages constructed around, though partially blocked in some areas, collects storm water and channel ultimately drains into the Sokoto River.

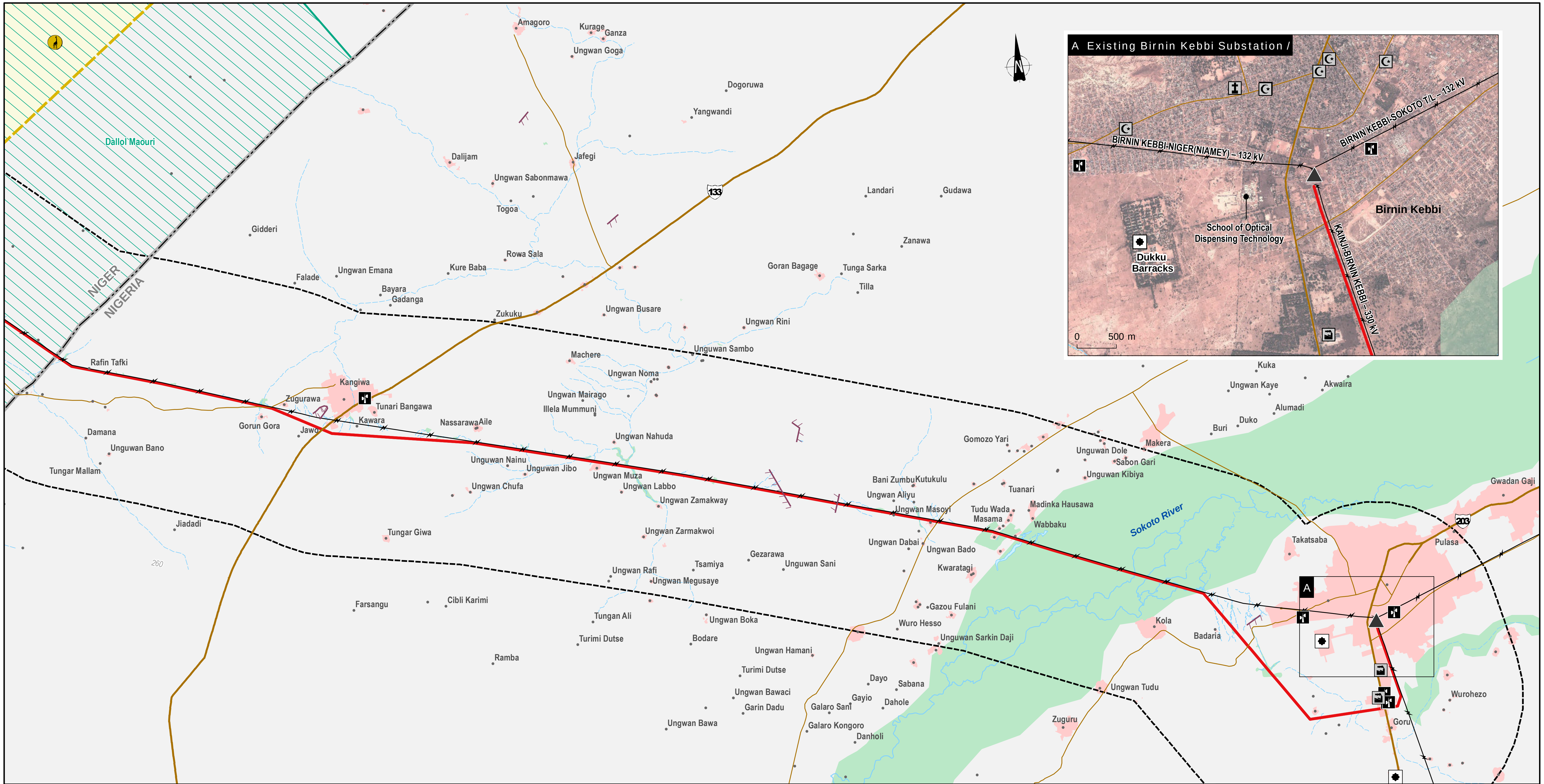
There are two major dams in the Sokoto-Rima River basin: Bakolori and Goronyo dams, both upstream of the point where the line route crosses the Sokoto River. The Bakolori dam is in Zamfara state, it was completed in 1978 and its reservoir was filled by 1981. It is a major reservoir on the Sokoto River, before it is joined with the Rima River. Water from the dam supplies the Bakolori Irrigation Project in Talata Mafara. The dam has a capacity of 450 million cubic meters, with a reservoir covering 8,000 hectares extending 19 km upstream. Goronyo dam is on the Rima River at Goronyo in Goronyo local government area of Sokoto state. It was completed in 1984 and commissioned in 1992.

The dam is a sand-fill structure with a height of 21 m and a total length of 12.5 km. It has a storage capacity of 976 million cubic meters. The dam is controlling floods and releasing water in the dry season for the planned Zauro polder project downstream in Kebbi state. Other dams within the basin are Gusau dam with a height of 22m and a total length of 800m located in Zamfara state and Zuru dam with a height of 15m and a total length of 700 m located in Kebbi state. There are also some small dams within the basin which include Zurmi, Marina and Shagari dams.

The basin is currently experiencing reduction in water flow with an estimated annual reduction in the total available water of about 1.70 billion cubic meters as compared to a peak monthly water demand of 17.11 Billion cubic meters for the month of April (which is the driest month in the basin) due to climate change, reduced rainfall, increasing evapotranspiration and increasing temperature. The Sokoto-Rima River Basin Development Authority (SRBDA) is implementing adaptation and mitigation measures to the current trend to minimize the significant impact on availability of water supply in the basin for the foreseeable future. These measures focus on sustainable developments to collaborative planning among the stakeholders within the basin. Abdullahi (2014).

SOURCE: (Abdullahi, 2014)

Figure 4-9 The Sokoto River Drainage Basin



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Mosque

Church

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Floodplain

Erosion

Infrastructure

National Road

Secondary Road

Telecommunication Tower

Military Base

Factory

Substations and Transmission Lines

Existing Line

Existing Substation

Project Component

Draft Final Line

Boundary

International Border

Study Area (5 km buffer)

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report

Surface Water

0 1,6 3,2 4,8 km
UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015
File: 141_24307_EIE_NG_cH_Water_160606.mxd

Map 4-4

June 2016

WSP

4.1.6.2 SURFACE WATER QUALITY

METHODOLOGY

Water samples were collected in both the dry season and the rainy season at 6 different locations within the Sokoto River. Two samples each at the shore and middle of the river at the point where the proposed line route will cross the river, and 100 m upstream and downstream.

Samples were collected at the shore (being careful not to disturb the sediments to avoid intake of suspended matters into the sample), from a bridge, and from a boat (for a reservoir and flooded areas). The sample bottles were thoroughly rinsed with the water sampled, at least three times, and completely filled to avoid air bubbles in the container. The samples were then properly labelled, with a sample log sheet prepared, as well as a custody sheet that would accompany the samples to the laboratory. For each sample, the log sheet contained Information on site, including the name identification, date, hour, name of the sampler, site location (GPS). The samples were kept cool in a cooler with ice (at 4 ^{0}C) and transported to the Mifor Consult Laboratory, No. 55, Marian Road, Calabar.

Likewise, temperature, pH, transparency, conductivity, turbidity, dissolved oxygen, dissolved solids, bicarbonate, carbonate, and alkalinity were all measured in the field using a portable analyzer. Other physicochemical properties were determined at the laboratory according to the standard procedures of APHA (1998), UNEP (2004) and Panday *et al.* (2005).

RESULTS

The results on surface water quality from the various sites are presented on the next table. Temperature was low in site A1 and may likely be due to the time of sampling, while transparency measurement was ≤10 due to dissolved substances and nature of the lotic water. The pH was neutral and the turbidity was high as a result of low transparency. It will always increase as transparency decreases. Carbonate was absent in the water with little bicarbonate. There was enough dissolved oxygen to support aquatic biota but BOD was also a bit high, meaning there are a lot of decomposers. As the dry season commenced there were slight changes observed on physicochemical parameters. The temperature at this location increases slightly from 25◦C to 26◦C; this may likely be due to time of sampling. Transparency decreases compared to rainy season, so does conductivity, pH and turbidity. These may likely be due to lack of rain that could dissolve the available nutrients in the water, therefore making the water more concentrated with dissolved solids. Data obtained from this site (A2) are presented below, which indicated that temperature was still not up to room temperature, while transparency measurement was low and the turbidity increases compared to A1 site. The pH was still neutral, while carbonate remains undetected in the water with little bicarbonate. Dissolved oxygen increases at this site compared to A1 while BOD decreases from the data obtained at A1. The data obtained in dry season was also observed to be slightly increased over the recorded data during the dry season. Though temperature and conductivity increased from what was obtained in rainy season. The uniqueness of the sampling locations was undetected carbonate from the water samples.

Results for B1 sampling site have indicated that physical variables tend to be stable more than chemical variables, in which chemical variables either decrease or increase drastically. This may be observed in the following results if compared to previous (A1 and A2). Temperature was still low, probably due to time of sampling. Dissolved oxygen increases slightly as compared to previous locations. While BOD decreases as DO increases.

Transparency measurement was ≥10.5. Turbidity fluctuates if compared to A1 and A2 sites. The pH was still neutral, while carbonate remains undetected and bicarbonate was low. There were slight variations of the data obtained in rainy season when compared to dry season, as presented in table 4-8.

Results at B2 site show slight variations from the previous sites. Though, temperature was still ≥25◦C while transparency measurement was ≥10.8cm. The pH was still neutral, while carbonate remains undetected and bicarbonate was still low. Dissolved oxygen increases slightly, BOD decreases as DO increases. Temperature variation was observed to increase or decrease depending on the time of sampling, with slight increases in some chemical variables such as pH, TDS, DO and BOD.

Table 4-9 Physiochemical Properties during Rainy and Dry Seasons

Variable	A1 SW/KLG/15/A1		A2 SW/KLG/15/A2		B1 SW/KLG/15/B1		B2 SW/KLG/15/B2		C1 SW/KLG/15/C1		C2 SW/KLG/15/C2		
	Rainy	**Dry**	**Rainy**	**Dry**	**Rainy**	**Dry**	**Rainy**	**Dry**	**Rainy**	**Dry**	**Rainy**	**Dry**	
Latitude	12°28.51N	12°28.52N	12°28.38N	12°28.39N	12°28.49N	12°28.48N	12°28.43N	12°28.43N	12°28.51N	12°28.51N	12°28.52N	12°28.52N	
Longitude	4°41.00E	4° 41.00E	4° 40.02E	4° 40.02E	4° 44.00E	4° 44.00	4° 42.06E	4° 42.06E	4° 30.40E	4° 30.40E	4° 34.40E	4° 34.40E	
Altitude	214M	213m	2015m	215m	216m	216m	216m	217m	215m	215m	216m	216m	
Time	9:30am	9:30am	9:40am	10:40am	10:26am	11:00am	11:04am	11:27am	12:pm	11:45am	1:20pm	11:59am	
Date	13/10/15	14/12/15	13/10/15	14/12/15	13/10/15	14/12/15	13/10/15	14/12/15	13/10/15	14/12/15	13/10/15	14/12/15	**Mean**
Temp.(C°)	25.00	26.90	25.30	25.00	25	25.8	25	25.8	36.5	30.3	30.3	Water was not found at this location	27.35
Transparency (cm)	10.5	9.00	10.70	9.20	10.5	8.6	10.8	11.0	39	40	40		18.12
EC (µs/cm)	284	286	257.00	259.00	262	265	259	261	517	518	518		335.09
pH	7.11	7.14	7.13	7.18	7.16	7.3	7.12	7.14	7.38	7.37	7.37		7.22
Turbidity(NTU)	337.00	340.00	444.00	447.00	401	404	238	239	785	786	786		473.36
TDS (ppm)	142.00	145.00	128.00	128.70	129	131	129	130	109	111	111		126.70
Carbonate (Mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND
Bicarbonate (Mg/l)	0.92	0.94	0.91	0.93	1.0	1.6	1.3	1.2	1.6	1.66	1.66		1.25
DO (Mg/l)	9.40	10.01	6.80	8.80	6.0	6.7	6.1	6.8	6.1	6.8	6.8		7.30
BOD (Mg/l)	36.90	36.6	28.30	28.70	25.4	25.9	24.5	24.8	25.1	25.	25.		27.84

Footnote: ND = Not Detected, EC= Electric Conductivity, TDS= Total Dissolved Solids, DO= Dissolved Oxygen, BOD= Biological Oxygen Demand Key: A, B, C = Different locations

A1, A2 Water samples at point of line crossing

B1, B2 = Water samples about 100m upstream of line crossing

C1, C2 Water samples about 100m downstream of line crossing

Results for C1 and C2 sites show slight variations from the previous sites, notably in terms of temperature and transparency at C1 and C2 remain the same. The water was clear from the transparency measurement, while turbidity was higher than all other sites. There was a uniform level of pH, bicarbonate and dissolved oxygen at both C1 and C2 sites with the exception of BOD levels that indicated slight variations all during rainy season. One interesting observation made at this sampling location was the dryness of site C2 in dry season. Therefore, samples were not collected from this location.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 BIODIVERSITY CONTEXT

In Nigeria, the area where the project is located is exclusively located in the West Sudanian Savanna ecoregion. It is a wooded savanna characterized by deciduous trees, typically *Combretum, Terminalia* and *Acacia*, and an understorey of long grasses, shrubs and herbs. The trees' height reaches a maximum of 10 m. Flora endemism is high (WWF, 2014).

A significant migration of wildlife is typical of the ecoregion considering the pronounced dry season. This includes annual passage of huge numbers of migrant birds on the Afrotropical-Palaearctic flyway, as well as the intra-African migration associated with the seasonal changes in terms of weather. Additionally, even if the hunting pressures have reduced their number over time, important numbers of large mammals move over the territory, notably elephants (*Loxodonta africana*, VU) that are of great conservation interest for maintaining the ecotourism potential of the protected areas. Wild dog (*Lycaon pictus*, EN) persists in small numbers in scattered populations in the savanna woodlands, as do lions (*Panthera leo*, VU), leopards (*Panthera pardus*, VU) and cheetahs (*Acinonyx jubatus*, VU) (WWF, 2014).

More locally, close to the border with Niger, there is a large natural habitat area hosting ligneous vegetation. The aquatic habitats inside the Sokoto River are expected to be important for local associated fauna considering that Sokoto is a tributary of the Niger River, a recognized important area for wildlife. However, the intensity of agricultural activities probably reduces the aquatic habitat integrity.

Savannas contain a mixture of forest and grassland species, as well as some species unique to this ecosystem type. Thorny acacia, eucalyptus, and baobab trees are scattered among the grasses. Savanna grasses are well adapted to fire because their buds are protected below the ground. Like the grasses, some mature savanna tree species are particularly resistant to fire, compared to other forest species. Many savanna trees have thick insulating bark that protects the inner growing layers of the tree from fire. Others, such as the baobab tree, can store tremendous amounts of water in their bark and trunk, protecting them from both fire and drought. Other savanna trees are capable of resprouting vigorously after fire. Despite these adaptations, frequent fire decreases the density of trees in most savannas, with tree seedlings especially susceptible to fire (Knapp, 2001).

The Sudanian Savanna contains a great diversity of plants and mammals, found nowhere else in the world. This ecoregion is composed of large expanses of acacia woodland areas. Most of the trees here are deciduous, characterized by an understory of grasses, shrubs, and herbs. The ecoregion occupies just a portion of a larger area identified as a center of diversity for plants, and hence significant for plant conservation. Given the pronounced dry season, there is a large seasonal migration of animals, in addition to the visitation by large numbers of migrant birds on the Afrotropical-Palaearctic flyway. Reichenow's Firefinches and the Niam-Niam parrots are found here and nowhere else (WWF, 2015).

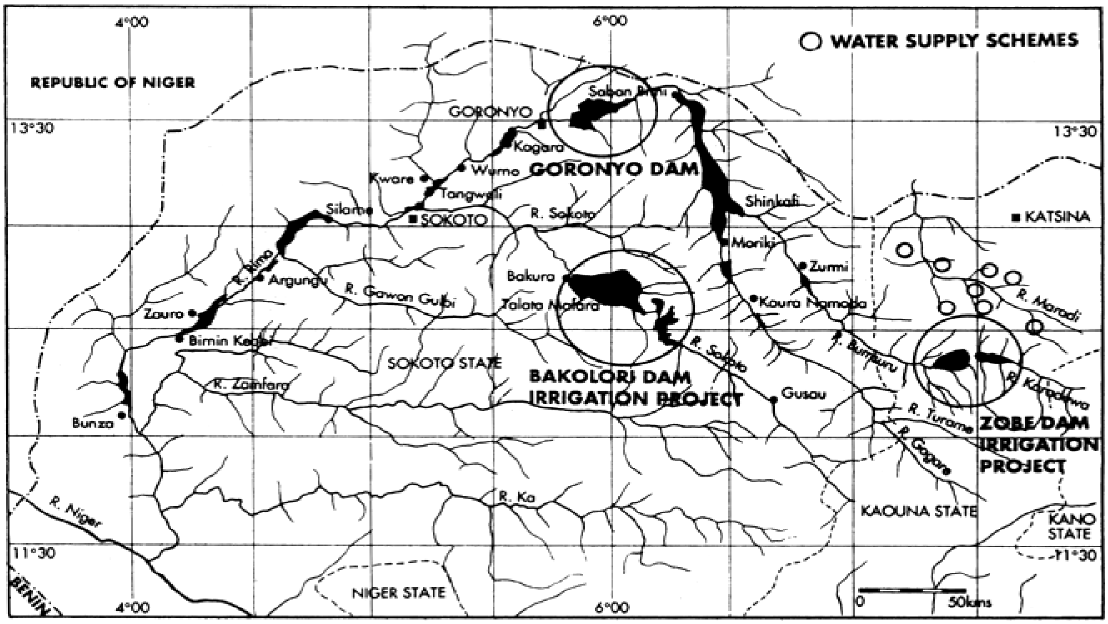
Savannas support a diverse array of herbivores, especially in the African savannas. Grassland grazers such as zebras and wildebeest are found with herbivores that feed on trees, such as giraffes and elephants. Elephants have been termed a keystone species of African savannas for the role they play in determining the density of trees. When elephant populations are low, acacia trees and shrubs may become so dense that the grasses are shaded out and grassland species disappear. Conversely, if elephant populations are too high, the trees may disappear along with those species that depend on woody plants for food and shelter. Another group of organisms that is particularly notable in tropical savannas for their diversity and numbers, if not their individual size, are the termites. Conspicuous above-ground termite mounds are present, but most termites live underground without building mounds. Termites fill a very important role as one of the major decomposers in savannas. As much as 90 percent of the grass biomass that is decomposed in some savannas can be attributed to termites. Thus, these organisms are valuable for making nutrients available to plants (Knapp, 2001).

Nigeria has a very rich fauna as a result of her diverse vegetation types. With 18 species, the Okwangwo Division of Cross River National Park has the highest diversity of primates recorded at any single site in Africa, including the endangered Cross River Gorilla (*Gorilla gorilla diehli)*.

Nigeria is also rich in forms of life other than those usually grouped as plants or animals, such as many species of viruses, bacteria, fungi, etc. (Anon, 2015).

The natural vegetation of the study area (Kebbi State) are characterized by medium sized trees such as *Parkia clappertoniana* (locust bean tree), *Vitellaria paradoxa* (Shea butter tree) and *Combretum* species largely located in the southern part of the state, while in the north, there is the predominance of open woodland with scattered trees such as *Acacia albida*, *Parkia clappertoniana*, Borassus and dum palms. The natural vegetation has however been altered in many areas by intensive cultivation, grazing, fuelwood harvesting and bush burning, giving rise to a form of parkland dominated by trees like *Piliostigma*, *Ziziphus*, *Mangifera Indica* and *Tamarindus*, especially in the south.

The upper reaches of the Sokoto and Rima rivers are fed by numerous streams and rivers which are usually filled by rain water run-off during the rainy season and dry up during the dry season. These streams and rivers are characterized by narrow width, of not more than 30 meters, shallow depth of 1 – 3 meters, and swift currents at high water level. The river banks usually show steep slopes, and flooding over the banks is not usually a common phenomenon.



(Source: Ita, 1993)

Figure 4-10 Sokoto-Rima River Basin

Flood ponds are common within the flood basins of most of the major rivers and are usually cut off from the main river channels during periods of low water. The seasonal streams and rivers are also segmented into series of pools in the deeper areas of their channels. These ponds and pools range in area between 10 and 100 hectares of water surface, and as a result of their progressive reduction in surface area and water volume during the dry season, they provide a good concentration of fish during the periods of lowest water level (FACU, 1989). Most of the pools have low fish production on account of their high turbidity and low fish supply since they are usually overfished prior to the next flood season.

Based on the results of the baseline characterization, the study area is not considered to be included inside a Critical habitat.

4.2.2 NATURAL HABITAT TYPES

4.2.2.1 TERRESTRIAL HABITATS

Degraded Environment at the Substation

Inside the area of the Birnin-Kebbi sub-station there are various plant species from grasses to trees. The tree species noted are the ubiquitous *Azadirachta indica* (Neem tree) and the usually planted *Mangifera indica* (Mango tree), as well as *Anarcadium occidentalis* (Cashew nut tree).

Shrubs recorded are largely dominated by *Sida cordifolia.* Grasses form a dense cover to the northern side of the installations, while the trees are concentrated around the administrative building up to the main entrance. Soil is sandy and flat except around the platform where it slopes into the concrete drainage that goes round the installation. Residential buildings were observed very close to the main entrance (western side of the substation) up to the main road that passes in front of the substation. Trees were noted within these compounds which include *Delonix regia* (Flambouyant tree), *Eucalyptus camaldulensis*, and *Azadirachta indica*.

The soil close to the fence at one point was observed to be depressed and prone to erosion. *Sida cordifolia* can be seen lining the ground on this side of the fence.

Tiger Bush

Tiger bush is a patterned vegetation community consisting of alternating bands of trees or shrubs, separated by bare ground or low herb cover, that run roughly parallel to contour lines of equal elevation. The patterns occur on low slopes in arid and semi-arid regions, Due to the natural water harvesting capacity, many species in tiger bush usually occur only under a higher rainfall regime (Anon, 2015i).

In semi-arid regions of West Africa, tiger bush vegetation is a striking example of a self-organized, banded vegetation pattern. It consists of regularly arranged woody stripes alternating with areas free of vegetation, whereby the distance between the vegetation stripes increases with decreasing precipitation.

The alternating pattern arises from the interplay of hydrological, ecological, and pedological phenomena. In the regions where tiger bush is present, plant growth is water-limited; the shortage of rainfall prevents vegetation from covering the entire landscape. Instead, trees and shrubs are able to establish by either tapping soil moisture reserves laterally or by sending roots to deeper, wetter soil depths. By a combination of plant litter, root macropores, and increased surface roughness, infiltration into the soil around the base of these plants is enhanced. Surface runoff arriving at these plants is thus likely to become run-on, and infiltrate into the soil.

Muller (2013) reported that in the tiger bush of the Sahel zone in tropical West Africa, several zones are differentiated. The "run-off zone" is free of vegetation. Its top soil has erosion crusts which prevent the infiltration of precipitation water to a large extent, although this zone cannot automatically be considered degraded. Precipitation water runs off superficially, following the slightly inclined surface and taking soil particles with it. The following "herb zone" is divided by some authors into a sedimentation and a pioneer zone. In this zone, soil particles from the run-off zone are deposited, while water penetrates still further into the woody stripes. Sedimentation crusts prevail. Benefitting particularly from the sedimentation and water input, the "herb zone" moves slowly upwards into the "run-off zone.

The "central zone" (or woody zone) represents the actual woody stripe of the tiger bush. Run-off water penetrates into the centre of the stripe where woody plants are tallest and where water consumption is highest (Cornet *et al.,* 1992). In fact, the woody plants receive an amount of water which corresponds to up to the quadruple amount of precipitation per area ("water harvesting system"). As a result, woody plants grow more luxuriantly and produce more biomass than they do outside the tiger bush under the same local climatic conditions (Valentin and d'Herbés, 1999). The ground layer in the central zone is developed only scarcely. Termites are very active in the soil and cause a high bioturbation. The silt proportion, humus and carbon contents are relatively high ("fertility islands" after Guillaume *et al.,* 1999).

Inside the project area, the main plant communities are ligneous species and herbaceous plants. Many of them are noted to be shrubs and grasses that can withstand little precipitation. Few members of the *Azadirachta indica* species were observed close by, especially in areas of cultivation. *Mitrocarpus hirtus* (button grass) was found to be the dominant herbaceous vegetation. The area is erosion-stricken with many gullies and a very hard surface. No special status plants were recorded.

4.2.2.2 AQUATIC HABITATS

Flood Plain

A floodplain is an area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge.

It includes the floodway, which consists of the stream channel and adjacent areas that actively carry flood flows downstream, and the flood fringe, which are areas inundated by the flood, but which do not experience a strong current. In other words, a floodplain is an area near a river or a stream which floods when the water level reaches flood stage (Anon., 2015d).

Floodplains are some of the most valuable places on Earth, both for people and wildlife. Fertile soils deposited by rivers make these areas extremely productive for agriculture. Floodplain forests and marshes are among the richest habitats for wildlife, both in terms of diversity and numbers. Within these areas, species like fish and waterfowl thrive, benefiting important commercial and recreational industries, too (Anon., 2015e).

Floodplains can support particularly rich ecosystems, both in quantity and diversity. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly; however the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture (Anon., 2015d).

The power line will cross the Sokoto River floodplain just west of Birnin Kebbi. The floodplain consists of numerous river channels that flow through permanent and seasonal wetlands as well as scattered terrestrial habitats. A large proportion of the floodplain is used for agricultural activities during the dry season and few trees are scattered in the fields. The powerline in Birnin Kebbi is adjacent to another section of floodplain associated to Kamfara River, a tributary of the Sokoto River.

Inside the study area, the plant community noted were largely grasses with *Hermarthria altissima* found to be dominant. *Oryza sativa* is extensively cropped. Other plants recorded were *Commelina nudiflora*, *Cyperus esculentus,* and *Melochia corchorifolia.*

Wetlands

Wetlands are some of the most productive ecosystems in the world. Some common names for different types of wetlands are swamp, marsh and bog. Depending on the type of wetland, it may be filled mostly with trees, grasses, shrubs or moss. To be called a wetland, an area must be filled or soaked with water at least part of the year. Some wetlands are actually dry at certain times of the year.

The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability. Wetlands are also considered the most biologically diverse of all ecosystems, serving as home to a wide range of plant and animal life. Wetlands also act like sponges by holding flood waters and keeping rivers at normal levels. Wetlands filter and purify water as it flows through the wetland system. Plants found in wetlands help control water erosion.

The biota of a wetland system includes its vegetation zones and structure as well as animal populations. The most important factor affecting the biota is the duration of flooding. Other important factors include fertility and salinity. In fact, species are highly dependent on water chemistry. The chemistry of water flowing into wetlands depends on the source of water and the geological material in which it flows through as well as the nutrients discharged from organic matter in the soils and plants at higher elevations of the wetlands. Biota may vary within a wetland due to season or recent flood regimes.

The wetlands inside the study area were observed to be fully under cultivation. Species noted include *Oryza sativa* and *Vigna unguiculata* among others.

The plants recorded in the study area are presented in the following section. The plant species varying from herbs to shrubs and to trees are spread across 18 families, with *Poaceae* having the largest number of species. The biodiversity observed was not very high probably as a result of proximity to different communities that exploit these species for food and energy. None of the species identified belong to the 164 species from Nigeria in the IUCN Red List (IUCN 2013, 2014). No endemic flora species exist in Kebbi state (Borokini, 2014), as well as in most states of the north including Sokoto, Zamfara, Kaduna, Katsina, Kano, etc.

4.2.3 FLORA

4.2.3.1 METHODOLOGY

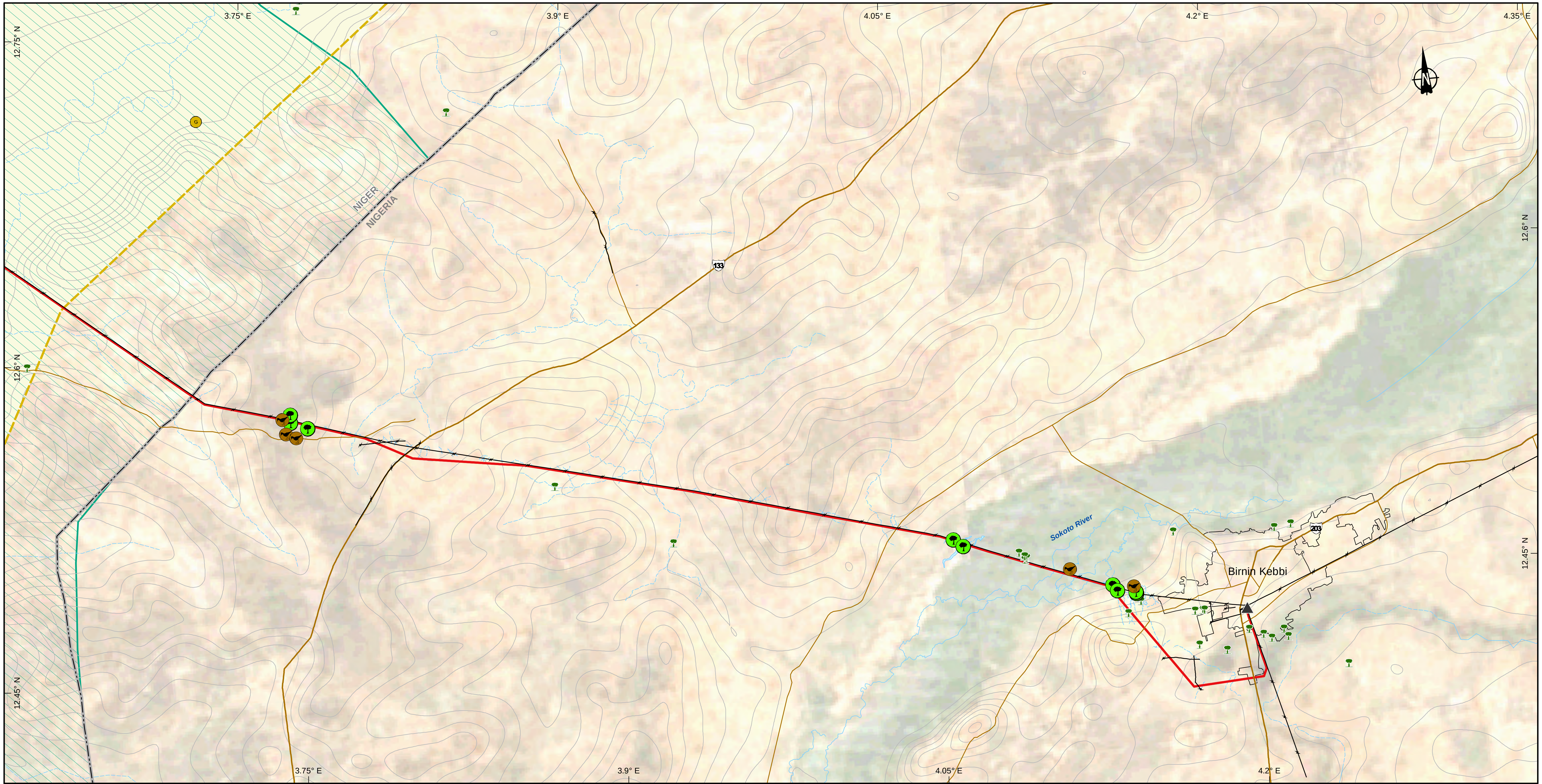
Flora Surveys

Complete Subjective approach, which is associated with the Braun-Blanquet (1932) method was employed in which both the selection of stands and location of samples within them were subjective. Familiarity with the vegetation was developed by extensive surveys in the reconnaissance visit and during the early period of the wet season survey, to conceptualize the communities. This was followed by subjective selection of stands considered especially typical by listing all species encountered in each habitat. Thereafter, a number of sample plots which best represent the community type were established by nested plot technique in the selected stands, based on the number of approved sample stations. An initial area of 1.0m x 1.0m was lined out on the ground, followed by larger and larger plots lined out in such a manner that each larger plot encompassed all the preceding smaller plots. All species encountered in the first plot and additional species in each of the larger plots were recorded until the species list became redundant. Within these sample plots, quadrats of 10m x 10m were made to record data on all vegetation types (trees, shrubs and herbs).

The survey was carried out in both wet and dry seasons. The habitats studied were Woodland in Dutsen Mulgu (2 sites) in Kangiwa local government, Wetland in dutsen Mulgu (1 site), Tiger bush in Birnin Kebbi local government (2 sites) and Wetlands (floodplains) in Kalgo local government (2 sites). The coordinates of the sites are given in the next table. Data was recorded on each survey, including serial number of survey, date of sampling, location (GPS coordinates), tentative floristic name describing the most obvious species composition, and general remarks on plant cover. The rainy season survey was conducted in the first week of October, while the dry season survey was carried out in December of 2015.

Table 4-10 Survey Sites Coordinates

Survey sites	Coordinates	
KLG_Wetland_1	$12^0$28’ 51.4 ‘’N	$4^0$3’ 44.7’’E
KLG_Wetland_2	$12^0$28’ 38.8’’ N	$4^0$4’ 0.8’’ E
BRK_Farmland_1	$12^0$27’ 12.4’’ N	$4^0$8’ 7.2’’ E
BRK_Farmland_2	$12^0$27’ 2.0’’ N	$4^0$8’ 14’’ E
BRK_Tigerbush_1	$12^0$26’ 54.5’’ N	$4^0$8’ 45.9’’ E
BRK_Tigerbush_2	$12^0$26’ 57.1’’ N	$4^0$8’ 45.2’’ E
KGW_Woodland_1	$12^0$13’ 45’’ N	$3^0$45’ 25’’ E
KGW Woodland_2	12^0 33’58’’ N	3.75702^0E
KGW Wetland	12^0 33’ 33’’N	3^0 45’ 53’’E



Biological Environment

Niger Giraffe Distribution Area

Internationally Designated Area

Ramsar Site

Human Environment

City

Built Environment

Plantation

Physical Environment

Intermittent Watercourse

Permanent Watercourse

Biological survey

Fauna

Flora

Substations and Transmission Lines

Existing Line

Existing Substation

Infrastructure

National Road

Secondary Road

Project Component

Draft Final Line

Boundary

International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Impact Assessment
Final Report

Biological survey sites

0 1.65 3.3 4.95 km

UTM, Zone 31N, WGS 84
Contour Interval : 10m

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c4_5_BioSurvey_171011.mxd

Map 4-5

October 2017

WSP

Density and Frequency

Density of species in the different habitats is the number of rooted individuals per unit area in each habitat. It is calculated by the following formula:

Density (D) = $\frac{\text{Total number of individuals of a species in all quadrats in a sample plot}}{\text{Total No. of quadrats in the sample plots studied}} \times 100$

Relative Density (RD) = $\frac{\text{Density of Species A in a particular habitat}}{\text{Density of Species A in all habitats}} \times 100$

Frequency (F) = $\frac{\text{No. of quadrats in which the species A occur (in a habitat)}}{\text{Total number of quadrats studied (in a habitat)}} \times 100$

Vegetation Layers

The number of layers will be determined by general observation of the vegetation. On the basis of this, the following number of layers will be distinguished:

L_1 = Ground stratum like lichens, etc.
L_2 = Herbaceous or ground flora
L_3 = Middle or shrubby layer
L_4 = Top layer or canopy layer of trees and epiphytes

Value of Local Species

This has been determined through literature and interaction with local people.

Abundance

This is the total number of individuals of a species recorded in all quadrats divided by the number of quadrats in which the species were present.

Abundance of a spp = $\frac{\text{Total no. of individuals of the spp. in quadrats of a given habitat type}}{\text{Total no. of quadrats of a given habitat type in which the species occurred}}$

The following abundance scale will be used:

Classes	Stalks per square metre quadrat
Rare	1 to 4
Occasional	5 to 14
Frequent	15 to 29
Abundant	30 to 90
Very Abundant	100+

4.2.3.2 RESULTS

A total of 41 different species were recorded with the grasses having the highest abundance and diversity (Table below). The region in a savanna has scattered trees and abundance of grasses especially during the rainy season. *Hermathria altissima*, *Sida cordifolia* and *Mitrocarpus hirtus* were noted to be the most widely distributed. Human disturbances in terms of exploitation of tree species may negatively affect their abundance.

Table 4-11 Table FS Floral Species Diversity

Families	Species	Types[1]	Status: National	Status: IUCN	Status: Endemism	Biological surveys: Woodland	Biological surveys: Tiger bush	Biological surveys: Wetland	Biological surveys: Farmland
Rubiaceae	*Mitrocarpus hirtus*	H						√	√
	Gardenia aqualla	S				√			
Euphorbiaceae	*Manihot esculentus*	S							√
Commelinaceae	*Commelina nudiflora*	H						√	√
Malvaceae	*Sida cordifolia*	S				√	√	√	√
	Urena lobata	S							√
	Melochia corchorifolia	H						√	
	Hibiscus sabdariffa	H						√	
	Corchorus tridens	H						√	√
	Grewia mollis	H						√	
Poaceae	*Eragrostis biformis*	H				√	√	√	√
	Eleucine indica	H							√
	Hermathria altissima	H						√	
	Saccharum spontaneum	H						√	
	Digitaria debilis	H					√		√
	Sorghum bicolor	H					√		
	Andropogon gayanus	H					√		√
	Thelepogon elegas	H							√
	Urelytrum giganteum	H						√	√
	Oryza sativa	H				√			
	Dactyloctenium Aegypticum	H				√			
	Oryza longistaminata	H				√			
	Setaria pallide-fusca	H				√			
Fabaceae	*Senna occidentalis*	H							√
	Acacia polyacanth	T							√
	Crotalaria sp.	H						√	
	Acacia nilotica	T					√		
	Vigna unguiculata	H					√	√	
	Mimosa pigra	S						√	
Zygophyllaceae	*Tribulus terrestris*	H						√	
	Balanites aegyptiaca	T					√		√
Convulvulaceae	*Ipomea muricata*	H						√	
Cyperaceae	*Cyperus esculentus*	H						√	
	Fimbristylis hispidula	H				√			√
Lamiaceae	*Ocimum basilicum*	H						√	
Combretaceae	*Guiera senegalensis*	S				√			
	Combretum micranthum	S				√			
	Combretum nigricans	T				√			
	Combretum glutinosum	S				√			
Meliaceae	*Azadirachta indica*	T				√			
Solanaceae	*Schwenckiaamericana*	H				√			
Onagraceae	*Jussiaea suffruticosa*	H				√			
Capparaceae	*Boschia senegalensis*	H				√			
Apocynaceae	*Hollarhena floribunda-pleoceras*	S				√			
Aspaargaceae	*Urigenea maritima*	H				√			
Cucurbitaceae	*Cucumis melo*	H				√			

[1] T: Tree, S: shrub, H: herb, L: liana, E: epiphyte

It was noted that most of the plant species were annuals that only survived during the wet season. Their abundance declines during the dry season due to the limited water availability. Some new species were encountered in the dry season that resulted largely from the dry season farming especially in the wetlands (e.g *Cucumis melo*).

Most of the species encountered in this survey have some special features that help them to withstand long drought periods and also resist high rates of evapo-transpiration. For most species, the frequencies and relative densities were noted to change between the wet and dry seasons, with generally higher densities observed during the wet season (next Table). Accordingly, some species were only observed during the wet season, such as *Crotalaria retusa, Ipomea muricata, Stylochiton lancifolius, Thelopogon elegas*, and *Cassia mimosoides*. The plant survey shows that most species are present in the study area in low densities except for a few species which tend to dominate the herbaceous layer (next Table). Depending on the location of the sample plot, the following species can be dominant: *Hemarthria altissima, Mitracarpus hirtus, Sida cordifolia, Fimbristylis hispidula* and *Crotalaria retusa*.

Table 4-12 Plant Species Densities

S/N	Species	Common Name	Density (Wet Season)	Density (Dry Season)
1	*Melochia corchorifolia*	Chocolateweed	4.33	1.44
2	*Saccharum spontaneum*	Wild sugarcane	0.56	0.11
3	*Crotalaria retusa*	Rattleweed	93.44	-
4	*Hibiscus sabdariffa*	Roselle	1.56	0.11
5	*Tribulus terrestris*	Goathead	0.11	0.11
6	*Commelina nudiflora*	Spiderwort	9.67	0.88
7	*Ipomea muricata*	Morning Glory	0.11	-
8	*Cyperus rotundus*	Yellow Nutsedge	9.87	0.44
9	*Hemarthria altissima*	African Jointgrass	426.33	55.44
10	*Oryza sativa*	Rice	61.57	29.22
11	*Corchorus tridens*	Wild Jute	1.22	2.00
12	*Ocimum basilicum*	Basil	2.44	28.22
13	*Mitracarpus hirtus*	Button grass	103.22	6.55
14	*Mannihot esculentus*	Cassava	2.22	0.55
15	*Stylochiton lancifolius*	Ground Arum	9.0	-
16	*Sida cordifolia*	Heartleaf Sida	150.55	68.11
17	*Urena lobata*	Caesarweed	0.44	0.44
18	*Eragrostis biformis*	Lovegrass	56.22	156.11
19	*Eleusine indica*	Goosegrass	0.22	0.22
20	*Monechma ciliatum*		51.67	9.88
21	*Senna occidentalis*	Coffee Senna	0.11	0.22
22	*Schwenckia americana*		0.22	0.22
23	*Acacia polyacanth*	White-stem thorn	1.67	2.88
24	*Digitaria debilis*	Crabgrass	3.89	3.89
25	*Thelopogon elegas*		0.11	-
26	*Sorghum bicolor*	Sorghum	0.11	0.11
27	*Vigna unguiculata*	Cowpea	0.11	11.77
28	*Guiera senegalensis*	Moshi medicine	1.33	11.77
29	*Fimbristylis hispidula*	Whisker of the Rat	89.89	198.22
30	*Combretum micranthum*	Kinkeliba	24.33	3.22
31	*Ludwigia octovalvis*	Primrose Willow	5.67	5.67
32	*Pennisetum pedicellatum*	Deenanth Grass	0.33	0.33
33	*Hollarhena floribunda-pleoceras*	False Rubbertree	0.33	0.33
34	*Combretum glutinosum*	Kantakara	1.11	1.11
35	*Mimosa pigra*	Mimosa	0.11	0.11
36	*Urginea spp.*		0.56	0.56
37	*Grewia mollis*		0.56	0.56
38	*Acacia nilotica*	Egyptian Mimosa	0.11	0.11
39	*Andropogon gayanus*	Gamba Grass	0.11	0.11
40	*Urelytrum giganteum*		0.11	0.11
41	*Cucumis melo*	Sweet Melon	0.11	0.11
42	*Dactyloctenium Aegypticum*	Common Crowfoot	0.22	0.11
43	*Cassia mimosoides*		46.89	-
47	*Ficus thoningii*		2.89	1.77
48	Unknown	Diyan Tafki	193.22	
49	Oryza hangistaminata		3.22	9.44
51	Unknown	*Solaba*	89.33	
13	*Parinari macrophylla*		0.11	13

4.2.4 HERPETOFAUNA

4.2.4.1 METHODOLOGY

Common methods of surveying herpetofauna were established and consisted in a pitfall trap transect within each sites sampled. Five trap arrays were installed along each transect, with each array consisting of three buckets, two double-ended funnel traps, and a 10 m drift fence. We positioned each trap array, 10 m apart, along each transect. Constructed drift fences were made with 0.4 m tall transparent plastic sheeting. The bottom 0.1 m of the plastic sheeting was buried to prevent animals from crossing underneath. Each animal caught was counted and recorded. Visual searching method was also used (Gibbons and Semlitsch, 1982; Froglife, 2003).

4.2.4.2 RESULTS

The study includes Riverine area, wetlands and woods. In each of these habitats, few species were observed. Reptiles were found to be more abundant in both rainy and dry seasons (Table 4-12 and 4-13). A total of 41 amphibians of three different species were surveyed in the rainy season; while104 reptiles of 5 different species were recorded. The numbers decreased in the dry season, during which only 14 individuals of amphibians and 82 reptiles were recorded. This may likely be due to better food availability and more favourable conditions for breeding during the rainy season than during the dry season.

Rana temporaria has the highest relative density among the species identified (57.14) during the dry season, but it was present at only one site (Table 4-13). During the rainy season, a total of 19 individuals of *Rana temporaria* were observed at three of the five survey sites. For reptiles, *Agama agama* was the most abundant species and it was observed at the five survey sites during both the rainy and the dry season. None of the species observed are on the IUCN Red List of Threatened species.

Rana temporaria (Source : Muséum national d'Histoire naturelle, 2017)

Agama agama (Source : Wikipédia, 2017)

Table 4-13 Occurrence and Relative Density of Herpetofauna Species during the Rainy Season

Name of the Location		**Unguwar Dodo**	**Mashayar Kwarkwari**	**Gangaren Mopol Barracks**	**Dutsen Mulgu**	**Fadamar Dutsen Mulgu**	**TOTAL**	**SPECIE RELATIVE DENSITY**
Local Government Area		Kalgo	Birnin Kebbi	Birnin Kebbi	Kangiwa	Kangiwa		
Type of Habitat		*Riverine*	*Agricultural*	*Woods*	*Woods*	*Wetland*		
Date of Sampling		13/10/2015	1410/2015	14/10/2015	15/10/2015	15/10/2015		
Latitude		12° 28.51 N	12° 27.12 N	12° 44.37 N	12° 33.45 N	12° 33.32 N		
Longitude		4° 30.40E	4° 8.7E	4° 14.58E	3° 45.25E	3° 45.53E		
Altitude		215 M	221 M	219 M	297 M	290 M		
Family	**Species**	**Number of Occurrence**						
Amphibians								
Ranidae	*Rana temporaria*	12	3	0	0	4	19	46.34
Bufonidae	*Bufo bufo*	8	5	0	0	7	20	48.78
Varanidae	*Varanus exanthematicus*	0	0	0	2	0	2	4.88
Total		20	8	0	2	11	41	
Density of All Species at Locations		48.78	19.51	0.00	4.88	26.83		
Reptiles								
Agamidae	*Agama africana*	7	2	3	9	5	26	25.00
Agamidae	*Agama agama*	10	8	6	17	8	49	47.12
Unknown	*Unknown*	4	5	0	7	3	19	18.27
Scincidae	*Mabuya sp.*	1	0	0	0	0	1	0.96
Unknown	*Unknown*	2	0	0	5	2	9	8.65
Total		24	15	9	38	18	104	
Density of All Species at Locations		23.08	14.42	8.65	36.54	17.31		

Table 4-14 Occurrence and Relative Density of Herpetofauna Species during the Dry Season

Name of the Location		Unguwar Dodo	Mashayar Kwarkwari	Gangaren Mopol Barracks	Dutsen Mulgu	Fadamar Dutsen Mulgu		
Local Government Area		Kalgo	Birnin Kebbi	Birnin Kebbi	Kangiwa	Kangiwa		
Type of Habitat		*Riverine*	*Agricultural*	*Woods*	*Woods*	*Wetland*		
Date of Sampling		13/12/2015	14/12/2015	14/12/2015	13/12/2015	13/12/2015		
Latitude		12° 28.51 N	12° 27.12 N	12° 44.37 N	12° 33.45 N	12° 33.32 N		
Longitude		4° 30.40E	4° 8.7E	4° 14.58E	3° 45.25E	3° 45.53E		
Altitude		216 M	222 M	219 M	298 M	291M		
Family	**Species**	**Number of Occurrence**					**TOTAL**	**SPECIE RELATIVE DENSITY**
		Amphibians						
Ranidae	*Rana temporaria*	8	0	0	0	0	8	57.14
Bufonidae	*Bufo bufo*	6	0	0	0	0	6	42.86
Varanidae	*Varanus exanthematicus*	0	0	0	0	0	0	0.00
Total		14	0	0	0	0	14	
Density of All Species at Locations		100.00	0.00	0.00	0.00	0.00		
		Reptiles						
Agamidae	*Agama africana*	5	4	6	9	4	28	34.15
Agamidae	*Agama agama*	7	5	8	10	6	36	43.90
Unknown	Unknown	3	0	0	7	3	13	15.85
Scincidae	*Mabuya sp.*	0	0	0	0	0	0	0.00
Unknown	Unknown	2	0	0	1	2	5	6.10
Total		17	9	14	27	15	82	
Density of All Species at Locations		20.73	10.98	17.07	32.93	18.29		

4.2.5 BIRDS

4.2.5.1 METHODOLOGY

The objective of the survey was to conduct a total count of all the birds present over a specified area to obtain an unbiased estimate of abundance without statistical inferences or underlying assumptions. It assumes that all individuals present in an area can be recorded; therefore, censuses are most useful for conspicuous species occupying discrete and well-defined habitats. A complete count of herons and cormorants nesting in trees, mapping and point transects, both visual and auditory methods were adopted (Bibby *et al*., 2000; Whitman *et al*., 1997; Haselmayer and Quinn 2000). Surveys were done during the dry and rainy seasons.

4.2.5.2 RESULTS

Biodiversity of birds is presented in Tables 4-14 and 4-15. Fourteen (14) species belonging to eleven (11) families were identified. None of these species is identified on the IUCN red-list. Birds were the most abundant fauna observed during the field surveys. There was clear indication that the diversity of these birds was favoured due to available water and variety of foods during the rainy season compared to dry season, where their number of occurrence decreased. In the rainy season, a total of 317 individuals were identified compared to 165 individuals during the dry season. Five different locations were adopted for the present survey. The highest number of individuals was recorded in the riverine during the rainy season with 87 individuals. This was followed by the woods at Kangiwa LGA, where a total of 65 individual birds were recorded. During the dry season, the highest number of individuals was recorded in the woods at Kangiwa LGA with 48 individuals followed by the riverine area with 40 individuals.

The species densities have shown that *Zenaida auriculata* has the highest density of any other species in both rainy season (29, 02%) and dry season (30, 30%).

Zenaida auriculata
(Source: AviBase, 2017)

Table 4-15 Occurrence and Relative Density of Bird Species during the Rainy Season

Name of the Location		**Unguwar Dodo**	**Mashayar Kwarkwari**	**Gangaren Mopol Barracks**	**Dutsen Mulgu**	**Fadamar Dutsen Mulgu**		
Local Government Area		Kalgo	Birnin Kebbi	Birnin Kebbi	Kangiwa	Kangiwa		
Type of Habitat		*Riverine*	*Agricultural*	*Woods*	*Woods*	*Wetland*		
Date of Sampling		13/10/2015	1410/2015	14/10/2015	15/10/2015	15/10/2015		
Latitude		12° 28.51 N	12° 27.12 N	12° 44.37 N	12° 33.45 N	12° 33.32 N		
Longitude		4° 30.40E	4° 8.7E	4° 14.58E	3° 45.25E	3° 45.53E		
Altitude		215 M	221 M	219 M	297 M	290 M		
Family	**Species**			**Number of Occurrence**			**TOTAL**	**SPECIE RELATIVE DENSITY**
Columbidae	*Zenaida auriculata*	15	10	23	23	21	92	29.02
Accipitridae	*Elanus caeruleus*	12	2	3	4	5	26	8.20
Motacillidae	*Anthus trivialis*	2	4	3	10	13	32	10.09
Cardinalidae	*Cardinalis cardinalis*	8	6	0	0	4	18	5.68
Accipitridae	*Diurnus accipitridae*	4	0	0	0	0	4	1.26
Ardeidae	*Egretta alba*	22	12	1	0	9	44	13.88
Turdidae	*Turdus merula*	7	2	3	4	1	17	5.36
Passeridae	*Petronia xanthocollis*	3	1	2	5	6	17	5.36
Corvidae	*Cyanocitta cristata*	1	2	3	6	1	13	4.10
Bombycilla	*Bombycilla cedrorum*	7	3	5	4	3	22	6.94
Emberizidae	*Melozone aberti*	3	0	1	2	0	6	1.89
Icteridae	*Quiscalus major*	1	2	5	4	0	12	3.79
Emberizidae	*Peucaea botterii*	0	2	2	1	0	5	1.58
Columbidae	*Streptopelia roseogrisea*	2	3	1	2	1	9	2.84
Total		**87**	**49**	**52**	**65**	**64**	**317**	
Density of All Species at Locations		**27.4**	**15.5**	**16.4**	**20.5**	**20.2**		

Table 4-16 Occurrence and Relative Density of Bird Species during the Dry Season

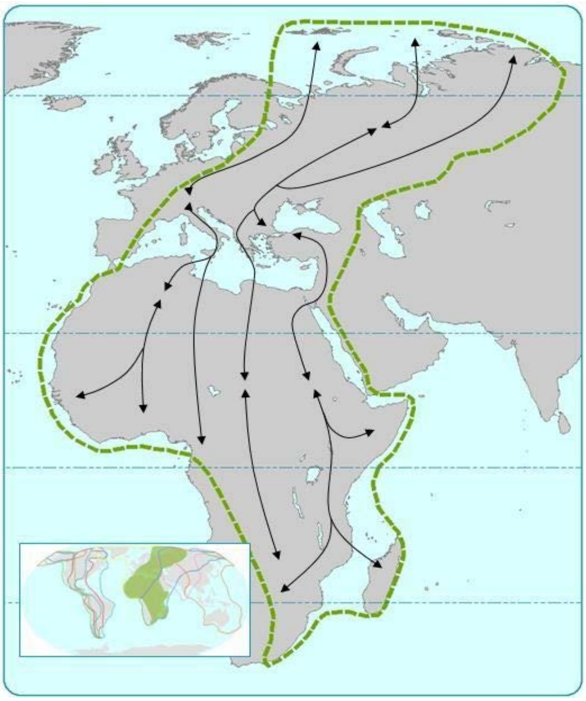
Name of the Location		**Unguwar Dodo**	**Mashayar Kwarkwari**	**Gangaren Mopol Barracks**	**Dutsen Mulgu**	**Fadamar Dutsen Mulgu**		
Local Government Area		Kalgo	Birnin Kebbi	Birnin Kebbi	Kangiwa	Kangiwa		
Type of Habitat		*Riverine*	*Agricultural*	*Woods*	*Woods*	*Wetland*		
Date of Sampling		13/12/2015	14/12/2015	14/12/2015	13/12/2015	13/12/2015		
Latitude		12° 28.51 N	12° 27.12 N	12° 44.37 N	12° 33.45 N	12° 33.32 N		
Longitude		4° 30.40E	4° 8.7E	4° 14.58E	3° 45.25E	3° 45.53E		
Altitude		216 M	222 M	219 M	298 M	291M		
Family	**Species**	**Number of Occurrence**					**Total**	**Specie Relative Density**
Accipitridae	*Elanus caeruleus*	3	1	0	0	1	5	3.03
Motacillidae	*Anthus trivialis*	2	1	3	10	5	21	12.73
Cardinalidae	*Cardinalis cardinalis*	7	4	2	0	3	16	9.70
Accipitridae	*Diurnus accipitridae*	3	0	2	5	0	10	6.06
Motacillidae	*Anthus trivialis*	4	3	4	9	7	27	16.36
Corvidae	*Cyanocitta cristata*	2	1	0	2	0	5	3.03
Bombycilla	*Bombycilla cedrorum*	1	3	0	2	3	9	5.45
Emberizidae	*Melozone aberti*	4	1	2	0	1	8	4.85
Icteridae	*Quiscalus major*	1	0	4	2	1	8	4.85
Columbidae	*Streptopelia roseogrisea*	1	0	1	1	3	6	3.64
Columbidae	*Zenaida auriculata*	12	5	7	17	9	50	30.30
Total		**40**	**19**	**25**	**48**	**33**	**165**	
Density of All Species at Locations		**24.2**	**11.5**	**15.2**	**29.1**	**20.0**		

4.2.5.3 MIGRATORY SPECIES

There are two known types of migration: long distance migration and daily migration. Long distance migrants can fly thousands of kilometers without stopping and will have the least exposure to power lines during migration (e.g., some shorebirds, swallows, swifts, and terns). They usually migrate at night while they rest and feed during the day (Manville 2007). Daily migrants take shorter flights and make numerous stops to rest and feed (Newton 2008). Daily migrants include cranes, ducks, geese, and raptors. In Nigeria, on 863 species present in the country, a total of 251 species are migratory (BirdLife International, 2017). Only two surveyed species inside the study area, *Anthus trivialis* and *Streptopelia roseogrisea* are migratory. They have been surveyed in both rainy and dry seasons.

Twice a year, billions of birds migrate vast distances across the globe. Typically, these journeys follow a predominantly north-south axis, linking breeding grounds in arctic and temperate regions with non-breeding sites in temperate and tropical areas. Many species migrate along broadly similar, well established routes known as flyways.

The Palaearctic-African flyways constitute collectively the world's largest bird migration system. Over 2 billion passerines and near-passerines, 2.5 million ducks and two million raptors migrate from their breeding grounds in Europe and central and western Asia to winter in tropical Africa.



Source: BirdLife International, 2017

Figure 4-11 Flyways Overlapping the Region of the Project

4.2.5.4 BIRDS SUSCEPTIBILITY TO COLLISIONS

Interactions between birds and power lines are a complex mixture of biological, environmental and engineering factors (APLIC, 2012). Of course, some bird species that are active in the vicinity of power lines are more susceptible to collision and electrocution risks than others. However, few principles influence the probabilities of these collisions to happen (APLIC, 2012):

- → Exposure to collisions is largely a function of behavior. Specific behaviors (such as flushing, courtship displays, and aerial hunting) may distract birds from the presence of power lines.
- → Exposure is increased for birds that make regular and repeated flights between nesting, feeding, and roosting areas in proximity to power lines.

- Susceptibility to collisions is partially a function of wing and body size and vision. Larger, heavy-bodied birds with short wing spans and poorer vision are more susceptible to collisions than smaller, lighter-weight birds with relatively large wing spans, agility, and good vision.
- Environmental conditions (such as inclement weather and darkness) may distract birds from the presence of power lines or obscure their visibility.
- Engineering aspects, including design and placement, can increase or decrease the exposure for collisions.

The orders of birds reported to be most susceptible to collisions included (APLIC, 2012) as presented in the next Table:

Table 4-17 Taxonomic Groups of Birds that are the most Susceptible to Collisions

Orders	Families	Common Names
Gaviiformes	*Gaviidae*	Loons
Podicipediformes	*Podicipedidae*	Grebes
Procellariiformes	*Diomedeidae* *Procellariidae* *Hydrobatidae*	Albatross Shearwaters/Petrels Storm Petrels
Pelecaniformes	*Phaethontidae* *Sulidae* *Pelecanidae* *Phalacrocoracidae* *Anhingidae* *Fregatidae*	Tropicbirds Boobies/Gannets Pelicans Cormorants Anhingas Frigatebirds
Ciconiiformes	*Ardeidae* *Threskiornithidae* *Ciconiidae*	Herons/Bitterns Ibises Storks
Anseriformes	*Anatidae*	Waterfowl
Falconiformes	*Cathartidae* *Pandionidae* *Accipitridae* *Falconidae*	Vultures Ospreys Hawks Falcons
Galliformes	*Cracidae* *Phasianidae* *Odontophoridae*	Curassow Pheasants Quail
Gruiformes	*Rallidae* *Aramidae* *Gruidae*	Rails Limpkins Cranes
Charadriiformes	*Charadriidae* *Haematopodidae* *Recurvirostridae* *Scolopacidae* *Laridae* *Alcidae*	Plovers Oystercatchers Stilts/Avocets Sandpipers/Phalaropes Gulls/Terns Auks (Alcids)
Apodiformes	*Apodidae* *Trochilidae*	Swifts Hummingbirds

Table 4-16 Taxonomic Groups of Birds that are the most Susceptible to Collisions (cont'd)

Orders	Families	Common Names
Columbiformes	*Columbidae*	Pigeons/Doves
Strigiformes	*Tytonidae* *Strigidae*	Barn Owls Typical Owls
Passeriformes Part I	*Tyrannidae* *Alauidae* *Hirundinidae* *Corvidae* *Paridae* *Sittidae* *Certhiidae* *Troglodytidae* *Muscicapidae*	Flycatchers Larks Swallows Jays/Crows Chickadees/Titmice Nuthatches Creepers Wrens Kinglets/Thrushes
Passeriformes Part II	*Mimidae* *Motacillidae* *Bombycillidae* *Ptilogonatidae* *Laniidae* *Sturnidae* *Vireonidae* *Coerebidae* *Pycnonotidae*	Mockingbirds/Thrashers Pipits/Wagtails Waxwings Silky-Flycatchers Shrikes Starlings Vireos Bananaquits Bulbuls
Passeriformes Part III	*Emberizidae* *Fringillidae* *Passeridae*	Warblers, Sparrows, etc. Finches Weaver Finches

Based on these identified species, there are 5 species of birds surveyed inside the study area that are more susceptible to collision with the powerline, these are *Streptopelia roseogrisea, Cyanocitta cristata, Petronia xanthocollis, Egretta alba and Zenaida auriculata.*

4.2.6 MAMMALS

4.2.6.1 METHODOLOGY

Survey units were divided into three replicate survey sites, this was established per assessment unit, in an effort to reduce spatial variability in fauna assemblages and increase precision in the estimation of population characteristics. Species accumulation and number of species detected within a defined sampling area were identified and recorded; binoculars were used to assist with species identification (Thompson and Thompson 2007b).

4.2.6.2 RESULTS

The only species of mammals observed during the field survey were domestic animals including cattle, sheep, horses, goats, camels, cats, dogs, and donkeys. According to the Global Biodiversity Information Facility, this region of Nigeria could potentially host 25 mammal species (Table below). None of these potential species are listed in the IUCN Red List of threatened species. Most of the potential mammal species that have been identified in Kebbi State are either small mammals or bats.

In terms of threatened species, the following species are present in the Sudan savanna vegetation zone in which the powerline is located: *Hippopotamus amphibious* (vulnerable), *Loxodonta africana* (vulnerable), *Panthera pardus* (near threatened), *Panthera leo* (vulnerable), *Hyaena hyaena* (near threatened), and *Eidolon helvum* (near threatened) (Happold 1987). A large proportion of the powerline right-of-way is covered by cultivated land leaving little natural habitats susceptible to host threatened species.

Table 4-18 List of Potential Mammal Species

Family	Scientific name	IUCN status
Erinaceidae	*Atelerix albiventris*	
Galagonidae	*Galago senegalensis subsp. senegalensis*	
Muridae	*Arvicanthis niloticus*	
Muridae	*Cricetomys gambianus*	
Muridae	*Dasymys rufulus*	
Muridae	*Gerbilliscus sp.*	
Muridae	*Lemniscomys zebra*	
Muridae	*Mastomys sp.*	
Muridae	*Mus musculoides*	
Muridae	*Taterillus gracilis*	
Nycteridae	*Nycteris macrotis*	
Nycteridae	*Nycteris thebaica*	
Pteropodidae	*Epomophorus gambianus*	
Pteropodidae	*Micropteropus sp.*	
Pteropodidae	*Micropteropus pusillus*	
Rhinolophidae	*Hipposideros caffer*	
Rhinolophidae	*Hipposideros sp.*	
Rhinolophidae	*Hipposideros ruber*	
Rhinolophidae	*Hipposideros ruber subsp. guineensis*	
Rhinolophidae	*Rhinolophus landeri*	
Sciuridae	*Heliosciurus gambianus*	
Sciuridae	*Xerus erythropus subsp. leucoumbrinus*	
Soricidae	*Crocidura longipes*	
Soricidae	*Crocidura olivieri odorata*	
Viverridae	*Genetta thierryi*	

4.2.7 AQUATIC FAUNA

4.2.7.1 METHODOLOGY

Diversity of aquatic fauna, especially fish, was evaluated with structured questionnaires, which were distributed to respondents (fishermen) around the Riverine area. Standard questionnaire formats were used for the survey (Garratt and Bond, 2001; Rattray and Jones, 2007).

Water samples were collected using plankton mesh into sterile sampling bottles and brought to the laboratory for observation using microscopes at the six sample sites for water quality. Sampling has been done for both wet and dry seasons. Mycobiota were also sampled.

4.2.7.2 RESULTS

Fish

The fish species found at this study area were reported from the interview conducted with structured questionnaires. The following fish species were identified as being present in the study area. During the rainy season, 18 species were reported to be available in the river. However, in the dry season, only five (5) species were reported to be available. Out of these five species, *Clarias gariepinus* and *Synodontis clarias* are present in abundance compared to other species. This is likely due to the reduction in water volume and frequent fishing by fishermen. Fishermen also reported that the river had an important diversity of fish species, but their availability decreased as the volume of water decreased during the dry season. None of the identified species are considered threatened.

Clarias gariepinus
(Source: Encyclopedia of Life, 2017)

Synodontis clarias
(Source: Hippocampus Bildarchiv, 2017)

Table 4-19 Checklist of Fish Species Both during Rainy and Dry Seasons

GPS Features		**Name of the Location: Unguwar Dodo River**	
		Rainy	**Dry**
Latitude		12°28.51N	12°28.52N
Longitude		4°41.00E	4° 41.00E
Altitude		214M	213m
Time		12:30pm	9:30am
Date		13/10/15	14/12/15
Family	**Species**	**Presence/Absence During the Seasons**	
Mormyridae	*Mormyrus longilostris*	++	-
Cichilidae	*Oreochromis niloticus*	++	-
Clariidae	*Clarias gariepinus*	++	++
Latidae	*Lates niloticus*	+	+
Mochokidae	*Synodontis petricola*	+	-
Distichodontidae	*Distichondus rostratus*	+	-
Bagridae	*Bagrus docmak*	+	-
Alestidae	*Hydrocynus forskahlii*	-	-
Clariidae	*Clarias anguillaris*	+	+
Clariidae	*Clarias camerunensis*	+	-
Claroteidae	*Clarotes laticeps*	+	-
Anabantidae	*Ctenopoma petherici*	+	+
Nothobranchiidae	*Epiplatys bifasciatus*	+	-
Mochokidae	*Synodontis batensoda*	++	-
Mochokidae	*Synodontis budgetti*	++	-
Mochokidae	*Synodontis clarias*	+	++
Mochokidae	*Synodontis schall*	+	-
Mochokidae	*Synodontis sorex*	+	-
Cichlidae	*Tilapia zillii*	+	-

Footnote: + Present, ++: Present in Abundance, - :Absent

Plankton

Phytoplankton are the autotrophic components of the plankton community and a key factor of oceans, seas and freshwater basin ecosystems. Plankton abundance and distribution are strongly dependent on factors such as nutrient concentrations, water quality, and abundance of other plankton (Anon. 2015k). Planktons indicate the nutrient-richness of water. Nutrients in soil from watershed get washed into rivers.

Wet season data indicated more richness in plankton species and diversity, which could be attributed to the abundance of water at the time and the more conducive environment in terms of lower temperature. The extremes of temperature reached in this region play a great role in the shrinking of water bodies during the dry season thereby affecting the population of aquatic organisms. The tables below show plankton species sampled in both wet and dry seasons.

Table 4-20 Plankton Species in Surface Water (Wet Season)

Samples	Species identified
SW/1310/KLG/PL/A1	*Limulus spp.* (Horseshoe crab) *Euglena* Ehrenberg*, Gloetrichia J.* Agardh
SW/1310/KLG/PL/A2	*Tubifex* spp. (Oligochaetes), *Anthopysa* Bory*, Nitzschia Frenguelli spp.*
SW/1310/KLG/PL/B1	*Achnanthes adanata bory, Spirogyra charophyta, Closterium lunula* Ehrenberg, *Gymnura* spp. (Spiny-rayed fish), *Zynema, Chlorella, Suctoria* (Ciliates), *Karenia* (Dinoflagellates).
SW/1310/KLG/PL/B2	*Gloetrichia, Oscillatoria, Lyngbya, Botrydium, Aphanizomenon, Cyanobacteria, Anabaena, Cladophora, Frenguelli*
SW/1310/KLG/PL/C1	*Anacystis meneghini, Ulva, Dichotonosiphon*
SW/1310/KLG/PL/C2	*Suctoria, Ascaris, Brachionus spp. Karenia, Ankistrodesmus* (Chrysophyta),

Table 4-21 Plankton Species in Surface Water (Dry Season)

Samples	Species identified
SW/1312/KLG/PL/A1	*Spirogyra, Ascaris lumbricoides, Copepod Cyclops, Oedogonium*
SW/1312/KLG/PL/A2	*Oscillatoria, Oedogonium*
SW/1312/KLG/PL/B1	*Dichotomosiphon*, Mougeotia, Cladophora, *Chlorella*
SW/1312/KLG/PL/B2	*Cyanobacteria, Anabaena, Spirogyra, Tolypothrix*
SW/1312/KLG/PL/C1	*Oscillatoria, Lyngbya, Mougeotia*
SW/1312/KLG/PL/C2	*Hirudo, Monhysteria, Copepod diaptomus, rhabditis male*

Mycobiota

The mycobiota recorded was dominated by species of Penicillium, Trichoderma, and Aspergillus species in both wet and dry seasons. Penicillium fungi are versatile and opportunistic (See Tables above). They are post-harvest pathogens. Penicillium species are one of the most common causes of fungal spoilage in fruits and vegetables (Anon., 2015j). The implication of Penicillium species in allergy, asthma, or other respiratory problems has been a subject of several studies worldwide. Strong associations between Penicillium spp. and health problems were also reported by Cooley et al. (1998).The results from this study are consistent with the findings of Arvanitidou et al. (1999) that Aspergillus is one of the more commonly isolated genera in water.

Most Trichoderma species are soil borne and are characterized by rapidly growing colonies that have a great potential for spore production. The genus includes species reported to cause mycoses and allergy in humans. Several of the molds are potential toxin producers, and exposure to small amounts of toxins for several years may have negative effects on the immune system.

Sampled surface water is heavily contaminated with Aspergillus spp. (as can be seen in both the wet and dry seasons), largely because the samples have contact with ambient air, leading to fungal contamination from the air into the water (Warris and Verweij, 2005). Water-related problems like off flavor and odor have been connected to the presence of molds (Gunhild et. al., 2006).

4.2.8 ECOSYSTEM SERVICES

An ecosystem is defined as a dynamic complex of plants, animals, micro-organisms and non-living components interacting as a functional unit. Human communities are an integral part of ecosystems and are beneficiaries of many goods and services they provide. These benefits are recognized as Ecosystem Services (ES).

The concept of ES has grown in importance over the last decade, particularly following the Millennium Ecosystem Assessment. The definition of this concept comes from the evaluation report, which states that such services are the benefits people obtain from ecosystems (IFC, 2012). ES could be considered as the direct and indirect contributions of ecosystems to human well-being (Kumar, 2009).

ES are grouped into four categories that have been studied:

→ Supply services: which refer directly to products people obtain from ecosystems (e.g. agricultural products, plants to eat, game, medicinal plants, fresh water, biofuel, timber, etc.);

→ Regulating services: which are the benefits humans obtain from the regulation of ecosystem processes (e.g. climate regulation, waste decomposition, purification of water and air, etc.);

→ Cultural services: which refer to the non-material benefits people obtain from ecosystems (e.g. sacred and spiritual sites, ecotourism, education, etc.).

→ Supporting services: which are the natural processes that maintain the other services (e.g. nutrient cycling, genetic production and genetic exchange channels, etc.).

The benefits that local communities obtain from local natural and modified habitats are crucial in their well-being. ES provided within the project potentially impacted habitats or ecologically associated with these habitats have been assessed at a high-level. They are described briefly in next table.

Table 4-22 Ecosystem Services Provided Within the Project Potentially Impacted Habitats or Ecologically Associated With These Habitats

Ecosystem services	Description
Agricultural potential and production	Areas with agricultural potential, including all crops and agricultural products grown by local communities for human and livestock consumption. The agricultural potential varies depending of the soil types and water content.
Livestock and forage resources	Forage resources, water and other supporting livestock and animals owned for consumption, domestic or commercial uses. Livestock in the area is pretty restricted. However, the floodplain and rivers play an important role in terms of forage resources and water access.
Fishing and fisheries	Fishing stock caught or aquaculture within the water streams activities are of great importance for local communities. Fishing activities are usually done to cover proteins needs for the family or to provide punctual incomes.
Hunting and bush meat	Animal species trapped or hunted for consumption, including insects, mammals, birds, amphibians and reptiles. Hunting is pretty limited in the area as it is not known to support an important density of large animal.
Wild food products	Products collected in the wild for food, other than animal proteins (vegetal products, mushrooms or honey). According to discussions with women, there are few plants that are integrated in alimentation. Alimentation is mainly based on crops and proteins from animals and insects.
Traditional medicine	Minerals, plants or animals used in order to maintain people's health as well as to prevent, diagnose, treat or care for physical and mental diseases. Traditional medicine is widespread inside the local communities.
Timber wood	Wood exploited economically. There are few specimens of timber species inside the project area.
Building materials	Mineral or vegetal material (ligneous or non-ligneous) used for construction purposes on the properties. Houses are made with local natural material, mainly wood and bricks made locally. Earth and sand are used in 3 out of 10 affected households to build their house, and they are used more often in rural areas (49%) than in urban areas (12%).
Carpentry and craft	All the material and wild products used to construct furniture and to make craft objects. Long herbs found along the river are used to produce mats.
Biofuel	Animal or vegetal products used as energy sources. People use wood as a main source of energy and there is an important production of charcoal in the project area. The vast majority of affected households (91.2%) use wood as cooking fuel.
Water resources	Groundwater and surface water used as tap water or for domestic, commercial or agricultural means. Comprises all the natural processes that regulate its quality or quantity.
Genetic resources	Genes or genetic information used to improve animal or vegetal species. In the project area, it is mainly materialized by improved crops used by local communities that are more resistant and show better production in the prevalent local conditions.
Regulation services	
Air quality control	Ecosystems influence in terms of gases exchanges or filtration of physical or chemical particles in the air (ex: dust, O_2, CO_2).
Climate regulation	**Global:** Ecosystems influence the absorption or emission of green gases and in the regulation of air masses. **Regional and local:** Ecosystems influence on regional and local temperatures, rainfalls or on other climatic parameters.
Water regulation	Ecosystems influence on the amplitude and period of water flow, water storage, aquifer filling and flood prevention. They also play a role in the filtration and decomposition of organic matter and pollutants. Riparian habitats in the project area play an important role in water regulation.
Erosion control and soil quality	Role of ecosystems in preventing erosion by retaining soil by intercepting rainfall, reducing the speed of runoff, etc. Role in maintaining the physical and chemical properties of soils. Natural habitats in the project area play an important role in water regulation and provide a given protection to soil erosion.
Pollination	Role of ecosystems in the pollination of crops, cultivated trees and wild trees and plants. Animals (insects, birds, mammals, etc.) of surrounding habitats come to pollinate crops and other flowering plants.
Regulation of natural risks	Ecosystem capacity to reduce the damage caused by natural disasters and limits the frequencies and intensities of fire.
Cultural Services	
No cultural service has been identified inside the study area	

Ecosystem services	Description
Support Services	
Primary production	Production of organic matter by plants through photosynthesis and nutrients input. It forms the basis of the food chain.
Nutrient cycles	Nutrient cycles in the ecosystems (phosphorus, nitrogen, carbon, sulfur, etc.). Habitat Natural or modified areas which support flora and fauna communities.
Water cycle	Water transition through different receptors (atmosphere, terrestrial and aquatic habitats) in all its phases (solid, liquid and gaseous).

4.3 HUMAN ENVIRONMENT

4.3.1 METHODOLOGY

The preparation of documentation of the social aspects of the human environment of the affected area commenced with a literature review (Fichtner's Feasibility Study Report, legal documents, scientific literature, etc.) where the key elements for the development of the report were assessed. Subsequently, the EIES was conducted through:

- Inventory of key official statistical reports of demographic, economy agriculture, etc.
- Consultations with a number of key stakeholders at the national, regional and local levels (see section 6);
- A census of all 16 affected communities and 498 households was done to register their affected assets and socioeconomic characteristics. This census was based on two (2) separate surveys (community and household surveys). The first survey was meant to assess the affected households' assets and socioeconomic circumstances and the second survey assessed the community's characteristics and assets that would be affected by the project implementation. To gather information on socioeconomic characteristics of the surroundings, a control group of households living outside the affected corridor and representing no less than 10% of the total number of affected households was also interviewed. The census was undertaken from October 14 to 24, 2015.

4.3.2 POLITICAL CONTEXT

Nigeria practices the presidential system of government with three tiers of government; Federal, State and Local. At all the three levels, there are executive arm, legislative and judicial with separation of powers and checks and balances. The exception is that there are two legislative houses at Federal level –Senate and House of representatives, and there is no judicial arm at Local Government Level. (Chapter 1, Part 2 of the Constitution of the Federal Republic of Nigeria1999).

Three Senators are elected from each of the 36 states and one from the Federal Capital Territory. Number of houses of representatives from each state depends on certain demographical data.

There are 29 political parties registered in Nigeria by the Independent National Electoral Commission (INEC). Candidates vying for any elective political office must do so through a political party. Independent candidacy is not allowed under the relevant laws (Independent National Electoral Commission, 2015).

In Kebbi State, two of these parties are popular, there are the -All Progressives Congress (APC) and Peoples Democratic Party (PDP). The present governor of the state was elected under the APC, during the April 2015 elections. Likewise, all 3 senators and 8 federal house of assembly representatives from Kebbi state are from the APC. The state house of assembly consists of 24 members, from which only two are from PDP and the rest from APC (Independent National Electoral Commission, 2015).

There is Emirate councils that constitute the traditional governance authority in the state. These are emirates of Gwandu, Argungu, Yauri and Zuru. The next layer is district heads who report to the emires who are 35 in total. Village chiefs report to the district heads. The emires, district heads and village chiefs are not allowed to participate in partisan politics under the laws of Nigeria.

4.3.3 ADMINISTRATIVE STRUCTURE

Nigeria operates a three-tier Government system as defined under the constitution: Federal, state, and local government authorities. Kebbi State is one of the 36 states and was created out of Sokoto State on August 27, 1991 with its capital at Birnin-Kebbi. Its major towns include Birnin-Kebbi, Argungu and Yelwa. Kebbi State is divided into 21 local government areas, four emirate councils (Gwandu, Argungu, Yauri and Zuru), and 35 districts (College of Agriculture of Zuru, 2015)). Kebbi state derived its name from the 14th century "KEBBI KINGDOM" which was a province of the former Songhai Empire. Islam is the predominant religion. (Dierk Lange, 2009) Located in north western Nigeria, Kebbi State occupies an area of 36,800 km2. The state shares boundaries with Sokoto State on the north-eastern axis, Zamfara State on the eastern part, Niger state on the southern part and Republic of Niger on the western part.

The current distribution of responsibilities among the three tiers of Government is provided in the Second and Fourth Schedules of the 1999 Constitution. Next Table provides the description of their respective responsibilities.

Hence, strictly speaking, the Constitution does not really provide the list of functions to be executed by the Federal Government of Nigeria and the states (as it does for the Local Government Councils), but only the subjects upon which they can legislate. However, these legislative lists form the guidelines for other legal decrees and sectoral policies reports that lay out the specific responsibilities of the different tiers of government. (Stuti Khemani, 2001).

The chairman and his councillors represent the executive arm of the local government area. The state Local Government Service Commission appoints and posts administrative secretaries, accountants and other auxiliary staff. Each LGA has eight key departments which are The Central administration, finance, education, works, social welfare, health, agriculture and natural resources and information. Each of these is headed by an elected councillor.

Table 4-23 Respective Responsibilities for Tiers of Government

Tier of government	Responsibilities
Federal only	Defense; Shipping; Federal trunk roads; Aviation; Railways; Posts, telegraphs and telephones; Police and other security services; Regulation of labor, interstate commerce, telecommunications; Mines and minerals; Social Security; Insurance; National statistical system; National Parks; Guidelines for minimum education standards at all levels; Water resources affecting more than one state.
Federal-State (shared)	Antiquities and monuments; Electricity; Industrial, commercial and agricultural development; Scientific and technological research; Statistics and surveys; University, technological and post-primary education; Health and social welfare.
State-Local (shared)	Primary, adult and vocational education; Health services; Development of agriculture and non-mineral natural resources.
Local government	Economic planning and development; Cemeteries, burial grounds; Homes for the destitute and infirm; Markets; Sewage and refuse disposal; Roads, streets, street lighting, drains, other public facilities.

Kebbi State is made up of four emirate councils: Gwandu, Argungu, Yauri and Zuru. His Royal Highness, the Emir of Gwandu is the State Chairman of the Emirate Council, with the Emirs of Argungu, Yauri and Zuru as members.

Within each emirate council, there are various traditional title holders. Each emirate council is made up of district heads and councillors that are hereditary with some few being appointed. The emirate councils are the custodians of traditional values, and institutions and are much closer to the people within the state. In terms of pushing government policies and programmes, soliciting for peace, they have performed creditably well over the years.

The history of state formation in Kebbi through the pre-colonial to the colonial and present eras entrenched a particular form of politics that has provoked sub nationalism and cultural context of hostility and hatred against the Hausa/Fulani especially in Zuru.

The judiciary is an independent arm of government which is headed by the Chief Judge of the state. It is composed of three units: the High Court, the Sharia and Area Courts. The High Court and Magistrate Courts are headed by judges and magistrates respectively; while the Sharia Court of Appeal is under the honourable Grand Khadi who is assisted by Khadis. The Sharia Court of Appeal deals with Sharia matters referred to it by Sharia Area Courts. All three courts have one chief Registrar, they are serviced by a Judicial Service Commission and are answerable to the Chief Judge of the state. Each of the twenty one local government areas is headed by an elected chairman with councillors representing the wards.

4.3.4 LAND PLANNING AND USES

The Kebbi Urban Development Authority (KUDA) is responsible for controlling developments in urban centers, while the Local Government Areas have responsibility for rural areas. The sub-station and small portion of the line route within Birnin-Kebbi (up to the location where it crosses the Abuja Road) is managed by KUDA, while the remaining entire line route is under the respective local governments.

There are no specific future projects planned for these areas covered by the project except for a road construction from Birnin-Kebbi to Kola Village in Birnin Kebbi LGA by the State Government. The project is to tare the existing laterite road connecting the two locations.

Land is mainly used for agricultural purposes in the rural portion of the line route. Map 4-6 shows land use map of a 10km strip along the line route.

4.3.5 DEMOGRAPHY

Population

Nigeria is the most populous country in Africa with a total of 177 155 754 inhabitants. The ages structure shows that there are 43.2% of population below 14 years of which men are 39 151 304 and women with 37 353 737. The median age (18.2) is consequently young. People over 65 years old constitute only 3% of the population (Federal Office of Statistics, 2004).

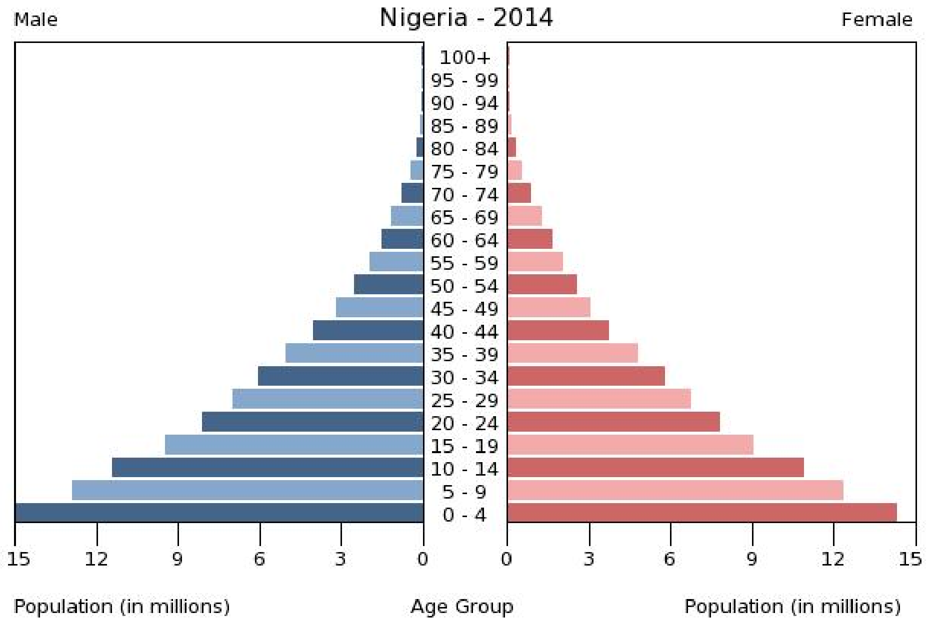
Using the 1991 population census and based on a 2.83% growth rate, the projected population of Kebbi State for the year 1999 is 2.587 million (NPC, 1992). This increase is the result of improved medical care, better nutritional standards and internal migration since the creation of the state in 1991. Further projections from a more recent census show that the population of the state will stand at 3,630,931 by 2011, with a population density of 56/km^2 (150/sq mi) ranking 22nd out of the 36 states that make up Nigeria.

In general terms, the rural population, which accounts for 78% of the state total, lives in small and highly dispersed settlements. Their main occupation is mainly production-subsistence farming as well as animal pasturing, some trading and public service.

Arewa and Dandi Local Government Area are among the four LGAs crossed by the study area and shares a boundary with the Niger Republic. Their headquarters are in the towns of Arewa and Kamba respectively. They have together an area of 3,901km² and a population of 184,030 at the 2006 census. Thirdly, Kalgo LGA was created in 1996 out of Bunza LGA with its headquarters in the town of Kalgo. It shares a west border with Bunza LGA and has an area of 1,173 km² and a population of 85,403 at the 2006 census. The fourth LGA that falls within the corridor is Birnin Kebbi LGA which also serves as the state's capital city. From the 2007 numbers, the city has an estimated population of 268,420 and accounts for eight % of all urban population (Online Nigeria, 2015).

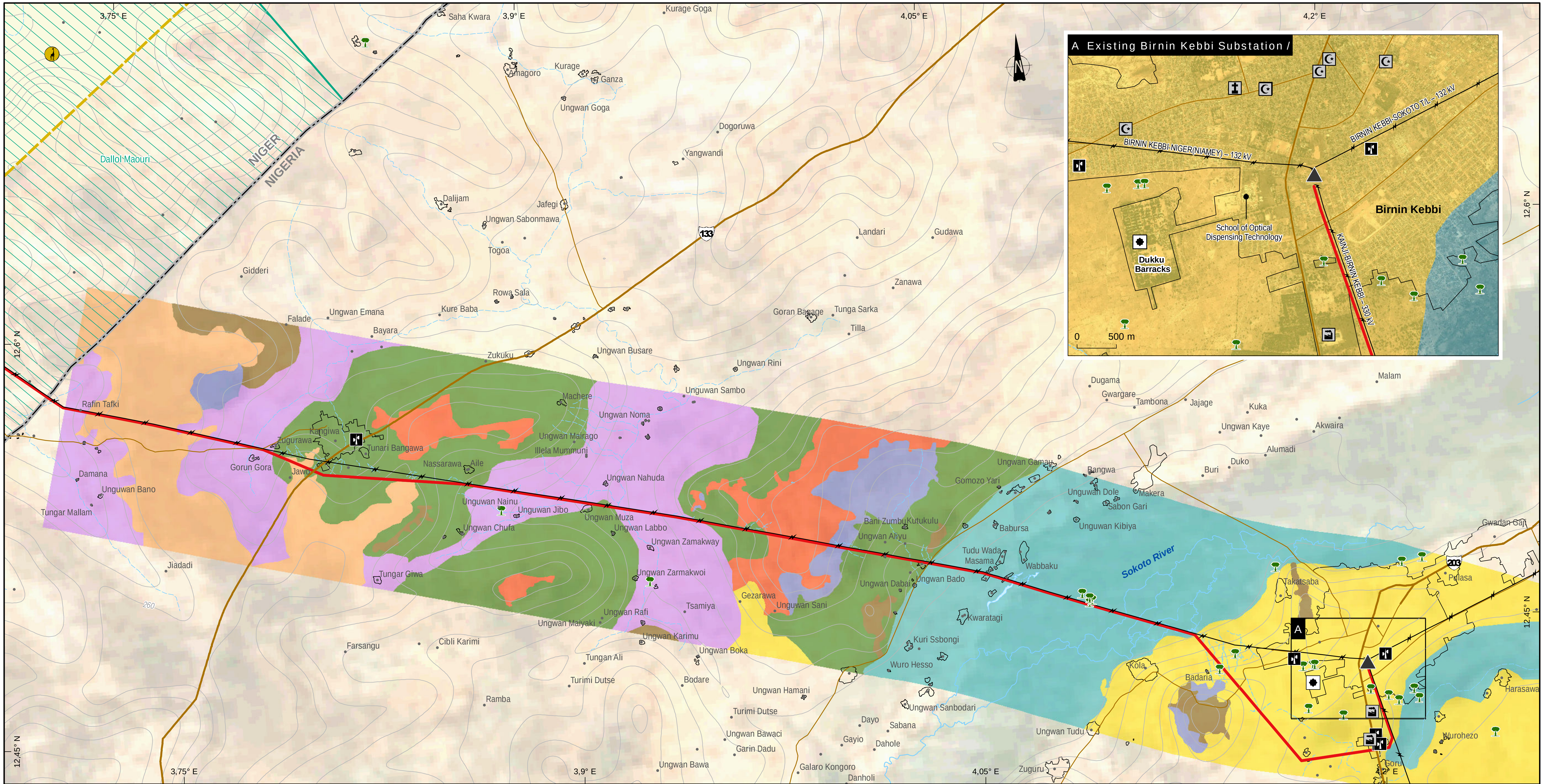
The vast majority of households are headed by men. The 498 households that are affected by the project, (98,8%) are headed by men. Most of them (93,4%) are married either with one (46,2%) or many woman (47,6%). In total these 498 households have 3 054 members almost equally divided between males (49,8%) and females (50, 2%). As for the general population of Nigeria, a large share (40,3%) of household members are under 15 years of age[1].

[1] For a complete picture of the socioeconomic situation of affected households see the RAP report.



Source: CIA, 2014.

Figure 4-12 Nigeria Age Structure by Sex



Biological Environment	Physical Environment	Infrastructure	Project Component
Niger Giraffe Distribution Area	Intermittent Watercourse	National Road	Draft Final Line
Internationally Designated Area	Permanent Watercourse	Secondary Road	**Boundary**
Ramsar Site	**Land Use**	Telecommunication Tower	International Border
Human Environment	Cultivated Land	Military Base	
City	Degraded Area	Factory	
Built Environment	Floodplain	**Substations and Transmission Lines**	
Plantation	Hill	Existing Line	
Mosque	Tiger Bush	Existing Substation	
Church	Intensive Cultivation		
	Lateritic Iron Capped Hill		
	Agricultural-Shrubby Vegetation Mozaic		

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Impact Assessment
Final Report

Land Use

0 1,65 3,3 4,95 km

UTM, Zone 31N, WGS 84
Contour Interval : 10m

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c4_4_OccSol_160606.mxd

Map 4-6

June 2016

WSP

The project wayleave crosses a total of 16 villages and sub-counties, with a population of 592 200 inhabitants.

Table 4-24 Population Distribution in Villages Affected by the Wayleave

Population Characteristics		Local Governmental Area			Total
		Arewa/Dandi	Birnin Kebbi	Kalgo	
Number of villages crossed by the wayleave		6	6	4	16
Number of villages crossed by the wayleave with a special group		1	4	4	9
Total population in villages crossed by the wayleave		9 500	563 500	19 200	592 200
Villages' sociodemographic characteristics					
Ethnic Group	Hausa	88.2%	64.6%	71.9%	65.2%
	Fulani	5.5%	32.1%	5.1%	30.8%
	Zabarmawa	3.2%	3.1%	9.0%	3.3%
	Other	3.2%	0.2%	14.1%	0.7%
Occupation	Farmer	94.1%	86.9%	82.7%	86.9%
	Pastoralist	11.1%	8.3%	14.3%	8.5%
	Self-employed	12.4%	2.2%	11.5%	2.6%
	Private employee	2.2%	0.1%	0%	0.1%
	Public employee	5.1%	2.6%	4.2%	2.7%
Religion	Muslim	99.2%	100%	100%	100%
	Christian	0.8%	0%	0%	0%

Notes: The villages' sociodemographic characteristics are calculated from the total number of village population in a row. The village members may have more than one occupation. The total does not equal 100%.
Source: Local Community Questionnaire.

The main ethnic groups present in the villages are the Hausa 65.2% and the Fulani 30.8%. The LGA of Birnin Kebbi group has a larger proportion of Fulani (32.1%) than the two other LGAs (around 5%). Kalgo LGA is more ethnically diversified since 14.3% of its population is classified in the ''other ethnic groups'' category. The special groups indicated are essentially Fulani pastoralists that crosses the region with their cattles.

The main occupation is farming; 86.9% of the population being in that category. It should be noted that Pastoralist and Self-Employed are more frequent occupation in Kalgo (14.3% and 11%) and Arewa/Dandi (11.1% and 12.4%) than in Birnin Kebbi LGA (8.3% and 2.2%).

Also, the population is almost entirely Muslim, with only a very small proportion (0.8%) of the Arewa/Dandi LGA population being Christian.

Literacy

Despite continued efforts, the educational standards of the state are well below the national average. The age % of females in school is one of the lowest in the country, reflecting limited educational opportunities for girls until very recently.

In the 2013 literacy status, it was determined by assessing the respondent's ability to read all or part of a sentence. Only women and men who had never been to school and those who had not completed a primary-level education were asked to read the cards (in the language they were most likely to be able to read). Those with a secondary education or higher were assumed to be literate (National Population Commission, 2014).

Nigerian summary shows that 53% of women between 15 and 49 are literate. Literacy levels decline with age, from 66% among women aged from 15 to19, to 36% among women aged from 45 to 49. Literacy is much higher in urban than in rural areas. More than 7 in 10 urban women (77%) are literate, as compared with less than 4 in 10 rural women (36%) (National Population Commission, 2014).

There are differences in literacy across zones, with literacy levels being the highest among women in the southeast (84%) and the lowest among those in the northwest (26%), including Kebbi state. Specifically, 90% or more of women in Abia, Anambra, Imo, Ekiti, and Osun are literate. On the other hand, only 10% of women in Sokoto, 14% in Kebbi, 11% in Jigawa, and 11% in Zamfara are literate. Literacy increases with increasing wealth, ranging from 7% among women in the lowest wealth quintile to 93% among those in the highest wealth quintile.

The 2013 NDHS Nigerian report also shows that men are much more likely than women to be literate (75% versus 53%). Similar to women, men aged from 15 to 24, show a level of literacy of 80%, when men living in urban areas reach 91%. Men in the highest wealth quintile have the highest literacy level (97%). The gap in literacy levels between women and men is notable in the north central, north east, and northwest zones, (where Kebbi state belongs).

Infant mortality and life expectancy

Recent surveys in 2013 and published in June 2014 by the Nigerian National Population Commission, revealed that, in Nigeria, infant and under-5 mortality rates in the past five years are 69 and 128 deaths per 1,000 live births, respectively. At these mortality levels, one in every 15 Nigerian children dies before reaching the age of 1, and one in every eight does not survive to their fifth birthday. Infant mortality has declined by 26% over the last 15 years, while under-5 mortality has declined by 31% over the same period. Childhood mortality rates are higher in rural areas than in urban areas. Also, childhood mortality is higher in Kebbi state as well as other parts of the northwest. The neonatal mortality rate is 37 deaths per 1,000 live births, the post-neonatal mortality rate is 31 deaths per 1,000 live births, and the perinatal mortality rate is 41 per 1,000 pregnancies (National Population Commission, 2014).

According to the report, mortality rates are presented for a 10-year period preceding the survey to ensure a sufficient number of births to study mortality differentials across population subgroups. The table shows that infant and child survival are strongly influenced by their socioeconomic characteristics. Mortality rates in urban areas are consistently lower than those in rural areas. Infant mortality is 43% higher in rural areas (86 deaths per 1,000 live births) than in urban areas (60 deaths per 1,000 live births).

The urban-rural difference is even more pronounced in the case of under-5 mortality. There are zonal differences in infants and under-5 mortality as well. Under-5 mortality rates range from a low of 90 deaths per 1,000 live births in the south west to a high of 185 deaths per 1,000 live births in the northwest.

Early care for newborns, infants and young children can help in preventing their death. Such care ranges from feeding programs, vaccines administration, and protection from mosquito bites and other measures of infections prevention.

About ten years ago, specifically 2004, Nigeria’s average under-5 mortality rate was very high. But right from then, there has been a steady decrease until 2014 when there was a record of only 89 children dying before their fifth birthday in every 1,000 live births. Although the national average in 2014 was 89, some states had numbers much higher than the national average. These states include notably Kogi (169), Katsina (155) and Kaduna (167). The death prevalence in 2014 however, was much higher in rural areas with 98 deaths against 66 in the urban. The northwest zone (where Kebbi state is located) with 121 and north east zone with 78 had the highest under-five mortality rates than the other zones. The south west zone showed the lowest with 45.

The deaths of infants under one year per 1,000 live births in Nigeria was also very high in 2004 where 100 children died without seeing their first birthday in every 1,000 live births. The death of infants has been on the decrease since 2008 in which 75 infants died per 1,000 until 2014 with a record of 58.

The prevalence of infant mortality in 2014 was more prominent in the rural areas, with a record of 63 deaths, than in the urban areas, with a record of 46 deaths per 1,000 live births.

Across the zones, the northwest with 77% (implying Kebbi state and others), followed by south east with 69, had more infants dying without seeing their first birthday in every 1,000 live births.

The life expectancy of Kebbi state is 46 years, while globally in Nigeria it reaches 53 years (Men) and 55 years (Women).

Nigerians are now said to be living longer than they used to, despite the fact that heart diseases, lower respiratory tract infections and strokes, which top the list of 20 major causes of premature deaths worldwide, are equally killing Nigerians in large numbers (National Population Commission, 2014). Among the project's 498 affected households, 80 of them (16%) lost one member in the last year. The main cause of these deaths is malaria.

In the new World Health Statistics 2014 report published by the World Health Organisation (WHO), the world was said to have witnessed major gains in life expectancy in recent decades. The report revealed that Nigerians' life expectancy that stood at 46 years in 1990 rose to 54 years in 2012 (WHO, 2014).

A major highlight of the report is that women live longer than men in Nigeria. Their life expectancy rose from 47 years in 1990 to 55 years in 2012, while Nigerian mens' life expectancy was 45 years in 1990, it rose to 53 years in 2012.

Migration

Migration has an important impact on demography in Kebbi state. It is prevalent mainly among the poorer farming populations in rural areas. After harvest in November/December, male adults from the ages of eighteen to thirty years move to urban areas in search of jobs during the dry season (National Population Commission, 2014).

Such jobs could be on farms where lowland/fadama cultivation is practised within the state and in Sokoto and Zarnfara states. Sometimes, they migrate to take on non-farm employment in urban areas within the region and frontiers such as lbadan, Lagos, Enugu or Port Harcourt just to mention a few. Many have taken to trading, manicure and other jobs in their places of destination with the hope of raising some money to take back home and increase their income. There are cases of wet season migration particularly from the south which is common with the Dakarkari and Kambari, Zurmi, and Silami emirates.

It is common among those who finish their first weeding early to migrate northwards in search of farm labour. This type of migration is usually short, between four to five weeks after which they return home and continue with subsequent farm work.

Overall, the high incidence of rural-urban migration which characterized the 1980s, has declined following a reduction in job opportunities in urban areas.

Since the beginning of the Structural Adjustment Programme in mid 1980s, most urban industries have operated below capacity and construction works have declined, providing consequently limited or no opportunities for migrants in urban areas. Many «cirani» migrants are contented with dry season farm work in the fadama and on government irrigation projects.

4.3.6 SOCIO-ECONOMIC CONTEXT

Nigeria has emerged as Africa's largest economy; the 2013 GDP is estimated at US$ 502 billion (National Population Commission, 2014). Oil has been a dominant source of government revenues since the 1970s but regulatory constraints and security risks have limited new investment in oil and natural gas. Nevertheless, the Nigerian economy has continued to grow at a rapid 6-8% per annum (pre-rebasing), driven by growth in agriculture, telecommunications, and services. Despite the potential for resources exploitation, oil-rich Nigeria has been hobbled by inadequate power supply, lack of infrastructure, delays in the passage of legislative reforms, an inefficient property registration system, restrictive trade policies, an inconsistent regulatory environment, a slow and ineffective judicial system, unreliable dispute resolution mechanisms, insecurity, and pervasive corruption. Economic diversification and strong growth have not translated into a significant decline in poverty levels; over 62% of Nigeria's 170 million people live in extreme poverty and 29% (2007 est.) of the children between 7 and 14 are engaged in child-labor (CIA, 2014).

With over 75% of the state population residing in rural areas, farming is the major occupation in Kebbi state. A significant number of urban dwellers also engage in farming to supplement their income. Rainfall is seasonal, as such most farming is carried out during the wet season on the upland during which food and cash crops such as millet, sorghum, maize, rice, beans, cassava, cotton, and tobacco are cultivated. It is estimated that 60 to 70% of the arable land in the state is irrigable. During the dry season, farming is carried out in the vast fadama/ lowlands fields where crops such as tomatoes, onions, pepper, sugar cane, vegetables and sweet potatoes and wheat are cultivated. Farming is mostly based on indigenous techniques, using local inputs of seeds, family and animal labour and informal credits (Online Nigeria, 2014). After harvest, in November/December, male adults from the ages of 18 to 30 move to urban areas within Kebbi state and other parts of Nigeria, and some as far as Niger Republic, in search of jobs during the dry season.

About 20% of the people engage in these activities to either supplement their income from the farm or those from the private or public sector. Less than 2.5% of the state active labour force is engaged in formal public or private sector employment (Kebbi, 1996). The state government is the highest employer of labour and accounts for 87% of the paid formal employers. The relatively small proportion in the private sector (10%) can be explained by the fact that there are few formal jobs.

Among the affected households, the main occupation of the majority of the head of households is farming (79,5%). Only 8,4% are employees of a private (1,6%) or public (6,8%) organization.

Among the 16 communities crossed by the project a large spectrum of occupation and services are present.

Table 4-25 Workforce in the Villages Crossed by the Wayleave

Workforce	Local Governmental Area			Total
	Arewa/Dandi	Birnin Kebbi	Kalgo	
Experienced pylon assembler	16.7%	33.3%	25.0%	25.0%
Carpenter	66.7%	100%	75.0%	81.3%
Welder	33.3%	83.3%	0%	43.8%
Electrician	16.7%	83.3%	50.0%	50.0%
Truck driver	66.7%	66.7%	25.0%	56.3%
Taxi (car, tricycle, motorcycle)	83.3%	100%	100%	93.8%
Heavy machinery operator (shovel operator, caterpillar, etc.)	16.7%	50.0%	25.0%	31.3%
Mechanic	66.7%	83.3%	100%	81.3%
Mason	66.7%	83.3%	100%	81.3%
Painter	33.3%	66.7%	25.0%	43.8%
Chainsaw operator	33.3%	0%	0%	12.5%
Commercial Farm workers	83.3%	83.3%	75.0%	81.3%
Other workforce	16.7%	33.3%	50.0%	31.3%
Number of villages	**6**	**6**	**4**	**16**

Source: Local Community Questionnaire: % means the proportion of village that have the type of workforce. For example, 66.7% of the village crossed by the project in Arewa/Dandi LGA have at least one mechanic among its workforce.

The above table shows the distribution of artisanal skills across the villages impacted by the project. The composition shows a mix of carpenters, auto-mechanics, masons, and several others. Chainsaw operators as less common. It is envisaged that they would continue with their work lives post settlement and would particularly find temporary jobs as the project is implemented. For instance, masons could be involved in the laying of concrete foundations for the pylons.

Table 4-26 Services of Villages Crossing the Wayleave

Services	Local Governmental Area			Total
	Arewa/Dandi	Birnin Kebbi	Kalgo	
Trucks/Lorry	0%	0%	25.0%	6.3%
Mechanical (dealers, repairs, etc.)	16.7%	16.7%	75.0%	31.3%
Petroleum products (sales, storage, etc.)	66.7%	50.0%	100%	68.8%
Heavy machinery (crane, bulldozer, excavator, etc.)	0%	0%	0%	0%
Materials (wood, stone, sand, cement, etc.)	66.7%	83.3%	75.0%	75.0%
Food eating place	16.7%	66.7%	75.0%	50.0%
Sleeping place (hotel, lodge)	16.7%	0%	0%	6.3%
Logging companies	0%	50.0%	0%	18.8%
Bank/Mobile money	0%	0%	25.0%	6.3%
Post office	0%	0%	0%	0%
Security company	16.7%	0%	0%	6.3%
Other service	16.7%	16.7%	25.0%	18.8%
Number of villages	**6**	**6**	**4**	**16**

Source: The Local Community Questionnaire % means the proportion of villages that have a certain type of service. For example, 66.7 percent of the village crossed by the project in Arewa/Dandi LGA have at least one store/petro-station where petroleum products can be found.

The table above presents the composition of services available within the impacted villages. These will be positively impacted and it will be helpful if local building material needs are sourced from these communities. Materials such as sand, stones, cement and wood, petrol for machinery, and services (food, lodging) for the construction work can be bought in the villages when the project is being executed.

Income, disparities and poverty

Typical of oil-rich economies, Nigeria exhibits severe economic inequality and poverty. The GINI index was last measured at 42 in 2015 and about 62% of the population lives on $1.25 a day or less.[2]

According to the World Bank, although the national poverty rate was 33.1% in 2012-13, the rate was 44.9% in rural areas but only 12.6% in urban areas. Perhaps more disturbing are the wealth variations between Nigeria's different geopolitical regions, with more impoverishment found in the north than in the south. For instance, whereas the poverty headcount in the relatively more industrialised south-west, with the lowest poverty rate, fell from 21.2% in 2010-11 to 16% in 2012-13, the count in the north-east rose from 47.1% to 50.2% over the same period3. Kebbi state is among the 10 states displaying the most important poverty incidence in Nigeria.

The effects of Nigeria’s income inequality on human development are profound. In 2011, Nigeria was ranked 156 out of 187 countries and territories, with a human development index (HDI) of 0.459 – in the ‘low human development’ category. But when adjusted to reflect inequality, Nigeria’s HDI drops to 0.278 – a loss of 39.3% due to inequality in the distribution of the dimension indices.17 The average

[2] ACF-IRIS, 2016. Nigeria Trends, Challenges and Opportunities of the Demographic Shift and its Link to Stunting,

[3] The Economist, 2014, Falling poverty and rising income inequality in Nigeria, http://country.eiu.com/article.aspx?articleid=1432272327&Country=Nigeria&topic=Politics

loss due to inequality for low HDI countries is 33.3%, and for sub-Saharan Africa 34.5%, so Nigeria is clearly one of the worst performers.[4]

4.3.7 EXISTING INFRASTRUCTURES

Water Provisioning

Sources of drinking water vary on the territory of the state. They are presented in next Table.

Table 4-27 Sources of Drinking Water in Kebbi and Nigeria

	Pipe Borne Water Treated	Pipe Borne Water Untreated	Bore Hole/ Hand Pump	Well/ Spring Protected	Well/Spring Unprotected	Rain Water	Stream/ Pond/ River	Tanker/ Truck/ Vendor	Other Sources
Kebbi	5.4	0.7	11.3	30.1	41.2	0.2	9	2.1	
Nigeria	8.1	2.3	26.8	18.7	14.6	0.6	24.4	4.1	0.3

Kebbi has a lower proportion of population connected to treated water, borehole and hand-pump compared to Nigeria's average. Most of Kebbi state population uses unprotected or protected springs and wells. Treated pipe water is provided to 5.4 % of the population and 11,3% use bore hole or hand pump. The results from the surveyed 498 households affected by the project show that the vast majority (88,8%) get their domestic water from a well.

Electricity Infrastructures

The Kaduna Electricity Distribution Company (DISCO) is the main supplier of power to the state. This is followed by the State Rural Electricity Board (REB) that uses diesel driven generators to supply electricity at specified hours in a day (Online Nigeria, 2014). Nigeria is an important electricity producer with a 24.87 billion kWh production. According to a 2012 estimate, none of the kWh produced is exported (CIA, 2014). However, only 55.6% of the population, mainly in urban areas has access to electricity (World Bank. 2016). Even with the electricity potential, kerosene and fuel wood are the major fuels used by households for cooking in both rural and urban areas.

Only a third (37,3%) of the 498 affected households is connected to the electricity main network. They use electric power essentially for lightning.

Education Infrastructure

Recent surveys revealed that the state has a total of 303 primary schools and 29 post primary schools. It also has the Federal University of Birnin Kebbi as well as three higher institutions namely Kebbi State Polytechnic (Birnin-Kebbi), College of Agriculture (Zuru) and School of Health Technology (Jega). The state also hosts a number of Islamic schools and other centres of Nomadic Education.

Health Infrastructures

The health system of Kebbi state remains overstretched by a burgeoning population; physical facilities are decaying, equipment is obsolete and there is a scarcity of skilled health professionals. In addition, the roles of stakeholders are misaligned and coordination systems are weak. These are further compounded by the dearth of data which poses a challenge to evidence based planning, policy formulation, resource allocations and health systems management. Many of the public primary health care (PHC) facilities serve only 5 to 10% of their capacities or potential patients load due to loss of confidence in public PHC facilities, as such the secondary and tertiary facilities are used more or less as primary health care facilities. The referral system between the various levels of health care is inefficient and virtually non-existent.

[4] Save the Children, undated, Born equal country case; Nigeria https://www.savethechildren.org.uk/sites/default/files/images/Born_Equal_Nigeria_case_study.pdf

The 2008 National Health Data Survey (NHDS) indicates very weak health indicators for Nigeria including routine immunization rates of BCG 15.1%, DPT3 7.2%, Polio3 28.3% and Measles 21.1%, antenatal care from a health professional is 12.3%, last live birth protected against neonatal tetanus is 11.7%, 6.2% of pregnant women were delivered by a health professional with 4.8% delivered in a health facility (National Population Commission, 2014).

It is important to note that in contrast to the above, for the period from January to September 2009, routine immunization coverage by antigens shows much higher coverage (BCG 58%, DPT3 65%, HB3 68%, Polio3 80%, Measles 72%, TT2+ 45%).

Despite this indication of progress, concerted efforts are needed to resuscitate the decaying infrastructure, address the serious technical manpower deficiencies, especially in rural areas.

Household Infrastructures

Housing characteristics in Nigeria reflects households' socioeconomic situation. They also may influence environmental conditions (e.g., use of biomass fuels and resulting exposure to indoor air pollution) that have a direct bearing on the health and welfare of household members.

Using the most recent (2013) demographic and health survey, 56% of households in Nigeria have access to electricity (84% in urban areas and 34% in rural areas).

Cement is the most common flooring material used in Nigerian households (46%). The use of cement has increased since 2008 (when the figure was 42%), and increases have been observed in both urban and rural areas. Urban households remain more likely to use cement (53%) than rural households (40%). Earth and sand are used in 3 out of 10 households, and they are used more often in rural areas (49%) than in urban areas (12%). Fourteen % of households use carpet as a flooring material.

The number of rooms used for sleeping in relation to the number of household members is an indication of demography. A shared room increases the risk of contracting communicable diseases. The proportion of households using one room for sleeping has decreased from 43% to 39% over the past five years.

The houses of affected households have generally a roof made of corrugated iron sheets (80,9%) walls made of mud brick (45,8%) or mud (28,3%) and dirt floors or sand (55%) or smoothed mud (26,1%). The vast majority (91,2%) of them use wood as cooking fuel.

Cooking and heating with solid fuels can lead to high levels of indoor smoke, which consists of a complex mixture of pollutants that can increase the risk of contracting diseases. Indoor air pollution has important implications for the health of household members.

Solid fuels include charcoal, wood, straw, shrubs, grass, agricultural crops, and animal dung. Forty-six% of households cook in the housing unit where they live, 21% use a separate building, and 29% cook outdoors. No data on the rural and urban differences are provided in the national statistics.

Wood is the main type of cooking fuel, used by 64% of households (38% of urban households and 83% of rural households). In addition to wood, kerosene is an important type of cooking fuel in urban areas as it is used by 48% of urban households (National Population Commission, 2014).

In Kebbi state, 12.5% of the population lives in the urban areas. Consequently, 87,5% of the population lives in the rural areas in basically three forms of settlements; dispersed, nucleated and linear, with most residing in what could best be described as nucleated. People have concentrated along river valleys and close to sources of drinking water particularly in the drier parts of the state in Gwandu and Argungu emirates.

Whereas, in the more humid areas, such as in Yauri and Zuru emirates, many nucleated settlements have been relocated. Linear settlements, mainly as a response to the penetration of road networks, have emerged.

These linear settlements always have an indigenous or early settlement where the village or district head resides. Incidentally, due to easy access, linear settlements have attracted more people at the expense of the older nucleated settlements which are declining in number. Younger generations and a number of prospective businessmen have settled in the new (linear) settlements leaving the aged at the older settlements.

Nucleated and linear settlements can be differentiated by the types of buildings they host and their morphology. In the drier areas of Arewa/Dandi and part of the humid south, where animal rearing is a major occupation, dispersed settlements are common amongst the Fulani, Arawa Dakarkari and Kambari. Many dispersed settlements are also common even amongst farming communities in these areas.

By their nature and design, therefore, they represent the least developed groups and areas as it has always been difficult for the state to provide them with any of the basic facilities and services. Development in the rural areas has been geared towards improving the life of the rural dwellers so as to discourage rural-urban drift.

Economic Infrastructures

Going by the amended 1991 local government edict, all local government headquarters are designated urban. This is not necessarily on the basis of population size, but the administrative function they are expected to perform. Such functions have led to the siting of relevant departments and offices for both federal and state authorities.

Their newly acquired status has also led to some road construction, provision of basic amenities and services such as electricity, pipe-borne water, health and postal services. Telephone services are available in Birnin-Kebbi, Argungu, Yauri and Zuru only. Kebbi State has twenty-two urban areas including Koko, against the twenty-one designated local government headquarters.

In terms of urban primacy, Kebbi state has no problems. Prior to colonialism, Birnin Kebbi (the state capital) had to contend with the supremacy of Sokoto, the headquarters of the caliphate, and the emirates headquarters of Argungu, Zuru and Yauri. Each of these, except Sokoto emirate, consists of different cultural groups and at various times, in a war with Kebbi before European colonization in 1780 (Online Nigeria, 2015). Furthermore, even after 1900, the emirates were allowed to develop independently, with a disposition towards Sokoto. Since independence in 1960, and following early state creation, the city of Sokoto had always been the state capital, (Northwest and Sokoto State) until 1991 when Kebbi State was created.

The creation of local government areas, the location of emirate headquarters away from major roads linking the north to the south, the decline in oil revenue and the fact that many of these emirate headquarters were basically agrarian with no commerce or industry, have militated against the emergence of primate cities in Kebbi State.

Today, Birnin-Kebbi accounts for 8% of all urban population, while Argungu, Zuru and Yauri account for 15%, 13.5% and 14% respectively. The balance is distributed among Jega, Koko, Kamba, Bagudo and other LGA headquarters (Kebbi, 1999).

The 16 villages and sub-counties crosses by the project display the following infrastructures as presented in the next Table.

Table 4-28 Community Infrastructures in Villages Crossed by the Wayleave

Infrastructure			Local Governmental Area: Arewa/Dandi	Birnin Kebbi	Kalgo	TOTAL
Number of villages crossed by the wayleave			6	6	4	16
Percentage of communities with at least one infrastructure (%) and number of infrastructures (No)						
Schools	Primary	%	66.7%	50.0%	75.0%	62,5%
		No	6	3	6	15
	Secondary	%	16.7%	16.7%	0%	12,5%
		No	3	1	0	4
	Tertiary	%	0%	0%	0%	0%
		No	0	0	0	0
Heath facility	PHC	%	0%	16.7%	50.0%	18,8%
		No	0	1	2	3
	Hospital	%	16.7%	0%	50.0%	18,8%
		No	2	0	2	4
Market/Trading center		%	66,7%	100%	100%	87.5%
		No	7	10	9	26
Slaughterhouse		%	66,7%	16.7%	75.0%	50.0%
		No	5	1	3	9
Administrative buildings		%	16,7%	50.0%	0%	25.0%
		No	1	4	0	5
Religious sites	Church	%	16.7%	0%	0%	6,3%
		No	1	0	0	1
	Mosque	%	100%	100%	100%	100%
		No	19	73	16	108
	Other religious site	%	0%	16.7%	0%	6,3%
		No	0	1	0	1
Heritage or cultural site		%	66.7%	50.0%	100%	68.8%
		No	5	7	4	16
Machinery/Production centre		%	83.3%	33.3%	50.0%	56.3%
		No	14	61	17	92
Water supply facilities		%	83.3%	83.3%	100%	87.5%
		No	14	27	44	85
Lodging facilities		%	16.7%	0%	0%	6.3%
		No	4	0	0	4
Police centre		%	0%	33.3%	25.0%	18.8%
		No	0	2	1	3
Number of infrastructures			**81**	**191**	**104**	**376**

Source: Local Community Questionnaire % means the proportion of village that have the type of infrastructure. For example 66.7% of the villages crossed by the project in Arewa /DandiLGA have at least one primary school.

Surveys of community infrastructure indicate that there are no tertiary institutions in the affected settlements and the primary schools are the most common 6 Nos. each in both Arewa/Dandi and Kalgo LGs and 3 Nos. in Birnin Kebbi LG. Arewa/Dandi also has 3 Nos. secondary schools in Arewa LG and 1 No. in Birnin Kebbi LG.

There are another 10 Nos. Markets/Trading centers serving the PAPs' neighbourhood in Birnin Kebbi LG, 9 Nos. in Kalgo LG, and 7 Nos. in Arewa/Dandi LG. The most occurring community facility are Machinery/Production centres with 61 Nos. in Birnin Kebbi (being the most urban of the LGs.), 17 in Kalgo LG, and 14 in Arewa/Dandi LG. These indicate a vibrant state of economic activities among communities.

Furthermore, on the social aspect, there is a vast number of religious/worship places distributed as follows: 73 Nos. mosques in Birnin Kebbi LG, 17 Nos. in Arewa/Dandi LG, and 16 Nos. in Kalgo LG. Also worthy of mentioning is the fact that there is 1 No. church in Arewa/Dandi LG.

It is envisaged that the project will not significantly alter the lifestyle of the community as the vast majority of these community facilities will not be directly impacted (see RAP for the affected community structures in Birnin Kebbi).

Beside Birnin Kebbi only two other communities have any infrastructures connected to the electric grid.

4.3.8 LAND USES

Generally, land use within the upland areas along the study area were either fallow, extensively or intensively cultivated. Few areas were used for community structures within Birnin Kebbi, Sandare and Ungwan Musa.

The crops were either cultivated as single crop of hungry rice at Sandare and Zukuku. Mixed cropping includes the cultivation of millet (gero, maiwa), sorghum, cowpea, groundnut and rosselle, whereas multiple croppings involved millet (gero) and cowpea cultivation.

Rice is extensively cultivated around the low land areas, mainly within the Sokoto flood plains. However, most part of the floodplain is inundated during rainy season peaks around September and October. In these areas, fishing is also practiced.

Inside the study area, the main crops grown by the affected households are millet (84,9%), beans (77,5%) and sorghum (51,4%). The vast majority of the households also raise some animals like goats (70,9%) cows (69, 5%) and sheep (65,9%).

The land use within the hilly areas (mostly in the north areas of the route) are fallow with regenerated forest and shrubs in some areas and sparse shrubs in other areas, as presented in Map 4-6.

In the transhumance farming system, farmers also perform an internal transhumance outside the national borders (especially with Niger), a practice dictated by the search for pastoral resources (pasture, water and saline lands). During the rainy season, animals of Nigeria go on transhumance in pastoral areas.

The Department of Animal Production and Husbandry Services confirmed that the line route will cross the International Transhumance Stalk Route around Birnin Kebbi and most likely around Kangiwa as well.

4.3.9 EDUCATION

Kebbi state has a long history of educational pursuit dating back to the post jihad years, when the area came under the influence of the Sokoto Caliphate, during which it witnessed the development of Islamic education. At present there are a number of informal Islamic and Quranic schools all over the state (Online Nigeria, 2014). In Nigeria, 61.3% of the population reaches the literacy level.

The proportion of men that can read or write is higher than women, respectively 72.1% and 50.4%.

About one in five women and men have completed some primary education (19% and 21%, respectively). 6% of women and 9% of men have more than a secondary education. Large percentages of both females (40%) and males (30%) have no education. Households in rural areas are far below their urban counterparts in educational attainment; 54% of women in rural areas and 22% in urban areas have no education, and the corresponding figures for males are 40% and 14%.

Across the geopolitical zones, the north east and the north west (including Kebbi state) lag behind others in educational attainment, with more than 60% of females and about half of males having no education. While the proportion of children aged from 6 to 16 that never attended school, in the southern zones put together, is 45%, many states in the northern zones have proportions alone that are more than the combined proportions of the entire southern zones; for example, Borno has 72%, Zamfara 68%, Sokoto 66%, Kebbi 60%, Yobe 58%, Bauchi 52%, Jigawa 48%, Niger 47%, and Katsina 45%.

Among the project's 498 affected household heads, 54,2% declare not having received any formal education, 17,2% have primary education, 13,9% reached the secondary level and 12,4% the higher education levels.

According to the Nigeria's 2013 demographic and health survey report, the percentage of women with no education increases steadily by age group, from 31% among women aged from 15 to 24 to 54% among women aged from 45 to 49. There are urban-rural differences that are more pronounced at the lowest and highest educational levels. For example, more than half of rural women have no education, as compared with 16% for urban women. Among urban women, 46% of urban women have a secondary education or higher, compared with 14% of rural women.

Across states, the highest proportion of women with more than a secondary education is in Federal Capital Territory (FCT)-Abuja (30%), followed by Ekiti (26%). In these states, as well as in Abia, Anambra, Imo, Rivers, Lagos, and Osun, women have completed a median of 11 years of schooling or more. Access to education increases with women's wealth.

Indeed, a substantial variation in educational attainment occurs across the wealth quintiles. Only 8% of women in the wealthiest households have no education, as compared with 81% in the poorest households. Among men, 5% of those in the wealthiest households have no education, compared with 71% in the poorest households. Median number of years of educational attainment is higher for women (4.7 years) than for females (1.7 years) (National Population Commission, 2014).

4.3.10 HEALTH

Knowledge of HIV/AIDS and related diseases among the young women is increasing. There is a general consciousness that HIV/AIDS is real. In 2004, only 18.3% of the young ladies within 15 and 24 years old had comprehensive and correct knowledge about HIV/AIDS prevention, and transmission and others. There was a rise in this percentage in 2012 (33%). There was not much difference in the record for 2014 (32.8%). Thus the trend remained at the national level. But in terms in geographical difference, the urban areas, with 37.8%, showed that there were more young women with comprehensive knowledge than the 30.5% in the rural (National Population Commission, 2014).

Overall, 60% of women and 71% of men know a place where they can get an HIV test, an improvement since the 2008 NDHS (when the figures were 49% and 65%, respectively). Knowledge of a place for HIV testing is highest among sexually active women and men who have never been married (83% and 86%, respectively) and among urban women and men (77% and 81%, respectively). Knowledge of where to get HIV testing increases with increasing education and wealth. Across age groups, the youngest female and male respondents (aged between 15 and 19) are least likely to know a place where they can go to be tested for HIV (51% and 56%, respectively). By marital status, never-married women and men who have not yet initiated sexual activity are least likely to know a place to obtain an HIV test (57% each).

Among the zones, women's and men's knowledge of a place to get tested for HIV is lowest in the northwest, where Kebbi is part of (39% and 55%, respectively). Urban women are however more likely than rural women to have been tested for HIV and have received the test results (14% and 7%, respectively).

The proportion of women and men who had been tested in the recent past and had received the results of their last test was lowest in the northwest and highest in the south. Coverage ranged from 4% in the northwest to 17% in the south among women and from 2% in the northwest to 17% in the south among men. Among the states, the percentage of women who had been tested for HIV and received the results of their last test was the highest in Cross River (33%) and the lowest in Kebbi (1%). Among men, the corresponding proportions were 30% in Cross River and 1% in Kebbi and Zamfara.

Looking at the issue of immunization in Nigeria, measles vaccination and other killer diseases for example, is becoming popular and the coverage is improving though slowly. In 2004, there was a record of 50% of measles vaccination. It went down to 41.4% in 2008 and appreciated again to 55.8% in 2012. There was a significant increase in 2014 in which 63.1% of children under the age of 1 were immunized against measles. The analysis of the survey results by geo-political zones showed that over 80% of one year old children were immunized in the south east (82.4%), south west (81.2%) and south (80.3%). Although north central (77.0) was not bad, north east (42.4) and the area where Kebbi state belongs to, that is, northwest (35.4%) were not encouraging. One year old children were more predominantly immunized in the urban areas (56.2%) than the rural areas (39.95%).

Women and children under five constitute 22.9% and 20.2% of the population of Kebbi State respectively. They are the most at risk groups regarding health issues. The leading cause of morbidity in Kebbi State is malaria with 250,359 cases in 2008 as reported by the State epidemiology unit (Ministry of Health, 2010). Nigeria's maternal and infant mortality rates remain high. A recent report has also identified malnutrition as another serious problem militating against longevity in Nigeria. It said that about one million children under the age of five die in Nigeria every year from malnutrition. The report ranks Nigeria among the six countries of the world that account for all child deaths from malnutrition worldwide. The pilot study, conducted in four states in the north, Jigawa, Zamfara, Kebbi and Katsina, showed that one in five children in the country suffers from acute malnutrition. It also reported low awareness among families and communities on how best to feed infants and children. Situations such as these can only reduce life expectancy in the country.

Some health determinant indicators have been collected on the households affected by the project through the household socioeconomic survey. Food consumption analysis of affected households and control group households shows that most of the households could afford three meals per day, 95.4% for the former and 97.6% for the latter (Table below). Meat consumption per week was fair as averagely, 87.4% of the affected people could afford to eat meat 2 to7 days per week. The food consumption and nutrition statistics and analysis for PAP depict good food consumption, coverage and sustainability of household nutrition. Nutritional status has been referred to as the best global indicator of the wellbeing of children.

4.3.11 GENDER ASPECTS

The Hausa society, of which Kebbi state is a part, is patriarchal with a strong male influence on virtually every sphere of life. Women in seclusion are generally believed to be dependent, submissive and dominated by their husband and their life assumed to be restricted to the domestic sphere. They have very little freedom to take decisions on their own without being permitted by the men. This is because of the nature of the purdah system which places the responsibilities of wives and their children on husbands while the women are expected to remain secluded doing domestic work. It is the men, not the women, who by convention participate in public life and who monopolize public affairs (Adamu, 1998; Khalid, 2002).

According to Khalid (2002), the sole role of the women in the north-western part of Nigeria is perceived generally to be in the home, caring for the young and cooking for the family. It is the responsibility of the husband to provide for them and their children just as it is the women’s responsibility to do domestic work. Adamu (1998) opines that many secluded women view this relationship in reciprocal and contractual ways rather than dependency. Thus, marriage remains the central and important role of a woman. Khalid (2002) explains that the influence of traditional division of labour along gender seems to dictate the form and content of purdah in Hausa society.

Table 4-29 Food Consumption of Affected Households and Control Group Households, Nigeria

Vulnerability	Local Governmental Area				Control Group
	Arewa/Dandi	Birnin Kebbi	Kalgo	Total	
Meal(s) per day (%)[1]					
One meal per day	0	1.0	0	0.4	0
Two meals per day	1.6	6.2	5.1	4.2	2.4
Three meals per day	98.4	92.8	94.9	95.4	97.6
Meat consumption per week (%)					
0 day	2.2	5.6	0.9	3.2	0
1 day	3.2	8.7	20.5	9.4	8.3
2 – 4 days	42.5	34.4	39.3	38.6	28.6
5 – 7 days	52.2	51.3	39.3	48.8	63.1
Fish consumption per week (%)					
0 day	39.8	14.9	4.3	21.7	19.0
1 day	22.6	8.2	7.7	13.5	8.3
2 – 4 days	28.0	51.3	32.5	38.2	36.9
5 – 7 days	9.7	25.6	55.6	26.7	35.7
Meat and fish consumption per week (%)					
0 day	1.6	2.1	0	1.4	0
1 day	1.1	1.0	0	0.8	1.2
2 – 4 days	25.3	14.9	14.5	18.7	15.5
5 – 7 days	45.7	32.3	17.9	33.9	26.2
More than 7 days	26.3	49.7	67.5	45.2	57.1
Meeting the food needs of the household by the household heads (%)					
Never	1.1	0.5	0	0.6	0
Seldom	1.6	0	0	0.6	0
Sometimes	6.5	1.0	2.6	3.4	0
Often	10.2	6.2	9.4	8.4	2.4
Always	80.6	92.3	88.0	86.9	97.6
Household that purchase food for their needs (%)	26.9	56.4	82.1	51.4	66.7
Number of households	**186**	**195**	**117**	**498**	**84**

Note: One control group household did not give information. Percentage is calculated from the number of respondent households (83).

Source: Snap Survey Questionnaire Data Analysis.

This could be observed in the socialization of children. The most crucial feature of this socialization for the girls is their training into different household management chores both productive and reproductive and many other activities connected with their future roles as wives and mothers. And unlike boys, girls are expected to assume adult responsibilities much earlier. Adamu (1998) emphasizes that the practice of seclusion in Hausa society restricts women to the private sphere and denies them access to the public.

This explains why in the north-western part of Nigeria and particularly in Muslim dominated areas, (such as Kebbi state), female employment rate is lower than the southern parts. Females are generally not expected to participate as members of public employment due to these cultural and religious restrictions. But as Pindiga (1998) notes, Islam is not antagonistic to women employment and participation in public life. Moreover, the widespread reluctance of Hausa men to give women a chance to partake in public life is neither rooted in the Islamic faith nor in the legacies of the founders and reformers of the religion (Khalid, 2002). The result of the reluctance of Hausa men to give women a chance to partake in public life is that female employment opportunities in the civil service are somewhat low.

Looking at the differences between sexes in social terms, gender is essentially a consideration of what society expects from men and women. In Kebbi state, such expectations are very clear. Men are the leaders, the bread winners and authority structure within the family, community and society is vested in them and hence more attention is given to them making them better equipped for their future roles. Women occupy a rather low status in the society, hence the preference for male children in the family.

The rather low status of women serves to reduce their decision making capabilities in matters affecting their spheres of livelihood. In the absence of her husband and other male relatives, she can hardly take decisions that might involve the outside community. Most often than not, it is the men, not women, who monopolize decision-making both at the community and family levels. The ideal woman and wife is viewed as submissive, obedient and contented to enjoy reflected status from her husband. The sole role of the women is perceived generally to be in the home caring for the young and cooking for the family. Marriage and childbearing remain, therefore, the central most important role of women.

In particular, the low status of women and their limited education hinder their ability to make decisions. For most women in Kebbi State, the problems begin from the fact that they are not involved in the choice of economic activities and marriage partners as they are married off in their early and mid-teens.

Even in case of complications women cannot decide to seek care from health facility in the absence of her husband and other male relatives. As such women with prolonged and obstructed labour or ill health are conveyed to the hospital only when the situation is hopeless and when it is too late. Such restrictions on women's access to formal health services tend to prevent problems being detected in time, contributing to the high rates of maternal mortality and morbidity.

This centralized political form is powerful in the communities and a dynamic force for change. As such any innovation or change of custom and accepted ways of handling must necessarily go through the traditional leaders. Along with religious leaders, they cannot be bypassed. What is even more critical in the context of Kebbi state is that there is no traditional authority structure or public officers for women equivalent to those of the men. Issues concerning women are therefore handled by men and using the traditional authority structure, as the initial contact is the most appropriate if not the only option.

4.3.12 VULNERABLE GROUPS

Currently there are no cases of IDPs; refugees in the LGAs crossed. However, among the 498 affected households, some are vulnerable for different reasons, for example the heads of households are widows or children, etc. The following table shows that among the project's affected households, 45 are headed by a person that is handicapped or chronically sick and 51 do have to take care of a chronically sick or handicapped member.

The other potential source of vulnerability is related to the fact that for a lot of households the affected parcel is the only one that they use. In the vast majority of these cases the 20% or more of the parcel is occupied by the project ROW. This poses a risk to the PAP since TCN policy does not allow the PAP to use the ROW for cultivation. A replacement land must be provided to these households.

Table 4-30 Household Vulnerability of Affected Households

Vulnerability	Local Governmental Area			
	Arewa/Dandi	**Birnin Kebbi**	**Kalgo**	**Total**
Head of Household Characteristics (number)				
Female	2	3	1	6
Widowed[1]	1	0	0	1
Child[2]	1	1	0	2
Handicapped or chronically sick	6	22	17	45
Number of household with at least one handicapped or chronically sick member[3]	6	26	19	51
Number of household that use only one land parcel who is inside the ROW	177	89	90	356
Number of households	**186**	**195**	**117**	**498**

Notes: 1- The head of household registered in "Widowed" category is also registered in "Female" category.
2- The "Child" category includes a head of household aged 18 and under.
3- Others than the head of household.
On the other hand, it is important to note that there are no indigenous groups in the project area.

4.3.13 INDIGENOUS PEOPLE

There are no indigenous groups inside the study area.

4.3.14 ETHNICS AND RELIGIOUS AFFILIATIONS

In Nigeria, the ethnic context is rich with more than 250 ethnic groups. The following are the most populous and politically influential: Hausa and Fulani 29%, Yoruba 21%, Igbo (Ibo) 18%, Ijaw 10%, Kanuri 4%, Ibibio 3.5% and Tiv 2.5%.

Kebbi state hosts diverse ethnic groups, among which Hausas, Fulanis, Kabawa, Dakarkaris, Kambaris, Gungawa, Dandawa, Zabarmawa, Dukawa, Fakkawa and Bangawa are dominant.

These ethnic groups speak diverse languages and dialects, with the Hausa language spoken all over the state. The distribution of these ethnic groups shows that the Gungawa are found in Yauri local government, Kambaris in Zuru, Sakaba in Wasagu and Yauri LGAs, Dukawa in Sakaba Wasagu, Zabarmawa in Arewa, Dandi and Bunza LGAs and Dakarkaris in Zuru LGA. Most (86,9%) of the 498 affected household heads are from the Hausa ethnic group.

The majority of the people in Kebbi state are Muslim following the 1804 Fulani jihad. However, there are minority groups of Christians and traditional worshippers particularly in the south of the state. These ethnic diversities and religious differences notwithstanding, the people of Kebbi live in peace with one another (National Population Commission, 2014).

Using the 1952 census and figures from the 2002 World Christian database (WCD) and the current 2006 population, Ostein (2007) has estimated the percentage of Muslims in Kebbi state to be 84% or 2,704,254 out of the state’s 3,238,628 in the 2006 census. This means that non-Muslims in Kebbi constitute 16% or 535,374 of the population. This, when compared to the national data is skewed. The 2001 report from The World Factbook by CIA, maintained that about 50% of Nigeria's population is Muslim, 40% are Christians and 10% adhere to local religions. The vast majority of affected household heads (99,8%) are Muslim.

In terms of culture and arts, gold smiting, weaving, carving, sculpturing and knitting are popular in the area. Through these, various items such as domestic utensils, agricultural tools, body adornments, decorative materials and fishing equipment are produced for local and commercial use.

4.3.15 ARCHEOLOGICAL AND CULTURAL HERITAGE

Based on information obtained from the National Commission for Museums and Monuments (NCMM), headquarters in November 2015, the following archaeological/ historical sites are known to exist in Kebbi State:

- Karishi traditional settlement
- Tomb of Abdullahi Fodio in Gwnadu
- Girmache shrine in Zuru
- Alwasa battlefield in Argungu
- Ancient settlements at Gungu
- Kanta’s millitary arsenal at Gungu
- Kanta old palace at Argungu
- Slave market at Illo and ancient wall at Yawuri

However, none of these sites are crossed by the line route. There are no tombs, shrines or cemeteries affected by the project.

4.3.16 LANSCAPE AND VISUAL ASPECTS

The line starts at the existing Birnin Kebbi Substation (Lat 12.43627, Long 4.1990). The landscape is completely urbanized around the substation and along the first 5 km of the corridor that runs to the south parallel to the existing 330KV line from Kainji to Birnin Kebbi (Plate 11).

At the end of this section, the line reaches the outskirts of Birnin-Kebbi. It then turns to the west just outside Goru Village and crosses the Birnin-Kebbi to Jega Road. The landscape is flat and presents constructed elements (factory, houses, etc.) mixed with patches of cultivated fields and houses.

The line turns to the northwest just outside Unguwan Mairago Village, passing through military lands presently used for farming. It joins the existing 132KV line by the bank of Sokoto River and runs parallel to it to the boarder. This section of the line crosses a flat landscape essentially composed by cultivated parcels in the periphery of Birnin-Kebbi and in the floodplain of the Sokoto River. The military barrack is an important feature of the landscape in the area near Birnin-Kebbi.

After crossing the Sokoto River floodplain, the line goes through a flat rural landscape were it runs through cultivated areas and small patches of savannah (Plate 12).

Plate 11 House construction in Birnin Kebbi along the ROW

Plate 12 Cultivated parcel affected by the ROW

5 ALTERNATIVES ANALYSIS

This chapter describes and analyzes alternatives that led to the selection of the draft preliminary provisional line route. He exhibited then how the final provisional route has been selected, then this line route is presented in details.

5.1 ANALYSIS METHOD OF THE LINE ROUTE

5.1.1 METHOD OF IDENTIFYING ROUTES

The project involves the construction of a 330kV steel tower power line over 880 km between Birnin Kebbi in Nigeria (NG) and Ouagadadoudou in Burkina Faso (BF), crossing Niamey in Niger (NE). The project also joins Malanville region in Benin while passing through Niger. This power line will be constituted of theses sections:

→ Birnin Kebbi (NG) – Niamey (NE)

→ Niamey – Ouagadougou (BF)

→ Zabori (NE) – Malanville (BJ)

The method for identifying routes uses the principles of optimization to identify the route offering the best compromise between the multiple social, environmental and economic criteria while ensuring compliance with local, regional and national development plans as well as the guidance provided by the power companies of each country involved in the project.

A straight line between two substations is the most interesting solution to minimize the length of the line to build and minimize the project footprint. However, this type of solution is often unfeasible because of the technical constraints, the needs of the population, and environmental protection often conflicts and diverts the line. Line route options were developed based on the consideration of certain environmental and social constraints as well as taking advantage of areas with lower impacts. Positioning a power line is thus performed in a process of compromises, taking into account specific criteria. WSP has determined a list of criteria to map the line and explore all possible solutions.

5.1.1.1 GENERAL CHARACTERISTICS OF THE LINE ROUTE TO CONSIDER

In accordance with the terms of reference of the mission, the general characteristics of the line route to be 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

→ 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

5.1.1.2 DESIGN METHODS OF ALTERNATIVE ROUTES

The identification of alternative line routes aims to respect the criteria previously presented and find the best compromise when the solutions conflict. The design of the line route options as well as the mapping of the supporting environment, were carried out simultaneously to maximize feedback between the two processes that allow exploring a maximum amount of solutions.

The method used to generate the alternative line routes is based on an iterative approach. Generally, WSP first evaluates, on a large geographical area, a multitude of potential line routes, then specifies gradually. The main steps of the approach are as follows:

- → **Step 1**: Identification of line routes within a radius of 10 km around Fichtner's reference line route. The line routes were designed by cartographic optimization from scenarios taking into account existing infrastructures and environmental and social constraints obtained from a literature review.
- → **Step 2**: From the line route options generated in the previous step, mapping of social and environmental components was carried out in a corridor of 10 km. This mapping was conducted by photo-interpretation of satellite images in which villages, military bases, national routes, power transmission lines, airports, major rivers, floodplains, sloped areas, plantations, pastoral areas, protected areas, important bird areas for conservation, key biodiversity areas, Volta Valley zones, and Ramsar sites have all been identified. The line route options were then optimized to avoid a maximum of constraints, and use areas that have less impact.
- → **Step 3**: WSP Experts, on line power transmission, assessed the line route options to anticipate technical constraints. The options were also submitted to the electricity companies in each country concerned (WAPP, NIGELEC, SONABEL, CEB, and TCN) during working sessions that took place in April, 2015. The stakeholders submitted amendments that have been considered.
- → **Step 4**: On the basis of the options arising from the preceding steps, mapping in the 80 m RoW of the two line route options was conducted. This mapping was aimed to identify the concessions, buildings, paths, trails, streams, forests, savannahs, floodplains, erosion zones, plantations, agricultural and subsistence sites. The options have therefore been amended with respect to elements stemming from the detailed mapping. Based on the set of elements mapped at this stage, the priority issues as well as the zones of major constraints have been identified and located.
- → **Step 5**: The different line route options developed, as well as the Fichtner options, were compared by multi-criteria analysis. The analysis identifies the line route option that causes the least impact on the environment, the social environment and project costs based on the cartographic analysis.
- → **Step 6**: This step includes the review mission's draft selected line route. This mission was conducted in June, 2015, as consultations with regional and national authorities, to obtain feedback on the feasibility of the draft proposed line route options. The draft line route inspection mission helped to verify the validity of the mapped components, characterize by field observations the different areas under major constraints and identify the alternatives supported by local knowledge and field data. The areas visited in Nigeria were the Sokoto river floodplain, military facilities and built environments in Birnin Kebbi and Kangiwa.
- → **Step 7**: A draft preliminary line route review workshop, held from July 8th to the 10th, 2015, in Cotonou, brought together representatives of the WAPP, electricity companies, ministries of the environment of the countries concerned and WSP. Based on the results of this workshop, and the integration of all the comments received, the draft preliminary line route was optimized. This optimized line route was the subject of the comparative analysis according to the mapped criteria and the various maps updated to represent the draft final line route. All the results of these steps are found in the Draft Final Report: Line Route Project and are summarized in this section.
- → **Step 8**: Following the completion of the ESIA comprising a characterization and more detailed analysis of the environmental and social components as well as the assessments of impacts associated with the project, the draft final line route will be optimized to identify the final line route. Indeed, the detailed baseline characterization of physical, biological and human components during the ESIA will allow a more detailed comprehension of local context and will lead to slight modifications of the draft final line route.

5.1.1.3 DESCRIPTION OF MAPPED CRITERIA

The mapped criteria correspond to statistics and information measured from the WSP mapping. These calculations allowed us to produce the statistics presented in this report.

To facilitate the understanding of the analysis, all the criteria are presented as to be minimized. Thus the accessibility criterion is transformed into inaccessibility to be minimized; the best option is the one that will get the lowest score.

Line length: The length of the line corresponds to the distance of each section of the line route. The shorter the line is, the less chance to impact the environment and the lower the costs.

Angle points (> 15°): The number of angle pylons exceeding 15°. The angles are calculated using the deviation from a rectilinear route. At this stage, it is anticipated that a group of pylons will be developed with pylon alignment up to 2°, suspension pylons until 15°, corner pylons from 60° to 15°, and finishing pylons from 60° to 90°. Maintaining low angles will reduce the overall cost of the line route since angle structures are more expensive than the alignment structures and low angles.

Inaccessibility (> 5 km): Inaccessibility sections correspond to a line route that is more than 5 km from a national or a secondary road. The objective is to minimize the distance to reduce the costs of construction and maintenance, as well as the footprint on untouched territories. The human concentration tends to be inversely proportional to the inaccessibility, causing this criterion to conflict with the built environment criterion (see below).

River crossings: Crossing length of the Niger River. The line route crosses the Niger River in two places. The riverbanks evolve with the wet and dry seasons. Satellite images have located the fluctuations of the water level and determined the best places to cross the river from a technical and economic point of view. The options presented are aimed to minimize the span between two pylons to reduce costs.

Proximity to an airport (<2 km): The number of exclusion zones crossed by the route. The distance of the route to an airport is a security constraint. The regulations in force in concerned countries require all aerial infrastructures, including power lines, to be more than 2 km from an airport. Consequently, an exclusion zone of 2 km was plotted around airports and airstrips that we have identified along the route.

Hilly areas: The length of the route through a hilly zone. The hilly zones have been identified from the data of the Shuttle Radar Topography Mission (SRTM) of NASA. The SRTM topography provides the entire planet at a resolution of 30 m. It is from this information that the hills of a height of at least 20 m were identified. These zones induce technical constraints and increase the visual impact of the line route.

The Ramsar site, IBA and KBA: The length of the line route through Ramsar sites, Important Bird Conservation Areas (IBA) or Key Biodiversity Areas (KBA). All three areas are internationally designated for their importance in protecting global biodiversity. A Ramsar site is a wetland of international importance, which has been designated by the acceding countries of the Ramsar Convention, the four countries targeted by the project; IBA is an important area for bird conservation and a KBA is considered a priority for the protection of global biodiversity. In addition to being areas of great ecological importance, they also provide a number of fundamental ecosystem services. The sites identified are the Dallol Bosso, Dallol Maouri, Dallol Boboye, the Middle Niger I and II, the site of Makalondi and W the national park of Niger. A corridor within these areas can threaten the integrity of the components of biodiversity and ecological processes whose presence led to their designation as areas of importance for the protection of biodiversity. A passage is also susceptible to generate costs to protect bird wildlife and bats to reduce the risk of collision and electrocution as it would require abatement of impact devices such as increasing the size of the cables as well as the installation of vibration dampers, spirals or deflectors on the cable to increase the visibility, the planting of tall trees above the power line at the limit of the right of way, or the avoidance of a power line in a radius of 500 m from a water body where bird wildlife is concentrated.

Classified forests: The length of the route through a forest reserve. The classified forests of the study area are mainly located in Burkina Faso and Benin. They have a protected status, which the legislature assigns specific exemptions to in some cases. By way of example, in classified forests of Burkina Faso, the rights of traditional uses recognized for local residents concerns the collection of dead wood, fruit picking and harvesting of medicinal plants. Any impact on a protected forest typically requires a volume compensation of timber or lost ecosystem services.

Full and partial wildlife reserves: Length of route through a full or partial wildlife reserve. The wildlife reserves, whether full or partial, have been designated for conservation and wildlife management. These reserves have a legal protection status at the national level. They are mainly located in Burkina Faso and Niger. There are four full and partial reserves in Burkina Faso, including the Reserve of Pama Singou, Aril and Kourtiogou. In Niger there is the full reserve of Tamou and the partial reserve of Dosso. The partial reserve of Dosso is the only one crossed by the line route options. Its crossing poses a biodiversity issue as it is integrated into the buffer zone of the W National Park. It will involve mitigation and compensation measures to limit or offset the impacts of the loss and the fragmentation of the habitats in place.

Wooded area without status: The number of wooded areas crossed by the line route. Forested areas with no status have been mapped in the 80 m RoW from the line route options. A wooded area is a grouping of trees covering more than 25 % of the soil. In addition to completing various supply services in natural resources for local people or the regulation of water quality and erosion, these areas are preferred habitat for wildlife. The loss of wooded areas threatens the sustainability of the services and ecological roles provided.

Floodplains: The length of the route in floodplains has been mapped in the 80 m RoW. This is the expanse that suffers flooding when rivers flood. Their location is generally influenced by topographical settings and governed by the presence of being permanent or seasonal water associated with rainfall and water sources present throughout the territory. By their hydromorphic nature, floodplains are often composed of unstable soils and can be susceptible to erosion thus causing the installation of masts to be more complex. Floodplains are also very rich ecosystems whose ecological balance could be disrupted.

Distribution areas of Niger's giraffes: The length of the route through the distribution area of the giraffes of Niger (Giraffa camelopardalis peralta). The subspecies of giraffes in Niger are considered critically endangered by the IUCN Red List. There are only 366 individuals who operate in an area of approximately 31,200 km² (Marais et al., 2014). Many conservation actions have allowed populations to increase in recent years, there remained approximately only 50 individuals in the early 1990. Any additional fragmentation or habitat destruction is a threat to the sustainability of this subspecies.

Built Environment: The length of the route through the built environment, ignores the total number of buildings to be moved. The built environment refers to the perimeter of agglomerations of villages, towns or cities and agglomeration development plans where available. The perimeter has been identified by satellite images. This criterion indicates that the line route will cause the relocation of households, resulting in compensation costs.

Concessions and buildings: Number of concessions and buildings (including administrative and community infrastructures, and important religious or cultural sites) identified in the right of way of the line route. Concessions correspond to a grouping of buildings (huts or small houses) often separated by a fence. All the concessions as well as isolated buildings included in the 80 m right of way from the line routes were counted, with the exception of those in the reference line route of Fichtner that were estimated by sampling. This criterion indicates that the route will cause the relocation of households, resulting in compensation costs.

Recognized pastoral zones: The length of the route, through a pastoral zone. Recognized pastoral zones are territories delineated and dedicated to livestock activities. These include water infrastructures, animal health, firebreaks and farmhouses. These arrangements are intended to enhance the grazing land and foraging resources. Several pastoral areas have been identified and some of them are crossed by the line routes: Silmiougou, Mankarga V7, Yarkanre, and Tapoa-Boopo. Crossing the pastoral areas will disrupt the use, legally recognized, by the populations of local farmers, and ultimately threaten their welfare.

Plantations: The length of the line route in a vegetation planting area. Areas identified as those supporting plantation of trees and other vegetation organized in rows. Most plantations appear to be orchards. Crossing the plantations may require compensation measures when they are doomed to commercial or subsistence exploitation. The trees that are cut may need to be compensated by replanting others to offset their current ecological role.

Volta Valley zones: These are areas managed by the Sate in Burkina Faso to organize the development of the fertile land of the Volta Valleys and promote the economic development based on agriculture. The passage through the Volta Valley zones involves compensation for crops lost in the right of way (RoW), minimally during the construction phase.

Crops: The length of the route that passes through an area dedicated to agriculture. These zones dedicated to crops are sometimes fenced plots demarcated identifiable on satellite images. The passage through the crop zones involves compensation of lost crops in the right of way, minimally during the construction phase.

5.1.1.4 DESCRIPTION OF THE MULTI-CRITERIA ANALYSIS

The mathematical method of multi-criteria analysis (MMA), a quantitative tool, was used to compare the line route options. This method has the advantage to state explicitly the criteria that led to the selection of a line route. The MMA is a method designed to evaluate alternatives based on criteria that are measured in different units of measurement. The approach used, is the hierarchical multi-criteria analysis. The analysis includes six steps:

1. hierarchical breakdown of the criteria according to the three pillars of sustainable development
2. identification of evaluation scales of measurable impacts
3. identification of analysis of criteria and measurable criteria groups
4. establish the relative weight of the criteria and criteria groups
5. calculation of the weight of the criteria
6. calculating the sum of the values of weight on criteria, by criteria group, to rank the options

The hierarchical analysis approach is based on the pillars of sustainable development: environment, society and economy. The anticipated impacts affected are social aspects such as the well-being of affected communities, environmental aspects affecting primarily the conservation of natural habitats and associated species, and economic aspects aimed at achieving the least expensive and technically feasible project. Table 5-1 shows the three groups of criteria and their relative importance established according to the impact and importance of the issues on the environment. Groups of environmental and social criteria are equivalent in overall importance, while the economic group is of lesser importance.

Table 5-1 Relative Importance of Criteria Groups for Analysis

Group Criterion	Importance (%)
Economic	25
Environmental	37.5
Social	37.5

The value of the criteria is established from our experience in similar projects in West Africa, according to our understanding of local and global issues. The qualitative importance of each criterion is transformed into digital values according to the system presented in table 5-2.

Table 5-2 Value of the Importance Attached to the Criteria

Importance	Value
Low	1
Average	2
High	5
Very high	10

The criteria analysis described in table 5-3 reflect the environmental and social components that have been mapped. The weight of the 21 criteria is calculated by dividing the value of the criterion by the sum of the group's values.

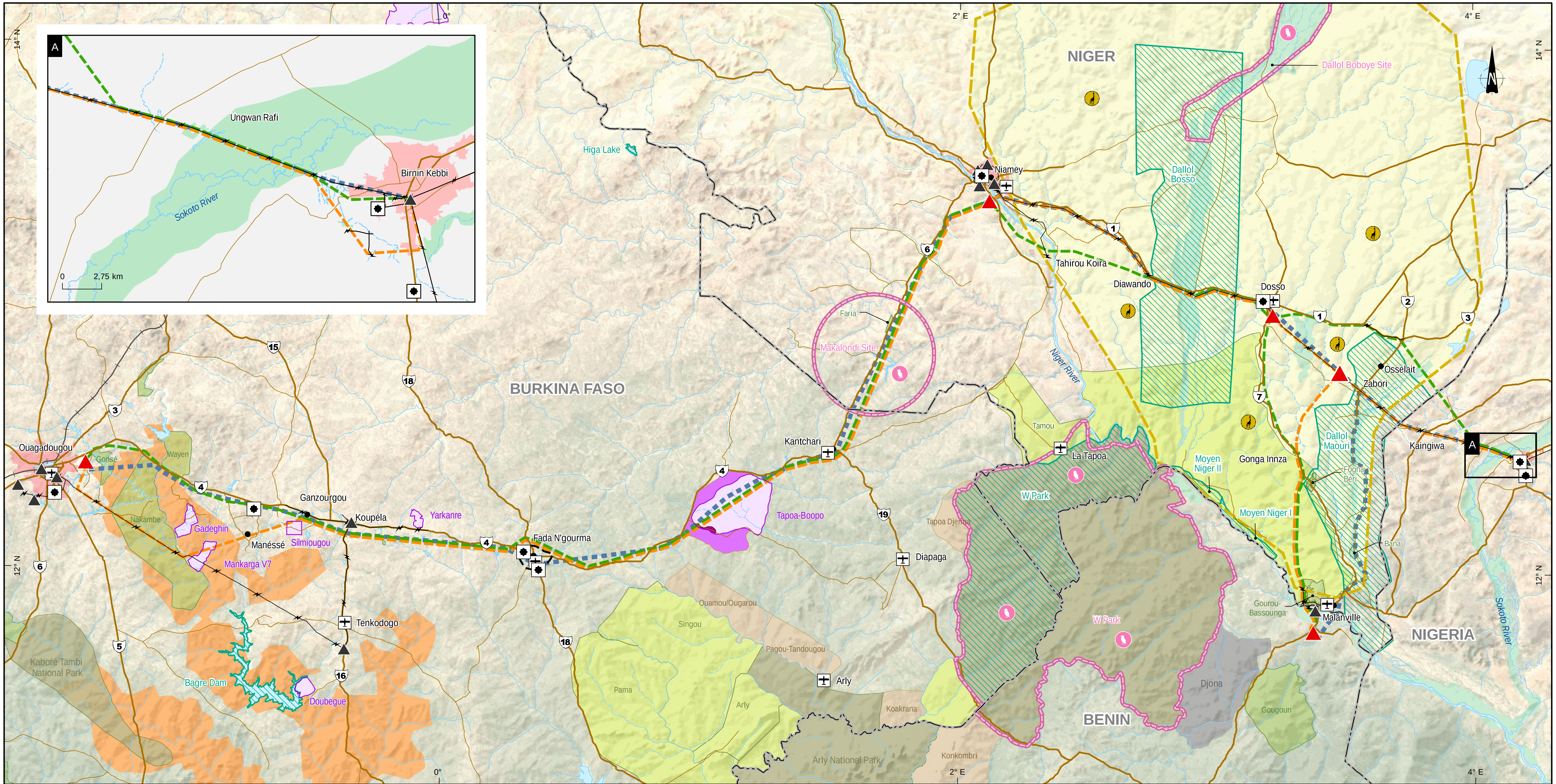
Table 5-3 Criteria and the Relative Importance Used in the Analysis

Criteria	Unit	Importance	Value	Weight (%)
Technical and Economic				
Line length	km	Low	1	6
Angle points (>15)	Number	Average	2	13
Inaccessibility (>5km)	km	Average	2	13
River crossings	km	High	5	31
Proximity to an airport (<2km)	Number	High	5	31
Hilly areas	km	Low	1	6
Environmental				
Ramsar site, IBA and KBA	km	Very High	10	32,2
Classified forest	km	High	5	16,1
Full and partial wildlife reserve	km	High	5	16,1
Wooded area without status	km	Low	1	3,2
Floodplains	km	High	5	16,1
Distribution areas of Niger's giraffes	km	High	5	16,1
Social				
Built environment	km	Average	2	9,5
Concessions and buildings	Number	High	5	23,8
Recognized pastoral zone:	km	High	5	23,8
Planting	km	Average	2	9,5
Volta Valley zones	km	High	5	23,8
Crops	km	Average	2	9,5

The weighted value of the criteria of each option is compared to a target route in which the reference values are determined by the minimum value of each criterion. Thus, the weighted value of each criterion is obtained by the measured value divided by the value of the target route and multiplied by the weight of the criterion. The sum of weighted values for each criteria group is multiplied by the importance of the criteria groups to determine the value of the impact of the route.

5.1.2 ALTERNATIVES DESCRIPTION

A preliminary route for this project has been identified during the feasibility study produced by Fichtner in 2006 and the preliminary Environmental and Social Impact Assessments (ESIA) produced in 2007. The route proposed by Fichtner is a reference line used to compare the other route options. However, since the submission of Fichtner's study in 2007, the environment in which the project takes place has evolved. Certain human populations migrated, communities developed, areas to protect were determined and infrastructures were built. Searching for alternative routes thus seemed to be necessary to reduce impacts and control the implementation cost of the project. The route proposed by Fichtner and the other 2 alternative routes are described in further sections (Map 5-1).



Biological Environment

- Niger Giraffe Distribution Area

Nationally Designated Area

- National Park
- Classified Forest
- Total or Partial Wildlife Reserve
- Hunting Area
- Cynegetic Area

Internationally Designated Area

- Ramsar Site
- Important Bird and Biodiversity Area
- Key Biodiversity Area

Human Environment

- City
- Built Environment
- Planned Built Environment
- Pastoral Area (approximate delineation)
- Agropastoral Area (approximate delineation)
- Area Occupied by Migrants
- Volta Valley Zones

Infrastructure

- Airport-Aerodrome
- National and Interstate Road
- Departmental Road
- Railroad
- Military Base

Substations and Transmission Lines

- Existing Line
- Existing Substation

Physical Environment

- Intermittent Watercourse
- Permanent Watercourse
- Reservoir
- Floodplain

Project Components

- Proposed Substation
- Option 1
- Option 2

Line

- Reference Line Route Proposed by Fichtner

Boundary / Limite

- International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Impact Assessment
Final Report

Line Route Options

0 16,5 33 49,5 km

UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015
File: 141_24307_EIE_NG_c5_1_Global_160606.mxd

Map 5-1

June 2016

WSP

5.1.2.1 NO PROJECT OPTION

The no project option involves that the project will not be implemented and represents the status quo.

Many environmental and social issues are currently faced in the Project area:

- → No access to national economic benefits associated power availability: revenues from electricity trade, increased stability of the national electrical network, potential economic growth associated with increased access to electricity;
- → No access to local economic development benefits that would derive from increased power supply to communities and households;
- → Loss of forest cover due to limited access to electricity as a substitute for charcoal and unsustainable agricultural practices, leading to soil erosion and increase of sediment loads in watercourses.

Under the no project option, these national and local challenges would remain, and probably worsen with time with environment degradation.

Socio-economic benefits and economic gains anticipated from the project would not be reached. Employment opportunities anticipated from the undertaking would not be forthcoming, while household food security and finances which would have contributed to the development of local community and the nation through taxes would also not be reached.

A number of benefits and resultant entrepreneur establishments that would have benefited the local people would no longer be within sight. In terms of socio-economic environment, the “no-project” alternative would not provide additional opportunity for the provision of income generation activities and job creation.

In addition, the development and growth of the region as well as the nation at large, would remain unchanged due to lack of this additional thrust for the development of the electricity transport in the area.

5.1.2.2 LINE ROUTE PROPOSED BY FICHTNER

Generally, the Fichtner reference route follows major roads to facilitate access to the line, to optimize the costs of construction and of maintenance. It includes 4 substations: Birnin-Kebbi, Zabori, Malanville and Ouagadougou. The principal reaches are: Zabori – Malanville: 124 km;

- → From Zabori, the line runs south to Madotchi in the Ramsar Dallol Maouri site. It then crosses the wetland to link Koutombou, to then head south and join Bengou. At Bengou, it passes through the wetland again, runs along national road 7 for 13 km before crossing the Niger River to Gaya Bagouri-Tounga, to join Bembéréké (BJ), 200 km away. The analysis of this portion of the line route up to Malanville reveals the following issues:
  - several angle points, particularly near the communities of Madotchi, Yélou and Bengou
  - crossing of the Ramsar site of Dallol Maouri for 100 km, of which almost 20 km is in the wetlands and two crossings (at Madotchi and Bengou)
  - crossing of the Niger River to a width of about 500 m
- → Niamey – Ouagadougou: 475 km
  - The corridor follows national highways 6 and 4, mainly to the south of the road, crossing twice. The line route runs a total length of 475 km, 94 km in Niger and 381 km in Burkina Faso. Analysis of the route from Niamey to Ouagadougou reveals the following issues:
  - crosses a pastoral area of 38 km between Niamey and Fada Ngouma (BF)
  - passes through Fada Ngourma airport and enters the exclusion zone, 1.2 km from Kanchari airport (BF)

- crosses the protected forest of Nakambe (BF) for 11 km and the classified forest of Gonse (BF) for 5.5 km when approaching Ouagadougou
- the route enters the built-up area of Ouagadougou

→ Niamey – Zabori– Birnin Kebbi: 264 km

- From Niamey, the corridor follows an existing power line of 132 kV to Zabori for 134 km. It crosses the Dallol Bosso for a distance of 36 km on an east to west axis. From Zabori, the route branches off to join Birnin Kebbi to the east and Malanville to the south. The line route towards Birnin Kebbi follows the existing line of 132 kV for 80 km until the existing substation of Birnin Kebbi via Kaingiwa (NE). The southern route towards Malanville runs along the wetlands in the Ramsar site of Dallol Maouri for 97 km, then along national highway 7 to Malanville. The analysis of this portion of the route shows that:
- It enters the exclusion zone of Kaingiwa airport
- It affects the built-up area of Birnin Kebbi for a distance of about 5 km
- it crosses the Ramsar site of Dallol Bosso for 36 km
- it crosses the Ramsar site of Dallol Maouri for 25 km, the north-west and north-south axes

Table 5-4 presents the relative principal statistics of the route proposed by Fichtner. These come from the WSP technical and environmental data analysis over Fichtner's route.

Table 5-4 Technical, Environmental and Social Criteria Evaluation of the Reference Line Proposed by Fichtner

Criteria	Fichtner
Technical and Economic	
Line length	848
Angle points (>15) †	46
Inaccessibility (>5 km)	139
River crossings	4
Proximity to an airport (<2 km) †	2
Hilly areas	106
Environmental	
Ramsar site, IBA and KBA	208
Classified forest	17
Full and partial wildlife reserve	0
Wooded area without status	191
Floodplains	9
Distribution areas of Niger's giraffes	284
Social	
Built environment	35
Concessions and buildings†	356
Recognized pastoral zone	40
Planting	2
Volta Valley zones	40
Crops	72

Values are in km, except criteria marked by † which are numbers

5.1.2.3 OPTION 1

Nigeria (50 km)

Option 1 arrives at Dosso (NG), enters Nigeria at 4 km west of Amagoro, takes a southeasterly direction on a relatively flat savannah territory to join the existing 132 kV line, 8 km east of Ungwan Rafi. The line route crosses the floodplain of the Sokoto River for 8 km, through an erosion zone situated 5 km west of Birnin Kebbi and bypasses the military barracks of Dukku by the north and joins the existing substation of Birnin Kebbi.

Niger (456 km)

Option 1 favors the Niger River crossing in a narrowing zone to join the Niamey substation to Diawando. It leaves the projected substation at Niamey south-east to cross the Niger River close to Tahirou Koura, where the span required for the crossing is 420 m in dry periods. Thereafter, the line crosses a savannah zone without relief for 42 km to join in the proximity of Diawando, the existing line of 132 kV and National Highway 1. Both options skirt by the south, entering the Ramsar site of Dallol Bosso for 37 km.

Option 1, which aims to bypass the Ramsar site of Dallol Maouri, intends to insert a substation at 6 km south of Dosso to connect in the east, Nigeria towards Amagoro (NG), and bypass the Ramsar site of Dallol Maouri by the north.

The link to Benin in the south is along National Road 7 through the savannah and some hilly areas. This option has the advantage of implementing a transformer substation in Dosso, a larger urban center than Zabori.

Between Gonga Innza and Tenda, it goes through, as option 2, the Dosso partial reserve along National Highway 7, and leaves the road continuing south. The line route runs along tertiary roads to the east of Tara, still in the partial reserve of Dosso and bypasses the classified forest of Guru-Bassounga in the west. In Tara, the line route heads southeast for 2 km to the site of Ladane Kwara through savannah and rice fields to reach Benin.

Burkina Faso (363 km)

From Ouagadougou substation, option 1 (363 km) heads north along National Road 4, mainly in the savanna and forest. This option has the advantage of being easily accessible by road and crosses already disturbed but inhabited areas. It also bypasses the classified forests of Gonse, Nakambe and Wayen. At 1 km northeast of Ganpéla, the option passes through a floodplain 450 m wide, north of National Road 4. The Airport of Fada N'gourma is bypassed north, along the national road. The route then crosses the pastoral zone of Tapoa-Boopo and the area occupied by migrants, 63 km east of Fada N'gourma. Just before crossing Tapoa-Boopo, 4 km north of Tanwolbougou, the route crosses a floodplain for 2 km. After crossing Tapoa-Boopo, the line route joins the national highway and avoids the airport of Kantchari by the south before reaching the border by Kampyagui.

Benin (13 km)

The Beninese line route contains only one option. Alternative routes are limited when entering in Benin. The Gourou-Bassounga forest, the Gonga Karima airport and dense built environment favor a route entering west from Malanville.

This option starts at the Niger border, and crosses the Niger River 4 km northwest of Malanville. It continues in a rice field area along the Niger River and bypasses Malanville by taking a south-westerly direction for 5 km into the savannah. The route bypasses a floodplain from the western stretch of the Niger River through rice fields and bypasses Badjékali by the west. Finally, the route joins National Road IE2 and the planned substation at Malanville, 3 km south of Badjékali. The evaluation of Option line route 1, using the different analyzed criteria, is presented in table 5-5.

Table 5-5 Technical, Environmental and Social Criteria Evaluation of the Option 1 Line Route

Criteria	Option 1
Technical and Economic	
Line length	881
Angle points (>15) †	25
Inaccessibility (>5 km)	154
River crossings	1
Proximity to an airport (<2 km) †	-
Hilly areas	151
Environmental	
Ramsar site, IBA and KBA	90
Classified forest	0
Full and partial wildlife reserve	64
Wooded area without status	167
Floodplains	10
Distribution areas of Niger's giraffes	306
Social	
Built environment	3
Concessions and buildings †	273
Recognized pastoral zone:	40
Planting	2
Volta Valley zones	21
Crops	69

Values are in km, except criteria marked by † which are numbers

5.1.2.4 OPTION 2

Nigeria (58 km)

Option 2 arriving to Zabori (NE) enters Nigeria 11 km west of Kaingiwa and runs along the existing power line from the south, through some hilly areas. To avoid the exclusion zone of 2 km around Kaingiwa airport, the line route leaves the existing line for 9 km, which is in the exclusion zone. The line route then again follows the existing line, and joins east of the floodplain of the Sokoto River. To reach the substation of Birnin Kebbi, the route bypasses the Dukku barracks and some villages in the south, adding 7 km and crossing a densely built environment for nearly 4 km along existing lines. The line route of Option 2 crosses several areas of erosion, either 1 km east of the Niger border, in Kaingiwa or 6 km northeast of Ungwan Megusaye.

Niger (422 km)

Two options are presented to link the substation of Niamey to Diawando in the east: In order to join the Niamey substation to Diawando in the East, option 2 follows the existing power line, but crosses the river in a section where it is wider than option 1.

Option 2 leaves the planned substation of Niamey north-east, crossing built environments and the Niger River with a span of 510 m in dry periods (card 13). On the east bank of the Niger River in Niamey, the line runs along and crosses existing lines of 330 kV and 132 kV in a built-up environment, which could create more significant impacts. The line route then follows the existing power line from the south and joins Diawando.

As for option 1, close to Diawando, it skirts National Highway 1 and the existing 132 kV power line from the south, entering the Ramsar site of Dallol Bosso for 37 km.

This option includes a substation 10 km northwest of Zabori, so close to the coupling point, but goes through the Ramsar site of Dallol Maouri for 24 km along the existing electric line going to Kaingiwa (NG). To reach Benin, the route goes to National Highway 7 to the south and joins the other option, 5 km northeast of Gonga Innza.

Between Gonga Innza and Tenda, this option goes through the Dosso partial reserve along National Highway 7, and leaves the road continuing south. The line route runs along tertiary roads to the east of Tara, still in the partial reserve of Dosso and bypasses the classified forest of Guru-Bassounga in the west. In Tara, the line route heads southeast for 2 km to the site of Ladane Kwara through savannah and rice fields to reach Benin.

Burkina Faso (379 km)

Option 2 distinguishes itself from option 1 in the Ouagadougou – Ganzourgou segment passing through the south for 11 km along the existing 132 kV power line (Ouagadougou - Bagre Dam), crossing the classified forest of Nakambe for 52 km, then exiting the line in a north easterly direction and returning to Ganzourgou via Manesse. Therefore, this option line route passes through a built-up area for 300 m, and the pastoral zone of Mankarga V7 for 53 km. This option runs through flood plains, including Tanvi Nakamtenga, for 1.4 km and another near the pastoral area of Mankarga V7. Even if Option 2 runs along an existing power line, it has the disadvantage of being potentially more disruptive to the biological environment and be less accessible on the segment connecting the existing line route to Ganzourgou.

Benin (13 km)

As mentioned previously, the Beninese line route does not include an option assuring the junction to Niger. Option 2 thus follows option 1 as described above.

The evaluation of Option line route 2 using the different analyzed criteria is presented in table 5-6.

Table 5-6 Technical, Environmental and Social Criteria Evaluation of the Option 2 Line Route

Criteria	Option 2
Technical and Economic	
Line length	876
Angle points (>15°) †	26
Inaccessibility (>5 km)	288
River crossings	2
Proximity to an airport (<2 km) †	-
Hilly areas	121
Environmental	
Ramsar site, IBA and KBA	111
Classified forest	36
Full and partial wildlife reserve	64
Wooded area without status	136
Floodplains	7
Distribution areas of Niger's giraffes	287
Social	
Built environment	6
Concessions and buildings †	258
Recognized pastoral zone:	50
Planting	2
Volta Valley zones	62
Crops	63

Values are in km, except criteria marked by † which are numbers

5.1.3 SELECTION OF THE DRAFT PRELIMINARY LINE ROUTE

The line route options described were analyzed on the basis of mapped criteria. The following tables show the results of the weight value for the analysis criteria for Option 1, Option 2 and Fichtner's line route. The lowest global weighted value indicates the optimal line route option.

5.1.3.1 EVALUATION OF OPTIONS ACCORDING TO ENVIRONMENTAL CRITERIA

The following table presents the evaluation of environmental criteria weight values of the different options. Option 1 distances itself by its lower score, essentially because of the avoidance of crossing a classified forest and the reduction of the travel distance in a Ramsar site, an IBA or KBA.

Table 5-7 Evaluation of Environmental Criteria Options

Criteria	Weighted Value			
	Weight (%)	Option 1	Option 2	Fichtner
Ramsar site IBA and KBA	32,2	21	26	49
Classified forest	16,1	0	33	15
Full and partial wildlife reserve	16,1	24	24	0
Wooded areas without status	3,2	3	3	4
Floodplains	16,1	18	13	17
Distribution areas of Niger's giraffes	16,1	17	16	16
Score		84	115	101
Rank		**1**	**3**	**2**

5.1.3.2 EVALUATION OF OPTIONS ACCORDING TO SOCIAL CRITERIA

The table below shows the evaluation of options for social criteria. It is noted that Option 1 is the option that seems the most optimal from a social point of view. The criterion that favors this option is the bypassing of the Volta Valley zones. Option 1 touches more plantations, crops and concessions than Option 2, but enters almost 2 km less in built environments (towns and villages).

Table 5-8 Evaluation of Social Criteria Options

Criteria	Weighted Value			
	Weight (%)	Option 1	Option 2	Fichtner
Built environment	9,5	2	4	23
Concessions, buildings †	23,8	22	21	29
Pastoral zone status	23,8	22	27	22
Plantation	9,5	10	8	10
Volta Valley zones	23,8	12	36	23
Crops	9,5	10	9	10
Score		78	105	117
Rank		**1**	**2**	**3**

Values are in km, except criteria marked by † which are numbers.

5.1.3.3 EVALUATION OF OPTIONS ACCORDING TO ECONOMIC CRITERIA

The table below presents the evaluation of options for economic criteria including technical aspects. It is noted that Option 1 is the most optimal from an economic point of view, despite the fact that the line route is longer by 21 km. The number of angle points is almost equivalent, but Option 1 is more accessible than Option 2 on nearly 130 km. Option 1 also offers a better place to make the crossing of the Niger River near Niamey, since the span is shorter, it touches less agricultural territories. It also respects the request of the NIGELEC to move away from urban areas.

Table 5-9 Evaluation of Economic Criteria Options

Criteria	Weighted Value			
	Weight (%)	Option 1	Option 2	Fichtner
Length of line route	6	6	6	6
Angle points (>15) †	13	10	10	18
Inaccessibility (>5 km)	13	10	19	9
Crossing of rivers	31	15	28	51
Proximity to an airport (<2 km) †	31	-	-	94
Hilly zones	6	7	6	5
Score		48	69	183
Rank		**1**	**2**	**3**

Values are in km, except criteria marked by † which are numbers

5.1.3.4 COMPARATIVE ANALYSIS RESULTS

The table below presents the comparative analysis results according to the criteria groups used. Option 1 is the most optimal line route according to the criteria. Although it is longer, it allows for better avoidance of the environmental and social constraints that are present. Also, the additional costs associated with its length can be offset by better access to a wider stretch of the line route and also by an optimal site for crossing the Niger River, which reduces the technical constraints and associated costs.

Table 5-10 Evaluation of All Options

Criteria	Weight (%)	Option 1	Option 2	Fichtner
Technical and economical	25	48	69	183
Environmental	37.5	84	115	101
Social	37.5	78	105	117
Score		73	100	127
Rank		**1**	**2**	**3**

5.1.4 SELECTION OF THE DRAFT FINAL LINE ROUTE

5.1.4.1 IDENTIFICATION OF DRAFT FINAL LINE ROUTE METHODOLOGY

This section presents the steps that led to the development of the draft final line route. This route has been developed in the framework of a detailed and comprehensive mapping exercise supported by the realization of a review mission of the line route which brought together WSP, representatives of the WAPP and representatives of the power companies. Subsequently, other working meetings and consultations were conducted to complete the cartographic identification following field reconnaissance work. More specifically, the following steps were carried out to achieve the final identification of the draft final line route:

→ Analysis of constraint areas. The constraint areas identified (called “hot spots”) following the proposed line route options have been identified and analyzed using cartographic tools and a literature review in the purpose of limiting the elements to characterize in the line route review mission framework.

→ Review of the line route, as part of a review mission of the hot spots. This review has enabled the consultant to make the links between observation issues from interpretations originating from satellite images and other data sources, and the reality on the ground. The review mission has brought together representatives of the consultant, the WAPP and power companies of each country. The review of the line route has not only allowed these electricity companies to appropriate the draft preliminary line route but also to validate characterization elements previously obtained. Finally, the review mission has primarily enabled characterizing the hot spots and identifying the alternative solutions when potentially significant impacts were to be avoided.

→ Presentation of the draft preliminary line route. Participants of this meeting held in Cotonou from the 8th to the 10th of July, 2015, included representatives from power companies and ministries concerned as well as representatives of the WAPP and the consultant, who presented the draft preliminary line route. The consultant selected for the feasibility study was also present. The first day of the meeting was devoted to presenting the elements which drove the selection of the draft preliminary line route. The second day was devoted to the presentation of hot spots. This day resulted in numerous exchanges with the participants on the changes to bring to the draft preliminary line route. The participants then formulated, during the third day, different changes to provide in each concerned countries.

→ Adjustment of the line route. The different demands for change were analyzed and an optimal line route was proposed. This adjustment necessitates even more detailed analysis of the Malanville area in Benin, on arrival at the substation of Birnin Kebbi in Nigeria, on arrival at the substation of Ouagadougou in Burkina Faso and for the bypassing of Fada N'gourma in Burkina Faso.

→ Agglomeration development plan research. In order to take into account the evolution of the urban fabric when the line route is situated close to urban areas, additional analysis work was completed. In fact, the preliminary line route already avoids urban areas but is not too far away to answer two general characteristics to take into consideration: stay nearby cities and towns (to facilitate electrification) and to not impinge in the built environment (to avoid relocation of populations). When analysis of the line route confirmed a possible interaction of the draft preliminary line route with the evolution of the urban fabric of some agglomerations, development plans were researched and analyzed. The line route was then adjusted accordingly.

→ Complementary research. In the framework of the draft preliminary line route adjustments, additional analysis work of protected areas (including Ramsar, IBA reserves partial and / or total) crossed by the line route was performed. The area was analyzed again to ensure that the line route passed through an optimal area with the least strong ecological interest and that all alternatives had been taken into consideration. Where applicable, the line route was adjusted. Meetings were also conducted with national authorities responsible for Ramsar sites and for the partial reserve of Dosso in Niger as well as with the authority responsible for the classified forest and partial reserve in Burkina Faso.

→ Taking into account all the obstacles, administrative and community infrastructures, cultural and religious sites in the RoW of the line. These obstacles, infrastructures and sites have already been taken into consideration in the preliminary version of the line route, but it was not made clear in the report. The change was made in the previous sections that present the line route analysis method. Additional research work was performed as part of the revision framework of the line route to improve the identification work that was conducted previously. Analysis of territorial issues to gather the opinions of the African Development Bank (AfDB) on the line route and especially on the crossing of sensitive areas. The AfDB forwarded, after the review meeting and adoption of the draft preliminary line route report, a series of comments to the WAPP who handed them over to the consultant. The latter analyzed these comments to take into account, wherever possible, in the framework of adjustments to the draft preliminary line route report.

5.1.4.2 DRAFT PRELIMINARY LINE ROUTE MODIFICATIONS

The main recommendations and changes to the draft preliminary line route are the following:

General Requests

→ Consider the rapid expansion of the urban fabric of cities and development plans.

→ The likely expansion of cities was taken into account. In some cases, particularly as the review mission or the development plans indicated to us, the line route, notably at Fada N'gourma and Malanville, was moved. In the case of Dosso it is the option farthest from the city that has been chosen and the line route has been changed to avoid suburban area. In the case of Birnin Kebbi, the military barracks of Dukku has been bypassed to follow the line route corridor of the Kainji-Birnin Kebbi power line. By doing so, the Federal Medical Centre was also bypassed.

Specific Requests – Nigeria

Favor option 2 in Nigeria; it is more accessible:

→ option 2 was preferred in Nigeria

Optimize arrival of the line route at Birnin Kebbi substation.

→ Following discussions with the TCN, the option of the line route arriving at the Birnin Kebbi substation, by the south along the Kainji-Birnin Kebbi power line route, was selected.

→ The draft final preliminary line route bypasses, by the south, the military barracks in Birnin Kebbi. By doing so, the Federal Medical Centre was also bypassed as previously mentioned.

Specific Requests – Niger

→ Favor option 1 for crossing the Niger River, and Option 2 for crossing the Dallol Maouri, except for the development of Dosso.

→ Option 1 was preferred. The passage near Dosso was reconfigured to avoid the urban perimeter and to connect the substation of Zabori.

→ Move closer to the substation of Zabori.

→ The transformer substation was brought closer by 3.3 km to Zabori, near the boundary of the Ramsar site of Dallol Maouri, as requested by the NIGELEC, to facilitate access for the employees.

→ Crossing the river at Tahirou Kouara (formerly Sekoukou).

→ The draft final preliminary line route crosses the river at Tahirou Kouara.

→ Crossing the Dallol Maouri.

→ The draft final preliminary line route crosses the Dallol Maouri following the existing power line.

→ Shift the line route towards the village of Tara to avoid felling large trees like the Palmyra palm which are protected species.

→ The draft final line route has been moved by 100 m to avoid protected trees and to move away from the urban perimeter of Tara.

Specific requests – Burkina Faso

→ Favor Option 1 in Burkina Faso.

→ The line route mainly follows option 1 in Burkina Faso with the amendments presented below.

→ Consider the status of the Gonse forest and remain between 100 m and 300 m from the line route.

→ The Gonse forest is a partial wildlife and forest reserve. Verification of legal texts and exchanges with national supervisory authorities suggests that the passage of the power line on the site is possible subject to the fulfillment of several components. This section of the line route has been modified to pass to the south, as close to National Road 4 as possible.

→ Arriving at the substation to the east (Ouagadougou) from the north:

- Arrival at the substation to the east was modified in consideration of the new status of the Gonse forest and the requirements of the SONABEL while minimizing the impacts on the built environment.

→ Staying within 1200 m of the road, where possible:

- The draft final preliminary line route is closer to the road in areas where further analysis revealed apparently acceptable impacts. The presence of several built environments is a major constraint and from the demands of the SONABEL, the proximity to the road has been preferred, as opposed to the criteria of the built environment, the length of the line route and the angle points.

→ Circumvent the agro pastoral areas of Tapoa-Boopo:

- The draft final line route bypasses the area of Tapoa-Boopo through the north between Sakoari and Ougarou and avoids Matiakoali as well as the hilly areas.

→ Bypassing the suburban area of Fada N'gourma, the future Fada N'gourma University site as well as a large built estate:

- The draft final line route is 2 km north of the preliminary line route to reflect the Fada N'Gourma development plan as well as the anticipated development of the university. The large estate referred to by the review mission report should be avoided, even if it could not be precisely located.

→ Bypassing the suburban area of Mogtedo:

- The draft final line route has been moved at Mogtedo to allow the expansion of the urban fabric, while maximizing the accessibility to the line route. A shooting range in this vicinity was mentioned in the review mission, but further analysis was unable to locate it precisely.

→ Bypassing the suburban area of Zempasgo:

- The draft final line route was moved at Zempasgo to allow the expansion of the urban fabric, while maximizing the accessibility to the line route. The review mission noted the presence of a military camp that could not be precisely located.

Specific Requests – Benin

→ Review the path of the line route until the Malanville substation:

- Following discussions with the CEB and the town of Malanville, the path of the line route around Malanville until the substation, has been modified, including bypassing the built environment of Malanville. The draft final line route now passes to the west of the provisional preliminary line route since the flood zone previously considered proved to be less significant after further investigation.
- The draft final line route avoids the truck station close to the Malanville substation.

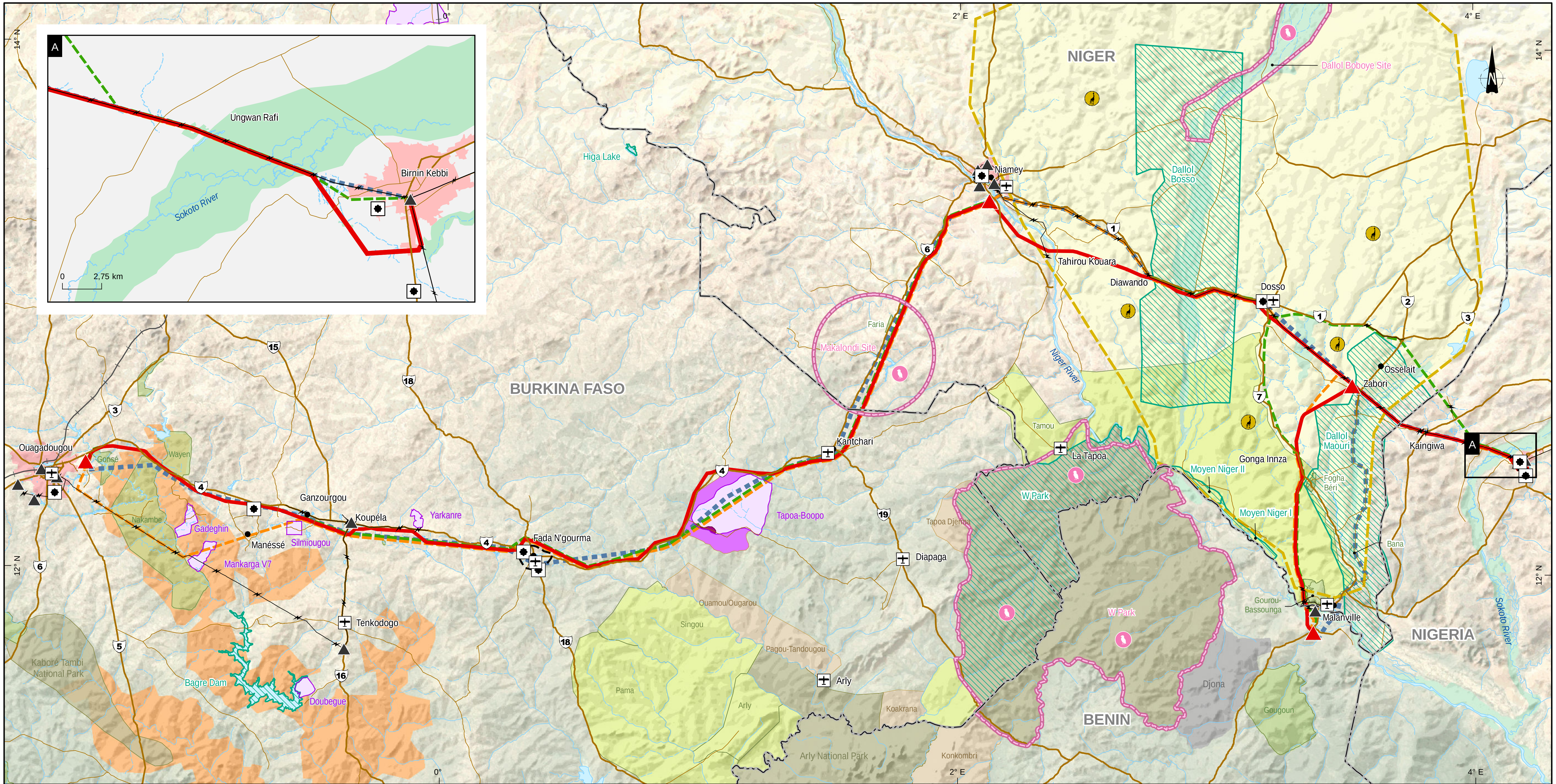
→ Review the angle point on the bank of the Niger River.

- The angle point located on the south bank of the Niger River, at the entry to the line route in Benin, was moved south of the dyke and the road.

5.2 DRAFT FINAL LINE ROUTE PRESENTATION

5.2.1 DRAFT FINAL LINE ROUTE DESCRIPTION

The draft final line route that takes into account the comments made in the framework of the review meeting and adoption of the draft preliminary line route report, is presented below, from Nigeria to Benin through Niger and Burkina Faso. The draft final route was described in the chapter on Project Description, and statistics by country are shown in table 5-11. The 5-2 Map presents this draft final line route.



Biological Environment

- Niger Giraffe Distribution Area

Nationally Designated Area

- National Park
- Classified Forest
- Total or Partial Wildlife Reserve
- Hunting Area
- Cynegetic Area

Internationally Designated Area

- Ramsar Site
- Important Bird and Biodiversity Area
- Key Biodiversity Area

Human Environment

- City
- Built Environment
- Planned Built Environment
- Pastoral Area (approximate delineation)
- Agropastoral Area (approximate delineation)
- Area Occupied by Migrants
- Volta Valley Zones

Infrastructure

- Airport-Aerodrome
- National and Interstate Road
- Departmental Road
- Railroad
- Military Base

Substations and Transmission Lines

- Existing Line
- Existing Substation

Physical Environment

- Intermittent Watercourse
- Permanent Watercourse
- Reservoir
- Floodplain

Project Components

- Proposed Substation
- Draft Final Line Route
- Option 1
- Option 2

Line

- Reference Line Route Proposed by Fichtner

Boundary

- International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Impact Assessment
Final Report

Draft Final Line Route

0 16,5 33 49,5 km

UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_EIE_NG_c5_2_Trace_160606.mxd

Map 5-2

June 2016

WSP

Table 5-11 Draft Final Line Route Statistics by Country

Criteria	Nigeria	Niger	Burkina Faso	Benin
Technical and Economic				
Line length	62.0	420.4	381.0	12.0
Angle points (>15) †	6	13	16	2
Inaccessibility (>5 km)	24.9	166.4	1.5	-
River crossings	-	1.0	-	0.2
Proximity to an airport (<2 km) †	-	-	-	-
Hilly areas	14.1	85.2	22.5	-
Environmental				
Ramsar site, IBA and KBA	-	110.1	1.5	-
Classified forests	-	-	0.9	-
Full and partial wildlife reserve	-	64.0	-	-
Wooded area without status	5.0	57.8	73.0	-
Floodplains	2.0	5.2	2.8	0.1
Distribution area of the giraffes of Niger	-	269.4	-	-
Social				
Built environment	2.2	0.5	0.9	0.1
Concessions, buildings †	8	105	156	1
Pastoral zone status	-	-	-	-
Plantation	-	1.9	0.6	0.7
Volta Valley zones	-	-	21.5	-
Crops	22.1	22.4	53.5	6.0

Values are in km, except criteria marked by † which are numbers

5.2.2 DRAFT FINAL LINE ROUTE EVALUATION

The multi-criteria evaluation allows seeing the optimization work that has led to the identification of the draft final line route. Table 5-12 shows the assessment criteria for all of the proposed preliminary options as well as for the draft final line route. The draft final line route is slightly shorter that the proposed preliminary options, a total distance of 866 km. It is slightly less accessible than option 1, but more accessible than option 2 and avoids more hilly areas. The draft line route crosses Ramsar sites in Niger over a longer distance. However, the impact is minimized since the optimization effort of a crossing site in areas with less strong ecological interest. Among others, the length of the line route in the area of distribution of Niger's giraffes and the pastoral areas is reduced. The route also allows reducing the encroachment in terms of concessions and the built environment, taking into account the development plans of nearby cities.

Naturally, given the need for compromise in the selection of the line route, the latter does not always obtain the highest score in terms of economic, environmental and social performance. Indeed, the draft final line route ranks second with respect to economic criteria (table 5-13) and environmental criteria (table 5-14), but first with respect to social criteria (table 5-15). Nevertheless, the cumulative scores of the different weighted criteria show that it has the best overall performance when faced against all the options that have been proposed (table 5-16).

Table 5-12 Evaluation of Criteria for all the Line Route Options

Criteria	Option 1	Option 2	Fichtner	Draft Final
Technical and Economic				
Line length	881	876	848	875
Angle points (>15) †	25	26	46	37
Inaccessibility (>5 km)	154	288	139	193
River crossings	1	2	4	1
Proximity to an airport (<2 km) †	-	-	2	-
Hilly areas	151	121	106	122
Environmental				
Ramsar site, IBA and KBA	90	111	208	112
Classified forests	0	36	17	1
Full and partial wildlife reserve	64	64	-	64
Wooded area without status	167	136	191	136
Floodplains	10	7	9	10
Distribution area of the giraffes of Niger	306	287	284	269
Social				
Built environment	3	6	35	4
Concessions, buildings †	273	258	356	270
Pastoral zone status	40	50	40	-
Plantation	2	2	2	3
Volta Valley zones	21	62	40	21
Crops	69	63	72	104

Values are in km, except criteria marked by † which are numbers

Table 5-13 Comparison of Technical and Economic Criteria of the Draft Final Line Route

Criteria	Weighted Value				
	Weight %	Option 1	Option 2	Fichtner	Draft final
Line Length	6	6	6	6	6
Angle points (>15) †	13	9	10	17	14
Inaccessibility (>5 km)	13	10	19	9	12
River crossings	31	17	32	59	17
Proximity to an airport (<2 km) †	31	0	0	125	0
Hilly areas	6	8	6	5	6
Score		50	73	221	55
Rank		**1**	**3**	**4**	**2**

Values are in km, except criteria marked by † which are numbers

Table 5-14 Comparison of Environmental Criteria of the Draft Final Line Route

Criteria	Weighted Value				
	Weight %	Option 1	Option 2	Fichtner	Draft final
Ramsar sites, IBA and KBA	32,2	22	28	52	28
Classified forest	16,1	0	43	20	1
Full and partial wildlife reserves	16,1	22	22	0	22
Wooded areas without status	3,2	3	3	4	3
Floodplains	16,1	17	13	16	18
Distribution area of Niger's giraffes	16,1	17	16	16	15
Score		82	124	108	86
Rank		**1**	**4**	**3**	**2**

Table 5-15 Comparison of Social Criteria of the Draft Final Line Route

Criteria	Weighted Value				
	Weight %	Option 1	Option 2	Fichtner	Draft final
Built environment	9,5	2	5	28	3
Concessions, buildings†	23,8	22	21	29	22
Pastoral zone status	23,8	30	37	29	0
Plantation	9,5	9	8	9	12
Volta Valley zones	23,8	14	41	26	14
Crops	9,5	9	8	9	13
Score		86	119	131	65
Rank		**2**	**3**	**4**	**1**

Values are in km, except criteria marked by † which are numbers

Table 5-16 Final Evaluation of Options

Criteria	Weight (%)	Option 1	Option 2	Fichtner	Draft Final
Technical and Economical	25	50	73	221	55
Environmental	37,5	82	124	108	86
Social	37,5	86	119	131	65
Score		75	109	145	70
Rank		**2**	**3**	**4**	**1**

5.3 CHANGES MADE TO THE FINAL PROVISIONAL 330 KV NORTH CORE POWER LINE ROUTE FOLLOWING COMPLETION OF THE PRELIMINARY ESIA AND RAP

With the aim of taking into account information gathered during field inventories, some adjustments were made to the line route in Niger and Burkina-Faso.

In Niger, the line route was modified at the request of the NIGELEC to avoid houses located south-east of Doss city. Deviation has a length of about 35 km.

It moves further away from the current line route toward the south just before the Koumbo-Koye-Deye village, about 12 km away from Dosso, to join the current line route in a straight line, 19 km away from Dosso and 7 km before Birni Ngaoure city.

In Burkina-Faso, SONABEL requested that 2 infrastructures identified during field inventories should be avoided: circumvention of a school in Wakou and of a sports field in Koupela. Regarding sacred sites, SONABEL asked that they all be avoided. Thus, minor adjustments will be made to bypass ten sacred sites along the line route.

6 STAKEHOLDER ENGAGEMENT

This chapter outlines the public information and consultation process that has accompanied the completion of the ESIA study and RAP for the WAPP 330 kV North Core Project. Relevant national and international requirements for stakeholder engagement and public disclosure are first briefly reminded. The main elements of the approach developed by the consultant to facilitate the informed participation of the project's stakeholders in the development of the studies are then exposed. Finally, the public information and consultation activities performed at the different stages of the studies, the organizations reached and the concerns, expectations and recommendations made by the latter are reported.

6.1 NATIONAL AND INTERNATIONAL REQUIREMENTS

6.1.1 NATIONAL REQUIREMENTS

The Nigerian EIA act requires public participation in the EIA process at the following stages:

- → Scoping: Meeting with communities and other stakeholders to document their concerns and obtain their views about the project for consideration for inclusion in the scope of the study.
- → Impact Assessment: Consultation with key stakeholders to inform them of responsibilities for mitigation.
- → Review/Approval: Report is displayed at designated public centers for general public to review and submit comments. The dates and venue for display is announced in newspapers and on local radio stations. Review pane also sits in public to present their comments and views about the project. Date and location for meeting is advertised in newspapers and radio.

6.1.2 INTERNATIONAL REQUIREMENTS

World Bank's Requirements

The World Bank's Operational Policy 4.01, on Environmental Assessment, requires that, during the EIA process, the project-affected groups and local NGOs are consulted about the project's environmental aspects and their views are taken into account. Stakeholders' consultation shall be initiated as early as possible and should occur at least twice: (a) shortly after environmental screening and before the terms of reference for the EIA are finalized; and (b) once a draft EIA report is prepared.

For meaningful consultations, O.P. 4.01 emphasizes on the disclosure of relevant material in a timely manner and in a form and language that are understandable and accessible to the groups being consulted. For the initial consultation, it stipulates that a summary of the project's objectives, description, and potential impacts shall be disclosed. For consultation on the draft EIA report, stakeholders need to be provided with a summary of the EIA's conclusions. In addition, the proponent is expected to make the draft EIA report available at a public place accessible to project-affected groups and local NGOs.

Accordingly with its Policy on Access to Information, which became effective on July 1, 2010, the World Bank will make publicly available all information about projects under preparation, projects under implementation, analytic and advisory activities, and Board proceedings. The policy also outlines a clear process for making information publicly available and provides a right to appeal if information-seekers believe they were improperly or unreasonably denied access to information or there is a public interest case to override an exception that restricts access to certain information.

African Development Bank

The African Development Bank's requirements on public consultation and disclosure that apply to the EIA development process are set forth by the Operational Safeguard (OS) 1 on Environmental and Social Assessment. Among its specific objectives, OS1 aims to "Provide for stakeholders participation during the consultation process so that affected communities and stakeholders have timely access to information in suitable forms about Bank operations, and are consulted meaningfully about issues that may affect them."

The OS1 stipulates that it is the borrower or customer's responsibility to carry out and provide evidence of meaningful consultations with communities potentially affected by the environmental and social impacts, and with local stakeholders. The borrower or customer must ensure broad community support, especially for projects involving the resettlement of over 200 people (Category 1 projects).

The OS1 also points out that the consultation of stakeholders must be preceded by the disclosure of relevant environmental and social information to ensure that participants are fully informed.

International Finance Corporation’s Performance Standards (PS).

IFC’s requirements for stakeholder engagement that apply to the ESIA process are mainly found in PS1, on the Assessment and Management of Environmental and Social Risks and Impacts.

PS1 requires that the outcomes of the engagement process be taken into account in both the assessment of risks and impacts (art. 11) and in the development of management plans and programs (art. 15). It requires that special attention be given to:

→ The informed consultation and participation of Affected Communities: A dialogue must be established early with affected communities during the ESIA process and must include information sharing. Participation must be free of external manipulation, interference or intimidation, and must be conducted on the basis of timely, relevant, understandable and accessible. Consultation should be inclusive and must be culturally appropriate. It should lead to the incorporation into the decision-making process of the views of the Affected Communities on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

→ Vulnerable groups: Individuals and groups that are likely to be affected by the project in an uneven or disproportionate manner because of their disadvantaged or vulnerable status must be identified and their participation facilitated.

→ The wider participation of stakeholders: The proponent must identify and engage with stakeholders who are not directly affected by the project, but who have existing relationships with local communities and / or interest in the project (local government, NGOs, etc.).

6.2 APPROACH

6.2.1 GENERAL OBJECTIVES

General stakeholder engagement objectives for this study were to:

→ Inform stakeholders on the proposed infrastructures and activities and seek their informed opinion about the socio-environmental risks and opportunities potentially associated with the project, as well as the measures and actions that need to be taken in order to manage the anticipated impacts.

→ Generate a social and institutional dialogue in order to assess and strengthen the project’s social acceptability.

→ Help to consolidate, through the ESIA process, the efforts made by the WAPP and TCN in order to establish lasting relationships with affected communities and other stakeholders.

6.2.2 TARGET STAKEHOLDER GROUPS

Target stakeholder groups for the stakeholder engagement process have included:

→ concerned ministries and national agencies

→ state-level (Birnin Kebbi) and LGA-level (Birnin Kebbi, Arewa and Kola) authorities and technical services

→ customary authorities

→ communities and households affected by the line route

→ industrial and commercial actors affected by the line, if any

→ NGOs and other civil society organizations in the fields of nature conservation, community development and human rights

A comprehensive list of the stakeholder organizations and communities that were identified for this project, in Nigeria, is presented in Appendix 3.

6.2.3 STAKEHOLDER INFORMATION AND CONSULTATION ROUNDS

Four stakeholder information and consultation rounds were conducted through the development of the ESIA study and RAP for this project. Those were planned according to key stages, or decision moments, throughout the study where the informed participation of stakeholders was likely to make the most significant contribution to the on-going analysis, namely the environmental and social scoping stage (1st round), the preliminary route assessment stage (2nd round), the documentation of the affected communities and displaced households (3rd round) and the disclosure of the ESIA, ESMP and RAP preliminary results (4th round).

The next table outlines the studies' stakeholder engagement process and presents, for each consultation round, the specific engagement objectives, target groups and implementation periods.

Table 6-1 Objectives, Target Groups and Implementation Periods Specific to Each One of the Four Stakeholder Information and Consultation Rounds

Round	Objectives	Target Groups	Implementation Period
ROUND 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	• National Electricity Company (TCN) • Concerned ministries • Regional Administration	Jan. 2015.
ROUND 2: Line Route Study	• Involve key stakeholders in the analysis of the «hot spots» identified along the provisional line's route	• National Electricity Company (TCN) • Concerned ministries • Regional Administration	June 2015
ROUND 3: Engagement with affected communities	• 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	• State-level and LGA-level authorities and technical services. • Affected Communities / Community leaders. • Women representatives. • Customary chiefs. • NGOs	September and October 2015
ROUND 4: Disclosure of Preliminary Results (ESIA, ESMP and RAP)	• Present, validate and enhance preliminary ESIA and RAP results • Ensure compliance of the proposed measures with the requirements of regulatory authorities • Evaluate the social acceptability of the project and proposed measures	• National Electricity Company (TCN) • Concerned ministries at national and state levels. • Local authorities and community leaders from affected LGAs. • NGOs.	February 2016

6.3 ACTIVITIES PERFORMED AND RESULTS ACHIEVED

The activities performed and the results achieved for the different stakeholder information and consultation rounds are briefly described hereafter. Detailed consultation reports for each consultation round, including meeting minutes and registers of participants' signatures are appended to this report.

6.3.1 FIRST AND SECOND CONSULTATION ROUNDS

6.3.1.1 ACTIVITIES PERFORMED AND ORGANIZATIONS REACHED

A first informative and consultative forum (initial consultation) was held on January 7th, 2015, in Birnin Kebbi, with a group of key stakeholders at regional and national levels. It allowed identifying the key environmental and social issues perceived by stakeholders in relation to the project. A map depicting the study area and the preliminary line route options, printed in a large format, was presented and a technical paper was distributed summarizing the broad lines of the project, objectives and deadlines for the completion of the ESIA and RAP, and the main impacts and benefits usually associated with electrical transmission lines The detailed minutes of this initial consultation meeting is presented in Appendix 4.

The second round of consultations was initiated in March 2015 with a working session with TCN on the environmental and social constraints associated with the provisional line route options. Consultative meetings on the selected draft preliminary line route followed in June and July 2015, in parallel with the draft preliminary line route review field mission, this time with the aim to deepen exchanges with stakeholders on sections of the selected line route posing specific challenges ("hot spots") and with possible adjustments addressing these issues. Notes and pictures of the meetings are presented in Appendix 5.

The next table indicates the dates, locations and stakeholder organizations met during the 1st and 2nd consultation rounds.

Table 6-2 Dates, Locations and Stakeholder Organizations Met During the 1st and 2nd Consultation Rounds, in Nigeria

Date	Location	Organization
1st round		
07.01.2015	Birnin Kebbi	Transmission Company of Nigeria (TCN) Federal Ministry of Environment Kebbi State Ministry of Lands and Survey Kebbi State Ministry of Environment Kebbi State Environmental Protection Agency Birnin Kebbi Local Government Area Kalgo Local Government Area Arewa Local Government Area Community Representatives along the Line Route
2nd round		
21.04.2015	Maitama Abuja	Transmission Company of Nigeria (TCN)
18.06.2015	Birnin Kebbi	Transmission Company of Nigeria (TCN) – Substation Manager
19.06.2015	Birnin Kebbi	Dukku Military Barracks
19.06.2015	Birnin Kebbi	Federal Medical Center

6.3.1.2 CONCERNS AND EXPECTATIONS RAISED BY STAKEHOLDERS

Discussions with stakeholders at these early stages of studies have helped identify a number of general concerns and expectations associated with the advent of a new power transmission line. These are summarized below:

→ Residential and commercial development around the substation and along the existing 132 kV could present an expensive compensation for the properties (general concerns expressed by stakeholders).

- → Encroachments on the existing 132 kV ROW with involvement of community leaders could be an issue for eligibility for RAP. This was confirmed by the Kebbi State Ministry of Land, Housing and Urban Development at the scoping meeting in January, 2015.
- → Call for the payment of adequate compensation to persons affected by project (PAP).
- → Kebbi State Environmental Protection Agency (KESEPA) requested to be involved in the field data collection.
- → It was raised that the terrain in most sections along the existing 132KV line is prone to erosion to the extent that erosion control structures have had to be constructed to support some towers and prevent them falling.
- → Stakeholders hope that the project will create new opportunities for rural and urban electrification, which would accelerate development in the area.
- → Anticipated jobs as unskilled labour during construction.
- → The construction of access roads is generally perceived as positive as it will improve accessibility to remote villages.

The next table summarizes the main comments and recommendations made by stakeholders, specifically on the draft preliminary line route. The table also indicates the nature of the adjustments that were brought to the project in response to these inputs from stakeholders.

Table 6-3 Concerns, Comments and Recommendations from Stakeholders on the Draft Line Route

Concerns	Comments / Recommendations	Adjustments Made to the Line Route
Compensation costs	It raises the issue that the proposed route is likely to generate high compensation costs given the residential and commercial developments along the existing 132 kV line and near the substation site.	Line route option 2, which minimizes the encroachment on densely built areas of Birnin Kebbi, was chosen (see Line Route Report, section 7.2).
High risk of erosion	The terrain, in most sections of the route, is conducive to erosion. Erosion control structures have also been put in place along the existing 132 kV line to support the towers and prevent them from falling.	This issue will be dealt with during construction, on a pylon-by-pylon basis. Where needed, the location of some pylons will be adjusted to avoid erosion-prone areas.
Rivers and humid environment around Badariya	It raises the issue that the Badariya sector is particularly sensitive because of the many rivers and wetlands to cross.	The analysis of the environmental conditions in the Badariya sector has indicated the feasibility of running the new line along the existing 132 kV. The ESMP will provide environmental protection measures for works undertaken in wetlands, including obligations for contractors.
Crossing Birnin Kebbi military installations	The commander met indicated to be in favour of the line route passage on the military site since the project will improve access to electricity for military instillations. The case will be presented to the higher military authorities who will take the final decision as to whether or not to cross the site.	The chosen line route completely avoids the military installations (see Line Route Report, section 7.2).
Encroachment on reserved land for the development of the Federal Medical Centre	The proposed line route crosses the site of the Federal Medical Centre, which is undergoing conversion to a university hospital. Lands affected by the line route are reserved for the construction of a nursing school, residences, a library and other educational pavilions. The centre hopes that the line route can be modified to avoid installations, emphasizing that they are in deficit of available land.	The chosen line route completely avoids the medical center (see Line Route Report, section 7.2).

6.3.2 THIRD CONSULTATION ROUND

6.3.2.1 ACTIVITIES PERFORMED

The activities carried out in Nigeria as part of the third stakeholder engagement round were the following:

→ One informative and consultative meeting in Birnin Kebbi with State-level authorities and technical services (workshop).

→ Informative and consultative meetings with LGAs authorities, LGAs technical services and representatives from communities and urban neighbourhoods affected by the line route. Two meetings were held, one in Birnin Kebbi and the other in Kangiwa with representatives from both Arewa and Kalgo LGAs.

→ Focus group discussions with representatives from women's groups in Birnin Kebbi, Kalgo and Arewa LGAs.

→ Field walks with representatives from the communities affected by the line route to locate it and identify potentially affected sensitive elements.

→ Informative and consultative meetings with traditional leaders of regional influence, i.e. the Emirs of Gwnadu and that of Argungu.

→ Group meeting hosted by TCN in Abuja with concerned ministries and national agencies, including follow ups with the agencies to collect relevant information.

During the meetings, large printed maps were used to illustrate the route under study within each LGA. Printed images illustrating examples of the type of proposed infrastructures (pylons and lines) were also exhibited. A project background information document, in a poster format (A3), was produced and distributed by the consultant to local authorities and representatives prior to meetings for public advertising.

Representatives from all the communities likely to be affected by the line route were invited to attend LGA meetings. Through these meetings, community leaders received information about the project, asked questions and expressed their concerns and expectations. The meetings were also used to complete and validate with local stakeholders the list of potentially affected communities, as well as to identify the communities that could be reached by a future rural electrification program associated with the project.

Finally, traditional leaders were met in their respective royal courts in order to present the project and receive their advice and recommendations, particularly in view of the resettlement process.

Detailed minutes, photos and signatures of attendees to meetings are provided in Appendix 6, along with an example of the communication tool used in communities.

6.3.2.2 STAKEHOLDERS MET

The following tables list the stakeholder meetings held as part of the third information and consultation round according to the different target groups, namely the Ministries and other national stakeholders, the State-level authorities and government services, the LGA and community representatives, the women's groups and the traditional leaders.

The same materials were also presented to media representatives, which were broadcast on radio and television stations in Kebbi State as well as in newspapers for public awareness.

Table 6-4 List of Meetings Held with National and State-Level Stakeholders During the Third Consultation Round

Date	Place	Organizations Met
17/09/2015	Birnin Kebbi	Kebbi State Water Board Kebbi State Ministry of Women Affairs *(in charge of Social Services)* Sokoto-Rima River Basin Development Authority, Kebbi State Area Office Kebbi State Rural Electrification Board Kebbi State Ministry of Lands and Housing *(Surveyor General's Office, Physical Planning and Valuation and Acquisition Departments)* Kebbi State Ministry Environment Kebbi State Ministry of Agriculture *(departments of livestock, Forestry and Fisheries)*
09/10/2015	Abuja	Federal Ministry of Environment (*Department of Environmental Assessment and Department of Forestry)* Federal Ministry of Agriculture *(Department of Animal Production and Husbandry Services and department of Agriculture)* National Parks Services Nigerian Civil Aviation Authority National Commission for Museums and Monuments Savannah Conservation Foundation Federal Ministry of Works *(Department in Charge of Federal Roads)*

Table 6-5 List of LGA Meetings Held During the Third Consultation Round

Date	Place	Organizations Met	Participants
17/09/2015	Birnin Kebbi	Birnin Kebbi Local Government Area (LGA) Village Heads of affected settlements in Birnin Kebbi LGA	*10 participants, including director of works from Birnin Kebbi LGA, and representatives from 5 different communities.*
18/09/2015	Kangiwa	Arewa LGA Kalgo LGA Village Heads of affected settlements in Arewa LGA Village Heads of affected settlements in Kalgo LGA	*41 participants, including 7 technical services from Arewa and Kalgo LGAs, and representatives from 11 different communities in Arewa and Kalgo LGA.*
19/09/2015	Field Trip to line route	Village Heads of affected settlements Women groups Farmers Association Miyetti Allah Cattle Rerares Association LGA representatives	15 participants

Table 6-6 List of Meetings Held with Women Representatives During the Third Consultation Round

Date	Place	Organizations Met	Participants
19/09/2015	*Kangiwa*	Women group in Arewa LGA Women group in Kalgo LGA Farmers Association in Arewa LGA Miyetti Allah Cattle Rerares Association in Kalgo LGA	*41 participants including 8 women and community groups*
19/09/2015	Birnin Kebbi	Kebbi Women group Farmers Association in Arewa LGA Miyetti Allah Cattle Rerares Association in Kalgo LGA	*13 participants including 7 women and community groups*

Table 6-7 List of Meetings Held with Traditional Chiefs During the Third Consultation Round

Date	Place	Organizations Met	Participants
13/10/2015	Birnin Kebbi	Gwandu Emirate Council	10 participants
14/10/2015	Argungu	Argungu Emirate Council	8 participants

Table 6-8 List of Other Meetings Held During the Third Consultation Round

Date	Place	Organizations Met	Participants
15/10/2015	Birnin Kebbi	Media Houses	13 participants including representatives from 4 different TV/Radio and Newspaper stations
14/10/2015	Argungu	Argungu Emirate Council	8 participants

6.3.2.3 CONCERNS, EXPECTATIONS AND RECOMMENDATIONS EXPRESSED BY STAKEHOLDERS

The main concerns, expectations and recommendations made by stakeholders during the third round of consultation are summarized below, according to the different target groups.

Ministries, National Agencies and Other National Stakeholders

- **International Transhumance Stalk Route:** The Department of Animal Production and Husbandry Services observed that the line route is likely to cross the International Transhumance Stalk Route around Kangiwa in Arewa LGA.
- **Health Effects:** There is a need to evaluate the health and safety effects of the project activities within the corridor and include additional preventive measures.
- **Public Enlightenement:** Provide adequate enlightenment to the public, involving professionals such as the media houses located in Kebbi State.
- **Safety:** the need to engage a community oriented and environmental NGO to adequately sensitize the local communities and the natural resource user groups (especially the livestock grazers or herdsmen groups or associations and crop farmers) prior to the commencement of the project, and educate them on the dangers and risks of grazing, farming and settling near the transmission lines.
- **Forest Reserves:** The following forest reserves are likely to be crossed, Lema and Bagga Forest Reserves in Arewa LGA, Bulasa Forest Reserve in B/Kebbi LGA, and Gayi in Kalgo LGA.
- **Cultural Heritage and Archaeological Sites:** National Commission for Museums and Monuments listed the existence of the following in Kebbi State: Karishi traditional settlement, tomb of Abdullahi Fodio in Gwnadu, Girmache shrine in Zuru, Alwasa battlefield in Argungu, ancient settlements at Gungu, Kanta's millitary arsenal at Gungu, Kanta old palace at Argungu, Slave market at Illo and ancient wall at Yawuri. The need to evaluate if any will be affected was requested, as well as report any accidental discoveries to the Commission for appropriate action.
- **Road Crossing:**, the following roads will be crossed by the line and will require temporary shutdown during construction:
  - The Binin/Kebbi-Jega Road at LAT 12.40485, LONG 4.19723 just outside Goru Village
  - Makera-Bunza Road at LAT 12.48848, LONG 4.03634 near Sandare Village
  - Kangiwa-Kamba Road at LAT 12.54302, LONG 3.80910, just outside Kangiwa

Federal Ministry of Works require that an application for the usage of ROW should be made to the Ministry and approval obtained, after which the Controller of Works in Kebbi State will provide supervision on the specific dates.

- **Buffer Zone:** Consider the need for creation of a buffer zone of a reasonable perimeter distance round the transmission line and the local communities should be sensitized and given adequate publicity on this.

- → **Employment:** Consider involving and utilizing the local people for unskilled labour services required during the project implementation.
- → **Baseline Data:** The need to also gather baseline data of the area/ local communities likely to be affected by the project is important, this is in order to have baseline information for comparison and assessment of project impact (before and after intervention). This should be captured in the project preparatory meetings.

State-Level Stakeholders

- → **Encroachment on the Corridor:** The Surveyor General observed that there is encroachment by structures and farmlands on the corridor for the existing 132KV, to minimise this, there is need to make the beacons demarcating the corridor to be conspicuous at least 0.5 metres above the ground.
- → **Compensation:** It was noted that based on the requirements of the land use act, there is no compensation for land, only assets on the land will be compensated. Nevertheless, it was observed that fallow lands are either preserved for future for the children of the owner to use or even purchased with future plan for development. There should be some form of compensation for these fallow lands, based on human face.
- → **Public Enlightenment:** Provide adequate information on when the project will commence, to avoid loss of farm produce.

LGA and Community-Level Stakeholders

- → **Public Enlightenment:** Provide adequate enlightenment to the people living in the areas where the line will pass and how it will affect their properties.
- → **Safety:** Fulani (Herdsmen) have suffered seriously from the old line ranging from death of their people to death of cattle and even some serious health problems. Some of them climb the tower to observe their cattle grazing. What safety measures will prevent similar issues with the new line?
- → **Farming Under Wayleave:** Effects electromagnetic radiation from the lines should be evaluated though TCN does not allow farming or houses under the line.
- → **Compensation Payment:** All structures that will be affected should be appropriately compensated by the project.

Women Representatives

- → **Health and Safety:** Fulani (Herdsmen) have suffered seriously from the old line ranging from death of their people to death of cattle and even some serious health problems. Some of them climb the tower to observe their cattle grazing. There is the need to include safety measures to prevent similar issues with the new line.
- → **Compensation:** Compensation for community structures such as hospitals or dispensary or other government buildings should be adequate.

Customary Chiefs

- → **Compensation:** Ensure adequate **c**ompensation for the affected people as well as timely payment.
- → **Benefits to the People:** The plan to provide electricity to small towns and villages within 10km of the wayleave should be actualized.

6.3.2.4 CONCERNS AND EXPECTATIONS RAISED BY VILLAGE REPRESENTATIVES

In the community socioeconomic survey, the chiefs of the communities crossed by the project were asked if they had any concerns on the possible impact of the project on their community.

As can be seen in the next table, most of the chiefs expressed the view that the project will bring positive economic impacts in their community: jobs, electrification and infrastructure development.

The negative impacts mentioned are related essentially to the loss of land and trees because of ROW implementation. Adequate compensation is asked for and causes some concern.

Table 6-9 Potential Changes Related to the Project Perceived by Communities

Potential Change	Local Governmental Area			Total
	Arewa	Birnin Kebbi	Kalgo	
Positive economic impacts	4	6	4	14
Negative economic impacts	1	3	1	5
Other negative impacts and demands	0	2	2	4
No changes	1	0	0	1
Number of villages	**6**	**6**	**4**	**16**

Notes: Some village chiefs gave more than one answer so the total of impacts and demands exceeds the number of villages in the survey.

Positive economic impacts include: improved living conditions, the possibility of jobs, village electrification, development of new infrastructure and economic development of the villages.

Negative economic impacts include: expropriation and loss of trees, agricultural land and crops.

Other negative effects and applications include: security, obtaining adequate compensation and local hiring.

6.3.2.5 CONCERNS AND EXPECTATIONS RAISED BY THE HEADS OF AFFECTED HOUSEHOLDS

As can be seen in the next table, most of the PAP had no specific comments or concerns related to the project.

For those head of households that did make some comments on the project, the main concern or demand was related to compensations and concerns related to the loss they incur. The PAP asked for a fair compensation so they are not impoverished by the project.

It is noteworthy that many of the comments are positive. These PAPs agree to the project and see some benefits for them or the community.

Table 6-10 Concerns and Comments on the Project, Nigeria

CONCERNS AND COMMENTS	LOCAL GOVERNMENTAL AREAS			
	Arewa	Birnin Kebbi	Kalgo	Total
Agree with the project	1	27	1	**29**
Positive contribution of the project to the households, community	3	13	1	**17**
Loss caused by the project (income, land, trees structure)	2	16	6	**24**
Impact on health (electromagnetic field, electrocution)	0	1	1	**2**
Other negative aspects and demands	5	29	10	**44**
No concerns nor comments	175	118	100	**393**
Number of households	**186**	**195**	**117**	**498**

Notes: Some households gave more than one answer so the total of concerns and comments exceeds the number of households in the survey.

In the Other negative aspects or demands the PAP expressed concerns over the amount of compensation that will be offered for land.

6.3.3 FOURTH CONSULTATION ROUND

This last round of stakeholder information and consultation as part of the development of the ESIA and RAP has served to expose the main findings and recommendations contained in the preliminary RAP reports in order to pre-validate these elements and obtain feedback and suggestions from stakeholder to improve them. The activities carried out, the organizations reached and the results obtained are summarized below. The list of signatures as well as the minutes of meeting are presented in the Appendix 7.

6.3.3.1 ACTIVITIES PERFORMED

The activities carried out as part of the fourth stakeholder engagement round are:

- → one national meeting in Abuja with concerned ministries and national agencies
- → one State-level meeting in Birnin Kebbi with State authorities and technical services
- → group meetings in Birnin Kebbi and Arewa with LGA-level authorities and technical services and representatives from affected communities

6.3.3.2 STAKEHOLDERS REACHED

Tables below list the stakeholders met during the fourth consultation round.

Table 6-11 Participant Organizations and Representatives at the National Workshop on the Preliminary Results, Held on March 17, 2016, in Abuja

Organizations	Representatives
Federal Ministry of Environment (Environmental Assessment Department)	1. Mr. Kevin A. Ihebinike (Deputy Director, Environmental Assessment) 2. Waziri Ali Mala (Geologist{) 3. Mr. Anenyeonu NCS (Asst. Director -SD)
Federal Ministry of Environment (Forestry Department)	1. Dr. Onyekuru John (Deputy Director, Conservation) 2. Mr. T.A. Agadafini (Asst. Chief Forestry)
Federal Ministry of Lands and Survey	Representative did not sign attendance register
National Commission for Museums and Monuments	1. Mr. Alafiatayo Oladipo (Asst Director -Monuments) 2. Mr. Aribido Adeniyi (Archaeologist) 3. Ms. Aisha M. Aliyu (Principal Heritage Officer)
Federal Ministry of Agriculture (Dept of Animal Production & Husbandry Services)	Representative did not sign attendance register
Federal Ministry of Agriculture (Dept of Department of Agriculture)	*No representative*
National Parks Services	*No representative*
National Agency for Great Green Wall	*No representative*
Savannah Conservation Foundation (NGO)	Mr. Smith Rufus (Community Env Dev Officer)
Federal Ministry of Power, Works and Housing	Engr. Cyril Onyeneke (Deputy Director -Electrical)
Transmission Company of Nigeria (TCN)	1. Engr. Sadiq Salihu ((Principal Manager -SCADA) 2. Mr. Joseph Akande (Asst. Gen Mngr -CR&E) 3. Ms. Ruskin, I.B.A. (Manager -ERSU) 4. Mr. Yusuf Babatunde (Senior Manager-Chem) 5. Mr. Ero S.O. (Principal Manager -ERSU) 6. Engr. Leronard Ogwu (Principal Manager -Line Proj) 7. Mr. Nasiru Gaya (Principal Manager -Property) 8. Mr. Mohammed Jibril (Principal Manager -Wayleave) 9. Surv. J,F. Coker (Principal Manager -Survey) 10. Mr. Yusuf Mungadi (Senior Manager -Occupational Health and Safety) 11. Engr. Musa Argungu (Senior Manager -Line Proj) 12. Mr. Felix Dooshiya (Desk Officer 13. Randawa Silas (Asst Gen Manager -Wayleave) 14. Oluwatobi Babatunde (Manager) 15. Mr. Ibe Ifeanyi Samuel (Officer II-HSE) 16. Mr. M.S. Mohammed (Asst. Gen Mngr -S/S) Ms. Enamue Sera (Officer II -HSE)

Table 6-12 Participants to State-Level Workshop Held on March 14, 2016, in Birnin Kebbi

Organizations	Representatives
Kebbi State Ministry of Environment	Mr. Maijega Mohammed Ameen (Director of Environment)
Kebbi State Ministry of Lands and Housing	Mr. Adamu Babangida (Land Acquisition and Valuation Officer)
Kebbi State Ministry of Women Affairs (Department of Social Services)	Mr. Zubairu Bala (Senior Officer)
Sokoto-Rima River Basin Development Authority, Kebbi State Area Office	*No representative*
Kebbi State Rural Electrification Board	*No representative*
Kebbi State Ministry of Agric	1. Mr. Bala Mohammed (Director -Agric Services) 2. Mr. Kiskuwa Zaga (Director -Irrigation Engineering)
Federal Controller of Works in Kebbi State (Department in Charge of Federal Roads)	1. Engr. Mohammed Goni (Federal Controller of Works -Kebbi State) 2. Mr. Abubakar M. Kalgo (Field Officer -Highway)
1st Battalion Nigerian Army	Lt. C.C. Iwuala (Adjutant -Dukku Barracks B/Kebbi)
Transmission Company of Nigeria (TCN)	1. Mr. Joseph Akande (Asst. Gen Mngr -CR&E) 2. Ms. Ruskin, I.B.A. (Manager -ERSU) 3. Mr. Yusuf Babatunde (Senior Manager-Chem)

Table 6-13 Participants to LGA Workshop Held on March 14, 2016, in Birnin Kebbi

Organizations	Representatives
Birnin Kebbi LGA	1. Mohammed Usman Ambursa - Director of Works/Services 2. Hussain Bunza - Director Social Dev 3. Shehu Ahmadu - Director of Public Health
Kalgo LGA	1. Musa Hassan Kalgo - Sole Administrator 2. Garba Abdullahi Bauna - Director of Works/Services 3. Ms. Saude Mohammed Kamba - Director Social Development 4. Abubakar Dan Iya Bunza - Director of Health
Arewa LGA	1. Umaru Tanko Jega - Director Social Development 2. Yahaya Ahmed - Director of Works/Services 3. Ms. Saude Mohammed
Farmers Association (Birnin Kebbi LGA)	*No representative*
Farmers Association Kalgo LGA	*No representative*
Farmers Association Arewa LGA	Alh. Ahmadu Sarkin Noma - Sarkin Noma
Miyetti Allah Cattle Association (Birnin Kebbi LGA)	*No representative*
Miyetti Allah Cattle Association (Kalgo LGA)	Muhammad R/Kalgo - ArdoKalgo Fulani
Miyetti Allah Cattle Association (Arewa LGA)	Muhammad Dan Garso - Miyetti Allah
Transmission Company of Nigeria (TCN)	1. Mr. Joseph Akande (Asst. Gen Mngr - CR&E) 2. Ms. Ruskin, I.B.A. (Manager - ERSU) 3. Mr. Yusuf Babatunde (Senior Manager - Chem)
Director of Security Services	Ishaya Bazo -State Security Service

Table 6-14 Participants to Village Chief Workshop Held on March 11, 2016, in Birnin Kebbi

Villages	Lga	Representatives
Eri	Arewa	Sule Maigari -Village Head
Tudunwada K/Giwa	Arewa	Muhammadu Shabi -Village Head
Unguear Labbo	Arewa	Alhaji Sallou -Village Head
Unguwan Musa	Arewa	Usman Sani -Village Head
Zukuku	Arewa	Ismaila Talabu -Village Head
Kola	B/Kebbi	Usman Zarumai -Head of village
Nasarawa 2	B/Kebbi	Malam Shehu Hanafi -Village Head
Sabon Gari Gorun	B/Kebbi	Hassam Mohammed -Village Head
Unguwan Dambo	B/Kebbi	Muhammad Hakimi -Village Head
Unguwan Mai Rago	B/Kebbi	*No representative*
Ungwan Gaga	B/Kebbi	Garba Liman -Village Head
Kutukullu	Kalgo	Muhammet -Village Head
Nayalwa	Kalgo	Muhammadu Kabiru -District Head
Sandare Babba	Kalgo	Maigari Sani -Village Head
Unguwan Dodo	Kalgo	Garba Hakimi -Village Head
Unguwan Masoyi	Kalgo	Garba Hakimi -Village Head Bello Hakimi

6.3.3.3 CONCERNS, EXPECTATIONS AND RECOMMENDATIONS EXPRESSED BY STAKEHOLDERS

The main concerns, expectations and recommendations made by stakeholders during the third round of consultation are summarized in the table below.

Table 6-15 Concerns, Expectations and Recommendations Expressed by Stakeholders

Topic	Comments and Recommendations	Adjustments to Final ESIA, RAP
Women	The culture of the people of the area does not encourage women to partake in certain types of jobs.	Specific management measures for gender integration are proposed in the ESIA
Crossing Highways	All highways have ROW of 45.72 m; avoid placing towers within the ROW.	This is planned under the project design with technical consultants
Public Enlightenment	Provide adequate enlightenment to the public, involving professionals such as the media houses located in Kebbi State. Affected communities have requested to be informed on timely manner when the project will commence, to avoid loss of farm produce.	Specific management measures are proposed in the ESIA
Encroachment on the corridor	The Surveyor General observed that there is encroachment by structures and farmlands on the corridor for the existing 132KV, to minimise this, there is a need to make the beacons demarcating the corridor to be conspicuous at least 0.5 metres above the ground.	This is already provided in the RAP; more specifically in the “Detailed line and substations survey and profiling” that will be completed by WSP.
Fair compensation	Local authorities and communities have emphasized their expectations over adequate and timely compensation of project-affected people.	This is already provided in the RAP.
Replacement of community structures	Communities and women representatives have asked for the adequate replacement of community structures such as hospitals, dispensary or other government buildings affected by the project.	This is already provided in the RAP.
Compensation for fallow lands	It was noted that based on the requirements of the land use act, there is no compensation for land, only assets on the land will be compensated. Nevertheless, it was observed that fallow lands are either preserved for future for the children of the owner to use or even purchased with future plan for development. There should be some form of compensation for these fallow lands, based on human face.	Fallow lands will be compensated in the final RAP.
Community Land	Ensured compensation is paid directly to the PAPs farming in the Wetland area surveyed as community land.	This was already considered in the RAP budget. Compensations will be awarded to PAPs.
Compensation for undeveloped land	It is recommended to pay compensation for lands that have no assets, where the owner has a certificate of ownership or customary ownership to avoid lengthy grievance or even litigation.	This is already provided in the RAP; both types of owners will be compensated. These will be supported by the TCN to find new land (when relocating).
Electrification of villages	The people of the area will be very happy and provide more support to the project if electrification of villages within 10km is approved.	An electrification program is already part of the program.
Community Compensation Fund (CCF)	Consider the Dukku Barracks as a community for the purpose of inclusion in the CCF projects and be invited to all engagements with communities the line crosses. The line passes through the Barracks land for several kilometers.	A note is made in the RAP for this purpose: The 1st Battalion Dukku Barracks could submit project proposals based on a formula to allocate community development funds.
When to vacate land	Provide adequate notice to vacate acquired land and ensure no crop is lost.	This is already provided in the RAP.
Wetland crossing	Claim of existence of dry season farmlands in Unguwan Dodo that were not included in the October 2015 survey.	There is no cultivated land in this area.

7 ASSOCIATED AND POTENTIAL IMPACT ANALYSIS

This chapter sets out the analysis of the impacts of the selected line route. To do this, the method of impact assessment is presented. Then, the description of the anticipated and residual positive and negative impacts for preconstruction and construction phase are exposed. These impacts on operating and maintenance phases are also presented.

7.1 METHODOLOGY OF IMPACT ANALYSIS

The impact analysis takes into account the following various phases of the project:

- → site preparation and infrastructures construction phase
- → infrastructures operation and maintenance phase
- → closure and rehabilitation phase

This analysis is based on a cause/effects matrix between project-related impact sources and valued environmental components. Impacts are defined by their intensity (low, medium, major), their extent (regional, local, limited) and duration (long, medium, short). The main expected impacts are also described.

For each of the project phases, a recapitulative table including impact sources, potentially affected elements and impact descriptions are presented. Cumulative impacts are also considered.

The method used to identify, analyze and mitigate environmental and social impacts, or to improve positive impacts places the project in a sustainable development perspective. The mitigation of anticipated negative impacts and the enhancement of positive impacts allow its environmental and social acceptability by stakeholders. The methodology used for the project impact assessment is presented in the following sections.

7.1.1 MANAGEMENT MEASURES (MITIGATION, IMPROVEMENT AND COMPENSATION)

The smooth integration of the project in its environment is promoted early in its planning and design stage by taking into consideration environmental and social concerns. The optimization of some of the project components helps alleviate potential environmental impacts on the receiving environment. Those are identified in the impact assessment procedure.

Any adverse effect that cannot be eliminated by project optimization will however be mitigated or compensated through the implementation of several management measures. The application of mitigation measures should reduce adverse impacts over the environment. Compensatory measures aim to compensate for the loss or permanent disruption of environmental elements or resources whereas enhancement measures allow increasing positive effects ensuing from project activities.

The various applicable measures for each phase are proposed for every analyzed component. The implementation of management measures is taken into consideration when assessing the magnitude of impacts. The impact described is consequently the residual impact.

7.1.2 POTENTIAL IMPACT ASSESSMENT

The evaluation of the project's eventual impacts is performed using a grid which relates impact sources with environmental and social components. This analysis allows identifying the components likely to be affected by future activities or infrastructures. Then, identified potential impacts are assessed.

7.1.3 IMPACT ASSESSMENT

7.1.3.1 IMPACT MAGNITUDE

Impact assessment consists in determining in first place the magnitude of impacts associated with project activities on the physical, biological, and human environments. Those impacts are either positive or negative.

The magnitude of an impact is determined by an overall assessment of how one or several impact sources affect an environmental component. This evaluation takes into account the measures included in the project design and determines the magnitude of impact persistence after management measures have been applied. The magnitude of the impact reflects the intensity of the impact, its extent, and its duration. Impact magnitude is ranked as major, moderate, or minor (Table 7-1).

Table7-1 Impact Magnitude Assessment Grid

Analysis Criteria			Magnitude
Intensity	**Extent**	**Duration**	
High	Regional	Long-term	Major
		Medium-term	Major
		Short-term	Major
	Local	Long-term	Major
		Medium-term	Major
		Short-term	Moderate
	Limited	Long-term	Major
		Medium-term	Moderate
		Short-term	Moderate
Medium	Regional	Long-term	Major
		Medium-term	Moderate
		Short-term	Moderate
	Local	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Moderate
	Limited	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
Low	Regional	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
	Local	Long-term	Moderate
		Medium-term	Minor
		Short-term	Minor
	Limited	Long-term	Minor
		Medium-term	Minor
		Short-term	Minor

7.1.3.2 IMPACT INTENSITY

The intensity of an impact over environmental and human components indicates the degree to which the assessed component is disturbed. The analysis will consider the component's properties, particularly its sensitivity and its capacity to accommodate to changes, as well as its estimated value. Impact intensity is divided into three levels:

→ High: the impact threatens or destroys significantly the concerned element integrity, or changes substantially or irreversibly its environmental distribution or role.

→ Medium: the impact alters the component quality, and its environmental distribution or role, without damaging its integrity.

→ Low: the impact slightly alters the concerned component without changing substantially its quality, and environmental distribution or role.

7.1.3.3 IMPACT EXTENT

The extent of an impact over natural and human environments refers to the area of the territory or to the proportion of the population affected by the proposed project. It can be regional, local or limited to the study area:

→ Regional: the impact affects the entire RSA (Regional Study Area) or a greater area, or the majority of the RSA's population.

→ Local: the impact affects mainly the LSA (Local Study Area) or bordering population groups.

→ Limited: the impact affects only a limited area or some individuals in the LSA.

7.1.3.4 IMPACT DURATION

The duration of an impact refers to the period of time during which the effects of the project will be felt in the environment. This parameter reflects the intermittent nature of an impact. Duration can be long-term, medium-term, or short-term:

→ Long-term: the impact is felt continuously or intermittently throughout the project's lifetime. The impact is often permanent or irreversible.

→ Medium-term: the impact is felt temporarily, continuously or intermittently, during the whole construction phase.

→ Short term: impact is felt temporarily, continuously or intermittently for a limited period of time in either of the project's construction, closure or rehabilitation phases.

7.1.3.5 PROBABILITY OF IMPACT OCCURRENCE

Impact assessment also involves defining the probability of occurrence, that is to say the probability that an anticipated impact will affect a component. This factor is not used to evaluate the magnitude; it is rather used to relativize impacts. The probability of occurrence can be high, moderate, or low:

→ High probability of occurrence: the impact will certainly occur.

→ Moderate probability of occurrence: the impact is likely to occur but the occurrence cannot be ascertained.

→ Low probability of occurrence: it is very unlikely that the impact will occur or it might occur only by accident.

7.1.3.6 KEY ELEMENTS FOR IMPACT ANALYSIS

The method used to assess the project's impacts relies primarily on extensive knowledge of the project and of its environment, as well as on experience in conducting environmental and social impact assessments for similar projects. It allows analyzing interactions between impact sources and identified valuable environmental and social components (VESC).

Project description, comprising the location of proposed infrastructures and their technical properties, operation, maintenance and closure processes have allowed identifying different sources of impacts likely to have an effect on the environment for each of the project phases.

Valued environmental components have been identified based on the baseline characterization study that has allowed for the identification of the most sensitive components and on the main issues raised by various stakeholders who have been met.

The different impact sources and VESC specific to the project and to its receiving environment are presented in the following sections.

7.1.3.7 SOURCES OF IMPACT

Sources of impacts are project components that can potentially affect the environment. They are divided according to project phases: construction and operation (table 7-2).

Table 7-2 Project Related Sources of Impacts

Sources of Impacts	Description
Pre-construction phase	
Land acquisition	Acquisition of the land needed for project implementation, more precisely at the location of the 140 to 150 towers. This acquisition is achieved prior to the start of construction works.
Population resettlement	Relocation of houses, secondary structures, commercial buildings, school, Mosque, trees and economic activities located inside the project area and that are part of the RAP.
Construction phase	
Site preparation	Site preparation for construction works: Overburden removal, deforestation, excavation and earthworks for the construction of the project's temporary and permanent infrastructures (ex.: access roads, buildings, workers camps, service and storage areas and maintenance areas for vehicles and equipment).
Exploitation of borrow of pits	Operation of various quarries to supply in granular material.
Implementation of construction sites	Development of temporary infrastructures and working sites, including storage areas for materials.
Construction activities	General activities related to the construction of electric line and substations.
Work in aquatic environment	Works in Sokoto River, its associated floodplain and several intermittent watercourses for the construction of the project's temporary and permanent infrastructures
Management of hazardous products and residual materials	Management, handling and transportation of hazardous products, contaminants, residual materials, waste, and any material for disposal.
Transport and traffic	Road transportation of workers, materials and equipment required for on-site construction and machinery circulation as well as roads and accesses maintenance.
Purchase of materials, goods and services	Needed purchases to undertake construction works.
Labor	Hiring of labor dedicated to construction works and presence of workers on-site.
Operation phase	
Presence and operation of line and substation	Presence and operation of the line and Birnin Kebbi substation
Facilities maintenance	Inspection and maintenance of conductors, towers and substations' structures
ROW maintenance	ROW related activities, including vegetation control and communities uses performed within the ROW.
Management of residual/hazardous material	Handling and storage of residual and dangerous products used in the operations, including hydrocarbons used in electric transformers and substations.
Transport / circulation	Transportation and circulation within the right-of-way, including refueling and maintenance of vehicles.
Purchase of material, goods	Necessary purchases to operate line and substations.

and services	
Presence of workers	Employees working on substations and line maintenance.

7.1.3.8 VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS

The characterization of physical (terrestrial/marine), biological and human environments together with consultation activities with stakeholders have allowed identifying the valued environmental and social components that may be affected by one or more impact sources (table 7-3). Impact analysis therefore focuses solely on those components.

Table 7-3 Valued Environmental and Social Components

Physical Environment VESC	
Air quality and climate change	Physicochemical properties of air, including dust content and greenhouse gases.
Noise levels	Characteristics of noise levels.
Soils and agricultural potential	Soils' physicochemical characteristics and structure, in particular their agricultural potential and sensibility to erosion.
Water resources	Hydrology and physicochemical properties of surface and groundwater.
Biological environment VESC	
Habitats, fauna and flora	Terrestrial and riparian vegetation associations forming natural habitats, and their associated fauna. Includes species with particular conservation status.
Avifauna	Birds inhabiting the project area, permanently or seasonally.
Aquatic and semi-aquatic habitats and fauna	Habitats and animals for which aquatic habitats are an essential part of their life cycles. Includes species with a particular conservation status.
Essential habitats	Natural or modified habitats of high biodiversity values.
Human environment VESC	
Land planning and use	Residential, commercial, and industrial land uses; access to natural resources (timber and non-timber products, hunting, fishing); agriculture.
Existing infrastructures	Existing infrastructures and services (road and train networks, power supply, gas, drinking water, municipal infrastructures, telecommunications).
Economy, employment and livelihoods	Local and regional economic development, employment, workforce employability, income and means of subsistence for affected communities.
Quality of life, health and safety	Well-being of the population related to their surrounding environment, their physical safety and their perception of situations that may constitute a risk to environment and/or health, considering the following elements: water and air quality, noise exposure, soil vibration, physical and economic security, risk perception, and services offered to the community.
Social cohesion	Nature and intensity of social relationships.
Vulnerable groups	People who, because of their gender, ethnicity, age, physical or mental disability, social status or economic situation could be prejudiced.
Cultural and archaeological heritage	Heritage sites, sacred sites and zones of archaeological potential.
Landscape	Landscape units and visual fields integrity.

7.1.3.9 INTERACTIONS BETWEEN IMPACT SOURCES AND VESC

Impacts assessment can be performed with a Leopold matrix, which relates the impact sources and the VESC. The potential impacts assessment is performed based on the different interactions thus identified (Figure 7-1).

7.2 POSITIVE IMPACTS OF PRE-CONSTRUCTION AND CONSTRUCTION PHASE

Positive impacts associated with the pre-construction and construction phase of the project are essentially associated with human components of the study area.

		Physical Environment VESC				Biological Environment VESC			Human Environment VESC							
	Impacts Sources	Air quality and climate change	Noise levels	Soils and agriculture	Water resources	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape
Pre-construction phase	Land acquisition												X	X		
	Population resettlement								X	X	X	X	X	X		
Construction phase	Site preparation	X	X	X	X	X	X	X	X	X					X	X
	Exploitation of borrow pits					X	X								X	X
	Implementation of construction sites	X	X		X	X	X	X								
	Construction activities	X	X	X	X	X	X	X	X	X	X	X			X	X
	Work in aquatic environment					X	X	X								
	Management of hazardous products and residual materials			X	X	X		X				X				
	Transport and traffic	X	X	X	X	X		X		X	X	X				
	Purchase of materials, goods and services															
	Labor					X	X	X				X	X			
Operation phase	Presence and operation of line and substation		X	X	X	X	X	X		X	X	X				X
	Facilities maintenance		X	X	X	X	X	X								
	Right-of-way maintenance		X	X	X	X	X	X			X	X				
	Management of residual/hazardous material			X		X	X	X								
	Transport / circulation		X	X	X			X								
	Purchase of material, goods and services															
	Presence of workers					X	X	X								X

Figure 7-1 Interaction Matrix Between Impact Sources and VESC

7.2.1 ECONOMY, EMPLOYMENT AND LIVELIHOODS

Impact Statement

→ Creation of short-term jobs

→ Stimulation of local economy by the purchase of local goods and services

Sources of Impact

→ Purchase of materials, goods and services

→ Labor

Mitigation Measures Integrated in Project Design

None

Management Measures

→ Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Positive opportunities for PAPs and communities can be in the form of temporary employment and business opportunities during the construction phase, including revenues from the sale of food and other consumable goods to workers.

It is expected that some jobs will be available during construction of the transmission line, mainly as casual workers. However, these employment opportunities are expected to be temporary and benefit the community in the short-term only. This would result in a minimal positive impact on employment, since few local people are likely to be employed. To maximize the project's positive impacts on the creation of jobs, the following mitigation measures will be implemented:

→ Apply human resources policies favoring local labor;

→ Implement training programs to build local capacity;

→ Disclose information on newly created business opportunities.

POTENTIAL IMPACT ON ECONOMY, EMPLOYMENT AND LIVELIHOODS – PRECONSTRUCTION/CONSTRUCTON PHASE

Intensity: Low	Nature: Positive Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON ECONOMY, EMPLOYMENT AND LIVELIHOODS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Positive Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: High	

7.3 NEGATIVE IMPACTS OF PRE-CONSTRUCTION AND CONSTRUCTION PHASE

7.3.1 IMPACTS ON PHYSICAL ENVIRONMENT

7.3.1.1 AIR QUALITY AND CLIMATE CHANGE

Impact Statement

→ temporary air quality deterioration

→ Low emissions of greenhouse gases

Sources of Impact

→ site preparation

→ implementation of construction sites

→ construction activities

→ transport and traffic

Mitigation Measures Integrated in Project Design

→ building the power line adjacent to existing linear infrastructure

Management Measures

→ Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

During the construction phase, several activities conducted simultaneously (e.g.: construction of access roads, excavations, levelling/earthworks, traffic along the ROW and on unpaved roads, etc.) could lead to a local increase in fine particles in the atmosphere. Moreover, the use of equipment and machinery during construction will generate exhaust emissions which will lead to an increase in concentrations of air pollutants. These activities could consequently generate low emissions of greenhouse gases. Impacts on climate is then limited because of the nature and the scale of construction activities. However, with the application of general management measures, potential air quality deterioration during the construction phase is not expected to lead to significant effects to neighbouring populations.

POTENTIAL IMPACT ON AIR QUALITY AND CLIMATE CHANGE – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON AIR QUALITY AND CLIMATE CHANGE – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: Medium	

7.3.1.2 NOISE LEVELS

Potential Impact

→ increase in noise levels locally

Sources of Impact

→ site preparation

→ implementation of construction sites

→ construction activities

→ transport and traffic

Mitigation Measures Integrated in Project Design

→ building the power line adjacent to existing linear infrastructure

→ circumvention of hamlets, villages and other urban areas

→ consideration of development plans of cities

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

During the construction phase, construction activities, traffic, as well as the use of construction equipment and machinery are likely to lead to a temporary increase in noise levels that may disturb neighbouring communities and local fauna. However, noise resulting from the construction work will only be experienced during a limited time frame, particularly along the powerline, and can be significantly reduced with the implementation of management measures mentioned above. Noise at the substation may be experiment a bite longer according to the type of works to be undertaken.

At construction sites, noise levels vary according to zoning from 60 dB to 85 dB, from residential to industrial areas. Emissions of noise from construction works with associated machinery (roller, grader, concrete mixer, generators, trucks, etc.) could reach maximum noise emissions of approximately 100 dB (LHSFNA, n.d.). If noise could excess permissible Noise Levels, the contractor will apply for a licence to emit noise in excess of the permissible levels.

POTENTIAL IMPACT ON NOISE LEVELS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON NOISE LEVELS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of occurrence: High	

7.3.1.3 SOILS AND AGRICULTURAL POTENTIAL

Impact Statement

→ soil erosion in erosion-prone areas

→ soil compaction in work areas

→ changes in soil chemical properties and risk of soil contamination

Sources of Impact

→ site preparation

→ construction activities

→ management of hazardous products and residual materials

→ transport and traffic

Mitigation Measures Integrated in Project Design

→ location of the line near existing roads

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

During the construction phase, construction of access roads, digging of foundation pits for the towers and removal of vegetation (for foundation purposes) are the main activities likely to affect soil structure and quality along the powerline. At the substation, site preparation will be reduced as the project only comprises extension of the existing substation in Bernin Kebbi. Foundations will be dug up to variable depths, depending upon the infrastructure type as well as tower type and soil characteristics. At the tower sites, all vegetation within the footprint of the tower base and for a distance still to be determined beyond the base in all directions will be cleared to ground level.

Excavation works and removal of vegetation, especially on steep slopes, would render soils unstable and more vulnerable to erosion. The line corridor is covered by three soil mapping units (see section 4.2.4.2): S1 (upland area), S2 (floodplain soils) and S3 (crest of degraded hills). From these three soil mapping units, S3 soils are the most likely to be eroded and leached. However, the topography in the study area is gently slopped. As vegetation cover stabilises the soils and ensures better resistance to erosion, removal of vegetation will be restricted to a minimum in order to prevent soil erosion. At the substation, the soil is made of sandy loam (S1) and do not lead to any restriction in terms of construction works.

Construction of access roads and vehicle movement along the project area can lead to soil compaction in those areas where soils are clayey or highly saturated. In the project area, floodplain soils found in S2 mapping unit are likely to be compacted. Application of specific mitigation measures such as de-compaction of soils following construction as well as avoiding construction activities during times when soils are saturated will help reduce adverse effects resulting from soil compaction in areas covered by this soil type.

Finally, soils can be contaminated during the construction phase by accidental oil/fuel spills from heavy machinery either at storage yards or work sites. In the event of an accidental spill, the proportion of soil contamination will depend on the magnitude of these accidental events. However, implementation of an Emergency Response Plan will help manage accidental spills properly.

POTENTIAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL– PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL– PRECONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Medium-term	
Probability of occurrence: Medium	

7.3.1.4 WATER RESOURCES

Potential Impact

- → modification to water quality
- → changes in hydrology
- → surface water contamination
- → groundwater contamination

Sources of Impact

- → site preparation
- → implementation of construction sites
- → construction activities
- → management of hazardous products and residual materials
- → transport and traffic

Mitigation Measures Integrated in Project Design

- → location of the line near existing roads

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Sources of impacts to watercourses and wetlands are removal of vegetation, construction of access roads, vehicle movement along the ROW and construction sites and excavation/piling for tower installations.

In Nigeria, the proposed line route crosses a main permanent watercourse: the Sokoto River as well as several intermittent watercourses. Moreover, the proposed line route crosses the Sokoto River floodplain over 8 km.

Vegetation removal in riparian areas can increase soil erosion in erosion prone areas, causing sediment to be deposited into the waterbodies, especially during rain events. Ultimately, this could lead to the deterioration of water quality as well as modification of aquatic habitats.

Construction of access roads as well as vehicle movement along the construction sites can result into changes in hydrology of watercourses. Depending on the level of disturbance, watercourses can be temporarily or permanently impaired. However, mitigation measures such as using existing roads instead of constructing new ones and limiting construction-related traffic (vehicles, machinery) to work areas will allow reducing impacts on water resources. A good dimensioning of culverts will also reduce impacts on local hydrology of crossed watercourses.

Moreover, erection of pylons within watercourses could potentially modify watercourse dynamics, reducing water flow and ultimately converting a lotic system into a lentic system. However, as pylons will be installed away from the riverbed of Sokoto River, hydrodynamic of this watercourse is not expected to be affected significantly.

Moreover, groundwater could be contaminated during digging of foundation pits for the towers or substations, particularly near watercourses or the floodplain. Proper management of excavation work will allow avoiding these potential impacts.

In addition, unsound waste management practices are likely to have an effect on water quality. Development and implementation of a waste management plan by the contractor and sub-contractors will allow mitigating that risk.

At the substation, runoff water will need to be properly managed during construction works in order to cause no impact on existing infrastructures and to not impair works progress

Finally, the risk of accidental oil spills from heavy machinery is present during the construction phase and could result into both surface water and groundwater contamination. The contamination level resulting from accidental spills will depend on their magnitude. However, implementation of an Emergency Response Plan will help managing them properly.

POTENTIAL IMPACT ON WATER RESOURCES – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Limited	
Duration: Medium-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON WATER RESOURCES – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Medium-term	
Probability of occurrence: Medium	

7.3.2 IMPACTS ON BIOLOGICAL ENVIRONMENT

7.3.2.1 TERRESTRIAL HABITATS, FLORA AND FAUNA

Impact Statement

→ permanent loss of natural habitat area and of its associated flora

→ terrestrial habitat fragmentation and degradation over small areas at the project site

→ modification of species composition in flora and fauna communities present in the project area

→ invasive species introduction and risk of spread

Sources of Impact

→ site preparation

- → exploitation of borrow pits
- → implementation of construction sites
- → construction activities
- → work in aquatic environment
- → management of hazardous products and residual materials
- → transport and traffic
- → labor

Mitigation Measures Integrated in Project Design

- → building the power line adjacent to existing linear infrastructure
- → limit power line crossing in woodlands

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Power line construction will require vegetation clearing along a 50 km long and 50 m wide corridor, corresponding to an area of 310.1 ha. Vegetation clearing will lead to a permanent loss of woody species in terrestrial habitats found along the corridor. Table 7-4 presents the different habitats and their impacted areas.

Table7-4 Land Use Area in the Power Line ROW

Land-Use	Area (ha)	%
Cultivated Land	69.4	22.4
Degraded Area	4.0	1.3
Tiger bush	29.1	9.4
Intensive Cultivation	66.7	21.5
Lateritic Iron Capped Hills	13.0	4.2
Agricultural-Shrubby vegetation Mozaic	71.4	23.0
Floodplain	56.5	18.2
Total	**310.1**	**100.0**

Most of the power line right-of-way consists of agricultural areas including Agricultural-Shrubby vegetation Mozaic, Cultivated Land and Intensive Cultivation which cover together 66,9 of the right of way. Even the floodplain, comprises gardening areas. However terrestrial agricultural dedicated areas still host trees and shrubs species. A total of 29,1 ha of tiger bush will need to be cut. This habitat which supports woody species, will experience more significant disturbances. Other habitats, which are sparsely vegetated and consist mostly of herbaceous vegetation, will experience fewer losses due to clearing, but remain vulnerable to disturbances that could occur during the construction phase, in particular to vehicles and machinery. The flora present in the power line right-of-way does not include any species identified in the IUCN Red List of threatened species or in a national list (Isichei 2010). There are no known endemic species in Kebbi State (Borokini 2014). However, many use-value species will need to be cleared, reducing their availability for local communities. Many management measures, such as targeted clearing measures led by a botanist and compensation for area and field tree loss, will limit the impacts.

However, the nature of some impacted habitat types, such as savannas and fields, will reduce the area that requires vegetation clearing and limit total habitat loss. In certain cases, vegetation clearing operations will consist of only cutting a few scattered trees and other woody vegetation.

Vegetation clearing should never lead to a decrease in protected and threatened species populations located in the right-of-way. A botanist will be included in the vegetation clearing team in order to protect the species or to relocate the specimens if possible.

He will be able to analyze real losses if they occur. GPS coordinates as well as local habitat descriptions will be noted and seeds will be harvested when possible. Every loss will need to be compensated and plantation success will be monitored in order to ensure no net loss of endangered species.

Vegetation losses represent habitat loss for local fauna and flora. Even if local fauna consists mostly of common species, terrestrial habitats impacted are susceptible to host some threatened wildlife species. Small fauna species are more susceptible to be impacted by habitat loss. Mortality could occur during vegetation clearing operations.

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. Monitoring the introduction and spread of invasive species in habitats disturbed by project activities is included in the management plan.

POTENTIAL IMPACT ON TERRESTRIAL HABITATS, FLORA AND FAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Magnitude: Moderate
Extent: Local	
Duration: Long-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON TERRESTRIAL HABITATS, FLORA AND FAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Magnitude: Minor
Extent: Limited	
Duration: Medium-term	
Probability of occurrence: High	

7.3.2.2 AVIFAUNA

Impact Statement

→ modification and degradation of bird habitat

→ disturbance and modification of local communities

Sources of Impact

→ site preparation

→ exploitation of borrow pits

→ implementation of construction sites

→ construction activities

→ work in aquatic environment

→ labor

Mitigation Measures Integrated in Project Design

Non applicable

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Construction activities will lead to habitat losses, modification and fragmentation for some terrestrial and water birds. Vegetation clearing will however be minimized as much as possible to limit habitat destruction and the fact that the habitats are mainly modified already reduces the anticipated impact. The habitat loss could impair highly ecologically important habitats for birds, as breeding or nesting sites. Prior to construction works, bird' surveys should be undertaken covering migration season and seasonal specificities, in order to validate areas of higher risk for bird communities.

Specific mitigation measures should then be proposed, notably for species of conservation interest and water birds, and to protect habitats of higher ecological importance for birds, or to develop relevant mitigation measures that should be adopted prior to construction works. There are areas, as the Sokoto floodplain and areas close to the Niger border (not far from the dallol Maouri Ramsar site), that are susceptible to host a higher density of birds. Indeed, some species use relatively few sites as migratory staging posts and wintering areas (AEWA, 2008). Workers responsible for vegetation clearing will pay attention to nest presence in woody vegetation in order to avoid active nest destruction. All natural habitat loss along the Niger River will need to be compensated and all trees present in the fields will be compensated to farmers.

Construction activities will also lead to increased noise which may disturb the bird species present in the area. However, as for the terrestrial fauna, the avifauna is likely to migrate to similar but quieter habitats located in the vicinity of construction areas. This phenomenon could cause a short term increase in habitat competition as the bird communities may concentrate in these adjacent habitats.

POTENTIAL IMPACT ON AVIFAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature : Negative Magnitude: Moderate
Extent: Local	
Duration: Medium-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON AVIFAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature : Negative Magnitude: Minor
Extent: Limited	
Duration: Medium-term	
Probability of occurrence: High	

7.3.2.3 AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA

Impact Statement

→ Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.

Sources of Impact

- → site preparation
- → implementation of construction sites
- → construction activities
- → work in aquatic environment
- → management of hazardous products and residual materials
- → transport and traffic
- → labor

Mitigation Measures Integrated in Project Design

- → use of wide span towers at river and marshland crossings
- → limit the number of pylons and access roads on watercourses and wetlands to the strict minimum

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

The project is located in part in the Sokoto River floodplain. During the construction phase, access road construction, vegetation clearing, and pylon construction will cause wetland and riparian habitat loss. Due to their soft and spongy soils, wetlands cannot support heavy loads, such as vehicles and machinery, and can become greatly damaged.

Construction activities can influence water quality or modify flooding patterns and surface water flow over a certain period of time. In any case, the recommendation is to avoid access road construction in the floodplain, giving priority to carrying construction activities during the driest period. If work in water is required, the contractor will elaborate a specific work plan in order to limit the potential impacts. Heavy machinery will need to be put on a support structure to distribute the load at the soil level.

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.

POTENTIAL IMPACT ON AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Magnitude: Moderate
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Magnitude: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Medium	

7.3.3 IMPACTS ON HUMAN ENVIRONMENT

7.3.3.1 LAND PLANNING AND USE

Impact Statement

- → loss of land, crops, trees and pastoral zones outside the ROW
- → disturbance of the International Transhumance Stalk Route around Birnin Kebbi and Kangiwa
- → resettlement

Sources of Impact

- → site preparation
- → population resettlement
- → construction activities

Conception Elements Limiting the Impact

- → consideration of the Sokoto River floodplain to find the most optimal location for its passage
- → circumvention of the Dukku military barrack
- → restriction of transmission line crossing in plantations and crop areas
- → restriction of transmission line passing in woodlands

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Agricultural activities and livestock will be affected during the work because of the cropping ban and the restrictions imposed regarding livestock circulation. Therefore, loss of land and crops will have to be compensated before the beginning of the construction.

As stated in the RAP, 498 households will lose a piece of land entirely or partially.

Heads of households in the properties affected by the project wayleave are predominantly men (98.8%). Women represent only 1.2% of heads of households. Hausa (85.9%) is the most represented ethnic among all leaders, followed by Zabarmawa (6.2%). The Fulani (12.8%) and Zabarmawa (13.8%) ethnic groups are more frequent among the affected households in Birnin Kebbi LGA. A majority (79.5%) head of households declare farming as their main occupation the other most frequent occupation being Public Employee (6.8%) and Self-Employed (9.6%). The households in Birnin Kebbi are more frequently Self-employed (20%) or Public Employee (10.3%).Almost all (99.8%) households are Muslim with only a small proportion (0.2%) being Christian. On average these households own 3.3 acres of land.

All those PAP will receive sufficient compensation to have the possibility to buy a new land, should the ROW take more than 20% of their parcel. For PAPs that lose less than 20% of their parcel, monetary compensation will be given for loss of crop space. Discussions with authorities and community stakeholders show that land is available in the vicinity of the line corridor. It is thus expected that no household should be impoverished due to lack of land, as all households will have the opportunity to acquire alternate cropland. It is also important to mention that TCN tolerate crop in the ROW after acquisition, as was observed in the existing 120kV corridor in the project area. The farmers are aware and agree in that case that any damages to crop or land due to maintenance activities are not compensated. Thus the ROW area is not completely lost for the households.

There are 25 houses belonging to 25 different households, (5 % of the total impacted households) that are currently located in the wayleave. These houses are classified as permanent concrete block (10 houses), and mud house (15 houses). These houses will be demolished and displaced before construction begins. Within the ROW, there are 6 commercial structures that will be affected by the project: one (1) block making industry, one (1) mechanics shop, one (1) sachet water distributor, two (2) shops and one (1) petro-station. Appropriate compensation and support will be given to the owners to minimize the impact of the displacement or reconstruction of these structures. Some community structures are also affected: one (1) Islamic school, two (2) mosques. One (1) natural area (a marsh that is heavily cultivated) is also impacted. Again, the key to minimize the impact is to start early in the process (at least one year before construction) in order to leave time to the community to properly plan the resettlement. All these structures must be replaced in kind and respect Nigerian specifications. As for the natural area affected, it is a heavily cultivated marsh area cooperatively owned and will be compensated so the cooperative will compensate its members.

If all those measures and compensation are properly implemented the impact will be minor since the physically resettled households will be able, in all if not most cases, to move on the same parcel or to a one nearby. As for the economically affected households the lost will be compensated by a new parcel or cash compensation in cases where the impact is small.

Furthermore, the International Transhumance Stalk Route around Birnin Kebbi and Kangiwa will be affected during the construction phase. The construction of the line near this route will have to be done before or after the migration period.

No land-use change is anticipated at the substation location, as the new bay will be located inside the substation area.

POTENTIAL IMPACT ON LAND PLANNING AND USE – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Long-term	
Probability of impact occurrence: High	

RESIDUAL IMPACT ON LAND PLANNING AND USE – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Long-term	
Probability of impact occurrence: High	

7.3.3.2 EXISTING INFRASTRUCTURES

Impact Statement

- → houses and other buildings located in the ROW will have to be relocated
- → need of existing infrastructures relocation
- → increase in traffic and circulation perturbation
- → damage to existing infrastructures
- → modification of the surroundings for the construction the access roads

Sources of Impact

- → population resettlement
- → site preparation
- → construction activities
- → transport and traffic

Conception Elements Limiting the Impact

- → circumvention of the Dukku military barrack
- → circumvention of concessions, hamlets, villages and other built environments
- → considerations of development plans of cities

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

The interconnection line avoids villages, and borrows an existing corridor in Birnin Kebbi which limits the number of buildings that need to be moved. Nonetheless, some 25 houses, 11 secondary structures, 6 commercial structures, and 3 community buildings located in the ROW will be either demolished or moved. In most cases (17/25) the space exist to reconstruct on the same plot or nearby for the affected households located in rural area. In Birnin Kebbi (8 houses) in some cases the owner might not have the opportunity to rebuild their home on their existing property. A new plot will have to be find or a nearby house may be bought to resettle some of these households. Using adequate, appropriate resettlement procedures and sufficient compensation, the project's impact on these households will be minimized, but still potentially important in those cases where the household's residence must be moved to another plot. Sufficient time and care to help communities and households to implement the resettlement are essential to minimize the impact of the relocations.

Concerning public infrastructures, roads, electricity and telecommunication infrastructures were studied.

On main roads, the presence of vehicles and building materials can lead to increased traffic in addition to being a risk of damage. A petrol station falls inside the ROW and will need to be relocated at least 25 meters out of ROW in compliance with regulatory provisions.

Moreover, to the possible extent, existing roads will be used as access roads to the ROW. The ROW itself will be used to the extent possible to move material from one site to the other. New access roads (permanent or temporary) could be built only if clearly needed. These new accesses will be built while minimizing environmental impacts through careful location and implementing appropriate mitigation measures (dust control, culverts, fragile environments protective barriers, etc.). The temporary access will be removed and the land restore to its original state after construction.

Construction work should have no impact on the operation of nearby telecommunication antennas, except perhaps temporarily limiting their access.

POTENTIAL IMPACT ON EXISTING INFRASTRUCTURES – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: High	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: High	

RESIDUAL IMPACT ON EXISTING INFRASTRUCTURES – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of impact occurrence: Low	

7.3.3.3 ECONOMY, EMPLOYEMENT AND LIVELIHOODS

Impact Statement

- → creation of temporary jobs
- → economic development opportunities related to the electrification that may arise from the project
- → permanent loss of crops
- → loss of ecosystem services
- → temporary disruption of activities related to tourism and leisure
- → inflation risk
- → compensation and resettlement measures distribution

Sources of Impact

- → presence and operation of the line and substations
- → wayleave maintenance
- → population resettlement
- → construction activities
- → transport and traffic

Conception Elements Limiting the Impact

- → circumvention of the Dukku military barrack
- → circumvention of concessions, hamlets, villages and other built environments
- → bringing the power lines closer to existing roads
- → considerations of development plans of cities
- → electric line passing restriction in plantations and crop areas

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

There will be no significant adverse impacts on local and regional economy during the line construction. Some speculation could occur before the start of construction, which could result in a rise of commodity prices.

During the construction phase, the upward pressure on the prices of commodities in areas where construction will take place (due to the increased demand by employees or contractors) may temporarily cause slight distortions of the market. However, this risk is low for several reasons. First, the most important site associated with the redevelopment of the Birnin Kebbi station is located in a suburb. It is likely that many of the workers are recruited locally which will minimize the need for services. On the other hand, the arrival of workers and contractors' purchases in the urban area will not have a significant effect on demand because of the importance of the economy already serving a population of several thousand people. Moreover, contractors could announce that local products and services will not be purchased beyond a certain price to reduce the risk of a high inflation.

Moreover, the impacts to the villages and communities located along the line will be relatively small due to the limited duration of the project, to population resettlement along the corridor and the limited number of workers involved. Moreover, as the compensation and reconstruction related to ROW clearing will be completed before the construction site risks of inflation will be very limited.

However it is crucial that local and regional people are informed in advance of the onset and duration of the construction work to enable them to adjust their supplies accordingly and avoid bottlenecks resulting in strong increases of price.

Other economic activities may be affected during the construction period. In fact, the noise produced by construction activities, equipment and trucking can reduce the aesthetic values for tourism and leisure activities that are very limited in the area. However, mitigation measures to limit disturbance of the site should help reduce the impacts of these activities during the construction period.

The clearing activities may also affect areas where communities are used to get access to ecosystem services as livestock resources, wild food products, traditional medicine, biofuel, timber wood, etc. The compensation and revegetation plan should take into consideration the planting of species of use-value for communities.

For affected households, the cultural loss of land is a risk of impoverishment. The majority lose a significant part of their unique plot. It is therefore essential that the TCN compensates to enable them to buy a plot to replace the one(s) they have lost before the work begins. This risk is quite low since firstly, despite the land use density, it is possible to find alternative plots including through family and village solidarity. On the other hand, one can only conclude by examining footprints of existing lines, that the TCN tolerates agricultural practices despite the official ban occupancy of the ROW. In this context, the risk of loss will be greatly reduced.

Compensation distribution can also create a "sense of wealth" among households who are unused to managing relatively large amounts of money. Some may go into debt or spend amounts received for inappropriate purposes. The RAP provides measures such as awareness, budget management and spreading payments when they are substantial.

POTENTIAL IMPACT ON THE ECONOMY, EMPLOYMENT AND LIVELIHOODS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: Medium	

RESIDUAL IMPACT ON THE ECONOMY, EMPLOYMENT AND LIVELIHOODS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of impact occurrence: Low	

7.3.3.4 QUALITY OF LIFE, HEALTH AND SAFETY

Impact Statement

→ increased pressure on community health services

→ risk of increased incidences of STIs and HIV / AIDS

→ risk of accidents and physical injuries involving local workers and residents

→ risk of accidents due to traffic related to the project
→ increased stress-related disturbances (noise, dust, air pollution)
→ environment disruption caused by workers' camps

Sources of Impact

→ population resettlement
→ construction activities
→ management of hazardous products and residual materials
→ transport and traffic
→ labor

Conception Elements Limiting the Impact

→ circumvention of concessions, hamlets, villages and other built environments
→ consideration of development plans of cities

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

All construction activity pose health risk to workers: accidents and injuries, fire and explosion hazards, poisoning, respiratory or hearing impairment related to excessive noise, dust etc. To reduce those risk and impacts all contractors and sub-contractors will have to comply with relevant WB health and safety requirements. To that effect a complete Health and security program must be put prepared by the contractor before construction start. Regular training and sensitizing session for workers must be provided.

As for the surrounding communities and households the construction phase of the project present significant source or impact or risk to their health and quality of life.

During the construction phase, the working population in the project area may increase temporarily, increasing the pressure on local health systems. The presence of a nurse in workers camp with necessary equipment will reduce the demand on local resources.

The influx of foreign workers in local communities can increase the risk of communicable diseases such as the transmission of HIV / AIDS. To avoid this impact, the contractor in charge of work should undertake a prevention program for communicable diseases among workers and local communities as indicated in the ESMP. The probability of impact remains is low since the passage of these workers will be only short duration in each community.

The construction of workers' camp(s) can be the source of pollution and various disturbances of the surrounding environment: waste, wastewater and excreta, soil pollution, etc. The following management measures will be implemented in each set up camp: waste and waste water management, latrines, containment of machinery in appropriate areas, etc.

Accidents are likely to occur during construction. In fact, construction sites have potential risks for workers and nearby communities because they can generate curiosity, especially among children. To prevent accidents, the contractor will ensure the proper use of equipment and implementation of all appropriate security measures for this type of work and to enforce them by employees (safety equipment port, etc.). The site and the equipment and material storage area will be confined by the use of temporary fencing. Unauthorized people will also be kept away from all construction sites. In addition, warning signs will be posted for public safety. Finally, educational programs in schools and communities could be implemented to educate people about the dangers and safe practices when playing or working near a high voltage transmission line.

The increase in traffic in the villages and the roads could also be a source of accidents. The contractor will develop appropriate strategies to minimize the need for transportation of supplies and will ensure compliance with all applicable laws, such as maximum load restriction and speed limits. These measures will minimize the risk of accidents that could be caused by the project related traffic.

An awareness program for truck drivers to speed limits and other precautionary measures will be implemented. Sign indications (inhabited area, school, pedestrian crossings, etc.) and speed limits will be in place where appropriate. Community awareness program will include all risks including road accident.

Regarding quality of life, disturbances (noise, dust, air pollution and risk of accidents) it will create a special stress in generally calm rural areas. Appropriate mitigation and containment of construction activities during normal working hours will reduce these drawbacks for the local population. In addition, the presence of foreign workers may cause nervousness in some communities. The information and stakeholder consultation program will reveal concerns and display measures and adjust them as needed.

Finally, this project can create an effect of "induced development", i.e. an influx of population in the area looking for jobs and commercial activities that may increase pressure on public services. This risk is low because of the "nature in motion" the construction site, its limited importance and its short duration. Furthermore, the presence of a large workforce in Birnin Kebbi will reduce the need recruit workers, good or services outside the area. Clear and defined procedures of recruitment and contract management that favor local workforce and workers need also to be largely publicised to discourage opportunist.

POTENTIAL IMPACT ON LIFE QUALITY, HEALTH AND SECURITY – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurence: High	

RESIDUAL IMPACT ON LIFE QUALITY, HEALTH AND SECURITY – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Medium-term	
Probability of impact occurence: Medium	

7.3.3.5 SOCIAL COHESION AND GENDER

Impact Statement

- → land use and conflicts related to compensation (could revive old quarrels)
- → tensions with outside workers
- → tensions over the awarding of jobs and contracts
- → marginalization of women from the compensation process
- → disruption of women subsistence activities

Sources of Impact

- → land acquisition
- → population resettlement
- → labor

Conception Elements Limiting the Impact

Non applicable

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

The compensation distribution among applicants (e.g. owner, tenants and family members) can create tensions within and outside the affected households. These negative impacts can be mitigated by ensuring the cooperation of legitimate leadership and good communication of the compensation rules and procedures to all interested parties. Moreover, it is possible that foreigners who come for preparation works disrupt some communities and their habits and traditional schedules.

The construction stage will primarily impact communities and social cohesion because of:

→ The presence of workers, sometimes outside of the region in the different sections of the line during construction. The exact number of workers is difficult to quantify, since the contractor will determine its labor needs according to its work program.

→ The population exposure to different value systems that may conflict with theirs due to the presence of different stakeholders (project managers, subcontractors, employees and / or consultants).

→ A strong increase in cash flow in the traditional villages or areas.

→ The increase in activities close to remote communities.

The factors mentioned could potentially lead to tensions, conflicts with the local and traditional authorities, and draw dividing lines between different groups.

In terms of gender relations, special attention should be paid to the treatment of women in monitoring the title / land and their registration. It is essential that the project will ensure that women are not left out of the process. This will be particularly important for the allocation of compensation for agricultural losses.

During the construction phase, the project's impacts on equality are mainly related to employment opportunities and land use by women. In the project area, traditional cultural norms play an important role in women and girls' education, paid employment and other benefits. With little education, women have little access to formal employment. Therefore, they represent a nonsignificant proportion of people currently employed in professional, technical and administrative, as the project intends, to some extent, to provide.

If women's hiring efforts are not made, the project will perpetuate the gap between men and women. At the very least, such an impact should be reduced to a minimum by hiring women with qualifications (technical books or administrative work, in general) and for general services (supply of workers, cleaning, etc.).

Furthermore, the lost land and subsequent losses of crops (annual and perennial) caused by the project could affect women more than men. Indeed, women are usually responsible for subsistence and struggling to provide for the household when crops are limited. The project must take into account this dynamic in the allocation and distribution of compensations. To reduce this impact women must have the relevant information at all stages of the claims process. The replacement land must be found quickly to limit impacts. Furthermore, in cases where households are given significant compensations, options of payment given in installments awareness of management compensation and adequate information for women should be provided. This formula has reduced inappropriate use of compensations by husbands or relatives.[1].

1 Burnside and Associates Limited, 2006, BUJAGALI INTERCONNECTION PROJECT RESETTLEMENT AND COMMUNITY DEVELOPMENT ACTION PLAN.

POTENTIAL IMPACT ON SOCIAL COHESION– PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: Medium	

RESIDUAL IMPACT ON SOCIAL COHESION– PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Medium-term	
Probability of impact occurrence: Low	

7.3.3.6 VULNERABLE GROUPS

Impact Statement

→ increased marginalization of vulnerable groups

Sources of Impact

→ land acquisition

→ population resettlement

Conception Elements Limiting the Impact

Non applicable

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

The compensation distribution can make some people more vulnerable (e.g.: women heads of households, disabled or elderly, etc.) to social and family pressures that would reduce their ability to use the funds. The reconstruction of houses is an important risk in that regards. Without proper monitoring head of households can mismanage the funds and leave is family in difficulty. The negative impacts can be mitigated by assuring the collaboration of legitimate leaders and an adequate follow-up with the PAPs regarding compensation distribution and management.

Moreover, the impacts on livelihood benefits of vulnerable groups can be more severe, as these groups generally have less resources and experience difficulty using the services available for their condition. It is essential to prioritize households and vulnerable people in terms of access to various social measures and programs that are offered especially in the RAP.

These PAPs will also receive special assistance in purchasing replacement land, organizing transportation to the relocation site and the construction of their new structures if necessary.

Risk of marginalization in host communities is low since in all cases the physically resettled will remain in the same community since he will be moved nearby. Nonetheless, monitoring of their integration will be made. The details related to vulnerable PAPs are provided in the RAP.

POTENTIAL IMPACT ON VULNERABLE GROUPS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: Medium	

RESIDUAL IMPACT ON VULNERABLE GROUPS – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: Medium	

7.3.3.7 CULTURAL AND ARCHEOLOGICAL HERITAGE

Impact Statement

- potential disturbance or destruction of archaeological sites and / or objects
- destruction or potential disturbance of burials and / or sacred sites

Sources of Impact

- site preparation
- exploitation of borrow pits
- construction activities

Conception Elements Limiting the Impact

Non applicable.

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Consultation with local and regional authorities did not identify the presence of any site or resource linked to the cultural heritage in the project area. No grave or cemetery is affected by the ROW.

However, during the construction activities, unknown archaeological sites or objects can be discovered and partially destroyed by the machinery used. An archaeologist should accompany the construction team, especially during excavation, and make sporadic checks at the pylon locations. If archaeological or historic remains are discovered, the construction works will immediately stop along this section of line, the Federal Department of Antiquities and the LGA authorities where the discovery took place and the State Ministry of Information Sports and Culture of Kebbi State should be informed.

POTENTIAL IMPACT ASSESSMENT ON CULTURAL AND ARCHEOLOGICAL HERITAGE – CONSTRUCTION PHASE

Intensity: High	Nature: Negative Importance: Major
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: Low	

RESIDUAL IMPACT ASSESSMENT ON CULTURAL AND ARCHEOLOGICAL HERITAGE – CONSTRUCTION PHASE	
Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: Low	

7.3.3.8 LANDSCAPE

Impact Statement

- → temporary degradation of the landscape on the site

Sources of Impact

- → site preparation
- → construction activities
- → exploitation of borrow pits

Conception Elements Limiting the Impact

- → ringing the power line closer to the existing roads
- → installation of the line along an existing line
- → use of the existing substation
- → power line passage restriction in wooded areas

Management Measures

Refer to Table 9-1 for the Construction Phase Management Measures.

Impact Description

Aesthetic impacts during the construction phase will be limited to work zones. Deforestation of the ROW will change the landscape in areas very limited since it is mainly crossing an agricultural area. Furthermore, the landscape is already disturbed by the presence of a transmission line. This project will be built in parallel to the existing line which will limit their impact. To minimize the impacts of the construction activities on the landscape, the existing access roads will be used whenever possible. Finally, all temporary work zones will be restored after construction**.**

In Birnin Kebbi's urban area, the impact will be minimal. Indeed, firstly, the existing substation, where additional equipment will be installed, will not be extended. On the other hand, new equipment (transformers, circuit breakers, etc.) will be diluted in the mass of existing elements. Moreover, with respect to the power line, the crossing of Birnin Kebbi's urban area does not lead to any landscape modification as it passes along the corridor of an existing line.

POTENTIAL IMPACT ON THE LANDSCAPE – PRE-CONSTRUCTION/CONSTRUCTION PHASE	
Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: High	

RESIDUAL IMPACT ON THE LANDSCAPE – PRE-CONSTRUCTION/CONSTRUCTION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Local	
Duration: Medium-term	
Probability of impact occurrence: High	

7.4 POSITIVE IMPACTS OF THE OPERATION AND MAINTENANCE PHASE

It is anticipated that the implementation of the North Core project will contribute to the WAPP objective which is to access to energetic resources at an optimized price. The benefits of the electricity access are mainly associated with the human environment and are described below.

7.4.1 IMPACTS ON HUMAN ENVIRONMENT

7.4.1.1 ECONOMY, EMPLOYMENT AND LIVELIHOODS

Impact Statement

→ Creation of jobs

→ Potential for economic development associated with electricity access originating from the project

Sources of Impact

→ presence and operation of line and substations

→ facilities maintenance

→ ROW management

Mitigation Measures Integrated in Project Design

None

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

The project could generate some temporary jobs for maintenance of the power line in riverside communities. However, the benefit generated by the project will certainly be opportunities for electrification that may arise.

Many indirect positive impacts can occur with the electrification of towns and villages and greater availability of electricity, provided that the project is properly optimized and integrated to its environment. With the additional input of energy, the community institutions and shopping malls could notably improve their services, increase their economic activities and accelerate growth in certain areas of expertise.

Improving the availability and reliability of energy in the region will include improving the storage and processing of agricultural products, increasing market value and / or extending their shelf life. The storage inside a refrigerator can keep dairy products, fruits and vegetables that can subsequently be sold or consumed during the following days. These improvements may add value to agricultural products and in the long term, generate better income for farmers.

Finally, rural electrification programs, being at the center of poverty reduction, could support rural economic development through the provision of energy for water pumps, grain mills, tourism, local industries etc.

POTENTIAL IMPACT ON ECONOMY, EMPLOYMENT AND LIVELIHOODS – OPERATION AND MAINTENANCE PHASE

Intensity: Medium	Nature: Positive Importance: Major
Extent: Local	
Duration: Long-term	
Probability of occurrence: Medium	

RESIDUAL IMPACT ON ECONOMY, EMPLOYMENT AND LIVELIHOODS – OPERATION AND MAINTENANCE PHASE

Intensity: Medium	Nature: Positive Importance: Major
Extent: Regional	
Duration: Long-term	
Probability of occurrence: High	

7.5 OPERATION AND MAINTENANCE PHASE

7.5.1 IMPACTS ON PHYSICAL ENVIRONMENT

7.5.1.1 AIR QUALITY AND CLIMATE CHANGE

Impact Statement

- Slight degradation or air quality locally
- Potential emissions of greenhouse gases

Sources of Impact

- presence and operation of line and substations
- facilities maintenance
- ROW management

Mitigation Measures Integrated in Project Design

None

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

During the operation phase, maintenance activities, particularly right-of-way maintenance and vegetation clearing activities, could have a negative impact on air quality. This impact will be felt locally in areas where vegetation clearing will take place. Transport and traffic associated with maintenance activities are also likely to generate dust, especially during dry periods.

Emissions from machinery could include greenhouse gases, but in very small quantities and over short periods of time. Indirect impacts on greenhouse gases could arise, however, through an increase need in energy generation, which comes from non-renewable energy sources (coal, natural gas, oil) that could be used. Countries, such as Nigeria, that could power the grid, are major producers of oil and natural gas. However, it is impossible to predict electricity production on the basis of these sources in the future. Several production projects, including renewable energy sources such as hydropower, wind and solar, are also planned in the sub-region.

POTENTIAL IMPACT ON AIR QUALITY AND CLIMATE CHANGE – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON AIR QUALITY AND CLIMATE CHANGE – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Medium	

7.5.1.2 NOISE LEVELS

Impact Statement

→ increase in noise levels locally

Sources of Impact

→ presence and operation of line and substations

→ facilities maintenance

→ ROW management

→ transport and circulation

Mitigation Measures Integrated in Project Design

→ building the power line adjacent to existing linear infrastructures

→ consideration of development plans of cities

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

During the operation phase, maintenance activities conducted near pylons, substations, transmission line or ROW could lead to an increase in noise levels which may disturb neighbouring communities. However, these disturbances will be temporary since they will be felt only during maintenance activities. Management measures proposed to reduce noise impacts during the construction phase will also be helpful in reducing noise impacts through the operation phase.

Moreover, operating transmission lines and substations emit a permanent background sound which is audible and which may also disturb communities in the vicinity to the line or substations. Noise produced by transmission lines, which mainly comes from conductors, can be experienced as a buzz or a crackle (Hydro-Québec TransÉnergie, 2013), whether noise produced by substations comes mainly from power transformers. In general, noise produced by substations is higher than that produced by transmission lines. Noise levels at substation for transformers dealing with power of 301 to 500 kV are at maximum 60 dB (Petrovic et al., 2012). With the distance, noise should not reach higher than accepted national standards.

In addition, weather conditions can have an influence in noise-related impacts. For example, noise propagation is likely to be higher during rain events than during dry conditions (Hydro-Québec

TransÉnergie, 2013). For the powerline, taking into consideration stimulation made with a 135 kV, noise could be around 20 dB during dry period and around 40 dB during rainy period (Hydro-Québec, 2008). Also, noise may be especially noticeable during nighttime hours when ambient noise levels are lower (Public Service Commission of Wisconsin, 2013). Overall, noise-related impacts during the operation phase are expected to be low.

POTENTIAL IMPACT ON NOISE LEVELS – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON NOISE LEVELS – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: High	

7.5.1.3 SOILS AND AGRICULTURAL POTENTIAL

Impact Statement

→ risk of soil contamination

Sources of Impact

→ presence and operation of line and substations
→ facilities maintenance
→ ROW maintenance
→ transport and circulation
→ management of residual/hazardous material

Mitigation Measures Integrated in Project Design

→ Building the power line adjacent to existing linear infrastructures

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

During the operation phase, oil leaks resulting from equipment breakdown and/or accidental spills from machinery used for maintenance purposes could lead to soil contamination. As during the construction phase, the risk of soil contamination due to leaks and/or accidental spills cannot be completely discarded. However, the application of management measures listed above will help reducing this risk significantly. In the event of accidental leaks and/or spills, the impact significance will depend on the volume of leaks and/or spills and the nature of pollutants. However, implementation of an Emergency Response Plan will help manage accidental spills/leaks properly.

POTENTIAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of Occurrence: Medium	

RESIDUAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of Occurrence: Low	

7.5.1.4 WATER RESOURCES

Impact Statement

→ Risk of ground water and surface water contamination

Sources of Impact

→ presence and operation of line and substations

→ facilities of maintenance

→ ROW management

→ transport and circulation

→ management of residual/hazardous material

Mitigation Measures Integrated in Project Design

→ consideration of the Sokoto River floodplain in order to find the most optimal area for line route crossing

→ building the power line adjacent to existing linear infrastructure

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

During the operation phase, oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to water contamination. As during the construction phase, the risk of water contamination due to leaks and/or accidental spills cannot be completely discarded. However, the application of management measures listed above will help reduce this risk significantly. In the event of accidental leaks and/or spills, the impact significance will depend on the volume of leaks and/or spills and the nature of pollutants. However, implementation of an Emergency Response Plan will help manage them properly.

POTENTIAL IMPACT ON WATER RESOURCES – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of Occurrence: Low	

RESIDUAL IMPACT ON WATER RESOURCES – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of Occurrence: Low	

7.5.2 IMPACTS ON BIOLOGICAL ENVIRONMENT

7.5.2.1 TERRESTRIAL HABITATS, FLORA AND FAUNA

Impact statement

- impairments of natural habitats and associated flora communities
- potential introduction of invasive alien species (IAS)
- local reduction of density for species of higher use value
- bat collision and electrocution

Sources of Impact

- presence and operation of line and substation
- facilities maintenance
- ROW maintenance
- management of residual/hazardous material
- presence of workers

Mitigation Measures Integrated in Project Design

- building the power line adjacent to existing linear infrastructure
- limit power line crossing of woodlands

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

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 within the ROW, which will result in continuous alteration of natural habitats. The most affected forms of flora will surely be woody species, comprising trees and shrubs, as they can grow taller. The periodic disturbance will maintain ROW habitats in earlier vegetation development stages, leading to the presence of more common species and rarity of specialized species. These vegetation disturbances will lead to a loss of habitats for some terrestrial fauna species. This long-term modification of natural habitats could cause a barrier effect for small fauna, limiting their movements or making them more vulnerable to predation. Nonetheless, these impacts remain limited for the power line given the degraded state of the habitats present.

Presence of the access road in previously inaccessible areas could lead to an increase in natural resources exploitation and a reduction of species communities with a higher use value.

Moreover, periodic ROW maintenance activities can also lead to IAS proliferation, especially if these activities include moving and clearing of vegetation. Once introduced, IAS will likely spread and impact adjacent areas with habitats that correspond to their ecological requirements. Proper cleaning of equipment and monitoring should be implemented to reduce the risks of spread and associated impacts on wildlife.

Power lines are susceptible to impact bat population during operational phase because there is a risk of collision and electrocution with flying mammals. Electrocution is only possible when bats get in contact with two wires at the same time. Locating the power line outside bat migratory paths and keeping cables apart should reduce the risks of collision and electrocution. A monitoring program should be implemented in order to follow up the number of mortality and species involved. Species specific mitigation measures should be proposed on the basis of monitoring results.

POTENTIAL IMPACT ON TERRESTRIAL HABITATS, FLORA AND FAUNA – OPERATION PHASE

Intensity: Medium	Nature: Negative Magnitude: Moderate
Extent: Local	
Duration: Long-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON TERRESTRIAL HABITATS, FLORA AND FAUNA – OPERATION PHASE

Intensity: Low	Nature: Negative Magnitude: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: High	

7.5.2.2 AVIFAUNA

Impact Statement

→ bird collisions with grounding cables causing injuries and death

→ modification and disturbance of bird habitats, with associated changes in bird communities

Sources of Impact

→ presence and operation of line and substation

→ facilities maintenance

→ ROW maintenance

→ management of residual/hazardous material

→ presence of workers

Mitigation Measures Integrated in Project Design

→ building the power line adjacent to existing linear infrastructures

→ limit line route crossing of woodlands

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

The presence of the power line is likely to affect bird communities during the operational phase, especially when located in open air space habitats as grasslands and wetlands. The presence of the power line can affect birds mainly through:

- → Collision with power lines or towers leading to death or injury. Greater collision risk is associated with the thin ground wire which is located above the thicker high voltage wire (BirdLife, nd).
- → Electrocution: Due to contact with live components.

The environmental characteristics and location of the power line can greatly influence collision probabilities. Collision rates between birds and the proposed power line could be highly variable both temporally and spatially. Along the line route, collisions may be more frequent inside the Sokoto floodplain and close the Republic of Niger border. There are many factors that can contribute to specie's vulnerability to collisions with power lines, such as flocking behavior, rapid flight, high wing loading, nocturnal migrants, and species with poor vision (cranes and waterfowl). Aquatic birds, including shorebirds, waterfowl, cranes, and herons, are known as the most common victims of power transmission lines (Rioux et al. 2013). Collision risks are higher for species with small binocular fields of vision and large blind areas. Thus visual field topographies, which have evolved primarily to meet visual challenges associated with foraging, may render certain bird species particularly vulnerable to collisions that extend into the otherwise open airspace above their preferred habitats. The concentration of water birds inside wetlands could increase the impacts on their populations. Based on the analysis provided in section 4.4.1.4, there are 5 species of birds surveyed inside the study area that are more susceptible to collision with the powerline, these are *Streptopelia roseogrisea, Cyanocitta cristata, Petronia xanthocollis, Egretta alba and Zenaida auriculata.* None of these species are considered as threatened. The Sokoto floodplain is certainly an area prone to birds collision as it is a wetland in proximity to the Niger river where birds are known to concentrate.

On the other hand, electrocution rates could be high for species nesting on power lines, such as storks. As well as putting them at risk of electrocution, this could escalate the probability of collision by increasing the amount of time spent flying close to power lines (Martin and Shaw, 2010).

It has been generally found that birds can usually avoid the highly visible bundled conductors on higher voltage overhead lines but often fail to see the smaller diameter shield wire [Alonso & Alonso 1999(a)]. Research in South Africa has established that very few collisions actually happen in the first and last 25% of the span [Anderson 2001].

Proposed mitigation measures should help reduce the risk of collision and electrocution. However, the success of mitigation measures could be highly variable from species to species. A proper bird mortality monitoring program should then be developed and implemented in order to identify areas and species that are more impacted. Collisions are thought to be more common during migratory movements (Morkill and Anderson 1991), which suggests that a better understanding of impacts during migration as well as other critical periods is needed. On the basis of monitoring programs, specific mitigation measures should be proposed.

POTENTIAL IMPACT ON AVIFAUNA – OPERATION PHASE

Intensity: Medium	Nature: Negative Magnitude: Moderate
Extent: Limited	
Duration: Long-term	
Probability of occurrence: High	

RESIDUAL IMPACT ON AVIFAUNA – OPERATION PHASE

Intensity: Low	Nature: Negative Magnitude: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Medium	

7.5.2.3 AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA

Impact Statement

- → disturbances of the water dynamics causing modifications in aquatic habitats and its associated fauna
- → potential introduction of invasive alien species

Sources of Impact

- → presence and operation of line and substation
- → facilities maintenance
- → ROW maintenance
- → management of residual/hazardous material
- → transport and circulation
- → presence of workers

Mitigation Measures Integrated in Project Design

- → building the power line adjacent to existing linear infrastructures
- → optimization of pylon location to minimize their presence in the floodplain

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

Hydrological condition modifications that could potentially be caused by the presence of pylons in the floodplain and of access roads could impact aquatic environments' ecological characteristics. These disturbances could also influence habitat availability and presence of some fauna species. It is not recommended to build permanent access roads in wetlands or in floodplains. However, roads might be necessary to access water crossings. Maintenance of roads and culverts is essential to ensure that they do not become an obstruction for aquatic fauna movements or that they do not cause erosion that could result in siltation of spawning or feeding habitats.

During the operation phase, workers and vehicles travelling along the ROW and the access road, especially for infrastructure maintenance and repair, could cause the spread of invasive alien species. These species could be introduced in wetlands and riparian habitats. Rigorous monitoring of invasive species will be done.

POTENTIAL IMPACT ON AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA – OPERATION PHASE

Intensity: Medium	Nature: Negative Magnitude: Moderate
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Low	

RESIDUAL IMPACT ON AQUATIC AND SEMI-AQUATIC HABITATS AND FAUNA – OPERATION PHASE

Intensity: Low	Nature: Negative Magnitude: Minor
Extent: Limited	
Duration: Long-term	
Probability of occurrence: Low	

7.5.3 IMPACTS ON HUMAN ENVIRONMENT

7.5.3.1 LAND PLANNING AND USE

No negative impact on **LAND USE AND PLANNING** is expected during the Operation Phase since the PAPs will have been resettled and that clearing activities will have been undertaken prior to the construction phase.

7.5.3.2 EXISTING INFRASTRUCTURES

Impact Statement

→ radio and television signal interruption

Sources of Impact

→ presence and operation of line and substation

Conception Elements Limiting the Impact

→ consideration of development plans of cities

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

No negative impact on houses and secondary structures is expected during the Operation Phase since these structures have been moved before construction. Moreover, transmission lines do not usually interfere with television and radio signals. In some cases, interference can occur very close to the ROW due to mild broadcast signals or poor reception of the equipment. There are no plans for another important effect on infrastructures during the operation phase.

POTENTIAL IMPACT ON EXISTING INFRASTRUCTURES – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: Low	

RESIDUAL IMPACT ON EXISTING INFRASTRUCTURES – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of impact occurrence: Low	

7.5.3.3 ECONOMY, EMPLOYMENT AND LIVELIHOODS

No impact on economy, employment and livelihoods is anticipated during operation phase.

7.5.3.4 QUALITY OF LIFE, HEALTH AND SAFETY

Impact Declaration

→ electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts

→ perception of risk associated with exposure to electromagnetic fields (EMF)

Sources of Impact

→ presence and operation of the line and substations

Conception Elements Limiting the Impact

Non applicable

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

The presence of power lines is a potential security risk for the people living nearby, where people sometimes try to make illegal connections. Pylon steel theft can also pose significant security risks in the case of the collapse of the tower. However, the towers must be designed according to best practices and standards. This will ensure the safe and reliable operation of the transmission line while ensuring the safety of neighboring communities thereof.

Health problems and exposure to the EMF are often raised when a new transmission line is proposed. Based on a recent comprehensive review of the scientific literature (World Health Organization - International EMF Project), the WHO concluded that despite extensive research, there is no evidence to date for concluding that an exposure of EMF of low intensity is harmful to human health (WHO 2007, WHO 2002).

POTENTIEL IMPACT ON LIFE QUALITY, HEALTH AND SECURITY – OPERATION PHASE

Intensity: Medium	Nature: Negative Importance: Moderate
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: Medium	

RESIDUAL IMPACT ON LIFE QUALITY, HEALTH AND SECURITY – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: Medium	

7.5.3.5 SOCIAL COHESION AND GENDER

Impact Statement

→ tensions between local populations and outside workers

→ economic disturbances caused by the loss of crops

Sources of Impact

→ presence of workers

→ ROW maintenance

Conception Elements Limiting the Impact

Non applicable

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

Although impacts on communities and social cohesion are likely to be felt mainly during the construction phase, they can also be felt to a lesser degree, during the operation phase due to the presence of workers' maintenance activities.

Although gender impacts are likely to be felt mainly during the construction phase, they are also likely to be felt to a lesser degree, over the maintenance activities. The loss of crops (annual and perennial) due to maintenance activities can affect women more than men. Indeed, women are usually in charge of subsistence activities and struggle to provide their household when crops are limited. A proper consideration of these dynamics in the allocation and distribution of compensation is recommended. Wherever possible, maintenance activities will be performed outside of the culture period.

POTENTIAL IMPACT ON SOCIAL COHESION AND GENDER– OPERATION PHASE

Intensity: Medium	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of impact occurrence: Medium	

RESIDUAL IMPACT ON SOCIAL COHESION AND GENDER– OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Short-term	
Probability of impact occurrence: Low	

7.5.3.6 VULNERABLE GROUPS

No negative impact on vulnerable groups is expected in the Operation Phase.

7.5.3.7 CULTURAL AND ARCHEOLOGICAL HERITAGE

No negative impact on the cultural and archaeological heritage is expected during the Operation Phase.

7.5.3.8 LANDSCAPE

Impact Declaration

→ permanent changes to the landscape

Sources of Impact

→ presence and operation of line and substation

Conception Elements Limiting the Impact

→ bringing the lines closer to existing roads

→ power line passage restriction in wooded areas

Management Measures

Refer to Table 9-2 for the Operation Phase Management Measures.

Impact Description

The overall aesthetic effect of a transmission line is likely to be negative for some people, especially where the proposed lines cross natural landscapes. The tall steel structures may seem out of proportion and not compatible with agricultural landscapes.

Research and experience show that the reaction to the aesthetics of transmission lines varies. Some residents do not notice nor oppose to it from an aesthetic point of view. For others, transmission lines or other utilities can be considered part of the infrastructures necessary to sustain life and everyday activities, and are therefore acceptable. Moreover, for some, new transmission lines can be seen in a positive way since they are associated with economic development. It is emphasized that the consultations conducted with the local populations have not raised the visual aspect as a negative impact.

Finally, during maintenance activities, the existing access roads will be used whenever possible to avoid further disruption of the landscape.

The redevelopment of the existing substation will have no impact on the landscape because it is already mixed with the urban area and it will not be extended and that the equipment added to the substation is the same as those already present.

POTENTIAL IMPACT ON LANDSCAPE – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Moderate
Extent: Local	
Duration: Long-term	
Probability of impact occurrence: High	

RESIDUAL IMPACT ON LANDSCAPE – OPERATION PHASE

Intensity: Low	Nature: Negative Importance: Minor
Extent: Limited	
Duration: Long-term	
Probability of impact occurrence: High	

7.6 DECOMMISSIONNING PHASE

It should be noted that impacts resulting from the project's decommissioning phase were neither identified nor assessed in the present report. Indeed, it is anticipated that the power line and associated substations will be continuously maintained and operated for several decades. This very long useable life makes it very difficult and potentially counter-productive to predict, at this stage, the circumstances under which the project installations might ultimately be decommissioned. However, it is recommended to conduct full assessment of the decommissioning phase impacts when enough information on the decommissioning phase becomes available.

7.7 CUMULATIVE IMPACT

The cumulative impacts are the result of the added or even synergistic effect of various past, present or projected projects. The impact assessment of the North Core Project, presented in the previous sections, focused on identifying the impacts of this single project on the various VESC found the study area. The cumulative impacts assessment identifies projects or other activities located in the project area that may have an effect on the VESC assessed. As with the analysis of direct and indirect impacts presented in the previous sections, the cumulative impacts analysis looked at a study area that varies by component. The study area of bio-physical components is more restricted. It extends over a width of 5 km all along the power line while that of the social components extends to the Keebi state.

7.7.1 INTERACTIONS OF OTHER PROJECTS AND ACTIVITIES WITH VESC

Cumulative impacts are generated when projects and activities are likely to have effects on the same VESC.

Projects and activities susceptible to generate cumulative impacts with the North Core Project are the ones located within the Kebbi state and they are the followings :

- → Expansion of Birnin Kebbi city;
- → 132 kV Birnin Kebbi to Niger powerline and 330 kV Kainji to Birnin Kebbi powerline;
- → New road from Birnin Kebbi to Kola village
- → Farming, including crops inside the Sokoto floodplain
- → Grazing
- → Fishing activities

The VESC that will be the subject of the cumulative impact analysis will be selected based on the following criteria:

- → a medium or major impact due to the project was identified for the EVE studied as part of the impact study;
- → There is potential for cumulative effect on the EVE with other projects or activities.

Given the nature of the potential interactions, the VESC that are analyzed are :

- → Terrestrial habitats, fauna and flora
- → Avifauna
- → Land planning and use
- → Economy, employment and livelihoods

The following table therefore suggests the potential interactions of the projects or activities susceptible to generate cumulative impacts with the identified VESC. Although no impact analysis of the projects or activities cited was carried out in this study, the interactions are based on experience in similar projects.

Table 7-1 Interactions in between identified VESC from the North Core project and projects and activities susceptible to generate cumulative impacts

Impacts Sources	TERRESTRIAL HABITATS, FAUNA AND FLORA	AVIFAUNA	LAND PLANNING AND USE	ECONOMY, EMPLOYMENT AND LIVELIHOODS
Expansion of Birnin Kebbi city	✕	✕	✕	
132 kV Birnin Kebbi to Niger powerline and 330 kV Kainji to Birnin Kebbi powerline	✕	✕	✕	✕
New road from Birnin Kebbi to Kola village	✕	✕	✕	✕
Farming, including crops inside the Sokoto floodplain	✕	✕	✕	
Grazing	✕	✕	✕	
Fishing activities		✕	✕	

7.7.2 CUMULATIVE IMPACTS IDENTIFICATION

On the basis of the projects identified, the cumulative impacts likely to be generated on the identified VESC are described below.

Terrestrial habitats, fauna and flora

- → Different developments and urban expansion will lead to a reduction in the total surface area of natural habitats. Reducing natural habitat areas and their connectivity could lead to the disappearance of the most specialized species. Moreover, population growth could increase pressures on the natural resources in place, limiting the presence of species with higher utility or cultural value and causing progressive loss of habitat. Power transmission lines have serious effects on land resources, particularly ligneous resources. Although the rights-of-way are generally not extensive, they may, however, encroach or fragment natural habitats along them. The loss of natural habitat areas reduces and fragments the habitat of flora and fauna species and could have an even more negative impact on the threatened species identified in the study area. The latter are generally the most sensitive to habitat loss. The effects of habitat loss, disturbance and fragmentation will limit the ecosystem services currently contributing to local populations well-being.

Avifauna

- → The multiplication of power lines in the landscape increases the risk of collision and potential electrocution of the bird fauna with those lines. As previously described, there are 5 species of birds surveyed inside the study area that are more susceptible to collision with powerline, these are *Streptopelia roseogrisea, Cyanocitta cristata, Petronia xanthocollis, Egretta alba and Zenaida auriculata.* None of these species are considered as threatened. However, they could locally suffered from population reduction because of an higher rate of mortality.

Land planning and use

- → The anthropization of the territory will have the effect of transforming the current occupation of the land. The development of linear infrastructures contributes locally to the densification of human occupation and the transformation of the current land uses. The areas allocated to natural habitats are thus likely to decline in favor of anthropized areas. If grazing and other agricultural activities are not generally prohibited on the right-of-way, other uses are, however, incompatible. Also, consecutive linear infrastructures implementation in a given territory could cause resettlement of populations. Displacement of populations in a context of land use change and population growth can lead to land conflicts and land access issues. the transmission lines, depending on their location, may create an induced development on the lands adjacent to the right-of-way or on those that have become accessible. In regions that do not have sufficient resources or housing, the cleared right-of-way can become places of choice for illegal construction, which in turn entail new environmental impacts, congesting local infrastructure and collective services.

Economy, employment and livelihoods

The North Core project together with identified projects and activities are also likely to generate positive cumulative impacts:

- → job creation, immigration of workers, electrification of the area will stimulate the local economy;
- → quality of life of the surrounding populations is likely to improve as a result of the improvement of public and private services and a more stable electricity supply: better lighting, improved cold chain for food and medicines, electrical machinery for industrial and domestic work, etc.

Projects that lead to electrification and the improvement of means of transport combined two pillars of economic development. Rapid economic development will accelerate changes in the lifestyles of the people living there. There are strong inequities, which can be accentuated in the absence of measures to distribute wealth and improve social mobility. These persistent inequities can lead to high vulnerability to poverty for part of the population and conflict.

In order to reduce the negative effects of anticipated cumulative impacts, Chapter 9 proposes the mitigation measures and Chapter 10 proposes the Environmental and Social Management Plan. By applying the mitigation hierarchy to manage anticipated project impacts, this reduces the project's contribution to the various expected negative cumulative impacts.

8 RISK ANALYSIS OF TECHNOLOGICAL ACCIDENTS AND EMERGENCY RESPONSE PLAN

This chapter presents the context for the analysis of environmental risks. It describes risks related to the storage and use of petroleum products and hazardous substances and the risks concerning the use of electric transformers. The nature of the emergency plan is also presented together with the organizational responsibilities. Emergency interventions to put in place in the event of an accidental petroleum product spill are exposed. Finally, training aspects are underlined.

8.1 OBJECTIVE

TCN's objective, in terms of risk management, consists of reducing risks to the lowest levels, as much as is reasonably possible. They strictly implement their Corporate Policy on Occupational Health and Safety that will need to be implemented during all project phases. However, an accident could affect persons on site as well as personal objects and the environment. Thus, risk identification is important in order to deploy appropriate staff and personnel to intervene with diligence and confidence in the case of a major accident.

8.2 ANALYSIS OF ENVIRONMENTAL RISKS

The use of a power line or an electrical station entails some environmental risks. These risks may be of a natural or a technological origin.

In general, natural risks are caused by natural phenomenon such as rain fall, floods, tornados, droughts, bush fires, etc. Natural risks could be the source of hazards or technological risks.

Technological risks rely on hazard identifications (hazardous products, system failures, sources which lead to breaking, generic project risks etc.).

Natural risks associated to the current project are mostly associated to lightning which could short circuit the system, erosion phenomena in particular in flooding zones or in areas which are prone to erosion and bush fires which could start in areas close to the lines or stations. However, these risks are managed at a technical level via the use of specific components during the conceptualization of the project (earthing cable, appropriate choice of tower location, foundation composition, adequate clearing zone, etc.).

The risk analysis relies mostly on the technological risks associated to the use of the power line and the stations on the North Ridge project. The sources of the two main risks are:

→ the storage and use of petroleum products

→ the use of electrical transformers

8.2.1 STORAGE AND USE OF PETROLEUM PRODUCTS AND HAZARDOUS SUSBTANCES

This section outlines the potential risks associated with the storage and use of petroleum products such as, diesel, light crude oils, fuel, lubrication oils and grease.

The hazards which can lead to identified major accidents are:

→ spills of petroleum products

→ fires and/or explosions involving petroleum products

→ spills of oils and grease

8.2.2 SPILLS OF PETROLEUM PRODUCTS

The nature and the location of petroleum products and other solicited hazardous substances will be detailed in the feasibility study.

Equipment corrosion, breaking/leaks in equipment or human error can lead to spills of petroleum products or hazardous substances resulting in the contamination of surface water, underground water as well as soil contamination or fires.

The following prevention or mitigation measures will be in place in order to reduce the risks of accidents, as well as their consequences in an emergency situation:

- the design of equipment and tanks in accordance with the requirements of the regulations, standards, applicable codes and appropriate industrial practices
- the design of secondary retention devices which have a sufficient capacity to contain the worst probable spill scenario
- double-walled tanks with a secondary retention basin which have a sufficient capacity to contain up to 110% of the stored volume
- training of all employees who are assigned to the handling of bulk petroleum products
- development and use of work procedures, if necessary
- continuous training of the operating staff including Safety Training
- continuous updating of the emergency response plan including the intervention procedures in case of an incident involving a petroleum product
- the storage and use of intervention materials (pails, buckets or plastic pools) in case of a spill close to the handling areas of petroleum products
- continuous service contract with a company which specializes in the cleanup of spills and in industrial cleaning
- preventative maintenance of tanks and all related equipment in order to reduce potential breaking and premature wear on the equipment
- completion of a risk analysis before every unusual task which has not been described by an appropriate work procedure
- inspection and conformity assessment of the bulk petroleum product storage tanks

The spill, while potentially being substantial, would be controlled at the area of the incident, due to the mitigation measures which are in place (double-walled tank, secondary retention devices, separators, etc.).

8.2.2.1 FIRE/EXPLOSION INVOLVING PETROLEUM PRODUCTS OR OTHER HAZARDOUS SUBSTANCES

A fire/explosion involving petroleum products or other hazardous substances could occur in exceptional circumstances, for example, a fire close to the petroleum tanks. Therefore, the probability of this occurrence is deemed to be very low. This type of incident could lead to serious injuries and potentially to the loss of the life of the person located within the impact radius, as well as damage to nearby buildings and infrastructures and therefore will necessitate an interruption of all operations and lead to economic losses.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents, as well as their consequences in case of an emergency situation. Supplementary mitigation measures to protect the petroleum product tanks, nearby infrastructures and the workers will also be elaborated during the operational phase of the project.

- the design of equipment and tanks in accordance with the requirements of the regulations, standards, applicable codes and appropriate industrial practices
- training of all employees who are assigned to the handling of bulk petroleum products

- development and use of work procedures, if necessary
- continuous updating of the emergency response plan including the intervention procedures in case of an incident involving a petroleum product
- preventative maintenance of tanks and all related equipment in order to reduce potential breaking and premature wear on all equipment
- completion of a risk analysis before every unusual task which has not been described by an appropriate work procedure
- inspection and conformity assessment of the bulk petroleum product storage tanks

8.2.2.2 SPILLS OF OILS AND GREASE

Spills of petroleum products such as lubrication oils and grease, following breaking/leaks in equipment, handling errors and machine spills, can lead to surface water and underground water contamination.

The following prevention or mitigation measures will be in place in order to reduce the risks of accidents, as well as their consequences in an emergency situation:

- the design of equipment and tanks in accordance to the requirements of the regulations, standards, applicable codes and appropriate industrial practices
- training and awareness of all workers to the protection of the environment
- development and use of work procedures, if necessary
- continuous updating of an emergency plan which includes intervention procedures in the case of an incident involving a petroleum product
- preventative maintenance of equipment in order to reduce potential breaking and premature wear on the equipment
- completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

A spill of lubrication oils and grease could eventually occur during the operational phase of the project. The impact level of the environment is deemed to be low given the quantities and the mitigation measures which are in place.

8.2.3 USE OF ELECTRIC TRANSFORMERS

This section outlines the risks associated to the presence of electric transformers.

The hazards which can lead to identified major accidents are:

- spills of dielectric oils
- fire, explosion involving an electrical transformer

8.2.3.1 SPILLS OF DIELECTRIC OIL

The spill of insulating oil found in the transformers could lead to the contamination of surface and underground water and as well as soils, following the corrosion of equipment, breaks/leaks of equipment or human errors.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents as well as their consequences in case of an emergency situation:

- preventative maintenance of transformers and related equipment in order to prevent breaking of equipment and premature wear on all equipment
- retention basin for all transformers that contain dielectric fluids

- extra transformers for the production equipment in case a breakdown or failure occurs in order to avoid a stoppage in operations
- completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

8.2.3.2 FIRE/EXPLOSION INVOLVING AN ELECTRIC TRANSFORMER

A fire in a transformer is a potential risk. Potential causes for a fire are contaminated dielectric oils, short-circuits and overheating.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents as well as their consequences in an emergency situation:

- preventative maintenance of transformers and related equipment in order to prevent breaking of equipment and premature wear on all equipment
- protection against lightning
- retention basin for all transformers that contain dielectric fluids
- extra transformers for the production equipment in case a breakdown or failure occurs in order to avoid a stoppage in operations
- completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

8.3 NATURE OF THE EMERGENCY RESPONSE PLAN

An appropriate emergency response plan will be elaborated in a more formal manner in function with the progress of each phase of the project, diligently, confidently and quickly in case of an accident. The contractor, in charge of the construction phase of the project, will be required to complete an emergency plan in order to mitigate every risk that he will have identified with the work which needs to be accomplished. Furthermore, the emergency plan will regularly be reviewed and adapted for the construction and operation phases of the project. The review must include all activities for each phase and the associated risks.

Any event that could threaten or affect the environmental components will trigger the emergency plan. The plan will allow for appropriate actions to be put in place to respond to the emergency situations arising from the identified risks.

The following section outlines the main elements that need to be retained and integrated in the emergency response plan which will be completed to quickly and efficiently intervene during the different phases of the project.

The emergency response plan includes three general objectives which are:

- clearly defining the role and responsibilities of all stakeholders, for all levels from construction to operations
- facilitating the communication of the plan to all concerned parties such as workers and the general population
- serve as a reference document during warning, mobilization and intervention procedures

In order to minimize the risks for all employees, the population and the environment, the following are the specific objectives of the plan:

- develop a mechanism to alert stakeholders and all concerned organizations
- coordinate the operational and intervention crews
- define the role and responsibilities of all stakeholders
- specify the different levels of authority
- reduce intervention time in order to minimize the effects on the environment

8.4 ORGANIZATION AND RESPONSIBILITIES

8.4.1 EMERGENCY MEASURES PLANNING COMMITTEE

A planning committee in charge of the emergency measures will be active within the TCN and will maintain an up to date emergency plan in order to efficiently mobilize workers in the eventuality that an emergency occurs. A thorough review of every item in the plan will be regularly completed by the emergency plan planning committee. The committee's role will consist of elaborating, preparing, updating and diffusing the emergency response plan as well as initiating and preparing large-scale simulations, reviewing the results and ensuring follow-ups. The committee must also train the workers and upper management via simulation and evacuation exercises, develop proper intervention relations with the civil authorities as well as initiate the annual emergency response plan review process and ensure that the operation plans are updated.

8.4.1.1 INTERNAL TEAM FOR EMERGENCY INTERVENTIONS

The internal emergency intervention team will consist of on-site staff and personnel who will represent the first line emergency team in charge of the communications and deployment in an emergency situation. The roles of this team will consist of receiving all emergency calls, giving them priority and giving them the required and needed attention. The team will convey all information to upper management without delay, as well as all appropriate emergency services and, if necessary, acquire external aid.

8.5 EMERGENCY INTERVENTIONS

8.5.1 PROCEDURE IN CASE OF A SPILL OF PETROLEUM PRODUCTS

TCN and its subcontractors will ensure that emergency procedures are rapidly put in place in the event of an accidental petroleum product spill.

Appropriate procedures will be established and communicated to all operating staff as well as suppliers. These procedures will outline the proper way of recuperating and cleaning all accidental petroleum product spills and any related products on site as well as off site.

The interventions will consist of:

- → wearing appropriate clothes and personal protective equipment (i.e. security goggles or sealed goggles, resistant gloves, etc.)
- → managing and controlling the leak (i.e. eliminating the ignition source, identifying the product which was used, stopping, if possible, the source of the spill by disabling or turning off the equipment that controls the flow of the product)
- → confining the spilled product (i.e. stemming the spilled product in order to prevent the product from migrating to a river of water or the sewer and absorbing with items found in the emergency kit such as absorbents, dry sand or any other dry and non-combustible material)
- → outlining a security perimeter (i.e. prohibiting traffic, vehicles, and any unauthorized staff near the accident)
- → evacuating the area if there is a fire or a risk of a fire
- → notifying the concerned staff that are in charge according to the warning procedures and following the instructions given by the team who is managing the emergencies
- → recovering all contaminants and restoring the contaminated area (in compliance to all regulations and appropriate practices in order to prevent the migration of any contamination)

The emergency response plan will include specific procedures for every emergency situation. All persons and organizations that must be notified for each situation will be identified in the final version of the emergency response plan. Also, the emergency response plan must include a risk communications program to the general population and a section on preventative measures.

These items will be integrated afterwards to the final version of the emergency response plan for the project. After each event, a report on the emergency situation will be completed with the personnel that is in charge in order to evaluate the measures which were taken, specify possible improvements and make the necessary changes to the procedures.

8.6 TRAINING

The operating staff benefits from continuous training in order to guarantee a certain level of knowledge and adequate competence. The operating staff must fully understand the emergency response plan's procedures. Each worker will be trained in order to know the warning and intervention procedures in the event of an emergency.

8.6.1 EMERGENCY INTERVENTION EXERCISES

The emergency response plan will be regularly tested in order to verify its efficiency level. A program consisting of a series of exercises will allow the users to verify the efficiency level of every aspect of an intervention, of the equipment and the workers identified in the emergency response plan. The plan will outline the types of exercises which need to be done and the frequencies at which they must be done. Every exercise will be evaluated in order to validate and/or improve the operational processes of the emergency response plan. These exercises will be analyzed in a post-mortem report.

9 MANAGEMENT MEASURES

This chapter presents the mitigation impact hierarchy that has been applied as part of the project. The following tables present management measures that will allow to avoid, mitigate, compensate or enhance impacts that were identified in the previous chapter. Table 9-1 presents management measures planned during pre-construction/construction phase whereas Table 9-2 presents measures to be implemented during operational phase.

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Air quality and climate change	Temporary air quality deterioration	X	X	Stockpiles of fine materials will be covered during period of high winds	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	X	X	Non-stabilized stockpiles and exposed soils will be sprayed with water regularly if dust generation is visible.	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Air quality and climate change	Temporary air quality deterioration Low emissions of GHG Soils and agriculture potential	X	X	Develop and apply a proper waste management strategy. Burning of solid wastes will not be permitted	Prior to and throughout the construction phase	Contractor
Construction activities	Air quality and climate change; Noise levels	Temporary air quality deterioration Low emissions of GHG Increase in noise levels	X	X	Generators, vehicles and machinery will be shut down when not in use	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration Lowe emissions of GHG	X	X	Maintain equipment and machinery in good running conditions, including brakes, mufflers and silencers, catalyzers	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	X	X	Cover excavated materials with erosion control blankets	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	X	X	Use water for dust suppression on dust generating areas	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	X	X	Restrict speed on loose surface roads to 25 km/h during dry or dusty conditions	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration Lowe missions of GHG	X	X	Prohibit idling of vehicles on-site to reduce emissions	Throughout the construction phase	
Construction activities	Air quality and climate change	Temporary air quality deterioration	X	X	Cover loads of brittle material during transport	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Noise Levels	Increase in noise levels	X	X	Restrict noise generating activities near residential or institutional sensitive receptors to the period considered as daytime by national noise standards	Throughout the construction phase	Contractor
Site preparation Implementation of construction sites Construction activities; Transport and traffic	Noise Levels	Increase in noise levels	X	X	Follow national noise standards. Apply for a license to emit noise in excess of the permissible levels	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation; Implementation of construction sites Construction activities Transport and traffic	Noise Levels	Increase in noise levels	X	X	Provide all internal combustion equipment with properly functioning silencers or mufflers	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas Soil compaction in work areas	X	X	Strictly restrict transport to identified access. Clearly mark out the limit of the ROW and access roads	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential; Water resources Vulnerable groups	Changes in soil chemical properties and risk of soil contamination; Surface water contamination; Groundwater contamination	X	X	All ignitable, reactive, flammable, corrosive and toxic materials will be stored in clearly labelled containers	Throughout the construction phase	Contractor
Construction activities; Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas	X	X	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas	X	X	Prepare and implement erosion and sediment control plans, particularly in areas identified as having high erosion potential	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas Soil compaction in work areas	X	X	Restrict materials and manpower movements to existing roads/tracks to the extent possible	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas	X	X	Identify and rehabilitate exposed soils immediately following construction activities	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil compaction in work areas	X	X	Avoid construction activities in areas where soils are highly saturated	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Construct a designated, signposted, concrete wash down bay that is fully contained and bunded for all excess concrete and concrete wash down (e.g. plastic lined)	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Regularly maintain the concrete washout bay, treating any water prior to release to natural systems	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Hazardous materials (mainly used oil and gas) must be stored in a manner that prevents interaction with each other or with the environment or from being tampered accidentally	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Quality of life, Health and Safety	Risk of accidents and physical injuries involving local workers and residents	X	X	International Chemical Safety Cards (ICSC) or Material Safety Data Sheets (MSDS) or equivalent data/information will be readily available in an easily understood language to exposed workers and first aid personnel	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil compaction in work areas	X	X	De-compact soils following construction with appropriate equipment	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential Water resources	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	X	X	Prepare and implement an Emergency Response Plan	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Control and reduce at source the production of wastes and hazardous waste (mainly used oil and gas)	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	X	X	Keep a Spill Containment Kit readily accessible onsite in the event of an accidental spill and ensure on-site staff is trained in spill response	Throughout the construction phase	Contractor
Site preparation Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential Water resources	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	X	X	Contain any spills onsite and clean up spills as soon as possible	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation; Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination; Risk of groundwater contamination	X	X	Document and report all spills to the FMEnv	Throughout the construction phase	Contractor PMU
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Characterize, remove and dispose of contaminated soils at sites authorized by relevant authorities	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential;Water resources	Changes in soil chemical properties and risk of soil contamination; Risk of surface water contamination; Risk of groundwater contamination	X	X	Ensure that equipment and machinery are in good operating condition, clean (power washed), free of leaks, excess oil, and grease	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Segregate and temporarily store excavated soils in order to used them as backfill when needed	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination		X	Ensure that all stationary equipment and machinery are installed above permanent spill containment facilities of sufficient capacity	Design stage	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	X	X	Remove any construction debris generated at the sites immediately after completion of construction activities	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas;	X	X	Revegetate areas of bare and disturbed soils as soon as possible with native species	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas	X	X	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Construction activities	Water resources	Risk of groundwater contamination	X	X	Pump out and dispose of any groundwater encountered during excavation in order to protect groundwater resources from contamination in case of spills	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	X		Ensure towers to be located outside the floodplain of all watercourses and permanent wetlands	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	X	X	Select access tracks so as to avoid crossing streams and other water bodies	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	X	X	Where stream crossings are unavoidable, construct suitable culvert. Under no circumstances will water bodies be blocked to provide access		Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	X	X	Avoid equipment and vehicle movements in rivers, floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Water resources	Modification to water quality; Risk of surface water contamination	X		Store hazardous material and vehicles minimally 100m away from wetlands and watercourses floodplains	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities Transport and traffic	Water resources	Changes in hydrology	X		Properly delineate wetlands and floodplain areas	Prior to construction work within or near aquatic habitats	Contractor
Work in aquatic environment	Water resources	Changes in hydrology; Modification to water quality; Surface water contamination	X	X	Set and implement strict procedures for in-water works.	Within or near aquatic habitats prior to and throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology; Modification to water quality; Risk of surface water contamination	X	X	Conduct activities during the dry season to minimize disturbance of sensitive shoreline and wetland areas.	Throughout the construction phase	Contractor
Construction activities	Water resources	Changes in hydrology; Modification to water quality; Risk of surface water contamination	X	X	Avoid material piling inside wetland areas and floodplains	Throughout the construction phase	Contractor
Construction activities	Water resources	Modification to water quality ; Risk of surface water contamination	X	X	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Construction activities	Water resources	Risk of surface water contamination	X	X	Do not refuel or service equipment within 100 m of any watercourse or surface water drainage installations	Throughout the construction phase	Contractor
Construction activities	Water resources	Modification to water quality; Risk of surface water contamination	X	X	While working within wetlands, restrict all equipment movements to access roads	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction activities	Water resources	Modification to water quality; Risk of surface water contamination	X	X	Install silt barriers (e.g., fencing) when working in steep riparian areas and along wetlands to minimize potential sediment transport to aquatic habitats	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora; Terrestrial habitat fragmentation and degradation over small areas at the project site Modification of species composition in flora and fauna communities present in the project area	X		Establish a Compensation and Revegetation Plan for lost natural habitats during construction phase The loss of ligneous species should be compensated at least by planting equivalent areas with native species Validate with a botanical expert: species chosen for restoration best time for revegetation depending on species to plant and habitat to restore preferential habitats for endangered species	Beginning of and throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora; Terrestrial habitat fragmentation and degradation over small areas at the project site Modification of species composition in flora and fauna communities present in the project area	X	X	Restrict construction activities, including vehicle movements and material storage, inside the RoW	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X	X	Minimize the construction of new access roads. Promote the use of existing access roads for machinery and vehicle movements, increasing their width as necessary.	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X		Promote the use of existing roads for transporting material and tower parts to the construction sites in order to reduce the project's footprint and minimize the need for new access roads	Throughout the construction phase	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora	X	X	Clearly mark the extent of vegetation cutting in the ROW with stakes at intervals of 50 m or less. Identify and mark the vegetation to be preserved along sections of the ROW.	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X	X	Shift tower positions and adjust tower intervals as practicable to minimize encroachment in ecologically sensitive areas	Design stage	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site. .	X	X	Undertake ROW vegetation cutting with the supervision of a botanist in order to identify and relocate if possible species of conservation concern as well as protect vegetation that does not represent a risk for the powerline. Any species of conservation concern that need to be cut will be located and its habitat will be fully described. This information will be integrated in the planning of reforestation program. If possible, collect seeds from species of conservation concern	During vegetation removal within the ROW	PMU
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X	X	Undertake a selective cutting of the vegetation in order to keep low scrubby and herbaceous species that do not represent a risk for the powerline	During vegetation removal within the ROW	Contractor
Site preparation Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X		Conserve all the vegetation (trees, shrubs, herbaceous plants, crops) present at the edge of watercourses and on steep slopes	Throughout the construction phase	Contractor
Site preparation; Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X	X	Use existing roads and trails as much as possible to minimize road construction and associated habitat fragmentation	Project Design Phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Invasive species introduction and risk of spread	X	X	Inspect and clean construction equipment properly after working in areas known to be infested with invasive species	Throughout the construction phase	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Invasive species introduction and risk of spread	X	X	Survey sensitive areas such as wetlands and shorelines for invasive species following construction and site re-vegetation	Throughout the construction phase	Contractor
Site preparation; Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	X	X	Develop and implement a construction waste management plan that strictly respect sound waste management practices	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation Construction activities	Land Planning and Use	Loss of land, crops, tree and pastoral zones in the ROW	X	X	Make chopped woody resources and residues available to local population in order to reduce additional pressures on natural resources	During vegetation removal within the ROW	Contractor
Site preparation Construction activities	Land Planning and Use	Disturbance of the International Transhumance Stalk Route around Birnin Kebbi and Kangiwa	X		Provide a plantation of woody plants and ensure that the construction of the line near the transhumance route is not done during the migration period	Throughout the construction phase	Contractor
Site preparation Construction activities	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora	X		Rehabilitate and revegetate temporary access road and work areas as soon as possible	Throughout the construction phase	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site Modification of species composition in flora and fauna communities present in the project area	X	X	Promote the selection of areas with less of a need for tree cutting for temporary work and storage areas	Throughout the construction phase	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area	X		Undertake a pre-construction survey, covering migration season and seasonal specificities in order to validate areas of higher risk for bat communities Develop adapted mitigation measures	Design stage	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area	X		Locate towers outside of bat breeding and bat migration area	Design stage	Contractor
Labor	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora. Terrestrial habitat fragmentation and degradation over small areas at the project site. Modification of species composition in flora and fauna communities present in the project area.	X	X	Implement a biodiversity protection awareness program with workers. Prohibit workers from owning firearms and other hunting gear, and raise awareness about the prohibition to engage in any kind of poaching.	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area	X	X	Inform the Contractor's E&S specialist when endangered fauna species are observed in or close to project sites	Throughout the construction phase	Contractor
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	X		Undertake a birds surveys to validate the presence of threatened species Undertake birds nest surveys within a period of 2 weeks before clearing to identify nest of protected or endangered species. Protect identified nests until chicks are mature Where a threatened bird species is nesting, do not undertake trees clearing within a radius of 1 km. Wait until the nest is deserted. Come monthly to the nesting site to verify, not more often	Two weeks prior to the vegetation clearing	PMU
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	X	X	Compensate any loss of breeding/nesting sites by the creation of suitable habitats elsewhere, notably from enhancement of degraded habitats	Prior to construction and throughout the construction phase	Contractor
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	X		Place "bird diverters" on the top (ground) wire to make the lines more visible to birds if the collision potential is high, in particular where the powerline crosses the Sokoto river floodplain) Typical installation if bird diverters requires: -Installation on both earth wires in a staggered pattern -Installation only on the middle lower 60% of the span -Installation at 10 m intervals on each earth wire	Throughout the construction phase	Contractor
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	X		Installation of indicator lights at night.	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component: Line	Project Component: Substations	Mitigation Measures	Implementation Timing	Responsibilities
Site preparation Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	X	X	Complete tree and/or brush cutting prior to or after the core nesting season	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Adjust pylon siting to span wetlands areas, or limit equipment access in wetlands, wherever possible	Prior to construction and throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Avoid the construction of a permanent access road inside a wetland or a watercourse	Throughout the construction phase	Contractor
Site preparation	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Perform all vegetation clearing work manually. Avoid vegetation clearing along stream shores and on steep slopes	Project Design Phase and Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Based on an appropriate project design, avoid erecting towers within wetlands. If unavoidable, select the most optimized site for each tower considering human uses and areas of higher ecological integrity	Project Design Phase and Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Prohibit construction of permanent access roads along river banks, in wetlands or in areas where soils are saturated	Project Design Phase and Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Avoid construction of temporary access roads along river banks, in wetlands or in areas where soils are saturated, to the extent possible	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Maintain fish access when road crossings of watercourse are unavoidable by utilizing clear span bridges or open-bottom culverts	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Avoid removing stream bank vegetation	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Maintain vegetated buffer zones within and around wetlands and along both sides of watercourse crossings. Restore as soon as possible any disturbed areas in the riparian buffer zone	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Dismantle temporary access roads built for construction phase in temporary wetland areas. Perform this dismantlement during the dry season and dispose of materials outside wetland areas	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Avoid equipment and vehicle movements in rivers, floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Set and implement strict procedures for in-water works	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Conduct activities during the dry season to minimize disturbance of sensitive shoreline and wetland areas.	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Do not operate heavy machinery in wetland areas with standing water	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora	X	X	Avoid material piling inside wetland areas	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
		disturbances					
Site preparation Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X	X	Do not throw debris in aquatic habitats and remove any debris introduced accidentally into the aquatic environment as soon as possible	Throughout the construction phase	Contractor
Work in aquatic environment	Water resources	Changes in hydrology	X		Always maintain hydrologic connectivity between upstream and downstream in the work areas	Throughout the construction phase	Contractor
Work in aquatic environment	Water resources	Changes in hydrology	X		Always ensure free flow of water and sufficient water supply in order to maintain a viable fish habitat downstream from the work areas	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Install diversion structures (canals, dikes, coffers) that neither obstruct fish movements nor diminish habitat width to less than 2/3 of the current water bodies, including rivers, wetlands, etc	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		After termination of construction work, restore natural river bed conditions (minor bed, natural obstacles, etc.);	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Aquatic and semi-aquatic habitats and fauna	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances	X		Use wetland mat or bridge for vehicle and machinery movement inside permanent wetland to avoid the need for building a road	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Site preparation Population resettlement Construction activities	Land Planning and Use Economy, employment and livelihood Existing infrastuctures Vulnerable groups	Loss of land, crops, tree and pastoral zones in the ROW Resettlement Houses and other buildings located in the ROW will have to be relocated Need of existing infrastructures relocation Permanent loss of crops Temporary disruption of activities related to tourism and leisure Compensation and resettlement measures distribution Increased marginalization of vulnerable groups	X	X	Implement Resettlement Action Plan	Prior to the construction phase	PMU
Population resettlement	Social Cohesion and Gender	Land use and conflicts related to compensation (could revive old quarrels)	X	X	Involve traditional leaders in the resettlement process	Prior to the construction phase	PMU
Population resettlement	Land Planning and Use	Loss of land, crops, tree and pastoral zones outside the ROW	X	X	Validate with local leaders temporary areas to be used during construction activities	Throughout the construction phase	Contractor
Transport and traffic	Existing infrastructures	Increase in traffic and circulation perturbation	X	X	Travel to and from the construction sites should be done during low traffic periods	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Existing infrastructures	Damage to existing infrastructure	X	X	Plan construction activities in collaboration with local authorities to minimize damage to existing infrastructures	Prior to and throughout the construction phase	Contractor
Construction activities Transport and traffic	Existing infrastructures	Damage to existing infrastructure	X	X	Rehabilitate damaged infrastructures after the construction	After the construction phase	Contractor
Site preparation Population resettlement	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	X	X	Provide compensation measures to affected tourism and recreation activities, if any	Prior and throughout the construction phase	Contractor
Purchase of materials, goods and services	Economy, employment and livelihoods	Inflation risk	X	X	Adopt procurement policies promoting local products and services, when available	Prior to the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component Line	Project Component Substations	Mitigation Measures	Implementation Timing	Responsibilities
Construction activities Transport and traffic	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	X		Promote portage of material and tower parts to the construction sites using existing roads in order to reduce project footprint and minimize need for new access roads	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	X		Mark out the access roads in order to reduce the multiplication of informal access	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	X	X	Provide compensations to affected households and landowners	Throughout the construction phase	PMU
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	X		Clearing will only be done when consent of each owner has been obtained to clear plantations or cut trees in the ROW.	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops Loss of ecosystem services	X		Undertake revegetation planting agro-forestry trees that increase availability of fodder or fruit trees, in order to maximize livelihood benefits for local population	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Loss of ecosystem services	X		Include species of use-value in the Compensation and revegetation plan	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	X		Carefully select the landing area of falling trees to minimize damages to crops	Prior to and throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Locate access roads and lay down areas away from residences to the extent possible	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Notify landowners along the line route about the construction schedule and activities	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	An accessible grievance mechanism for PAPs to address complaints at the local level needs to be implemented	Throughout the construction phase	PMU
Site preparationConstruction activitiesTransport and trafffic	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	X	X	Secure equipment and demarcate any excavation works areas	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Accidents and physical injuries involving local residents	X	X	Sign and fence construction areas where necessary	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction activities	Quality of life, health and safety	Exposure to EMFs from the transmission line	X		Design and build the transmission line as to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits.	Design stage	TCN
Construction activities	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Maintain equipment and machinery in good running conditions, including brakes, mufflers and silencers, catalyzers	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Locate temporary access roads and lay down areas away from residences to the extent possible	Throughout the construction phase	Contractor
Transport and traffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Restrict transport and circulation activities on public roads to the period between 6 a.m. and 6 p.m	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Notify landowners along the main public transportation routes about the construction schedule and activities	Throughout the construction phase	Contractor
Transport and traffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution)	X	X	Control speed of transport vehicles. Limit speed to 20 km/h inside villages and install signposts where relevant	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Risk of increased incidences of STIs and HIV / AIDS Risk of accidents and physical injuries involving local workers and residents Risk of accidents due to traffic related to the project	X	X	Require the Contractor to adopt policies and procedures that comply with national legislation and address all aspects of labor standards relevant to the project as specified by BM policies. Sub-contractors will be contractually required to comply with labor and health and safety legislation	Throughout the construction phase	PMU Contractor
Construction activities	Quality of life, health and safety	Adherence to labor standards and well-being of construction workers	X	X	Comply with TCN Corporate Policy on Occupational Health and Safety	Throughout the construction phase	PMU Contractor
Construction activities	Quality of life, health and safety	Adherence to labor standards and well-being of construction workers	X	X	Require the presence of a nurse in worker's camp with necessary equipment and supply to treat minor injuries, vaccinate workers, sensitize the workers to diseases prevention measures Have necessary vehicle and equipment for injured workers transfer to health center	Throughout the construction phase	PMU Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component: Line	Project Component: Substations	Mitigation Measures	Implementation Timing	Responsibilities
Construction activities	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	X	X	Require all contractors and sub-contractors to comply with relevant WB health and safety requirements, including specific provisions for: • Introduction, and use of, poisonous or other chemicals injurious to health; • Handling dangerous goods and specialized waste • Training • Provision of potable water • Working environment committee; • Use of helmets and other safety equipment • Personal injuries and accidents; • Damage to material, equipment and buildings • Poison treatment, chemical and fire injuries • Safety audit • Work done by hired personnel or firms • Operating cranes • Working with heat in confined places • Corrective action • Protective action; and, • Use of fall arrestors and anti-climbing devices to prevent public injury	Throughout the construction phase	PMU Contractor
Construction activities Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents			Supply drinking water and maintain its quality and ensure sanitation at the construction sites	Throughout the construction phase	Contractor
Construction activities Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	X	X	Develop and Implement an Hygiene, Health and Safety Management Plan according to OHSAS 18001: 2007 international standards	Prior to and throughout the construction phase	Contractor
Labor	Quality of life, health and safety	Risk of increased incidences of STIs and HIV / AIDS	X	X	Prepare and implement a STIsHIV/AIDS prevention program for both communities and workers	Prior to and throughout the construction phase	Contractor
Labor	Quality of life, health and safety	Risk of increased incidences of STIs and HIV / AIDS	X	X	Establish a voluntary and confidential STI screening program, including HIV / AIDS, for workers (to be included in subcontractor contracts)	Prior to and throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	X	X	Maintain construction camps in a clean and healthy condition as prescribed by international worker health standards.	Throughout the construction phase	Contractor
Labor	Social cohesion and gender	Tensions with outside workers	X	X	Communicate with communities effectively and involve their representatives	Prior to and throughout the construction phase	Contractor PMU
Labor	Social cohesion and gender	Disturbance of women subsistence activities	X	X	Encourage the recruitment of female workers	Throughout the construction phase	Contractor
Labor	Social cohesion and gender	Marginalization of women from the compensation process	X	X	Implement Resettlement Action Plan	Prior to and throughout the construction phase	PMU
Labor	Vulnerable groups	Increased marginalization of vulnerable groups		X	Encourage the recruitment of female workers	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites.			Apply the Physical Cultural Resources Management Plan	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites	X	X	Provide financial and logistical assistance for the relocation of known burial grounds, sacred sites, or any other cultural sites of importance to communities if needed	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites	X	X	Prepare and implement chance find procedures, including supervision of excavation works by an archeologist	Throughout the construction phase	Contractor
Construction Activities	Landscape	Temporary degradation of the landscape on the site	X		Use tubular pylon with modern design to reduce impact on the visual landscape of the Sokoto crossing area	Design stage	TCN
Construction Activities	Landscape	Temporary degradation of the landscape on the site	X	X	Minimize vegetation clearing around work areas	Throughout the construction phase	Contractor

Table 9-1 Management Measures to be Implemented During Pre-Construction/Construction Phase (cont'd)

Source of Impact	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Construction Activities	Landscape	Temporary degradation of the landscape on the site	X	X	Restore all temporary work areas, such as borrow pits and camp sites, as soon as possible	Throughout the construction phase	Contractor
Construction Activities	Landscape	Temporary degradation of the landscape on the site	X	X	Planting of trees or hedges in order to block the view in the ROW and camouflage particularly exposed and/or visible towers	Throughout the construction phase	Contractor

Table 9-2 Management Measures to be Implemented during Operational Phase

Sources of Impacts	VESC	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Facilities maintenance ROW management Transport and Circulation	Noise levels	Increase in noise levels	x	x	Provide all internal combustion equipment with properly functioning silencers or mufflers	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Prepare and implement an Emergency Response Plan	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Keep Spill Containment Kits readily accessible in the event of an accidental spill and ensure on-site staff is trained in spill response	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Contain any spills and clean up spills as soon as possible	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Document and report all spills to the FMEnv	Project lifetime	TCN
Facilities maintenance	Water resources		x	x	Grade ground surface at each tower site to provide drainage away from tower base.	Project lifetime	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Maintain all work inside the footprint of access road and RoW to reduce encroachment on natural habitats	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Clearly mark the extent of vegetation control in the ROW. Identify and mark the vegetation to be preserved along sections of the ROW	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Undertake selective control of the vegetation in order to keep low scrubby and herbaceous species that do not represent a risk for the powerline (species that cannot grow more than 4m in height)	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Dispose of organic material removed from the ROW properly and in collaboration with local communities	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Use mechanical method for vegetation control inside the ROW. Forbid use of chemical pesticides to control vegetation in the ROW	Throughout the operation phase	TCN

Table 9-2 Management Measures to be Implemented during Operational Phase (cont'd)

Sources of Impacts	VECS	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Undertake ROW vegetation cutting with the supervision of a botanist in order to identify and relocate if possible species of conservation concern as well as protect vegetation that does not represent a risk for the powerline. Any species of conservation concern that need to be cut will be located and its habitat will be fully described. This information will be integrated in the planning of reforestation program	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Potential introduction of IAS	x		Implement an IAS monitoring program following project construction and site re-vegetation in sensitive areas, forests reserves, and forest stands. Consider conduction along with ROW maintenance	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Potential introduction of IAS	x		Implement the vegetation management plan, including specific measures for IAS control	Throughout the operation phase	TCN
Presence and operation of line and substation	Terrestrial fauna	Bat collision and electrocution	x		Implement a bat mortality monitoring program in partnership with local communities	1 time/year in first 5 years of operation.	TCN
Presence and operation of line and substation	Avifauna	Bird collisions with grounding cables causing injuries and death.	x		Implement a bird mortality monitoring program in partnership with local communities Review mitigation measures according to their efficiency	2 times/year in first 5 years of operation. Once every 5 years later on.	TCN
Presence and operation of line and substation	Avifauna	Bird electrocutions and collisions	x		Develop specific mitigation measures for species that are involved in bird mortality	Throughout the operation phase	TCN
ROW maintenance	Avifauna	Modification and disturbance of bird habitat, with associated changes in bird communities	x		Schedule RoW maintenance activities to avoid breeding and nesting seasons of bird species with special status	Throughout the operation phase	TCN
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna. Potential introduction of invasive alien species	x		Undertake selective cutting of the vegetation in order to maintain low scrubby and herbaceous species that do not represent a risk for the power line (species that cannot grow more than 4m in height)	Throughout the operation phase	TCN

Table 9-2 Management Measures to be Implemented during Operational Phase (cont'd)

Sources of Impacts	VECS	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna Potential introduction of invasive alien species	x		Forbid use of chemical pesticides to control vegetation in the ROW	Throughout the operation phase	TCN
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna	x		Undertake monitoring of natural resources exploitation and implement a sensitization program in order to educate and increase local communities' awareness on natural resources protection	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna	x		Avoid destabilization of shores and sediments or other pollutants rejection in watercourses during road and wayleave maintenance	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna	x		Only excavate the lower third of ditches during drainage ditch maintenance in order to maintain ditch slope stability	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Potential introduction of IAS	x		Implement the vegetation management plan, including specific measures for IAS control	Throughout the operation phase	TCN
ROW maintenance	Land planning and use	Land use restriction in the ROW	X	x	Allow grazing cultivation in the ROW and wayleave, provided that plantations do not exceed 4 m in height. If possible, the ROW in urban area can be used for a number of purposes that will increase quality of life in neighborhoods crossed by the wayleave, e.g. gardening, playgrounds, walking paths	Throughout the operation phase	TCN
ROW maintenance	Land planning and use	Occasional infringement of crops by machinery for maintenance purposes	X		Plan for maintenance activities to be conducted outside of the growing and grazing seasons.	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, employment and livelihoods	Creation of temporary jobs	X	X	Apply human resources policies favoring local labor	Prior to the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, employment and livelihoods	Creation of temporary jobs		X	Implement training programs to build local capacity	Prior to and throughout the operation phase	TCN

Table 9-2 Management Measures to be Implemented during Operational Phase (cont'd)

Sources of Impacts	VECS	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
ROW maintenance Facilities maintenance	Economy, employment and livelihoods	Occasional infringement of crops by machinery for maintenance purposes	X		Compensate PAPs for any damaged crops during maintenance works		
ROW maintenance Facilities maintenance	Economy, employment and livelihoods	Creation of temporary jobs	X	X	Disclose information on newly created business opportunities	Prior to the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, employment and livelihood	Occasional infringement of crops by machinery for maintenance purposes	x		Carefully select the landing area of falling trees to minimize damages to crops.	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Vulnerable groups	n/a		X	Encourage the recruitment of female workers	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X		Maintain a minimum working distance of 2.13 m to the energized components during maintenance work	Throughout the operation phase	TCN
Presence and operation of the line and substations.	Quality of life, health and safety	Health problems associated with exposure to electromagnetic fields	x		Keep residences and other permanent structures such as schools, shops or offices out of the wayleave to minimize exposure to EMFs	Project lifetime	TCN
Presence and operation of the line and substations ROW maintenance Facilities maintenance	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X	X	Educate local populations to safe behavior in the presence of a high voltage power line	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X	X	Undertake awareness campaign to reduce bushfire and slash and burn practices under and close to the powerline	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X	X	Install warning signs and anti-climbing devices pylons	Throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X	X	Ensure the development of local and regional emergency plans in case of infrastructure breakdowns, especially near roads or residential areas	Prior to and throughout the operation phase	TCN

Table 9-2 Management Measures to be Implemented during Operational Phase (cont'd)

Sources of Impacts	VECS	Potential Impacts	Project Component		Mitigation Measures	Implementation Timing	Responsibilities
			Line	Substations			
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	X	X	Monitor and control illegal connections	Throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Health problems associated with exposure to electromagnetic fields	X	X	Educate the local population on Electromagnetic Field (EMF) risk	Prior to and throughout the operation phase	TCN
Presence of workers	Social cohesion and gender	Tensions between local populations and outside workers	X	X	Communicate with communities effectively and involve their leaders	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	X	X	Minimize the number of permanent access roads to and in the ROW. When possible, proceed to early closing and rehabilitation of temporary access roads nearby sensitive scenic areas	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	X	X	Allow tree and shrub species whose height is limited to 4m to grow within the ROW	Throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	X	X	Create visual barriers to reduce line visibility in sensitive areas when possible	Prior to and throughout the operation phase	TCN

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan set the implementation of proposed mitigation measures discussed in Chapter 9. Institutional framework for implementation as well as environmental and social surveillance and monitoring are discussed in next sections.

10.1 INSTITUTIONAL FRAMEWORK FOR IMPLEMENTATION

Responsibilities in the implementation and monitoring of the ESMP are shared between multiple stakeholders, including concerned ministries, competent authorities, the WAPP, the TCN and the contractors.

In this context, and to encourage the coordination of decisions as well as the appropriate application of the various management measures, of the specific management plans and of the ESMP, the WAPP and TCN will set up a Project Management Unit (PMU), who will be responsible for the project execution. Figure 10-1 illustrates the structure of such institutional organizations.

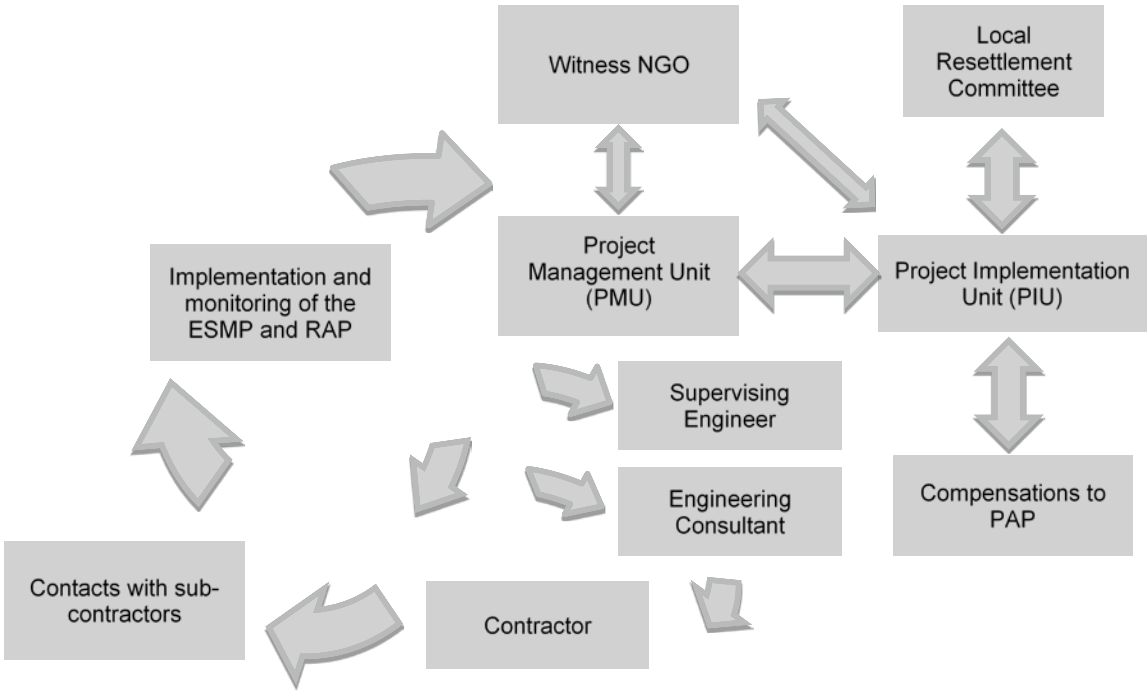


Figure 10-1 Institutional Arrangements for ESMP Implementation

10.1.1 PROJECT MANAGEMENT UNIT (PMU)

The PMU, consisting in a Technical Committee and in an Environmental and Social Management Committee, will be set up for the project implementation. The PMU will create a Technical Committee and an Environmental and Social Management Committee.

The Technical Committee should be composed of engineers and technical experts able to ensure compliance with the construction standards provided in the plans and specifications, bidding documents and contracts. The Technical Committee will oversee the Supervising Engineer who will supervise the Contractor responsible for the project construction. The Supervising Engineer will ensure that the Contractor (and its subcontractors) successfully implement the environmental and social clauses included in the contracts. The Supervising Engineer will have to recruit an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007 as well as a senior environmental specialist and a senior social specialist, which must have experience at the international level. The Supervising Engineer will be also responsible for day-to-day supervision of the Contractor as to ensure ESMP implementation as well as Health and Safety aspects during construction. The Supervising Engineer will also make sure that the Contractor recruits an Environmental expert and a Health and Safety expert with an OHSAS Certificate 18001: 2007 with experience at the international level as well as a liaison officers which will provide support for communications with local communities.

The Environmental and Social Management Committee should be composed of an environmental expert, a resettlement expert as well as an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007. They will be in charge to:

- → Oversee the proper application of mitigation and enhancement measures presented in the ESMP (including those relating to the RAP) that are the responsibility of the contractor and its subcontractors.
- → Implement management measures of the ESMP (including those related to the SEP and RAP) under their responsibilities.
- → Monitor the environmental and social performance of the project in accordance with the programs presented in the ESMP.
- → Do internal coordination with the PMU Project Engineer responsible for supervising the contractor in charge of the project construction.
- → Establish a mechanism for handling complaints and disputes with the communities and employees of enterprises. The PMU will have to set up a hotline for complaints.

The different specialists will be located in the project area, especially during the pre-construction / construction phase. These specialists will be supported by one or more liaison officers with the local communities and will have to master the local language (s).

The Environmental and Social Management Committee will also comprise experts from the professional TCN staff, and from departmental and local authorities that need to supervise the ESMP and RAP implementation.

These are notably:

- → Lands or Works department of LGA.
- → Kebbi state and Federal state Ministry of Environment specialists.
- → Land Use Advisory and Allocation Committee of the Kebbi State Ministry of Lands and Housing.
- → Representatives (4) of Local chiefs from affected communities.

Acting under the authority of the coordinators, each Committee will meet on a bi-monthly basis in the first weeks of the project, and then on a monthly basis unless more is necessary.

It is recommended that these Committee hire and appoint an environmental manager and technical assistants who will be responsible for monitoring on the field and a day-to-day implementation of the measures contained in the ESMP. These representatives will also be in charge of relations with local chiefs and PAPs to receive and document complaints and grievances related to environmental measures, nuisances, workers-population relations, etc. These complaints and related corrective measures will be discussed on a daily basis between the contractor and the environmental manager and reported to the committee at their regular meetings.

In the case of an incident that could potentially cause serious damage to the environment or equipment, the environment committee through its environmental manager will be authorized to stop work or to give instructions to the head contractor to ensure that impacts are minimized or eliminated. All cases need to be reported and discussed at the committee meetings.

In addition, the Environmental and Social Management Committee, as mandated by the TCN, will work closely with the Project Implementation Unit (PIU) created for the RAP implementation. The PIU will be in charge of the followings activities: estimation and delivery of compensation packages; livelihood restoration and vulnerable group assistance measures to affected households; reconstruction of community affected structures; implementation of the Community Compensation Fund's (CCF) funded measures.

The PMU should also have a Liaison Officer, to avoid and solve problems with the communities and to receive grievances. The liaison officer will work closely with the PIU.

10.1.2 PROJECT IMPLEMENTATION UNIT

Responsibility for the good implementation of the RAP lies on TCN. It is TCN's responsibility to insure the creation of the Project Implementation Unit (PIU) and to hire a witness NGO, with the help of the environmental committee of the PMU, at least one year before the start of construction activities, to insure implementation of the RAP.

This structure will take care of the implementation of the RAP, including the monitoring activities and implementation of the community compensation fund.

It is recommended that TCN hire, through a public proposal and selection process, a local consultant or NGO with good credentials to act as the PIU. An open bidding process must be put in place to recruit this organization.

This PIU should be in place to monitor the construction activities and impacts on environmental and social components, and implement the projects funded through the CCF.

It is estimated that the PIU will need to operate in full activity during 36 to 48 months (1 year before start of construction and all along construction operations) after which a limited team will monitor the long term impacts.

The PIU will be directed by a coordinator who will supervise all its associated activities.

The responsibilities of the PIU coordinator, approved by the various parties, will include:

- → Provision of information on activities and consultations with the PAPs.
- → Maintain an inventory of the goods 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 CCF.
- → Identification of the witness NGOs to be hired and facilitation of their involvement in the consultation activities, compensation and resettlement related activities.
- → Production of monitoring reports (see below) for the RAP implementation to appropriate government authorities, TCN and the contractor in charge of the line construction.

The PIU coordinator must rely on a team of professionals and support staff able to conduct all the following tasks. It is recommended that the PIU have:

→ **Support staff**: secretarial services, drivers, security and legal personnel, general accountants.

→ **Survey, Identification & Appraisal Team**: surveyors, appraisers, "option disclosure and agreement" officers in charge of relations with each PAP household (negotiations, compensation payment, PAP feed-back, etc.).

→ **Resettlement (house and community structures)**: ad-hoc urban planner and architect (consultants), engineers / construction supervisors.

→ **Cash compensation**: compensation officers, accountant, security officer.

→ **Database management**: database officers.

→ **Livelihood restoration and community forest**: agronomist / agro-foresters.

→ **Assistance to vulnerable people and displaced households**: social workers with at least one woman.

→ **Communication specialist**: Community engagement specialist (or a Liaison Officer) in charge of the information and participation program.

→ **CCF community project**: technicians or engineers on ad-hoc basis providing technical advices for community projects.

It is proposed that the PIU have offices located in easily accessible communities to facilitate transport, contact with population and local authorities. The PIU coordinator will assess the situation and propose proper localization to that effect.

The envisaged compensation amounts and resettlement modalities for each PAP will have to be approved and endorsed by the PAPs, the competent governmental authorities and by TCN.

Communities' and households' fears, regarding the non-payment of the claims, are important and widespread. In order to reduce those fears, it is strongly recommended that the approval of the start of the construction of the power line be conditional to the transmission of a satisfactory progress report from the PIU. This report must clearly establish, with the support of evidence, that compensations were paid, and that resettlement projects were successfully carried out prior to the initiation of the construction phase. The confirmation of the witness NGO of this report is essential.

Also, as a mitigation measure, the PIU should clearly identify the cut-off date (when will the verification survey come to an end and new compensation claims be refused) and disclose it well in advance to the PAPs and their representatives, provide them with the necessary contact information and procedures to fill in their compensation claims prior to the cut-off date.

10.1.3 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 PMU, 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 a recognized and credible Human Right advocacy group or a NGO active in rural development.

This outside look will ensure that proper procedures and stated compensation processes 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[1].

[1] Burnside and Associates Limited, 2006, Bujagali Interconnection Project Resettlement and Community Development Action Plan.

This NGO will revise PIU reports, 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 need be, to explain and discuss their difficulties of grievances.

10.1.4 CONTRACTORS

Each contractor shall appoint a qualified environmental manager who, after approval by the environmental and social management committee of the PMU, 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 manager appointed by the environmental and social management committee and the PMU during the entire construction period.

Furthermore, Contractor(s) will have to prepare and implement their own site specific Construction ESMP and Health & Safety Plan.

The liaison officers appointed, under the supervision of the environmental manager, will be in charge of ensuring that the work performed by subcontractors respect health, safety and environment directives. All national health, safety and environmental regulation as well as ESMP and RAP recommendations that meet international best practices, will have to be respected.

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

10.2 SUPPLEMENTARY INITIATIVES

The integration of environmental and social issues in the implementation of the North Core Project requires the application of two fundamental documents: the detailed Environmental and Social Management Plan and the Resettlement Action Plan. These two documents constitute individual but interrelated components of the project's environmental and social management strategy. They are summarized below and are reported separately.

10.2.1 DETAILED ESMP

The Environmental and Social Management Plan (ESMP) identifies more specifically the targeted objectives and the management measures to be implemented in order to ensure the optimal environmental integration of the North Core Power Line project, in compliance with national bylaws, but also with international best known practices applied in similar projects. The ESMP is intended to be useful, practical and operational.

The project's components are strongly linked with the conclusions from the environmental and social impact assessment study report. The ESMP encompasses the global methodology for the environmental and social management during the pre-construction/construction and the operational phases. It also comprises guidance in case of installations dismantlement. It clearly defines specific approaches that managers, employees and subcontractors should adopt. The ESMP combines the whole of the recommended management procedures as well as the specific plans prepared in order to avoid, enhance or mitigate the various anticipated risks and impacts, at the stakeholders' satisfaction.

The ESMP clearly attributes all roles, responsibilities and intervention areas to adequately identify and manage negative impacts on workers, on communities and on the environment within the project area and in its surroundings. The ESMP includes a summary of environmental and social impacts, a description of management measures, specific management plans as well as a monitoring system for the environmental and social performance, in an objective of continuous adaptation and improvement. The environmental and social management methodology used in this ESMP is presented in Figure 10-2.

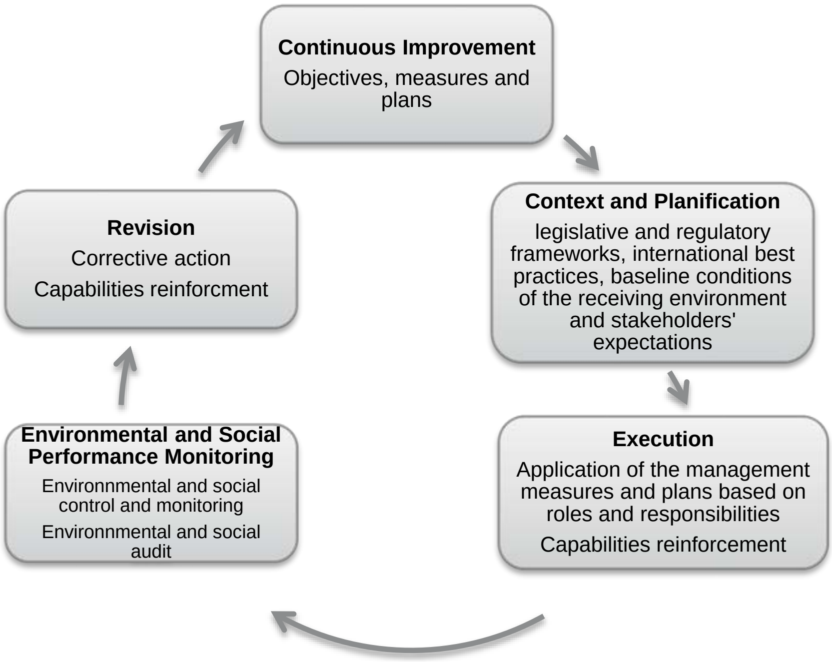


Figure 10-2 Environmental and Social Management Methodology Used in the ESMP

The various supplementary initiatives included in it are mainly:

- → The Vegetation Management Plan to lay down the basis for proper maintenance of the vegetation which does not compromise the safety of the power line while allowing the protection of terrestrial habitats and their ecological role. Budget: US $ 60 000 (NGN 18 900 000).
- → The Revegetation and Erosion Control Plan to compensate any loss of habitat and rehabilitate affected areas to protect local flora and fauna, protect access to ecosystem services for communities as well as to avoid and control any erosion phenomenon associated with the project activities. Budget: US $ 25 000 (NGN 7 875 000).
- → The Waste Management Plan, which outlines the management of residual waste materials. Budget: US $ 40 000 (NGN 12 600 000).
- → The Physical Cultural Resources Management Plan which proposes clear and realistic management measures aimed at the conservation of the physical cultural heritage linked to the archaeological sites and burials as well as its protection against the negative impacts resulting from the construction, operation or any other aspect of the project (budget: included at contractor's cost).
- → The Emergency Management Plan is the reference document to minimize the risks to employees, the population and the environment associated with the project (budget: included in contractor costs during construction $ 20 000 US (NGN 6 300 000).

These plans outline the various basic elements contained therein. However, they will have to be detailed prior to project implementation in order to ensure the full applicability of the measures they contain. It is important to mention that all the companies that will be in charge of the construction phase will have to develop a construction ESMP that clearly states how they will implement the various requirements identified in the ESMP. This construction ESMP will include a Hygiene, Health and Safety (HHS) Plan according to OHSAS 18001: 2007 international standards and strict procedures for in-water works and a Transport Management Plan, a Labor Influx Management Plan and a Workers Camp Management Plan.

These plans will also be reviewed periodically and adapted throughout the implementation of the project. The development and implementation of these plans will vary according to the plans and phases of the project. The following table identifies the responsibilities for developing and implementing plans during the pre-construction / construction and operational phases.

Table 10-1 Responsabilities for the development and implementation of proposed specific management plans

Plan	preconstruction/construction Phase		Operation Phase	
	Development of Detailed Plan	Implementation	Development of Detailed Plan	Implementation
Vegetation Management Plan	Contractor	Contractor	PMU	PMU
Revegetation and Erosion Control Plan	PMU	PMU	--	--
Waste Management Plan	Contractor	Contractor	PMU	PMU
Physical Cultural Resources Management Plan	Contractor	Contractor	--	--
Emergency Management Plan	Contractor	Contractor	PMU	PMU
Hygiene, Health and Safety Plan	Contractor	Contractor	PMU	PMU
Transport Management Plan	Contractor	Contractor	-	-
Labor Influx Management Plan	Contractor	Contractor	-	-
Workers Camp Management Plan	Contractor	Contractor	-	-

10.2.2 RESETTLEMENT ACTION PLAN

The Resettlement Action Plan (RAP) presents the stakeholder's eligibility to compensation aspect and resettlement program details for the local community and PAP. Given the approval of the RAP by the competent authorities and the Transmission Company of Nigeria (TCN), a comprehensive framework of measures were presented to the PAPs during local community consultations. The information provided during the consultations reduced any concern that may be raised by the PAPs, favoring their approval and their collaboration through the census and socio-economic survey. Further consultation and information activities will be performed during implementation of the resettlement compensations.

The RAP's goals and objectives are the followings:

- → To minimize involuntary resettlement through the optimization of the line route in collaboration with the environmental, technical specialists and relevant stakeholders (see section 2).
- → To address social issues related to land acquisition and to address livelihood restoration due to construction activities and other project related infrastructure construction.
- → To optimize compensation measures and support to all stakeholders through the identification and consultation of stakeholder and PAPs concerns (see section 4).
- → To prepare cost estimates for resettlement/compensation through measuring the affected assets and socio-economic status of the PAPs, identifying vulnerable PAPs and households, and assessing compensation and mitigation measures (see section 5-6-7-8).
- → To assess opportunities for affected communities and PAPs to have them benefit from the project's positive impacts (see section 8).
- → To provide baseline information to be able to, through post-project comparison, assess whether the PAP's socio-economic situation, as a result of the project, has positively changed or has maintained a status quo.
- → To comply with applicable laws in Nigeria in order to obtain the environmental authority's approval.
- → To integrate the best practices during project implementation in order to comply with guidelines of funding agencies, namely the World Bank (WB), the African Development Bank (AFDB), and the European Union (EU) and therefore facilitate international funding.

The evaluation of the social impacts of resettlement, carried out through field surveys, documents and stakeholder consultations and socioeconomic census of Project affected persons (PAPs) and assets, revealed that the North Core project had impacts on 448 PAP and the following assets:

- 25 houses and related secondary structures.
- 6 commercial structures.
- 3 community structures (1 Islamic school and 2 Mosque).
- 1 cooperatively cultivated marshland.
- 121.9 acres of land (531 parcels affected) will be expropriate for the ROW.
- 443 trees need to be destroyed and compensate.

Compensation for all these assets are prescribed in the RAP.

Various measures to restore income and livelihoods and provide post-displacement support are foreseen by RAP or will be developed during implementation.

These measures are:

- Reinforcement of agricultural practices and trees plantation.
- Assistance to PAP in all administrative steps for parcel transaction.
- Income support during household move.
- Assistance to vulnerable groups (administrative support, special economic allocation, etc.).
- Priority for employment and other benefits.
- A Community Compensation Fund will also be made available to affected communities to improve their infrastructures and services.

The total amount of the RAP is 1 385 637 783 Naira or 4 398 850 USD. The compensation strategy for project affected persons, the implementation responsibilities and the associated budget are described in detail in the RAP[2].

10.3 STAKEHOLDER ENGAGEMENT PLAN

From the start of the project implementation, a detailed Stakeholder Engagement Plan (SEP) will be developed and adopted by TCN. The following section is intended to provide guidance for the implementation of such a plan. It outlines the general objectives of the SEP, the target groups and the suggested methods of communication. The resource requirements and institutional organization for the implementation of the SEP are also discussed.

10.3.1 OBJECTIVES

The Stakeholder Engagement Plan aims to identify the preferred mechanisms for facilitating sustained communication with local communities and other external stakeholders in the pre-construction / construction and operation phases. Its main objectives are to:

- Maintain a social and institutional dialogue through which the population, authorities and other organizations concerned by the project will be informed about the activities of the project and will be able to express their opinion on the nuisances, risks or opportunities perceived in connection with the project, as well as on the measures and actions to be taken in response to the perceived or anticipated impacts.
- Ensure compliance with good public engagement practices in the implementation of major infrastructure projects.
- Ensure that the project implementation process contributes to strengthening TCN's efforts to build lasting relationships with affected communities, relevant authorities and other stakeholders.

[2] WSP (2017). *330 kV WAPP North Core Project - Nigeria - Niger - Burkina Faso - Togo/Benin - Environmental Impact Assessment Scoping Report update – Resettlement Action Plan - Nigeria*, Final Report. Various pages and appendices. Ref. 141-24307-00

10.3.2 TARGET GROUPS

The stakeholder groups targeted by the SEP include:

- → Relevant national ministries and agencies.
- → Local government authorities and technical services.
- → The communities crossed by the line route and the populations near the substations.
- → NGOs and civil society organizations in the fields of nature conservation, development and human rights.

A detailed list of the structures, organizations and communities identified as project stakeholders in NIGERIA is presented in Appendix 3.

10.3.3 STAKEHOLDER ENGAGEMENT PROGRAM

10.3.3.1 PRE-CONSTRUCTION PUBLIC EDUCATION CAMPAIGN

Prior to undertaking the implementation of the project, and once the sitting of the final line route has been completed, a public information and awareness campaign will be carried out to ensure a fair understanding by the affected communities of the project, the final line route and the main conclusions and recommendations formulated by the ESIA and RAP. This campaign will be developed and coordinated by the consultant responsible for the ESIA and RAP studies, in close collaboration with TNC. It will notably allow for the public disclosure of information in connection with:

- → The objectives and expected benefits of the project.
- → The timetable for the implementation of the project.
- → Anticipated environmental and social impacts and associated preventive and mitigation measures.
- → Compensation and resettlement assistance measures for affected households.
- → The public safety hazards associated with the presence of a power line and proposed mitigation measures.

The public information and awareness campaign will involve the following activities:

- → Field reconnaissance walks with representatives from each affected village or neighborhood to locate the line route.
- → Mobilization of concerned local government authorities (LGA) and technical services through an information meeting to be held in each one of the LGA affected.

To assist stakeholders in preparing for these meetings, non-technical summaries of the ESIA and RAP studies will be produced for public consultation and distributed at least two weeks prior to the meetings.

10.3.3.2 COMMUNICATION ACTIVITIES DURING PRE-CONSTRUCTION / CONSTRUCTION PHASE

Throughout the right-of-way clearing, land preparation and construction works, affected communities and other stakeholders will be notified in advance of the nature and timelines of the work planned. Information publicly disclosed will include the following:

- → Previous announcements of planned field activities (objectives, nature, organizations involved and timelines).
- → Any significant adjustments to the overall schedule, if any.
- → The anticipated local labor needs in the short and medium terms.
- → The results of the environmental and social monitoring program.
- → The evolution of the implementation of RAP and other specific management plans.
- → The dangers to public safety associated with the presence of a power line, the mitigation measures adopted and the dangerous behaviors to be avoided.

The preferred means of communication for this phase of project implementation include:

- → The mobilization of local government authorities and technical services during information and consultation meetings held every six (6) months during construction.
- → The production of a bi-weekly public information newsletter, for general and personalized distribution (targeted mailings), in English and in the local language of the project area.
- → Public adverts in the local media (newspapers and radio) to announce the start of work and any other steps of relevance to the public.
- → The distribution on TNC's website of bi-monthly bulletins and public notices.
- → The holding of individual meetings with the main ministries concerned by the anticipated impacts of the project, including Agriculture, Animal Resources, Environment and Forests, Land Use Planning and Road Infrastructure. These ministries will be met once before construction begins, and thereafter on an *ad hoc* basis when deemed useful.

10.3.3.3 COMMUNICATION ACTIVITIES DURING THE OPERATIONAL PHASE

During the project's operational phase, the following information will be made available to communities and other stakeholders in an accessible format and language:

- → Results of the project's environmental and social monitoring program.
- → Planning of maintenance works on the right-of-way and facilities.
- → Guidelines for land use restrictions within the right-of-way.
- → The dangers to public safety associated with the presence of a power line and the dangerous behaviors to be avoided.

The preferred means of communication for this phase of project implementation include:

- → The production of an annual report on the project's environmental and social performance, presenting a summary of the results of environmental and social monitoring, for disclosure to the general public in English and in the local language of the project area.
- → The mobilization of local government authorities and technical services through information meetings held annually during the first two years of operation and every two years thereafter. A copy of the annual report on the project's environmental and social performance will be provided to the individuals concerned prior to the meetings.
- → The filing of a copy of the annual report on the project's environmental and social performance in each town hall concerned, as well as on TNC's website, for public consultation.
- → Public adverts in the local media (newspapers and radio) to announce any major or irregular maintenance work.

10.3.4 RESOURCES AND RESPONSIBILITIES

The lead project manager within TNC will be responsible for the overall stakeholder engagement process, its diligent implementation and its success. The primary duties and responsibilities of the process will be assigned to the Health, Safety and Environment Manager.

TNC will ensure the availability of adequate human and financial resources on an ongoing basis for the development and effective implementation of the SEP. Under the supervision of the Health, Safety and Environment Manager, a Stakeholder Relations Manager will be appointed and responsible for implementation of the entire community engagement process. During the construction period, this Stakeholder Relations manager may be assisted by LGAs' community relations officers for the communication activities planned for the municipalities and villages concerned. All staff involved in stakeholder engagement activities will receive adequate training on the environmental, social and safety issues associated with the project and transmission lines in general, as well as on TNC's corporate policies so as to ensure that discussions with stakeholders are based on accurate information.

10.3.5 IMPLEMENTATION COSTS

A preliminary estimation of SEP implementation costs is given below, for indicative purposes only:

- Communication activities during the pre-construction / construction phase: 40,000 USD/year.
- Communication activities during the operational phase: 20,000 USD/year.

10.4 GRIEVANCE MECHANISM

Grievance redress mechanisms are essential tools for allowing stakeholders affected by the Project to voice concerns about environmental and socioeconomic issues affecting them as they arise and, if necessary, for corrective action to be taken in a timely fashion. Such mechanisms are fundamental to achieving transparency in the ESMP implementation process. The grievance redress procedure includes the use of records (grievance log) to determine the validity of claims.

It is essential that all projects incorporate a Grievance Redress Mechanism and one that is accessible, free, easily understood, transparent, responsive and effective, that does not restrict access to official grievance channels (such as the courts including traditional courts), and causes no fear of negative consequences for its recourse amongst users. Affected individuals and households should be informed about the existence of a grievance redress mechanism. General information regarding the existence of such mechanisms should be made public through community consultations.

The objective of the proposed grievance redress mechanism is to respond to the complaints of aggrieved villagers in a fast and transparent manner, and to ensure that they have avenues for presenting and addressing their grievances related to any aspect of the ESMP.

Potential grievances and disputes that arise during the course of implementation of the ESMP are often related to the following issues:

- Issues related to influx of labour including inflation, gender-based violence, sexual abuse and child abuse among others;
- Dissatisfaction regarding economic benefits to local communities during construction/operation phases;
- Issues related to nuisances caused by construction works such as dust and other air pollutant emissions, noise emissions, drinking water pollution, etc.;
- Environmental impacts affecting ecosystem services used by community members (ex. water pollution or hydrological regime modifications affecting fisheries resources);
- Issues related to effects of land-use changes caused by the project construction or operation;
- Issues related to damages caused to village or district infrastructures (roads among others);
- Disturbance of important cultural and archaeological heritage elements;
- Increased marginalization of vulnerable groups.
- And any other possibilities.

With respect to the implementation of the RAP, the complaints are mainly those related to the process and those related to ownership.

- Process complaints and litigation are typically associated with the following causes:
  - the omissions of assets in the surveys;
  - Wrong registrations of personal or community data;
  - errors in the identities of the people affected;
  - undervaluation feelings;
  - the basis for calculating compensation;
  - resettlement conditions;

  - disagreements on parcel boundaries, fields either between the affected people of the same locality or between two neighbors;
  - disputes over the ownership of a property or land use (two or more affected persons claim to be the owner of a certain property);
  - disputes over the sharing of compensation.
- Complaints and disputes over the right of ownership usually relate to the following cases:
  - the recent change in ownership of the asset;
  - succession in inheritance;
  - divorces;
  - the appropriation of a common good or production capital put in place by several people;
  - landholdings

The practice of grievance arbitration over resettlement issues in Nigeria is conducted within the framework of the Land Use Act (LUA) of 1978, reviewed under Cap 202, 1990. Two stages have been identified in the grievance procedure: customary mediation and judiciary hearings.

A grievance procedure based on community grievance committees, one per LGA, will be established for resolution of the disputes and complaints before the pre-construction phase for RAP implementation. This procedure created during RAP implementation should continue during the construction and operation phases and the same grievance process should apply.

10.4.1 CUSTOMARY MEDIATION

Procedures for grievances will be clearly explained during community meetings. At the village levels, a series of customary avenues exists to deal with dispute resolutions. Those avenues should be employed, when and where it is relevant as a “court of first appeal”.

Such customary avenues should provide a first culturally and amicable grievance procedure that will facilitate formal and/or informal grievance resolution for grievances such as:

- Wrongly recorded personal or community details;
- Wrongly recorded assets including land details and/or affected acreage;
- Change of recipient due to recent death or disability;
- Recent change of asset ownership;
- Wrong computation of compensation;
- Name missed out of register, etc.

A Customary Grievance Redress Committee (CGRC) shall be set up by the PIU in each LGA to address complaints from RAP and ESMP implementation. This committee will be assisted by the PIU who will act as TCN representative and its members will include:

- Representative of State Ministry of Land and Housing (Chairperson);
- Representative of Land Administration- (Secretary);
- Representative of the local Government Area (s) (Member);
- Respected local Elders (Members);
- Representative of Village Head of affected village (s);
- Representative of the Emirate Councils from all affected Emirates;
- Representative of Witness NGO.

PAPs’ or other stakeholders complaints should first be lodged verbally or in writing through this process via the Village Head.

It is expected that the committee will deal with the grievances they receive via the Village Head within three days of receipt of the complaint. The proposed solution will be presented to the PAP or other stakeholders in person if he attends the CGRC meeting, or by the PIU if the PAP is not present. If the complaint cannot be resolved at this level, or if the plaintiff is not satisfied with the settlement proposed, the plaintiff should then be referred to the official legal procedures.

10.4.2 COURTS OF LAW

The judicial process in accordance with applicable laws will be followed and the law courts will pass binding judgment on the matter.

10.5 ENVIRONMENTAL AND SOCIAL SURVEILLANCE

Environmental and social surveillance aims at ensuring that commitments regarding environmental and social measures included in the ESIA, and more particularly in the ESMP, are fully respected at the implementation phase. At first, this monitoring includes the validation and integration of management measures (avoidance, mitigation, compensation, improvement) and other environmental considerations from the plans and specifications, and then their implementation during construction. It also includes the global application of the management solutions proposed and the considerations raised by the contractor that oversees the construction phase. To facilitate surveillance operations, the contractor will have to hire an environmental specialist to verify the obedience to environmental and social measures. The non-obedience and unconformity could result in penalties. It will be possible that a contractor could not be paid because it contravenes to its environmental and social commitments. The environmentalist of the supervising engineer will also play a key role in the daily surveillance of the implementation of environmental and social measures during construction phase.

In addition, before starting construction work, WAPP and TCN will internally appoint a responsible person for environmental monitoring. The person responsible for environmental monitoring will be present on site on a regular basis, will be easily reachable at all times during construction and will be mandated to ensure the practical application of management measures on-site. This person will collaborate with the environmental specialist hired by the contractor. The role and authority of this specialist will be clearly defined in the environmental specifications to be provided to the contractor, but he/she will have sufficient power to compel the contractor to change his working procedures and techniques.

In addition to ensure the implementation of all management measures, those responsible for environmental surveillance will spot non-conformities, propose corrective measures and guide decision-making on-site in relation with environmental issues.

In summary, the activities related to environmental monitoring will allow:

- Overseeing the application of management or enhancement measures contained in the ESIA and in plans and specifications.
- Conducting on-site work inspections and reporting all non-conformities, or new issues or impacts not previously identified, to the contractor.
- Supervision of higher impact activities or activities occurring in sensitive zones (deforestation, work in aquatic environments such as floodplains or banks or near cultural or collective sites etc.) to constrain impacts.
- Recording all complaints and concerns raised by affected communities.
- Evaluating the efficiency and the quality of management procedures and identifying, in consultation with the environment committee of the PMU, alternative measures to put in place to resolve any unforeseen problems that may occur during the work.
- Ensuring that the work is performed in accordance with national environmental requirements and international best practices adopted by the funders.
- Addressing Health & Safety Supervision.

Corrective actions will then be added to the monitoring program to ensure there is a follow-up on their application and efficiency. The environmental and social surveillance program includes on-site inspections along with samplings, specific observations or investigations in neighbouring communities.

Surveillance will focus on the application of proposed management measures during construction phase. Detailed management plans to be produced will also propose surveillance methods and indicators to be included to the surveillance program. Different surveillance measures specific to the implementation of the various components of the RAP are also specified in the RAP and are part of the project monitoring program. The following Table shows additional measures, mainly at the level of the affected components, which should also be integrated into the monitoring program.

Biannual environmental surveillance reports will be provided to ministerial authorities during the work period.

10.6 ENVIRONMENTAL AND SOCIAL MONITORING

Environmental and social monitoring is an essential component of the ESMP; it allows evaluating the environmental performance during the project's operation phase. Essentially, this exercise should provide ongoing information on actual changes occurring in natural and socio-economic systems as a result of the project implementation. It also allows validating the implementation of the planned management strategies.

Throughout the project cycle, the monitoring of environmental and social performance allows a continuous assessment and improvement of the proposed management measures' efficiency, thus contributing significantly to the sustainable development of the project. Monitoring efforts are applied at different levels (local, along the ROW and in nearby communities or at national level) and therefore require the cooperation of several participants.

The elements included in the project follow-up are: location, frequency, and the designated officials. They are listed in the Table 10-3. It should be noted that the description of the ROW's initial conditions will have to be undertaken at the end of the work. The baseline data collected, in particular during the surveillance, will be compared with data collected during the monitoring.

Table 10-2 Specific Environmental and Social Compliance Measures

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Soil integrity	Visual inspection of construction sites and access roads Site assessment after a spill or identification of soil contamination	Signs of erosion, area involved, level of erosion, type of soil involved, period Sign of compaction, areas involved Signs of contamination Time needed to apply emergency measures plan (EMP) and to ask for corrective actions, if needed	Avoid the installation of erosive processes or control them Reduce soil compaction Avoid soil profile structure destruction Avoid any soil contamination	Along the ROW, access roads and work areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Hydrology	Visual inspection of natural water flow	Sign of obstruction to natural water flow Respect of natural run-off Proper dimensioning of culvert in regard to natural water flow along the access road	Ensure there is no obstruction to water flow and that size of culverts is well designed and well installed	Sokoto river and its floodplain, Selected sites along intermittent watercourses Construction sites for natural run-off	Continuously during works on water and near aquatic environments Twice a month run-off	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Water quality	Visual inspection of construction sites Evaluation of the time needed to apply EMP and to ask for corrective actions, if needed	Intensity of suspended particles in water (turbidity) Signs and intensity of water contamination	Avoid significant degradation of baseline conditions Comply with national standards	Sokoto river and its floodplain, Selected sites along intermittent watercourses crossed by the ROW Workers' camps Communal water withdrawal points near work sites in case of contamination	Twice a month during construction work on water and near aquatic environments	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Air quality	Visual inspection of construction sites, access roads; verification of equipment and machinery	Intensity of particle material in the air Exhaust emissions from vehicles, equipment and machinery	Avoid significant degradation of air quality	Along ROW, access roads and work areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Noise Levels	Inspection of construction sites Sampling during noisy activities with a sound level meter in trouble zones	Number of noise complaints dB	Conformity to national noise standards	In communities and cluster of houses close to construction sites with noisy activities	During noisy activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Vegetation integrity	Visual inspection of construction sites and access roads Vegetation surveys	Vegetation integrity outside ROW (area of affected vegetation and species composition)	Avoid significant degradation outside the ROW Protection of flora species with conservation status	Along and inside ROW and substation site	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Aquatic habitat integrity	Visual inspection of construction sites and access roads	Aquatic habitat integrity Number and area of degraded habitat Composition of degraded habitat	Avoid significant degradation of aquatic habitats	Sokoto river and its floodplain, Selected sites along intermittent watercourses crossed by the ROW	Continuously during works on water and near aquatic environments	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Birds conservation	Bird nests inventory within the ROW	Number of nests, species involved, threatened species, active or old nests	Avoid nest destruction, especially active ones or those of threatened species	ROW and substation site	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Fauna protection	Visual inspection of construction sites and access roads	Observed species, mortality, species involved, age, number of individuals, threatened species	Avoid habitat loss and disturbances for local fauna	ROW and substation sites	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Existing infrastructures	Visual inspection of access roads	Length of created access road	Reduce the length of created access road	Along the ROW	Monthly	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Nuisance felt by neighbouring communities	Grievance mechanism and surveys among communities	Type of nuisance, measures implemented to solve the problem, solved problem	Support the quality of life during the work period, in or around populated areas	Along ROW and substation sites, especially in populated areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Local and regional economy	Assessment of local communities' involvement in work or in the procurement of goods and services to the contractor	Number of locals involved in works Number of working days for locals Proportion of local workers and days of works for locals	Support local economy	Neighbour communities along ROW	During the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Local and regional economy	Grievance mechanism	Number of affected tourism and leisure activities	No affected communities	Along the ROW	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Workers health and safety	Complete register of the cause and type of injuries/accidents within communities	cause and type of injuries/accidents within communities	No injuries or accidents	At all construction sites	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Communities' health and safety	Complete register of the cause and type of injuries/accidents within communities	Cause and type of injuries/accidents within communities	No injuries or accidents	Communities in the ROW and near substation site	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Cultural and archaeological heritage	Register mechanism during construction work	Number of discovered heritage movable or immovable objects, sites, structures, groups of structures Conformity to the procedure of the Physical Cultural Resources Management Plan	No affected components of cultural or archaeological heritage	Along the ROW	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Land use	Visual inspection of construction sites and access roads, as well as properties used for cultures, livestock and other activities Grievance mechanism	Affected areas outside the RoW Rehabilitation of affected areas	Avoid encroachment into areas used by neighbouring communities not identified on the plans and specifications	ROW and substation sites	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Table 10-3 Environmental and Social Monitoring Components

Component	Method	Indicators	Standards / Targets	Location	Frequency	Responsibility
Noise level	Noise measurement	dBA	National standards	Sampling in communities and dwellings closest to the substations Representative sampling along the powerline	Annually for the first five years during rainy season	TCN PMU's Environmental committee
Electromagnetic fields	Sampling with proper device	µT	WHO	Along the ROW with representative sample of zones with human activities (crop areas, urban and rural zones etc.)	Annually for the first five years	TCN PMU's Environmental committee
Soil integrity	Visual inspection of construction sites and access roads	Signs of erosion, area involved, level of erosion, type of soil involved, period Sign of compaction, areas involved Signs of contamination Time needed to apply emergency measures plan (EMP) and to ask for corrective actions, if needed	Avoid the installation of erosive processes or control them. Reduce soil compaction Avoid soil profile structure destruction	Work areas in use and around pylons	Annually during the whole operational phase	TCN PMU's Environmental committee
Surface water quality	Visual detection of pollution or contamination signs (presence of oil, waste, etc.) Evaluate the time needed to apply the EMP and to ask for corrective actions, if needed	Intensity of suspended particles in water Signs and intensity of water contamination	Avoid significant degradation in relation with baseline conditions.	Selected sites along rivers and streams crossed by the ROW Downstream of electric substations	Twice per year for the first five years, in rainy season and in dry season. Then once every two years	TCN PMU's Environmental committee
Plant communities	Evaluation of the plant communities' composition via flora surveys	Number of species and families per habitat type Number of threatened species Number of exotic invasive species	Follow the plant communities' evolution after eventual degradation from openings and border effects Identification of invasive species	In the different types of habitats found in the ROW, focussing on areas with higher ecological integrity	Annually for the first five years, then once every two years	TCN PMU's Environmental committee

Component	Method	Indicators	Standards / Targets	Location	Frequency	Responsibility
Integrity of aquatic habitats	Evaluation of the presence of aquatic habitats and of their integrity	Aquatic habitat description Signs of degradation	Ensure the conservation of wildlife habitats	Zones where streams and wetlands are crossed	Annually for the first five years, then twice a year	TCN PMU's Environmental committee
Wildlife poaching	Validate the presence of a wild meat market with wildlife officers	Trends in poaching and bush meat markets	Avoid traffic of bush meat hunted from the line's ROW and access roads	In areas within a 5 km distance from existing roads	Annually for the first ten years	TCN PMU's Environmental committee, in collaboration with wildlife authorities
Bird or bat mortality	Monitoring of the mortality rate caused by collisions and/or electrocution	Species involved, location of the carcasses, period, number of threatened species individuals involved	No bird or bat mortality	Along the ROW and specifically in targeted zones (highest risk of collisions)	Three times for the two first years (targeting migration period), then annually	TCN PMU's Environmental committee, in collaboration with local communities
Social and Economic advantages for local communities	Monitoring of the rate of rural electrification and number of development projects	Number and rate of electrified communities number of development projects	Maximizing economic benefits for communities	Communities within ten km from the ROW and substation sites	Annually	TCN PMU's Environmental committee
Employees' health and safety	Complete register of the cause and type of workers' injuries/accidents	cause and type of workers' injuries/accidents	No injuries or accidents	Employees working in the line	Annually	TCN PMU's Environmental committee
Communities' health and safety	Register on HIV/AIDS prevalence in local population	Prevalence of HIV/AIDS	No propagation attributable to the project.	Communities in the ROW and near substation site	Annually	TCN PMU's Environmental committee, in collaboration with Health authorities
Communities' health and safety	Complete register of the cause and type of injuries/accidents within communities	cause and type of injuries/accidents within communities	No injuries or accidents	Communities in the ROW and near substation site	Annually	TCN PMU's Environmental committee, in collaboration with local communities

10.7 IMPLEMENTATION TERMS AND COST SUMMARY

10.7.1 IMPLEMENTATION SCHEDULE

On top of being a reference source in the management of environmental impacts of the project, the ESMP is also a guide for the rolling-out of various steps and procedures that are necessary for its sound implementation. The following provides an overview of the key logical steps necessary to ensure the efficiency of the ESMP, avoid doubling efforts and make sure that information is shared among all key project parties.

The pre-construction phase enables the creation of both PMUs, including the technical committee as well as environmental and social committee, according to the guidelines provided above. The fact that several individuals have to contribute to either the PMU or to committees on a regular basis calls for a sound selection of the members. Institutional continuity is key in this process, and changes in the composition of the teams should be kept to a minimum to maximise their efficiency. Therefore, nearly three months are attributed to the identification, selection and preparation (including training) of the PMU and PIU teams.

When the final right of way will have been selected, the pre-construction phase will lead to the land acquisition, associated to resettlement, and compensation of affected households. It is proposed that compensation of affected households start one year prior to the beginning of construction activities. An awareness program for PAPs will also be undertaken.

The construction phase is characterized, with regards to the ESMP, by the clearing of the ROW. In parallel with these activities is the implementation of the ESMP and its monitoring by the PMU. It is crucial that responsibilities for the implementation, supervision and monitoring of the ESMP are clearly defined. In the first year of the operation phase, some ESMP measures will be implemented associated to impacts arisen during the construction phase, as well as the monitoring of the vegetative state of revegetated areas and the well-being of resettled households. More generally, during the operation phase, a lot of effort will be devoted to the monitoring of the project performance according to environmental and social indicators.

A detailed ESMP transmission line and substation implementation schedule is proposed in tables below.

Table 10-4 ESMP and RAP Implementation Schedule – Line

	Activities	Months before Project Start												Year 1												Year 2												Year 3										
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	11	12
Phase 0 : Preparatory activities for Pre-construction phase (6 months)																																																
0,1	Setting-up of PMU's Environmental Committee and PIU NGO witness recruitement		x	x		x	x		x	x	x	x	x																																			
0,2	Implementation of training program							x		x		x																																				
0,3	Communities information and awareness		x	x			x		x	x			x						x						x						x						x						x					
0,4	Instruments, procedures and monitoring and compensation processes									x	x																																					
0,5	Right of way identification and establishment									x	x																																					
0,6	Plot/land investigation and structure identification										x	x																																				
0,7	Implementation of local resettlement committee (LRC)											x	x																																			
0,8	Compensation standards identification												x																																			
0,9	Compensation evaluation and signing of an agreement						x						x	x																																		
0,10	Preparation of Detailed Management Plans			x	x	x	x	x	x	x	x	x	x																																			
Phase 1 : Pre-construction (6 months)																																																
1,1	Reconstruction of houses and community structures													x	x																																	
1,2	Payment of compensations to PAP														x	x																																
1,3	Assessment and resolution of grievances														x	x																																
1,4	Population resettlement															x	x																															
1,5	Right of way freeing																	x	x																													
1,6	Implementation of Compensation and Revegetation Plan																	x	x																													
1,7	Implementation of Revegetation and Erosion Control Plan																	x	x																													
1,8	Implementation of Stakeholder Engagement Plan																	x	x																													
Phase 2 : Purchase and Construction (18 months)																																																
2,1	Mitigation and improvment measures implementation																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,2	Assessment and resolution of grievances																			x				x					x				x				x											
2,3	Implementation of Waste Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,4	Implementation of Vegetation Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,5	Implementation of Physical Cultural Resources Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,6	Implementation of Emergency Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,7	Implementation of Higiene, Heatlh and Safety Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,8	Implementation of environmental monitoring program																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,9	Implementation of Stakeholder Engagement Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
2,10	Restauration of income generator assets																					x	x					x	x							x	x											
2,11	Achievement of community support activities																							x	x					x	x						x	x								x	x	
Phase 3 : Operation and Decommissioning (3 months)																																																
3,1	Implementation of mitigation and improvment measures																																					x	x	x								
3,2	Environmental monitoring program implementation																																						x	x								
Operated by TCN																																																
TCN.1	Implementation of mitigation and improvment measures																																								x	x	x	x	x	x	x	x
TCN.2	Vegetation Management Plan																																								x	x	x	x	x	x	x	x
TCN.3	Revegetation and Erosion Control Plan																																								x	x	x	x	x	x	x	x
TCN.4	Waste Management Plan																																								x	x	x	x	x	x	x	x
TCN.5	Physical Cultural Resources Management Plan																																								x	x	x	x	x	x	x	x
TCN.6	Emergency Management Plan																																								x	x	x	x	x	x	x	x
TCN.7	Hygiene, Health and Safety Plan																																								x	x	x	x	x	x	x	x
TCN.8	Implementation of Stakeholder Engagement Plan																																								x	x	x	x	x	x	x	x
TCN.9	Implementation of environmental monitoring program																																								x	x	x	x	x	x	x	x
TCN.10	Environmental and social audits																			x								x									x											
TCN.11	ESMP update																								x						x						x						x					

Table 10-5 ESMP and RAP Implementation Schedule - Substation

	Activities	Year 1												Year 2												Year 3										
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	11	12
Phase 1 : Designing and approving (5 months)																																				
1,1	Implementation of Compensation and Revegetation Plan				x	x																														
1,2	Implementation of Revegetation and Erosion Control Plan				x	x																														
Phase 2 : Purchase and Processing (9 months)																																				
Phase 3 : Construction (14 months, of which 6 in parallel with phase 2)																																				
3,1	Implementation of mitigation and improvment measures									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,2	Implementation of Waste Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,3	Implementation of Vegetation Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,4	Implementation of Physical Cultural Resources Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,5	Implementation of Emergency Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,6	Implementation of Higiene, Heatlh and Safety Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,7	Implementation of environmental monitoring program									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,8	Achievement of community support activities											x	x					x	x						x	x								x	x	
Phase 4: Operation and Decommissioning (5 months)																																				
4,1	Implementation of mitigation and improvment measures																							x	x	x	x	x								
4,2	Implementation of environmental monitoring program																								x	x	x	x								
Operated by TCN																																				
TCN.1	Implementation of mitigation and improvment measures																												x	x	x	x	x	x	x	x
TCN.2	Vegetation Management Plan																												x	x	x	x	x	x	x	x
TCN.3	Revegetation and Erosion Control Plan																												x	x	x	x	x	x	x	x
TCN.4	Waste Management Plan																												x	x	x	x	x	x	x	x
TCN.5	Physical Cultural Resources Management Plan																												x	x	x	x	x	x	x	x
TCN.6	Emergency Management Plan																												x	x	x	x	x	x	x	x
TCN.7	Hygiene, Health and Safety Plan																												x	x	x	x	x	x	x	x
TCN.8	Implementation of environmental monitoring program																												x	x	x	x	x	x	x	x
TCN.9	Environmental and social audits							x								x									x											
TCN.10	ESMP update												x						x						x						x					

10.7.2 COST SUMMARY

Most of costs associated with the implementation of mitigation measures and improvements cannot be specified at this stage of the study. Many of these measures are to be under the responsibility of the contractor(s) who will build the project, so those costs will be integrated with other construction costs. It should be mentioned that the present ESMP imperatively needs to be appended to the construction tender documents to be published in order to ensure that those costs are placed under the responsibility of the project contractor(s). In this context, the environmental clauses are provided in Appendix 9. These clauses will have to be enhanced prior to the publication of the tender document to reflect the requirements of the ESMP.

Table below shows a summary of the main costs for the implementation of plans, programs and management measures which require additional costs.

Table 10-6 Preliminary ESMP Budget Estimate

Activities	Costs (USD) (5 years)	NGN (5 years)*
Phase 1 : Pre-construction		
Capacity Building and Training Program	270 000	85 050 000
Survey of sensitive areas for bird populations and nests surveys	50 000	15 750 000
Involvement of a botanist for clearing activities	10 000	3 150 000
Stakeholder Engagement Activities during preconstruction/construction phase	60 000	18 900 000
Sub-total Pre-construction Phase	**390 000**	**122 850 000**
Phase 2 : Purchase and Construction		
Install warning signs and anti-climbing devices	10 000	3 150 000
Document and report all spills to the FMEnv	5 000	1 575 000
Development of local and regional emergency plans in case of infrastructure breakdowns	50 000	15 750 000
Revegetation and Erosion Control Plan	25 000	7 875 000
Environmental and social surveillance	80 000	25 200 000
Sub-total Purchase and Construction Phase	**170 000**	**53 550 000**
Phase 3 : Operation		
Prepare and implement an Emergency Response Plan	20 000	6 300 000
Spill Containment Kits and spill response training of on-site staff	10 000	3 150 000
Document and report all spills to the FMEnv	5 000	1 575 000
Grade ground surface at each tower site to provide drainage away from tower base.	6 000	1 890 000
Implementation of the Vegetation management plan, including invasive alien species monitoring program in identified sensitive areas	15 000	4 725 000
Involvement of a botanist for maintenance activities to implement a selective vegetation clearing	15 000	4 725 000
Invasive alien species control program	20 000	6 300 000
Implement a sensitization program in order to educate and increase local communities' awareness on natural resources protection.	15 000	4 725 000
PAP compensation for any damage to their crops or assets during maintenance activities	10 000	3 150 000
Minimize the number of permanent access roads to and in the ROW. When possible, proceed to early closing and rehabilitation of temporary access roads nearby sensitive scenic areas	25 000	7 875 000
Stakeholder Engagement activities during Operation phase	80 000	25 200 000
Monitoring of environmental and social performance, including the development of adapted mitigation measures (notably for birds)	100 000	31 500 000
Environnemental Audit	20 000	6 300 000
Supervision of environmental and social monitoring from designated responsibles	45 000	14 175 000
Prepare and implement a Vegetation Management Plan	60 000	18 900 000
Prepare and implement a Waste Management Plan	40 000	12 600 000
Prepare and implement a Hygiene, Health and Safety Plan	100 000	31 500 000
Sous-total Operation Phase	**586 000**	**184 590 000**
Implementation of the ESMP	**1 146 000**	**360 990 000**
Implementation of the RAP	**4 398 850**	**1 385 637 783**
TOTAL	**5 544 850**	**1 746 627 750**

* Exchange rate : 315 NGN = 1 USD

[1] The cost was estimated for deflectors at the level of the Sokoto River floodplain. Deflectors will be marked every 10 m on 60% of the area between two pylons at the level of the two earthing cables.

11 REMEDIATION PLAN

This chapter presents the Remediation Plan. It includes the removal of the transmission line components, the electrical systems, the structural foundations and the access roads. A Revegetation Plan is also part of the Remediation Plan and has to be prepared following the Project useful lifespan for revegetation of the project footprint.

11.1 OBJECTIVES OF THE REMEDIATION PLAN

The Project, like other transmission lines, involves construction of permanent electricity infrastructures and therefore it is not envisaged that the transmission line will be decommissioned in the near future. However, after the Project's operational design lifespan, a reassessment of the current status of the transmission line shall be carried out. The decommissioning phase refers to all the activities which relate to the proposed transmission line when it is no longer in use.

The Remediation plan is intended to achieve the following objectives:

→ Comply with legislative and regulatory requirements for a decommissioning and remediation strategy;

→ Ensure as much as possible that all necessary decommissioning activities are completed prior to final project closure;

→ Ensure that measures are in place to maximize, to the greatest reasonable extent, the recycling and re-use of decommissioned materials, equipment and infrastructures to the benefit of people residing in the Project area;

→ Ensure that the receiving environment is free of all contaminants and is rehabilitated to a proper level.

11.2 TRANSMISSION LINE COMPONENTS REMOVAL

Assuming the transmission line has gone through its useful life and no longer serves a useful purpose for the area, it will be disassembled and removed. Initially the conductors will be de-energized, removed from the tower hangers, collected and be transported and disposed-off in accordance with relevant national waste management regulations and World Bank waste management guidelines applicable at the time of decommissioning. The lattice/tubular steel tower components would then be disassembled and removed, including grounding rods. Using lifting cranes, tower sections would be loaded in trucks and managed in accordance with relevant national waste management regulations and World Bank waste management guidelines applicable at the time of decommissioning.

11.3 ELECTRICAL SYSTEMS REMOVAL

The disassembly and removal of substation equipment will essentially be the same as its installation, but in reverse order.

11.4 STRUCTURAL FOUNDATIONS AND ACCESS ROAD REMOVAL

The areas around the transmission line towers, along with any access roads that were necessary, will be reclaimed. When towers are removed from their foundations, the foundations need to be removed too so as to enable re-vegetation of the land. The concrete and steel in the foundations will be broken-up and removed to appropriate depth. All concrete and steel debris will be removed from the site and disposed-off as per National and World Bank guidelines. The excavated lattice tower foundations are to be backfilled with soil material

11.6 RE-VEGETATION AND EROSION CONTROL

A Revegetation Plan is to be prepared following the Project useful lifespan for revegetation of the Project footprint. This plan is to be prepared in collaboration with a botanical expert and the following elements are to be considered in its preparation:

→ Best native plant species to be chosen for restoration;

→ Best time for revegetation depending on species to plant and habitat to restore;

→ Preferential habitats for endangered species.

Reclaimed areas will then be revegetated according to the plan. If erosion phenomena are expected to happen, erosion control measures, including revegetation and soil control structures, will be proposed.

12 CONCLUSION

The environmental and social impacts assessment was conducted by literature review, field surveys and in consultation with stakeholders. This study identified stakeholder concerns and expectations, as well as social and environmental constraints associated with the pre-construction/construction and operations of the Power Line and the substation associated with the North Core Project.

Management measures prescribed for the various phases of the Project limit the significance of negative impacts on the physical, biological and human environments, compensate for impacts that cannot be minimized or enhance the Project's positive impacts. The most significant impacts will occur during the construction phase. It will be important to ensure a strict implementation of the proposed measures by the various stakeholders. The right implementation of the Resettlement Action Plan and compensation measures for habitat lost are two fundamental elements for the reduction of anticipated impacts.

In the operational phase, significant impacts would also be felt, but the probability of occurrence is often lower. The environmental and social monitoring will remain a key element for analyzing the quality of prescribed measures, their effectiveness and also to detect unanticipated impacts. Proper planning of the implementation of the emergency plan and the monitoring of bird mortality, associated with the adoption of measures adapted to bird species and sensitive areas, will contribute to the environmental acceptability of the project.

The ESMP implementation is based on an adaptive approach that spans the life of the Project. It includes adaptation of management measures that take into account field conditions or situations that reduce actual Project impacts. Appropriate corrective measures will be planned in cases of non-compliance.

The ESMP is a commitment of TCN to the stakeholders involved, especially to the Nigerian authorities. Its implementation will ensure the Project's environmental and social compliance at all phases of execution.

The ESIA report is accompanied by a detailed ESMP which elaborates on the scope of the environmental and social management of the project and a RAP which presents among others compensation program and the eligibility criteria associated with the measures for the resettlement of people affected by the project.

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Yakubu M. (2006), “Genesis and classification of soils over different geologic formations and surfaces in the Sokoto plain, Nigeria”; unpublished PhD Dissertation, Department of soil science and agricultural engineering, Usmanu Danfodiyo University Sokoto.

Appendix 1

TERMS OF REFERENCE

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/2489/Vol.1/82
8th January, 2014.

The Chief Executive Officer,
Transmission Company of Nigeria (PHCN)
Corporate Headquarters,
Plot 441, Zambazi Crescent,
Maitama, Abuja

CHIEF EXECUTIVE OFFICER
TRANSMISSION COMPANY OF NIGERIA
10 JAN 2014
RECEIVED

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED CONSTRUCTION OF 54KM WAPP NORTH CORE 330KV DC INTERCONNECTION TRANSMISSION LINE BETWEEN BIRNIN KEBBI SUBSTATION AND NIGERIA/NIGER BORDER PROJECT KEBBI STATE.

Please refer to your letter dated 19th March, 2013 and the Ministry letter ref. FMEnv/EA/EIA/2489/vol.1/24 dated 4th April, 2013 on the above project.

2. Following the 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 the Terms of Reference submitted to the Ministry should address all identified issues that are relevant to the project during the scoping workshop.

3. The field data gathering and laboratory analyses of the environmental component of the study which will be Two (2) seasons include 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 PARAMETERS.	PARAMETER 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	5 nos. in each water body within and around the RoW + control sample	Colour, pH, turbidity, Salinity, hardness, heavy metals – Cu, Pb, Fe, DO, BOD, COD, THC, Electrical conductivity, Phosphate, SO_4, NO_3, TSS. Microbiology – (faecal coli form, total 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 &	2 Nos. in 10km + control sample	Depth to and thickness, hydraulics, recharge and, uses

		Microbial.		Colour, pH, turbidity, Salinity, hardness, heavy metals - Cu, Pb, Fe, K, Ba, DO, BOD, COD, THC, Electrical conductivity, Phosphate, SO_4, NO_3, TSS.
4	Soil	Physical	2 Nos. in 10km + controls samples	Profile (depth, type) colour, permeability, porosity, bulk density, texture (grain size).
		Chemical	2 Nos. in 10Km + controls samples	Heavy metals (V, Ni, Fe, Pb, Cu, Zn),pH, moisture content, sulphate, nitrate
		Soil Microbiology	2 Nos. in 10km + controls samples	Total heterogenic bacteria (total hydrocarbon, T. fungi, total hydrocarbon bacteria (THB), faecal coliform.
5	and Use	Land cover	-	Land Use types: Recreational, agricultural, forestry, industrial, residential, institutional, commercial. Trends etc
6	Ambient Air Quality		2 No. in 2km (in-situ @ different elevations)	Suspended particulate matter, NO_x, SO_x, CO_2, CO, VOCs, H_2S.
7	Noise	Noise level	2 No. in 2km (in-situ)	Db
8	Ecology	Vegetation		Flora and fauna, Habitat status, floral composition, density and distribution, vegetation structure, plant pathology
9	Geology	Local and regional		Stratigraphy, structure, fractures patterns, flow direction, aquifer level, Regional geology, Stratigraphic/Lithologic properties
10	Socio-Economic			Education, culture, distribution of livelihood, land use, etc. with structured questionnaire administration.
11	Health Impact Assessment			Health status and prevalent diseases within and around the project area and host community.

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. You should notify the Ministry in good time to enable us plane our participation in the field work.

5. I am further directed to request you to pay the sum of Five Hundred Thousand Naira (500,000:00) only in bank draft to the Ministry, as the Initial processing fee. Upon completion of the EIA studies, you are to submit Five (10) hard copies and One (1) soft copy of the draft EIA report to the Ministry.

6. Thank you for your co-operation.

J.A. Alonge
For: Honourable Minister

Appendix 2

GROUNDWATER LABORATORY ANALYSIS

Table 1 Sampling Locations and Details for Groundwater

SAMPLE CODE	LATITUDE	LONGITUDE	SAMPLING DATE (WET SEASON)	SAMPLING DATE (DRY SEASON)
GW/1710/ARW/01	12.55292	3.79647	17/10/2015	19/12/2015
GW/1710/ARW/02	12.55134	3.79487	17/10/2015	19/12/2015
GW/1710/ARW/03	12.53812	3.86847	17/10/2015	19/12/2015
GW/1710/ARW/04	12.51987	3.91049	17/10/2015	19/12/2015
GW/1710/ARW/05	12.50342	3.9322	17/10/2015	19/12/2015
GW/1810/KLG/06	12.45228	4.00111	18/10/2015	19/12/2015
GW/1810/KLG/07	12.4912	4.02023	18/10/2015	19/12/2015
GW/1810/KLG/08	12.47961	4.0239	18/10/2015	19/12/2015
GW/1810/KLG/09	12.48963	4.03256	18/10/2015	19/12/2015
GW/1810/KLG/10	12.48146	4.05544	18/10/2015	18/12/2015
GW/1810/KLG/11	12.48094	4.06525	18/10/2015	18/12/2015
GW/1810/BRK/12	12.44423	4.11538	18/10/2015	18/12/2015
GW/1910/BRK/13	12.43901	4.19583	19/10/2015	18/12/2015
GW/1910/BRK/14	12.40657	4.19937	19/10/2015	18/12/2015
GW/1910/BRK/15	12.40156	4.19057	19/10/2015	18/12/2015

Table 2 Ground Water Quality Data

Wet Season Water Quality Data

Sample/Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	MEAN	MIN	MAX
Turbidity	0.40	0.80	0.70	0.50	0.60	0.40	0.80	0.60	0.40	0.40	0.50	0.50	0.40	0.40	0.50	0.53	0.40	0.80
Hardness	46.00	65.00	56.00	45.00	52.00	55.00	48.00	43.00	44.00	44.00	48.00	42.00	40.00	48.00	46.00	48.13	40.00	65.00
Cond	950	1480	1375	973.	1280.00	880	1175.00	912.00	850.00	820.00	1120.00	804.00	750.00	835.00	1125.00	1021.93	750.00	1480.00
TDS	2.00	8.00	8.00	3.00	5.00	2.00	3.00	3.00	2.00	2.00	3.00	2.00	1.00	2.00	3.00	3.27	1.00	8.00
COD	57.10	57.20	66.10	41.20	48.30	35.70	48.30	50.50	60.20	33.00	48.70	44.80	35.70	38.60	40.30	47.05	33.00	66.10
PH	6.10	6.90	7.10	6.90	5.30	5.90	6.20	5.70	6.20	7.30	7.00	6.30	5.30	4.70	6.90	6.25	4.70	7.30
DO	11.50	9.80	10.50	8.60	7.80	6.50	10.30	10.90	14.50	6.70	9.30	10.10	6.80	7.20	8.90	9.29	6.50	14.50
BOD	43.70	37.70	39.10	32.60	31.00	25.20	39.20	42.00	54.10	24.80	34.20	38.10	25.80	27.10	34.20	35.25	24.80	54.10
Cu (mg/L)	0.14	0.15	0.12	0.13	0.14	0.13	0.12	0.11	0.10	0.12	0.12	0.10	0.14	0.10	0.12	0.12	0.10	0.15
Cr (mg/L)	0.02	0.03	0.02	0.02	0.10	0.06	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.10
Pb (mg/L)	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
Zn (mg/L)	0.12	0.11	0.12	0.11	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.10	0.12
Na (mg/L)	0.30	1.40	0.50	1.40	1.30	2.20	0.90	2.00	2.00	2.50	2.70	0.80	1.90	0.60	0.20	1.38	0.20	2.70
K (mg/L)	0.10	8.70	0.60	0.30	2.90	9.80	0.30	0.70	3.00	1.50	9.00	0.60	4.50	1.50	3.30	3.12	0.10	9.80
Ca (mg/L)	0.25	0.60	0.35	0.45	0.50	0.65	0.40	0.35	0.55	0.65	0.65	0.35	0.55	0.40	0.50	0.48	0.25	0.65
Mg (mg/L)	0.20	0.15	0.15	0.15	0.20	0.25	0.20	0.25	0.20	0.25	0.30	0.45	0.25	0.20	0.20	0.23	0.15	0.45
P (mg/L)	0.12	0.13	0.12	0.12	0.12	0.15	0.13	0.12	0.12	0.12	0.15	0.12	0.14	0.13	0.13	0.13	0.12	0.15
Fe (mg/L)	0.41	0.32	0.44	0.37	0.56	0.22	0.28	0.22	0.25	0.23	0.27	0.28	0.35	0.47	0.58	0.35	0.22	0.58
THC	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
SO4	23.00	26.00	25.00	30.00	22.00	25.00	20.00	23.00	23.00	22.00	24.00	24.00	20.00	22.00	23.00	23.47	20.00	30.00
CO_3	Nil	0.10	0.10	Nil	Nil	Nil	Nil	Nil	Nil	0.30	0.40	Nil	Nil	Nil	0.20	0.22	0.10	0.40
HCO_3	0.30	3.10	0.70	0.70	0.60	0.60	0.70	0.50	0.40	1.30	0.60	0.60	0.60	0.70	1.00	0.83	0.30	3.10
NO_3	6.40	11.00	11.20	6.20	8.40	5.20	5.60	5.20	5.00	5.00	6.60	6.20	4.40	5.20	6.20	6.52	4.40	11.20
Cl^-	0.60	1.20	0.50	0.70	0.90	1.70	0.50	0.90	1.10	1.10	1.50	0.60	1.50	1.50	1.80	1.07	0.50	1.80

Dry Season Water Quality Data

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	MEAN	MIN	MAX
Sample/Parameters	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	MEAN	MIN	MAX
Turbidity (NTU)	0.80	0.40	0.50	0.60	0.60	0.40	0.80	0.50	0.60	0.40	0.50	0.40	0.40	0.50	0.40	0.52	0.40	0.80
Hardness	40.00	56.00	44.00	48.00	52.00	48.00	55.00	48.00	45.00	43.00	46.00	46.00	44.00	42.00	65.00	48.13	40.00	65.00
TDS	5.00	10.00	12.00	5.00	6.00	4.00	5.00	4.00	7.00	7.00	8.00	9.00	5.00	4.00	8.00	6.60	4.00	12.00
Cond	870.00	1350.00	1420.00	980.00	1170.00	1040.00	1045.00	1147.00	855.00	860.00	1050.00	917.00	755.00	785.00	1270.00	1034.27	755.00	1420.00
THC	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
COD	42.30	44.70	56.30	41.20	45.20	36.80	52.60	48.60	58.20	48.70	48.70	44.80	35.70	38.60	40.30	45.51	35.70	58.20
PH	5.70	7.10	5.30	7.30	7.00	6.30	5.90	6.20	6.90	6.10	6.90	6.20	6.90	5.90	6.20	6.39	5.30	7.30
DO	10.30	7.80	8.60	14.50	9.80	11.50	8.90	7.20	7.90	10.10	9.30	6.70	7.80	10.50	8.40	9.29	6.70	14.50
BOD	32.50	35.70	44.40	34.60	32.10	32.50	40.70	38.30	41.20	34.20	34.20	38.10	25.80	24.80	27.10	34.41	24.80	44.40
Cu (mg/L)	0.15	0.14	0.09	0.11	0.11	0.11	0.09	0.12	0.09	0.13	0.15	0.12	0.13	0.08	0.15	0.12	0.08	0.15
Cr (mg/L)	0.04	0.02	0.01	0.00	0.07	0.04	0.01	0.03	0.01	0.03	0.03	0.03	0.01	0.01	0.05	0.03	0.00	0.07
Pb (mg/L)	0.03	0.00	0.01	0.00	0.02	0.01	0.02	0.02	0.00	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.00	0.03
Zn (mg/L)	0.14	0.10	0.09	0.09	0.09	0.10	0.09	0.13	0.09	0.11	0.13	0.12	0.10	0.09	0.14	0.11	0.09	0.14
Na (mg/L)	0.32	1.39	0.47	1.38	1.27	2.18	0.87	2.01	1.99	2.51	2.73	0.82	1.89	0.58	0.23	1.38	0.23	2.73
K (mg/L)	0.12	8.69	0.57	0.28	2.87	9.78	0.27	0.71	2.99	1.51	9.03	0.62	4.49	1.48	3.33	3.12	0.12	9.78
Ca (mg/L)	0.27	0.59	0.32	0.43	0.47	0.63	0.37	0.36	0.54	0.66	0.68	0.37	0.54	0.38	0.53	0.48	0.27	0.68
Mg (mg/L)	0.22	0.14	0.12	0.13	0.17	0.23	0.17	0.26	0.19	0.26	0.33	0.47	0.24	0.18	0.23	0.22	0.12	0.47
P (mg/L)	0.14	0.12	0.09	0.10	0.09	0.13	0.10	0.13	0.11	0.13	0.18	0.14	0.13	0.11	0.16	0.12	0.09	0.18
Fe (mg/L)	0.43	0.31	0.42	0.35	0.53	0.21	0.26	0.23	0.25	0.24	0.31	0.31	0.34	0.41	0.55	0.34	0.21	0.55
SO4	24.00	19.00	23.00	22.00	23.00	25.00	32.00	23.00	18.00	20.00	24.00	35.00	30.00	23.00	23.00	24.27	18.00	35.00
CO_3	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
HCO_3	0.70	0.70	0.70	3.10	0.50	0.60	0.70	1.30	0.60	1.00	0.40	0.60	0.60	0.60	0.30	0.83	0.30	3.10
NO_3	5.20	5.20	5.20	6.40	6.20	5.60	4.40	8.40	5.00	5.00	6.60	6.20	6.20	11.00	11.20	6.52	4.40	11.20
Cl^-	1.50	0.60	0.50	0.60	1.50	1.10	1.10	0.90	0.50	1.70	0.70	0.90	1.20	1.50	1.80	1.07	0.50	1.80

Appendix 3

LIST OF STAKEHOLDER ORGANISATIONS AND COMMUNITIES

WAPP 330 kV North Core Project	
Identified Project's Stakeholders in Nigeria	
Stakeholder groups and organizations	**Location**
Ministries and agencies at national level	
Federal Ministry of Environment - Environmental Assessment (EIA)	Abuja
Federal Ministry of Environment - Forestry Department	Abuja
Federal Mintsry of Lands and Survey	Abuja
National Commission for Musuems and Monuments	Abuja
Federal Mininistry of Agriculture (Department of Animal Production and Husbandry Services and department of Agriculture)	Abuja
National Parks Services	Abuja
Nigerian Civil Aviation Authority	Abuja
National Commission for Museums and Monuments	Abuja
Federal Ministry of Works (Department in Charge of Federal Roads)	Abuja
Administrative authorities at regional / sub-regional levels	
Kebbi State Ministry of Environment	Birnin Kebbi
Kebbi State Environmental Protection Agency (KESEPA)	Birnin Kebbi
Kebbi State Ministry Lands and Survey	Birnin Kebbi
Birnin Kebbi Local Government Area	Birnin Kebbi
Kalgo Local Government Area	Kalgo
Arewa Local Government Area	Arewa
Kebbi State Ministry of Women Affairs	Birnin Kebbi
Sokoto-Rima River Basin Development Authority, Kebbi State Area Office	Birnin Kebbi
Kebbi State Rural Electrification Board (REB	Birnin Kebbi
Kebbi State Ministry of Agric (Livestock)	Birnin Kebbi
Parks / Conservation areas administrators	
Great Green Wall Project	Abuja
Affected communities (cities, towns and villages)	
Badariya (Birnin Kebbi)	Project area
Kola	Project area
Kutukulu	Project area
Ungwan Dodo	Project area
Unguwan Mairago	Project area
Rafin Atiku	Project area
Kangiwa	Project area
Sandare	Project area
Ungwan Muza	Project area
Eri	Project area
Goru	Project area
Mahuta	Project area
Zukuku	Project area
Environmental NGOs	
Savannah Conservation Foundation	Abuja

Appendix 4

CONSULTATION ROUND 1 – MINUTES AND SIGNATURES

EEMS Limited
ISO 9001:2008 Certified Organisation

MINUTES OF SCOPING MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT(ESIA) AND UPDATE OF LINE ROUTE OF THE 330 KV WAPP NORTH CORE PROJECT HELD AT SAFFAR GUEST INN BIRNIN KEBBI ON 7TH JANUARY, 2015

1.0 AGENDA OF THE MEETING

1 Introductions
2 Opening Prayers
3 Welcome Address –TCN, Brinin Kebbi Sub/Station Manager
4 Presentation of Discussion Framework -Engr. Abubakar Bello (COO, EEMS)
5 Overview of the 330 KV WAPP North Core Project -Engr. O. Okoli (GM HSE, TCN)

TEA BREAK

6 Contributions/Comments by Institutional Stakeholders:
7 Contributions/Comments by Community Representatives:
8 Wrap Up
9 Closing Prayers

LUNCH

DEPARTURE

2.0 ATTENDANCE (attached)

3.0 INTRODUCTIONS

The meeting started at 11:45 am with introduction of the members of the high table by Abubakar Bello, who also coordinated the meeting. He apologised for starting the meeting late due to flight delay from Abuja, and informed participants that the meeting will be conducted in both Hausa and English languages, and urged participants to speak the one they are most comfortable with. There was translations between the two languages throughout to enable participation by all without hindrance. Each of the participants introduced individually. The total number of participants at the meeting was 35 and the following organidations were represented;

1. Transmission Company of Nigeria (TCN)
2. Federal Ministry of Environment
3. Kebbi State Ministry of Lands and Survey
4. Kebbi State Ministry of Environment
5. Kebbi State Environmental Protection Agency (KESEPA)
6. Birnin Kebbi Local Government Area
7. Kalgo Local Government Area
8. Arewa Local Government Area
9. 10 Communities along the Line Route.
10. Kungiyan Manoma (CBO –Farmers Association)
11. Kebbi State Rural Electrification Board
12. National Environmental Standards and Regulatory Enforcement Agency (NESREA)
13. Kebbi State Ministry of Agriculture

4.0 OPENING PRAYERS

Opening prayers were then said by the G.M. KESEPA –Mal. Musa Umar, after which the members were requested to sign the attendance register, while the deliberations went on.

5.0 WELCOME ADDRESS TCN BIRNIN KEBBI SUB-STATION MANAGER

The Manager represented by Engr. Aminu Haruna welcomed participants and express his delight on their attendance. He thereafter prayed for a fruitful deliberation.

6.0 PRESENTATION OF DISCUSSION FRAMEWORK BY ENGR, A. M. BELLO (COO, EEMS)

Abubakar Bello presented the Project and the ESIA process to the participants in order to acquaint them of what they are all about. The presentation covered the following ares;

- Brief Project Description
- The ESIA and RAP process
- Project Schedule
- General Benefits and Impacts of the Project
- The Purpose of Scoping Meeting
- Inputs Expected from Stakeholders
- Expected Outcome of the Meeting

After the presentation, participants were given the opportunity to ask questions based on the presentation. The following questions were asked

1 Is the project an expansion of the existing project, or a modification of it?

2 Can the farmlands under the new line be cultivated after the project?

3 How can the tower be built in flood plains such as the one around Kola Village?

4 Is the new line likely to pass over their cemeteries, and what to do in that case?

Engr Bello responded the questions in Hausa as follows.

1 The project is a completely new one –a 330KV electricity transmission line from Birnin Kebbi to Ouagadougou (Burkina Faso) passing through Niger and Benin Republic. It is likely to be laid parallel to the existing 132KV as much as possible, depending on the outcome of the update of line route study, which is ongoing.

2 For safety reasons, farming is not allowed under transmission lines. People or animals cannot also live under the lines. Hence, no form of development will be allowed along the right of way (ROW). The assets along the route will be adequately compensated in line with regulatory requirements and global best practices.

3 The foundation for each tower is designed to withstand geotechnical as well as ecological conditions specific to the locations. And project will be implemented in such a way to avoid or minimise impacts on water bodies as well as other environmental and social components, which is one of the objectives of the ESIA study.

4 It is not envisaged that the new line will affect cemeteries or other sacred sites.

7.0 OVERVIEW OF THE 330 KV WAPP NORTH CORE PROJECT BY ENGR. O. OKOLI (GM HSE, TCN)

Engr. Okoli started by expressing his pleasure for being in Kebbi state and stating his efforts to make sure he attended the meeting. He emphasized the need to carry everybody along and to ensure that no stakeholder is omitted. He went through the stakeholders' list to ascertain those who were present at the meeting. No representative from Eri was in attendance.

He then explained the significance of the project and the agreement they had during the regional meeting to use what he called 'the local content' in handling the project. He also explained that by Nigerian laws, compensations are for houses, economic trees, etc., but not for land.

He then highlighted the goal of the World Bank and other funding agencies to better the lot of the people when it comes to paying compensation, to ensure that they are taken to a better condition than they were before. He also noted the construction of access roads and job opportunities involved in the project that will all benefit the local communities.

He solicited for maximum cooperation from the leaders of the communities, and encouraged them to call at any time of the day for clarification of any issue related to the project. He specifically seek for the permission of the communities to allow their women to be interviewed during the socio- economic survey.

After the presentation which was in English, Abubakar Bello translated the speech in Hausa and then a tea break was taken.

The session resumed at about 2:05 pm.

The floor was then opened for the institutional stakeholders represented make their contributions.

8.0 CONTRIBUTIONS BY STAKEHOLDERS

Each institutional stakeholder made presentations, however complained about invitations reaching them late and the holidays shortly before the meetings.

8.1 The Minister Of Environment

The representative of the Minister –Mallam Mohammed Malami, explained the requirement of the EIA Act, and the significance of the scoping meeting. He also stressed the need for maximum cooperation of the communities to ensure the success of the project. He implore the stakeholders to be sincere when it comes to claims for compensation, and not to go about building new structures along the route or planting new trees to claim for compensation later.

He went further to explain to the stakeholders the opportunities they have to challenge the draft report if their needs are misrepresented, especially when the draft report goes on display for 21 working days in Kebbi and Abuja. He told them that announcement will be made in the media when the draft document is ready for their inputs.

He observed that EEMS should have presented to the stakeholders the proposed line route of the project and an alternative route to make them in a better position to understand what is at stake. He suggested that technical aspects of the project should be discussed in subsequent meetings. Lastly, he advised that the period of wet season data collection be shifted by at least a month not earlier than July, to ensure that the rainy season has stabilised before taking the data.

Comments: The minister's representative was reminded that the update of line route study is currently ongoing and the proposed route as well as alternatives can only be available after it is concluded.

8.2 Kebbi State Commissioner of Environment

The representative of the Commissioner of Environment (Musa K. Umar –GM KESEPA) welcomed participants to Kebbi State. He started by expressing their worry of not being carried along when it comes to baseline data collection. He offered the service of his staff to EEMS at no cost to ensure correct data collection and presentation.

Abubakar Bello responded to his grievances that no institution relevant to the project will be excluded or impeded from performing their normal responsibilities. This is one of the reasons we are consulting. However, he asked the GM to assist him with any document or of law or regulations which specify the involvement of the ministry is involved in baseline data. In the absence of that, staff of the ministry are free to follow our consultants to site at their expense. What was provided for the budget is for a Federal Ministry of Environment Staff in accordance with the EIA Act as well as the EIA Guidelines.

Abubakar Bello asked him if their Ministry is involved in RAP, to which he responded yes, although he could not give any supporting evidence to his claim.

8.3 The Commissioner of Land and Survey

The representative of the Commissioner conveyed a goodwill message from the Commisioner on the project. He then frowned at the illegal developmental projects (encroachment) currently going on under the existing line, which according to him were undertaken with the connivance of some village heads. He noted that their invitation letter reached them very late, and they came unprepared. However, he promised to send all the answers to the questions posed to them to the Project Managers.

He stressed the need to pay the communities adequate compensation, and offered to assist the project with maps of the route and a Digital Terrain Model (DTM).

8.4 Chairman of Kalgo LGA

Kalgo LGA was represented by the Secretary of the LGA –Musa Maiyama who pledged the unflinching support of Kalgo LGA for the project. He also complained about getting the invitation for the meeting late.

8.5 The Chairman of Arewa LGA

The Chairman Engr. A.Y. Tanko, expressed his happiness about the project and promised to support the project all the way. He also promised to get back to their communities and intimate them on the importance of the project, so that they will support it.

8.6 NESREA (Kebbi State Office)

After, expressing his delight about the project, he advised the consultants to make efforts to acquire the National Environmental Energy Sector Regulations as a working guide in the field.

8.7 Ministry of Agriculture, Kebbi State

The representative –Abubakar Abbas called upon the project proponents to ensure the protection of the means of livelihood of the communities.

8.8 Kebbi State Rural Electrification Board (REB)

The General Manager, stepped out when it was turn to make comments and his Assistant General Manager (AGM) Maintenance gave assurances of full support for the project. However, after the meeting the GM made specific request for the connection of rural areas along the line route to the 330KV line.

9.0 COMMENTS BY THE REPRESENTATIVES OF THE COMMUNITIES

Each community represented was called upon make comments about the project and issues of concern to them (if any)

9.1 Na-Yelwa District (Kutukulu, Sandare, Ungwan Dodo)

The Hakimi started by noting that the invitation for the meeting reached them very late. It was explained to him that this happened because of a wrong information obtained which specifies Kutukullu as the district instead of Na-Yelwa, and the invitation was therefore had to re-routed to him from Kutukulu.

9.2 Unguwar Muza

The representative suggested that Kungiyar Manoma (a CBO in the communities) should be included in the list of the stakeholders.

9.3 Kola District

Pledged support for the project.

9.4 Badaria

Same as (9.3) above.

9.5 Makera-Gandu

Same as (9.3) above.

9.6 Badariya

Same as (9.3) above.

9.7 Kangiwa

Same as (9.3) above.

9.8 Zukuku

Same as (9.3) above.

9.9 Goru

Same as (9.3) above.

10. CLOSING PRAYERS

In the absence of any other business, the meeting was closed at around 3:40 pm after a closing prayer by Mrs I. B. A. Ruskin of TCN.

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

SCOPING MEETING ATTENDANCE LIST:

NOTE: The proceedings of this meeting is video recorded for quality assurance purposes

Date: 07-01-2015, **Venue** Saffron guest Inn, B-kebbi

S/N	NAME, surname	ORGANIZATION	POSITION/DESIGNATION	PHONE NO	EMAIL	SIGNATURE
1	Engr. Olisa Mokdi	TCN	GM(HSE)	08033904855	olisadebeckoti @yahoo.com	
2.	Muhammad Malami	FMEn Abuja	Rep. FMEn	08068305873	usmanlande@ yahoo.com.sg	
3.	Engr. Aminu Haruna	TCN B/kebbi	Sm (PCM)	08059401383	aminuharuna 59 @ Yahoo.com	
4.	Shehu L. Zogirma	T.C.N. B/kebbi	Sm(Lines)	08065523875	SL Zogirma @yahoo.com	
5	Musa A. Maigana	Kalgo L/G.	See.	07035565547		

WSP

SHEET 01/05

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

SCOPING MEETING ATTENDANCE LIST:

NOTE: The proceedings of this meeting is video recorded for quality assurance purposes

Date: 07-01-2015, **Venue** Saffar guest inn, B- Kebbi

S/N	NAME, surname	ORGANIZATION	POSITION/DESIGNATION	PHONE NO	EMAIL	SIGNATURE
1	Engr. L. C. Ogunu	Transmission Company of Nigeria	Project Manager (Transmission lines)	08036186486	Lecogwu@yahoo.com	[signature]
2	Ruskin, I. B.A. (Mrs)	TCN	AM (ERSU)	07082339090	inemsunday@yahoo.com	[signature]
3	Dr. H. M. Maishanu	EEMS	Ecological Study Expert	08036790171	hmaishanu@gmail.com	[signature]
4.	HARO MAIKANO	EEMS	ESTATE SURVEYOR	08052993401	haro_maikano@yahoo.co.uk	[signature]
5	Olatayo Olowookele	EEMS	Project Operation Executive	08035900691	tayo@eemslimited.com	[signature]
6.	KHAMES Y.M	ARERA L/G Director of Local	Bins	080-6004593	—	[signature]
7	Abubakar M. Bello	EEMS	COO	08099027755	amsbello@eemslimited.com	[signature]

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SHEET 02 / 05

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

SCOPING MEETING ATTENDANCE LIST:

NOTE: The proceedings of this meeting is video recorded for quality assurance purposes

Date: 07-01-2015, **Venue** Saffar guest Inn, B/Kebbi

S/N	NAME, surname	ORGANIZATION	POSITION/DESIGNATION	PHONE NO	EMAIL	SIGNATURE
1	Engr. S.A. Bello	R.E.R.	G.M.	08033231530G	[illegible]	[signature]
2	Engr A.Y. Tanko	Arewa 4G	Hon chairman	08023532729	[illegible]@yahoo.com	[signature]
3	Engr Garba Jijima	R.E.B	A.G.M.(Maint)	08039495299		[signature]
4	Ladan Suraju	NESREA	FOI	08062476468	Siraaladan@yahoo.c	[signature]
5	Murtala Musa	NESREA	S.O	08066425227	Murigeo75@yahoo	[signature]
6	UMAR BASHAR	FED MIN OF ENVI	F.O II	0703906312	BASHARUMAR@g	[signature]
7	JAAFARU AHMED	FED MIN OF ENVI	S.O I	08038404091	ahmedjsfam@yahoo	[signature]
10	ALI GULU	MAIGARARGANDU	MAI UNGUWAN HAKIMIN GALEWAR MAIGARGANDU	08123862686		ALIGU

SHEET 03/05

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

SCOPING MEETING ATTENDANCE LIST:

NOTE: The proceedings of this meeting is video recorded for quality assurance purposes

Date: 07-01-2015, **Venue** Siffon Guest Inn B/Kebbi

S/N	NAME, surname	ORGANIZATION	POSITION/DESIGNATION	PHONE NO	EMAIL	SIGNATURE
1	Yahaya Ahd	Zukoku	Maigari	09031189302	nil	[signature]
2.	M.M. Mainasara	Udusokoto/EEMS	-	07069610019	mmgusau96@gmail.com	[signature]
3	M.U MAYELWA	KALGO	MAYELWA	08060917726	-	[signature]
4	Usman Sani	Kangiwa	Maigari	08123993082	-	[signature]
5	Abubakar A Ambursa	Min of Agric B/K	Represative	07030751867	-	[signature]
6	AHAMED U.	ALEIRO L/G	DIRECTOR OF Works	080-60045193	-	[signature]

SHEET 04 / 05

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

SCOPING MEETING ATTENDANCE LIST:

NOTE: The proceedings of this meeting is video recorded for quality assurance purposes

Date: 07-01-2015, **Venue** B/Kebbi

S/N	NAME, surname	ORGANIZATION	POSITION/DESIGNATION	PHONE NO	EMAIL	SIGNATURE
1	MUHAMMADU YUSUF	KESEPA	DIRECTOR ENV. ASSESS.	08068267005	muhammadyusufu@gmail.com	[signature]
2	Musa K. Umar	KESEPA	GENERAL MANAGER	08094035736	Umarmusa55@gmail.com	Umar
3	Surv. Musa I. I	Min. of land & Housing	Surveyor General	07034267454	Ibrahimillomusa@yahoo.ca	[signature]
4	TPL. MOH'D ALIYU	Min. of lands & Housing	DIR. Town Planning	08081162229	-	[signature]
5	Adamu Babangida	Min of Lands & Housing	Kebbi state Valuation and Acquisition officer	08035824060	adamubabangida77@gmail.com	[signature]
6	Muhammadu	DNGaLaDima		08054173230		[signature]
7	UMaRu	GAZAKi	BaDaRiya	08093182772		UMARU
8	HAKiMi	MARAFANBADARiyA		08083146016		MARAFA
9	Usaman Zaumimi	Zaumandi kata	—	0818298974	—	[signature]

WSP

SHEET 05/05

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Appendix 5

CONSULTATION ROUND 2 – MINUTES AND SIGNATURES

PHOTOS OF THE LINE ROUTE MISSION IN BIRNIN KEBBI, NIGERIA

Meeting of all participants of the Line Route Mission (TCN, NIGELEC and EEMS) at TCN Birnin Kebbi Sub-station

Tower 22 of the existing 132kv line to Niger – Nigeria border at the begining of FADAMA (flood plain)

No 141-24307-00

NOTES DE RÉUNION
MEETING NOTES

Lieu de la réunion / Venue : Birnin Kebbi Substation	**Date:** 18/06/2015 and 19/066/2015
Objet / Object Substation Hotspot	**Préparé par / Prepared by:** Mamoud Bello Abubakar

Participants :

Nom / Name	Compagnie / Company	Nom / Name	Compagnie / Company
Engr. Adekeye	Sub Station Manager -TCN	Olatayo Olasehinde	EEMS
Engr. Meyen Etukudo	TCN	Amadou Amadou	NIGELEC
Engr. Olisa Okoli	TCN	Issaka Houdou	NIGELEC
A. Mohammed	TCN	Kobou Yapi Daniel	WAPP
Engr. Mamoud Bello Abubakar	EEMS	Harouna Coulibaly	WAPP

Art.	Points discutés / Items Discussed	Suivi à faire Follow-up	Responsable, échéancier Responsible, Schedule
1.	**Ouverture de la réunion / Beginning of Meeting**		
2.	A site has been designated in the within the existing premises for the new sub-station. The team inspected the site, it is located towards the Southern perimeter, such that the new line to exit parallel to the 330KV from Kainji.		
	An issue was raised by TCN with regards to WSP adopting google map for the Line Route Update, instead of a Surveyor or other relevant personnel being physically on ground to confirm locations and also to ensure accuracy.		
3.	Arrangements for consultation with relevant agencies were made initially by EEMS, but WAPP mentioned that consultation is not the main purpose of the mission but identify and inspect the hot spots along the proposed alternative line routes.		
	TCN reminded that field data should be collected for two seasons for the ESIA as directed by Federal Ministry of Environment. And according to the schedule, by this time we should have done the dry season. He said it appears we would have to start with the rainy season and wait until November, for the dry season again before going bak to the field.		
	WAPP and TCN representatives were unanimous that military facilities should be avoided by all means, because of restricted access during operation and maintenance as well as sustainability of the line if issues of national security arise. Consider taking the line all the way out of town and angle at N12.416120, E004.201090 around Tower 728 of the existing Kainji 300kv line. However, the route option chosen should have minimal displacement of structures above all other considerations.		

No 141-24307-00

NOTES DE RÉUNION
MEETING NOTES

Lieu de la réunion / Venue : Dukku Army Barracks	**Date:** 19/06/2015
Objet / Object Line Route Alternative Passing through Barracks	**Préparé par / Prepared by:** Mamoud Bello Abubakar

Participants :

Nom / Name	Compagnie / Company	Nom / Name	Compagnie / Company
Engr. Meyen Etukudo	TCN	Cap. Adamu (Rep. Commandant)	Dukku Barracks, Birnin Kebbi
Engr. Olisa Okoli	TCN		
A. Mohammed	TCN		
Engr. Mamoud Bello Abubakar	EEMS		
Olatayo Olasehinde	EEMS		

Art.	Points discutés / Items Discussed	Suivi à faire Follow-up	Responsable, échéancier Responsible, Schedule
1.	**Ouverture de la réunion / Beginning of Meeting**		
2.	The Millitary Authorities are willing to support the project, and allow the line to pass through their facility, if this will help them get more reliable supply of electricity in the barracks. The captain will report to his commandant about the meeting to get the final decision on how to move forward.		
3.			

No 141-24307-00

NOTES DE RÉUNION
MEETING NOTES

Lieu de la réunion / Venue : Federal Medical Center Birnin Kebbi	**Date:** 19/06/2015
Objet / Object Line Route Alternative Passing through Hospital	**Préparé par / Prepared by:** Mamoud Bello Abubakar

Participants :

Nom / Name	Compagnie / Company	Nom / Name	Compagnie / Company
Engr. Meyen Etukudo	TCN	Dr. Abdullahi (Chief Medical Dir)	FMC, Birnin Kebbi
Engr. Olisa Okoli	TCN		
A. Mohammed	TCN		
Engr. Mamoud Bello Abubakar	EEMS		
Olatayo Olasehinde	EEMS		

Art.	Points discutés / Items Discussed	Suivi à faire Follow-up	Responsable, échéancier Responsible, Schedule
1.	**Ouverture de la réunion / Beginning of Meeting**		
2.	School of Optical Dispensing Technology of the Federal Medical Center (FMC) is located on the land traversed by the proposed line. FMC is transforming to University Teaching Hospital and the remaining land area traversed is reserved for School of Nursing, hostels, library and other training facilities. FMC would prefer, the line does not pass through there, because they have shortage of land.		
3.			

Appendix 6

CONSULTATION ROUND 3 – MINUTES AND SIGNATURES

ORGANIZATION NAME: State Authorities/Services
Date and time of the meeting: 17/9/2015 9:30am
Meeting location: Kebbi State Secretariat, Gwadangwaji, Kebbi State
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the project and ongoing status (team, goals, deadlines) 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure

No.	**Summary of discussions:**
1.	**Presentation of the project and ongoing studies:** (brief summary of the information provided on the project and ongoing studies)
2.	**Issues, concerns and expectations raised**
2.1	How would the pillars demarcating the corridor look like? Will it have foundation design and description? (Response by Surveyor General: The beacons demarcating the corridor are going to be conspicuous at least 0.5metres above the ground so as to avoid encroachment from farmers and other people.)
2.2	How will the compensation plan look like? Will bare land be compensated since it is the only means of survival for majority of the people? (Response: there is no compensation for land, only assets on the land will be compensated, e.g economic trees or crops or structures, etc.
2.3	When should the people stop using their affected land? (Response: they can use it until when the project start and the people will be informed appropriately when the project will start)
2.4	What measures are put in place to avoid encroachment (Response: there will be sensitization and monitoring measures will be put in place also)
3.	**Other information of interest**
3.1	(use this section to report any information of interest that is not a concern or an expectation)

Prepared by: Dr. Sheikh D. Abubakar, 17/9/2015

ORGANIZATION NAME: Community Leaders in Birnin-Kebbi Local Government
Date and time of the meeting: 17/9/2015 3:00pm
Meeting location: Kebbi State Secretariat, Gwadangwaji, Kebbi State
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the project and ongoing status (team, goals, deadlines) 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure

No.	Summary of discussions:
1.	**Presentation of the project and ongoing studies:** (brief summary of the information provided on the project and ongoing studies)
2.	**Issues, concerns and expectations raised**
2.1	Will the project affect all the communities that are close to the old line? (Response: It will only affect the people that live or own assets within the demarcated corridor of additional 35m on right hand side of the existing 330KV from Kainji and 50m corridor after turning away from the existing line, all the way the bank of River Sokoto)
3.	**Other information of interest**
3.1	(use this section to report any information of interest that is not a concern or an expectation)

Prepared by: Dr. Sheikh D. Abubakar, 17/9/2015

ORGANIZATION NAME: Community Leaders/Community Based Organizations
Date and time of the meeting: 18/9/2015 9:30am
Meeting location: Arewa Local Government Secretariat, Kangiwa, Kebbi State
Participants: See attached register of signatures
Agenda: 1. Opening prayers 2. Introductions 3. Welcome Address 4. Presentation of the project and ongoing status 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure

No.	**Summary of discussions:**
1.	**Presentation of the project and ongoing studies:** (brief summary of the information provided on the project and ongoing studies)
2.	**Issues, concerns and expectations raised**
2.1	Fulani (Herdsmen) have suffered seriously from the old line ranging from death of their people to death of cattle and even some serious health problems. Some of them climb the tower to observe their cattle grazing. What safety measures will prevent similar issues with the new line? (Response: there is going to be intense sensitization and enlightenment before the commencement of the project. Safety measures will also be included in the design to prevent people from climbing)
2.2	Will farmers be allowed to continue cultivating their land under the power line? (Response: No. because electric lines generate electromagnetic frequency radiation that are capable of causing several health problems especially for people that will stay under it for long.)
2.3	What will happen in a situation where an individual refuses to cooperate by releasing his farm for the line to pass through for personal reasons? (Response: according the land decree of Nigeria, land belongs to the Federal Government of Nigeria. Hence no body have power as an individual over land. However, if there are sacred sites of historical, cultural or religious importance that cannot be moved, will be avoided.
2.4	Who will compensate for structures such as hospitals or dispensary or other government buildings that will be affected? (Response: All structures that will be affected will be appropriately compensated by

	the project. For community assets they will be relocated to another location as may be agreed by the community. Except for sacred sites, renowned historical sites or community grave yard which needs community consent before they are moved.
3.	**Other information of interest**
3.1	It was observed that the information presented in the posters is not adequate. Hence it was suggested that: i. Fliers and pamphlets should be produced ii. Detailed implication of climbing the towers or grazing, farming and building under it should be clearly stated. iii. They should be produced in local language (Hausa and Ajami) for proper dissemination of the information

Prepared by: Dr. Sheikh D. Abubakar

ORGANIZATION NAME: Community Leaders/Community Based Organizations
Date and time of the meeting: 19/9/2015 12:00noon
Meeting location: Field Trip to Areas of Diversion from the Existing 132 KVA
Participants: See attached register of signatures
Agenda: 1. Assemble at State Secretariat 2. Opening Prayers and Departure to Site 3. Presentation of the line route to indicate where the line will pass 4. Comments by stakeholders 5. Response to comments 6. Closing prayers 7. Departure from Site

No.	Summary of discussions:
1.	**Presentation of the project and ongoing studies:** (brief summary of the information provided on the project, the line route showing where it will pass, using hard copy and online maps)
2.	**Issues, concerns and expectations raised**
2.1	When is the project likely to commence? (Response: We don't really know, but adequate notice will be given)
2.2	Should farmers plant their fields during the next season? (Response: Continue your normal work on the fields, notice will be provided on which season not to plant. And this is likely to be after compensation payments.)
3.	**Other information of interest**
3.1	The team for the field work will need community support with logistics for movement, for instance commercial motorcyclists that knows the terrain. The Community Leaders promised to contact motorcyclists in their areas to assist the survey team.
3.2	Community leaders to provide their representatives to work with the survey team for smooth survey. And requested that the representatives be paid daily allowance.

Prepared by: Dr. Sheikh D. Abubakar

MEETING MINUTES
WAPP NORTHCORE 330 kV PROJECT - ESIA AND RAP
CONSULTATION OF PROJECT STAKEHOLDERS

ORGANIZATION NAME: State Authorities/Services	
Date and time of the meeting: 09/10/2015 11:00am	
Meeting location: TCN Conference Room, Abuja.	
Participants: See attached register of signature	
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the project and ongoing status (team, goals, deadlines) 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure	

No.	Summary of discussions:
1.	**Presentation of the project and ongoing studies:** (Brief summary of the information provided on the project and ongoing studies). The following corrections/observations were made with respect to letters of invitation issued: i. Department of Animal Production and Husbandry Services and department of veterinary services are in charge of Livestock ii. Department of Agriculture is in charge of crop production iii. The title of CEO of National Parks Services is "Conservator General"
2.	**Issues, concerns and expectations raised**
2.1	The line is likely to cross the International Transhumance Stalk Route around Kangiwa. Since the line is not likely have effect on cattle grazing as long as they do not settle under the line. There is need for enlightenment for pastoralist to avoid temporary pastoralists settlements should not be within the 50m corridor.
2.2	Even with enlightenment people may still encroach the line corridor to build houses or farming. There is a need for additional measures to prevent this, due to the health and safety effects of such activities within the corridor.
3.	**Other information of interest**
3.1	Balarabe Mahmud of Department of Animal Production and Husbandry Services to provide the information on the exact locations (coordinates and citation) of the cattle route in Kebbi State.
3.2	Agada Theophilees of Forestry Department to provide list of forest reserves in Kebbi State as well as requirements for crossing.
3.3	No representative from the following Agencies attended the meeting Savannah Conservation Foundation (an NGO invited), Ministry of Works, Nigerian Civil Aviation Authority (NCAA) and National Commission for Musuems and Monuments (NCMM).

	It was agreed that they be consulted through written request for information, attaching the line route Map and relevant project descriptive information. • Ministry of Works to provide information about requirements for the line crossing the The Binin/Kebbi-Jega Road, Makera-Bunza Road and the Kangiwa-Kamba Road. • NCAA to provide information about minimum distance required between an airport and a high voltage electricity transmission line as well as identification of existing or proposed airfields near the line route. • NCMM to provide information Cultural Heritage and Archeology sites in Kebbi State likely to be affected, recommendations on procedures to follow in case of accidental discoveries • SCN to provide information on issues of concern and recommendations.

Prepared by: Engr. Mamoud Abubakar, 9/10/2015

MEETING MINUTES
WAPP NORTHCORE 330 kV PROJECT - ESIA AND RAP
CONSULTATION OF PROJECT STAKEHOLDERS

ORGANIZATION NAME: Emir of Argungu
Date and time of the meeting: 14/10/2015 11:00am
Meeting location: Emir of Argungu Palace, Argungu.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the project and ongoing status (team, goals, deadlines) 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure

No.	**Summary of discussions:**
1.	**Presentation of the project and ongoing studies:** Engr. Haruna Principal Manager Transmission, Birnin/Kebbi Substation introduced the WAPP project team and explained the purpose of the visit. Engr. Mamoud Bello provided summary of the information on the project and ongoing studies.
2.	**Issues, concerns and expectations raised**
2.1	NIL
2.2	NIL
3.	**Other information of interest**
3.1	The Emir was away, but was represented by high Chiefs in the palace. They pledged support for the project and appreciated the level of involvement of the people through various consultations that has taken place. And urged EEMS to report back on any challenges with the community or lack of cooperation from any village chief.

Prepared by: Engr. Mamoud Abubakar,16/10/2015

MEETING MINUTES
WAPP NORTHCORE 330 kV PROJECT - ESIA AND RAP
CONSULTATION OF PROJECT STAKEHOLDERS

ORGANIZATION NAME: Emir of Gwnadu
Date and time of the meeting: 13/10/2015 11:00am
Meeting location: Emir of Gwnadu's Palace, Brinin Kebbi.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the project and ongoing status (team, goals, deadlines) 5. Comments by stakeholders 6. Response to comments 7. Closing prayers 8. Departure

No.	**Summary of discussions:**
1.	**Presentation of the project and ongoing studies:** Engr. Haruna Principal Manager Transmission, Birnin/Kebbi Substation introduced the WAPP project team and explained the purpose of the visit. Engr. Mamoud Bello provided summary of the information on the project and ongoing studies.
2.	**Issues, concerns and expectations raised**
2.1	What does the communities stand to gain as a result of this project and the benfit to Kebbi State in general? RESPONSE : There is plan to provide electricity to small towns and villages within 10km of the wayleave.
2.2	Where will this transmission line pass? RESPONSE: The line will start from Birnin Kebbi Substation and head south, running parallel to the existing 330KV line from Kainji. After passing the grain reserve, it will turn right and pass just outside Goru Village. It will take another right turn just outside Unguwan Mairago avoiding Unguwan Dambo and Komawa and then join the existing 132KV line by the riverside and run parallel to it. It will pass through Unguwan Dodo, Kutukulu, Sandare, Unguwan Muza, Eri, Kangiwa and Zukuku, enroute to Niger, Benin and Burkina Faso.
2.3	Will there be any compensation for this communities or persons affected by this project? RESPONSE : There will be adequate compensation for individual and community assets affected. Relevant laws at Local Government, State and federal laws will be followed in addition to world bank and other donor requierements. We are actually here to conduct survey of the assets affected among other activities.
3.	**Other information of interest**
3.1	The Emir thanked us and prayed for the success of the project.

	The Emir thanked the project team for the visit and pledged the support of the Emirate as well as the Kebbi community for the project. He presented a gift of traditional dress to Mamoud.

Prepared by: Engr. Mamoud Abubakar,16/10/2015

MEETING MINUTES
WAPP NORTHCORE 330 kV PROJECT - ESIA AND RAP
CONSULTATION OF PROJECT STAKEHOLDERS

ORGANIZATION NAME: Dry Season Farmers Association

Date and time of the meeting: 23/10/2015 11:00am

Meeting location: Palace of District Head of Kola

Participants:

See attached register of signature

Agenda:

1. Introductions
2. Opening prayers
3. Reason for the Meeting
4. Comments by stakeholders
5. Summary of Resolutions
6. Closing prayers
7. Departure

No.	Summary of discussions:
1.	**Reason for the Meeting:** There is significant number of dry season farmers along the bank of River Sokoto in Kola Village affected by the line route. Portion of this farmland stretching up to 1.5km is completely submerged at the moment and inaccessible to conduct enumeration. Furthermore, boundaries are not identifiable and farmers use small parcels. The meeting was arranged with representatives of the two Farmers Associations –(1) Kola Farmers' Cooperative Society I and (2) Kola Farmers' Cooperative Society II with the involvement of the District Head (Zarumai of Kola) and Surveyor General of Kebbi State and other Community Leaders to agree on how the enumeration will be conducted. The following information was provided during presentations by EEMS, Surveyor General (SG) and the Cooperative Associations. a) The SG said water courses are normally community assets because the Ministry of Lands does not normally grant certificate of occupancy for water courses, rocks, etc. b) EEMS informed participants that farming will not be allowed within the 50m corridor for the project, and compensation will be paid for only crops within the corridor. c) And that crops cultivated on the land during dry season include rice, maize, onions, pepper, tomatoes, cabbage, lettuce, garden egg, alaiyaho, etc.
2.	**Resolutions**
2.1	The entire land with dimension of 1,500m by 50 m starting from existing 132KV tower 23 to tower 28, shall be treated as a single parcel and recorded under community assets in the community survey questionnaire.
2.2	At the time of compensation payment, the District Head of Kola i.e. the Zarumai of Kola will be responsible for identifying affected farmers with the involvement of Ministry of Land and Local Government.
2.3	Only farmers on farmlands within the wayleave can benefit, irrespective of whether they are association or cooperative society members or not.
2.4	Compensation for crops shall be paid based on size of farmlands.

State Authorities

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

Date: 17/09/2015, Location: Kebbi State Secretary conference hall

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	S.R.R.B.D.A	Sulaiman	APM (Engineering)	08036793438	[signature]
2	TCN Moha	Mohammed A	Mgr (Lines TCN)	08032424716	[signature]
3	EEMS LTD	Mamoud Abubakar	ESIA/RAP Coordinator	08099027755	[signature]
4.	EEMS LTD	DR SHEIKH D. ABUBAKAR	CONSULTANT	08035780040	[signature]
5.	EEMS LTD	Musa Yakubu Fakai	Field Officer	08060219302	[signature]
6	R.E.B.	ENGR. U.H. ALIJAN	AGM PLAN, RES & STAT	08065536922	[signature]
7)	MIN. OF LANDS	Adamu Babangida	Valuation and Acquisition	08035824060	[signature]
8.	Min. of Lands & Survey	Muhammad A. Illo	Urban and Regional Planning Dept.	08065631007	[signature]
9	Water Board	ABUBAKAR ZAGA	Dam Operation & maintenance	08065491535	[signature]
10	M.O.A	Abubakar Zaga	A D P R S	08097104532	[signature]

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State Authorities

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

Date: 17/09/2015, Location: Kebbi State Security Conference hall

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	KESEPA	Muhammad W. Yusuf	Director, Env. Assessment & Industrial compliance	08068267005 muhammadyusufw@gmail.com	[signature]
12.	EEMS	Faith Isaac	Field officer	07063409660	[signature]
13	Min. of land	Musa I. Ibrahim	Surveyor General	07034267454 Ibrahimillomusa@yahoo.ca	[signature]
14	ENVIRONMENT	M. A. MAIJEGA	DIRECTOR ENVIRONMENT	08035043858 ameenMaijega@gmail.com	[signature]
15	TCN	Engr. Olisa Okoli	GM (HSE).	08033964855 olisadebeokoli@yahoo.com.	[signature]

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 LGA & VILLAGE HEADS B/KEBBI

Date: 17/09/2015, Location: Kebbi State security conference hall

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	R/ATIKU	Alhaji A. Ibrahim	V. Head	07088904805	[signature]
2	B/KEBBI LG	MOH'D USMAN AMBURSA	DIRECTOR WORKS SERVICE	08101056893	[signature]
3	NASSARAWA I	Shehu Hamaji	Village-Head	08094369581	[signature]
4	KOLA ~~[illegible]~~	[illegible] ZAGGAMA	V.H.	08187989[illegible]	[signature]
5	EEMS	Musa Yakubu Fakai	Field Officer	08060219302	[signature]
6.	EEMS	Dr Sheikh D. Abubakar	Consultant	08035780040	[signature]
7	TCN	Eng. Olisa Okoli	GM (HSE)	08033904855	[signature]
8	EEMS	Engr. Abubakar Bello	ESIA/RAP Coord. Consultant	08099027755	[signature]
9	EEMS	Faith Isaac	field officer	07063409660	[signature]
10	B/KEBBI B[illegible]	Adamu Sadiku [illegible]	V. Head		[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 KARGO LGA + AREWA LGA

Date: 18/09/2015, Location AREWA LGA SECRETARIAT

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	ERI MAIGARI	SULE ERI	MAI GARI	—	AI
2	SANDARE HAKIMI	SANI-S/DARE	WAKILI	—	[signature]
3	U/MASOYI HAKIMI	GARBA HAKIMI	HAKIMI		GARBA
4	U/MUZA HAKIMI	USMAN SANI	HAKIMI MUZA	0709624093	UMS
5	MAHUTA MAIGARI	RASHIDU	MAGARI-MAHUTA	08132432284	[signature]
6	AREWA LOCAL GOVT	MUSA ALIYU	ELECTRICIAN	07067660224	[signature]
7	NAYELWA ~~KALGO~~	Magaji Kabiru	V/Head	08158835491	[signature]
8	Kutukullu	Maiarewa Kutuk	V/Head	08097037736	[signature]
9	UGuwa Jodo	Garba Hakimi	HakiMI	09097730449	Garba
10	ARWA	AISHATU SHUWA	WOMAN Co-ordinator	07066526129	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

KARGO LGA & AREWA

Date: 18/09/2015, Location: AREWA LGA SECRETARIAT

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature	
1.	Arewa L.G	MUH'D FIRCHIN	DIRECTOR OF ADMIN	070 67728724	[signature]	✓
2.	Arewa LG	Adamu Abdulrauf	Land officer	08036581829	[signature]	✓
3	KALGO LG.	SAUDE MOH'D	DIRECTOR SOCIAL DEV.	08066284792	[signature]	✓
4	TCN	Eng. Olisa Okoli	GM (HSE)	08033504855	[signature]	
5.	EEMS	Musa Yakabu Fakai	Field Officer	08060219302	[signature]	
6.	EEMS	Dr. Sheikh D. Abubakar	Consultant	08035780040	[signature]	
7	KUNUIYAR MANOMA	NUMA AMADU	CHAIRMAN	08138168612	[signature]	✓
8	District office Kangiwa	Aliyu Chadi	Mai-Kangiwa	08103539635	[signature]	✓
9	AREWA LGA APC	ISA B. MUSA	SECRETARY	07035314988	[signature]	✓
10	S.I.O1 Hassan	Hassan Ibrahim	S.I.O1	08167397977	[signature]	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 KALGO & AREWA

Date: 18/09/2015, Location ARERA LGA SECRETARIAT

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
01	ARENA LG OTEL	Nludi Suleimy	O.A. SOGALE	08066136430	[signature]
02	AREWA LGA.	NASIRU ABUBAKAR	DEPUTY DIRECTOR AGRIC	08033046383	[signature]
03	MIYATTI ALLAH	ABUBAKAR LULATE	MEMBER		[signature]
04	MIYATTI ALLAH.	UMARU MAISAMARI	CHAIRMAN	08167351000	[signature]
05	Dangaladima Kuka	Umar Faruk Ardo	Hakimi	08178319091	[signature]
06	Hallmi Zukukar	Samaila Talaba	Hakimi	07064341076	[signature]
07	Miyati Allah	Mohamadu Dikko Ardon Kalgo	Ardon Kalgo	08086255400	OIITITO
08	AREWA Local Govt	Abdullahi Sani	D.D WKS	08064461337	[signature]
09	TCN B/Kebbi	Mohamed Abu.	Mgr Lines (TCN)	08032424716	[signature]
10	EEMS Ltd	Engr. Abubakar Bello	ESIA/RAP Coord.	08099027755	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 KALGO & ARLEWA

Date: 18/09/2015, Location ARLEWA LGA SECRETARIAT

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11.	KALGO LGA	SAWUSI MOHD LAWAL	DIRECTOR AGRIC	08069452214	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 WOMEN GROUP/CBOs B/KEBBI

Date: 19/09/2015, Location: Kebbi State Secretariat Conf Hall, B/Kebbi

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	Head of farmers	Bello Sarkin Noma	farmers Head	08069114967 ~~08069114967~~	Mug.B
2	B/K.B Socia ~~W/co-ordinator~~ Department	Aishatu Mohammed	W/co-ordinator	07067601619	[signature]
3	Miyyeti Allah	Abubakar Dogo	Admin secretary	08163531545	[signature]
~~4~~	~~Chairman Abdulgalai~~	~~Abdul Bali Ch~~			
5	Miyyeti Allah	Abdul Galai	Chairman	08145272197	[signature]
6	EEMS	Faith Isaac	field staff	07063409660	[signature]
7	TCN	Engr Ohsa Okoli	GM (HSE)	08033904855	[signature]
8	EEMS	Engr Abubakar Bello	ESIA/RAP Co-ord	08099027735	Bello
9	KUNGIYAR MATA	SAUDATU USMAN	Secretary	08173344111	Sau
10	Dry season farmer	Abdu Kwari	Chairman	08034478140	Abdu

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 WOMEN GROUP/CBOs B/KEBBI

Date: 19/09/2015, Location Kebbi State Secretariate Conf Hall

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	Cooperative	Alh. Hamza	Secretary	0706 340 9661	Hamza
2	Gayyan mata	Salamatu Hassan	Chairman	0803 450 8987	Salamatu
3	Fishermen	Abdulahi Maikifi	Chairman	—	
4	Farmers Asso	Aliyu Maizana	Sec	—	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

Date: 19/09/2015, Location: Field Trip to Line Route

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	TCN B/Kebbi	Mohammed Abu.	Man Line	08032424716	[signature]
2	TCN	Engr Okesi Ocori	GM (HSE)	08033904855	[signature]
3	EEMS	Dr. Sheikh D. Abubakar	Consultant	08035780040	[signature]
4	EEMS	Musa Yakubu Fakai	Field Officer	08060219302	[signature]
5	EEMS	Dr N.B. Enisforunda	Field Officer	08035829009	[signature]
6	B/Kebbi L/G Shehu Hanafi	Shehu Hanafi	Village Head		[signature]
7	B/ KEBBI LG.	Usman Zabunmori	SAKATARE V.H.	08182989719	[signature]
8	B/kebbi LG	Aliyu A. Ibn	V. H (CHAIRMAN)	07088904805	[signature]
9	HEADS OF FARMERS.	BELLO S. NOMA	SARKIN NOMA	08069114967	Muhy.B
10	B/Kebbi Local Gov't	Aishatu Mohammed	Women Co-ordinator	07067601619	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

Date: 19/09/2015, Location: Field Trip to Line Route

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	MITOTTI ALLAH	Abubakar D/Gwaggo	Admin Secretary	08163551545	[signature]
12	MIYOTTI ALLAH	Abdul bari	chairman	08145272197	[signature]
13	EEMS	Faith Isaac	field Staff	07063409660	[signature]
14	EEMS Ltd	Engr. Akeredolu Mobel	ESIA/RAP Cord	08099027755	[signature]
15	Min. of Land	Musa I. Ibrahim	Surveyor General	07034267454	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 KOLA VILLAGE FADAMA FARMERS

Date: 23/10/2015, Location Zarumai Kola (Village Head) Residence

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
01	EEMS Ltd	ABUBAKAR Mamoud	ESIA/RAP Co-ordinator	08099027755 ambello@eemslimited.com	[signature]
02	Min. of land &Housing B/K	Surv. MUSA I.I	Surveyor General	07034267454 Ibrahimillomusa@yahoo.ca	[signature]
03	Usumanu	Zarumai Kola	Sarauniya V.H.	08187938719	[signature]
04	Farmer Associati Ahmed Kola	Ahmed Sambo	Secretary Kola II Farmers	07066527704	Ahmed
05	Farmer Associ Magaji	Magaji Chindo	Chairman Kola II Farmer	08161180280	[signature]
06	Farmers Assoc Kwarkwari	Liman Isah	Sec. Kwarkwari Far. Ass	08181063090	[signature]
07	Kola Village	Muhammadu Sarki	Head of The Village	08142398281	MS
08	Kola Village	Umar-u Zarumai	Dangaladima	08173777772	[signature]
09	Kola village	Abdullahi Totti	member		[signature]
10	Kola village	Monde Noni	Dry Season farmer		[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 CUSTOMARY CHIEFS – B/KEBBI LGA

Date: 13/10/2015, Location: EMIR OF GWANDU PALACE, B/KEBBI

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1.	GWANDU EMIRATE COUNCIL	MAJ. GEN. MUHD. ILIYASU H.R.H. EMIR OF GWANDU	EMIR OF GWANDU		08036154364
2	"	ALH. ABDULLAHI UMAR WAZIRI	WAZIRI GWANDU	08037020607 iwaziringwandu@yahoo.com	
3.	"	ALH. ABDULLAHI B. MAGAJIN RAFIN GWANDU	MAGAJIN RAFI GWANDU	08063056679	
4.	"	ALH. IBRAHIM BASHAR IUKB GALADIMA	GALADIMA GWANDU	08030437314	
5	"	IMAM MUKHTAR ABDULLAHI WALI	WALI GWANDU	08051340403	
6	"	ALH. ABUBAKAR ZAKI AHME BUNU	BUNU GWANDU	08064977520	
7.	"	ALH. IBRAHIM ABDULLAHI	IYA GWANDU	08097961347	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015 CUSTOMARY CHIEFS - ARGUNGU EMIRATE

Date: 14/10/2015, Location EMIRE OF ARGUNGU PALACE - KALGO & AREWA LGAs

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	ARGUNGU EMIRATE COUN.	Alh. Sani Aliyu	Rep. Emir of Argu. Kundudan Kalsi	08026268503	[signature]
2.	✓	Alh. Aminu Musa	Magajin garin Kalsi	08036056778	[signature]
3	✓	Alh. Kabiru Dukko	Member Argungu Emirate Council	08035347622	[signature]
4	✓	Alh. Abdullahi Sarki	✓		[signature]

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

NATIONAL AGENCIES

Consultation of Project Stakeholders, August - September 2015

Date: 09/10/2015, Location TCN Conference Room Abuja

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	FED. MIN. OF ENVIRONMENT, FED DEPT OF FORESTRY	AGADAFINI THEOPHILUS	PEG1	08064586982 theophilagadas@yahoo.com	[signature]
2	FED. MIN. OF AGRIC & RURAL DEV. DEPT. OF ANIMAL PRODUCTION ABUJA.	BALARABE MAHMUD	ASSIST DIRECTOR	08036204551 balarabemahmud@gmail.com	[signature]
3	DEPT. OF ANIMAL PRODUCTION & HUSBANDRY SERVICE (FMARD)	KUUSU DOORUMUN JACOB	LDO II	08062082001 jacobkuusu@gmail.com	[signature]
4	NATIONAL PARK SERVICE ABUJA	ENGR. GANA AHMED LAWAN	ASSIST CONSERVATOR OF ENGINEERING	ahmedlgana@yahoo.com 08023793210 07030269088	[signature]
5	Property Acquisition Dept. TCN	Esv. Akobundu. F. G (Mrs)	Manager (Property)	08034535027	[signature]
6	TRANSMISSION COMPANY OF NIGERIA	Engr. L. C. Ogwu	Asst. Gen. Mgr. (Lines)	08036136486	[signature]
7.	Wayleave Dept TCN	Oluwatobi K. Babalola	Manager (Wayleave)	tobie7134@yahoo.com 08122799533	[signature]
8.	CR&E (TCN)	E. K. Aluyu (Mrs)	Senior Manager (ESH)	kakacct2002@yahoo.com 08038055893	[signature]
9	~~Apollos Samson K~~				
10	FMARD, ABUJA	APOLLOS SAMSON K	ASSISTANT DIRECTOR	08034982208 apollossamson5@yahoo.com	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

NATIONAL AGENCIES

Date: 09/10/2015, Location: TCN Conference Room Abuja

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	Fed. Min. of Environment Abuja	Joshua Taiwo L.	Assistant Director Environmental ~~Assessment~~	08055270104 joshuatlimpu@gmail.com	[signature]
12	TCN	Engr. Olisa M Okoli	GMC (HSE)	08033904855 olisadebeokoli@yahoo.com	[signature]
13	EEMS Ltd	Engr. Abubakar M Bello	ESIA/RAP Coordinator	08099027755 ambello@eemslimited.com	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, October 2015

MEDIA HOUSES

Date: 15-10-2015, Location Filin Sauka, Birnin Kebbi

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	KBTV	Kunle Tajudeen	Camptroller News	kunle.tajudeen007@gmail.com 08035111154	[signature]
2	KB RADIO	Adeyemi Segun	Snr Reporter	08065723948 adedennis70@gmail.com	[signature]
3	NAN	Ibrahim Bello	Reporter	ib.bello89@gmail.com 08068262281	[signature]
4	LEADERSHIP	YAHAYA SARKI	CORRESPONDENT	ysarki94@gmail.com 07033076858	[signature]
5	~~YAHAYA UMAR B.~~ FRCN	YAHAYA UMAR BALARABE	CORRESPONDENT	07088856143	[signature]
6	TCN	Mrs Ruskin	Mgr (ERSU)	inemsunday@yahoo.com 07082339096	[signature]
7	EEMS LTD. ABUJA	DR. INYANG ATTING	CONSULTANT, HEALTH IMPACT ASSESSMENT	08037136193 dr_atting@yahoo.com	[signature]
~~8~~	~~Surv. Musa I. Ministry of la Housing~~				
8	Ministry of land & Housing, BIKESSA	Surv. MUSA I. Ibrahim	Surveyor General KBS	Ibrahimillomusa@yahoo.com 07034267457	[signature]
9	TCN	Ibe Ifeanyi	Officer II (ERSU)	07039084756 ifeanyiibe07@gmail.com	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, August - September 2015

MEDIA HOUSES

Date: 15 - 10 - 2015, Location: Fidin Sauka, Birnin Kebbi

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
10	EEMS Limited	Olatayo Olusehinde	Air quality & Background Noise / Project Operation Executive	08172242418 / tayo@eems limited.com	[signature]
11	EEMS Limited	Olatunde Olusehinde	Field officer	08134861235 / tunfol@yahoo.com	[signature]
12	EEMS Limited	Engr. Aboubakar Bello	ESIA/RAP Coordinator	08099027755 ambello@eemslimited.com	Bello
13	EEMS Limited	Adefila Adebisi	Logistics/HSEQ	08174636039 adebisi.adefila@eemslimited.com	[signature]
14	FMEnv Abuja	Joshua Taiwo L.	Assistant Director	08055270104 joshuatlimpus@gmail.com	[signature]

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Environmental and Social Impact Assessment (ESIA) for the 330 kV "North Core" Transmission Line Project

Public Information Document, September 2015

Project Overview

The Project involves the construction of a high voltage electrical transmission line over a distance of 880 km between Birnin Kebbi (Nigeria) and Ouagadougou (Burkina Faso), through Zabori and Niamey (Niger). It also connects with Benin in the region of Malanville, via Niger.

The project is part of a regional energy integration process, with the objective to: (i) promote and enhance electricity trade; (ii) improve power security and reliability of supply on the four national systems; and (iii) contribute to economic development and regional integration.

The transmission line will consist of the following sections:

- Birnin Kebbi (Nigeria) – Niamey;
- Niamey – Ouagadougou ;
- Zabori (Niger) – Malanville (Benin).

In Nigeria, the project includes the following activities:

- Construction of a high voltage (330 kV) transmission line over a distance of 62 km between Birnin Kebbi and Kaingiwa (border with Niger);
- Construction of a new 330 kV substation, or expansion of the existing one, in Birnin Kebbi;
- Installation of Supervisory Control and Data Acquisition (SCADA) and Fibre Optic systems

Studies underway will determine the best route option for the transmission line based on technical, environmental and social considerations.

Expected Project Benefits

- Increased reliability and security of energy supply;
- Increased capacity for energy exchanges between the countries;
- New opportunities for rural and urban electrification.

Impacts Sometimes Associated With Transmission Lines

- Wayleave clearance may bring about damage to vegetation and wildlife habitat;
- Transmission lines may open up virgin land and provide easy access to illegal loggers or poachers;
- Restrictions may apply on land use and agricultural activities under the line (within wayleave);
- Transmission lines may have effects on migratory birds and low flying aircrafts;
- Construction works may disturb seasonal crops and affect nearby population;
- Transmission lines may, for safety reasons, require people to resettle outside the wayleave.

Compensation for Lost Assets and Assistance to Affected Households

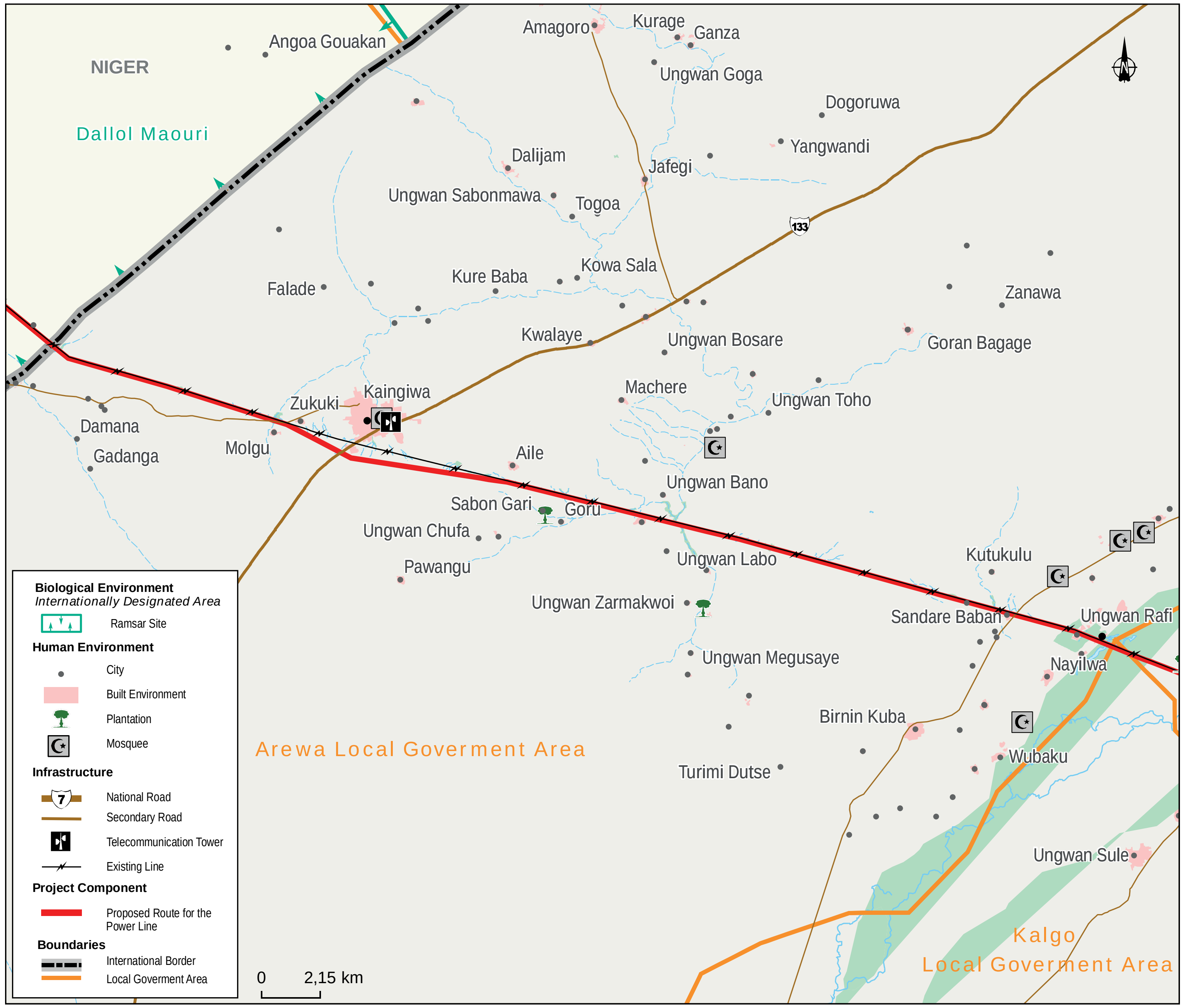
A Resettlement Action Plan (RAP) will define the compensation and assistance required to support the households and communities affected by the clearance of the power line's right-of-way, according to national procedures and World Bank's requirements. A socio-economic survey will be conducted with potentially affected households and communities in October 2015 so as to determine the project's impact on their properties and activities.

The Environmental and Social Impact Assessment (ESIA)

The completion of an environmental and social impact assessment is a legal obligation to obtain permits for the realization of the 330 kV North Core transmission line project. Initiated in December 2014, this study is expected to be finalized in 2016.

The ESIA aims to identify:

- Potential impacts on the natural environments (water, air, soils, wildlife, vegetation);
- Potential impacts on populations and human activities (health, security, cultural and economic activities);
- Measures required to mitigate negative impacts and to enhance project benefits;
- Required environmental and social monitoring and follow-up activities.



Public Information and Consultation Sessions

Informative and consultative meetings will be held in the Local Government Areas affected by the route of the transmission line (Birninkebbi, Kalgo and Arewa). These meetings, which will occur in September or October 2015, will enable community representatives, local authorities and other participants to obtain further information about the project and express their concerns, expectations and suggestions.

Contact : **WSP**

M. Frédéric Faustin
ESIA Director
Frederic.Faustin@wspgroup.com

WSP Canada, in collaboration with EEMS, was mandated to conduct the ESIA and Resettlement Action Plan studies for the 330 kV WAPP North Core Project.

Pictures of Consultation Round 3, September and October 2015, Nigeria

Consultative meeting with representatives of Bernin Kebbi LGA, September 17th, 2015

Consultative meeting with representatives of Bernin Kebbi LGA, September 17th, 2015

Consultative meeting with representatives of Arewa and Kalgo LGAs, September 18th, 2015

Consultative meeting with representatives of Arewa and Kalgo LGAs, September 18th, 2015

Consultative meeting with representatives of Arewa and Kalgo LGAs, September 18th, 2015

Consultative meeting with representatives of State Agencies, in Bernin Kebbi, September 17th, 2015


Consultative meeting with national level stakeholders in Abuja, October 9th, 2015


Consultative meeting with national level stakeholders in Abuja, October 9th, 2015


Consultative meeting with national level stakeholders in Abuja, October 9th, 2015

Appendix 7

CONSULTATION ROUND 4 – MINUTES AND SIGNATURES

ORGANIZATION NAME: LGA Authorities/Services
Date and time of the meeting: 14/03/2016 09:00 Hours
Meeting location: State Secretariat Conference Room, Birnin Kebbi.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the Preliminary ESIA, ESMP and RAP reports 5. Feedback from stakeholders 6. Response to comments/Round Up 7. Closing prayers 8. Departure

PRESENTATION OF THE PROJECT AND ONGOING STUDIES

The key findings and recommendations contained in the preliminary ESIA, ESMP and RAP reports was presented to LGA authorities and CBOs at LGA level; in order to pre-validate and obtain feedback and suggestions from stakeholders to improve them. And also to assess the level of compliance of key measures put forward by the preliminary ESMP and RAP reports with authorities' requirements and expectations.

FEEDBACK FROM STAKEHOLDERS

Topic	Comments and recommendations	the comment / recommendation by
Electrification of villages	The communities pledged unflinching support for the project and reiteration for earlier request for the electrification of villages along the line route.	Arewa LGA (Sarkin Noma, Farmers Association)
Public Awareness	Translate public awareness in Hausa Language and print in Ajami characters as well. Awareness should also be aired on local radio and TV stations	Kalgo LGA (Social Development) Kalgo LGA (Ardo Fulani)
Women	The culture of the people of the area does not encourage women to partake in certain types of jobs. Hence, the need to consult widely when hiring women.	Kalgo LGA (Social Development)

Prepared by: Engr. Mamoud Abubakar

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ORGANIZATION NAME: National Authorities
Date and time of the meeting: 17/03/2016 10:00am
Meeting location: TCN Conference Room, Abuja.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the Preliminary ESIA, ESMP and RAP reports 5. Feedback from stakeholders 6. Response to comments/Round Up 7. Closing prayers 8. Departure

PRESENTATION OF THE PROJECT AND ONGOING STUDIES

The key findings and recommendations contained in the preliminary ESIA, ESMP and RAP reports was presented to participants; in order to pre-validate and obtain feedback and suggestions from stakeholders to improve them. And also to assess the level of compliance of key measures put forward by the preliminary ESMP and RAP reports with authorities' requirements and expectations.

FEEDBACK FROM STAKEHOLDERS

Topic	Comments and recommendations	the comment / recommendation by
Accidental find	Ensure prompt reporting of accidental find of archaeological materials to National Commission for Museums and Monuments and further work suspended until Officers arrive site	National Commission for Museums and Monuments
Vegetation	It is recommended that trees removed should be replaced through revegetation programme.	Federal Department of Forestry
Report format	The ESIA report should be presented in line with the format in the EIA Sectoral Guideline	Federal Ministry of Environment (Environmental Assessment)
Crossing Cattle Routes	Try to minimise the number of towers placed in the international Transhumance Cattle Route	Federal Ministry of Agriculture (Animal Husbandry department)
Sokoto River Crossing	Contact National Inland Waterways Agency (NIWA) for their role	TCN (Wayleave Unit)
Burrow Pits	Ensure appropriate mitigation/rehabilitation of burrow pits	Savannah Conservation Foundation (NGO)
Community Land	Ensure compensation is paid directly to the PAPs farming in the Wetland area surveyed as community land	TCN (Environment Unit)
Compensation for undeveloped land	It is recommended to pay compensation for lands that has no asset, where the owner has certificate of ownership or customary ownership to avoid lengthy grievance or even litigation	TCN (Wayleave Unit)

Prepared by: Engr. Mamoud Abubakar

ORGANIZATION NAME: State Level Authorities/Services
Date and time of the meeting: 14/03/2016 13:00 Hours
Meeting location: State Secretariat Conference Room, Birnin Kebbi.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the Preliminary ESIA, ESMP and RAP reports 5. Feedback from stakeholders 6. Response to comments/Round Up 7. Closing prayers 8. Departure

PRESENTATION OF THE PROJECT AND ONGOING STUDIES

The key findings and recommendations contained in the preliminary ESIA, ESMP and RAP reports was presented to State level agencies; in order to pre-validate and obtain feedback and suggestions from stakeholders to improve them. And also to assess the level of compliance of key measures put forward by the preliminary ESMP and RAP reports with authorities' requirements and expectations.

FEEDBACK FROM STAKEHOLDERS

Topic	Comments and recommendations	the comment / recommendation by
Vegetation	It is recommended that trees removed should be replaced through revegetation programme. And the State Government pledged to donate seedlings for the revegetation programme	Kebbi State Ministry of Environment
	The report of the land survey to demarcate the wayleave should be submitted to State Government, and should be done with the participation of the Ministry of Lands/Survey. The beacon numbers is to be issued by Surveyor General of the State.	Kebbi State Ministry for Lands
Crossing Highways	All highways have ROW of 45.72m, and towers should not be placed within the highway ROW	Federal Controller of Works, Kebbi
Community Compensation Fund (CCF)	The Dukku Barracks needs to be considered as a community for the purpose inclusion in the CCF projects and be invited to all engagements with communities the line crosses. This is because line passes through the Barracks land for several kilometers	1st Battalion Dukku Barracks, Birnin Kebbi

Prepared by: Engr. Mamoud Abubakar

ORGANIZATION NAME: Village Chiefs of Villages crossed by the line
Date and time of the meeting: 11/03/2016; 09:00 Hours
Meeting location: State Secretariat Conference Room, Birnin Kebbi.
Participants: See attached register of signature
Agenda: 1. Introductions 2. Opening prayers 3. Welcome Address 4. Presentation of the Preliminary ESIA, ESMP and RAP reports 5. Feedback from stakeholders 6. Response to comments/Round Up 7. Closing prayers 8. Departure

PRESENTATION OF THE PROJECT AND ONGOING STUDIES

The key findings and recommendations contained in the preliminary ESIA, ESMP and RAP reports was presented to Head of Villages crossed by the line; in order to pre-validate and obtain feedback and suggestions from stakeholders to improve them. And also to assess the level of compliance of key measures put forward by the preliminary ESMP and RAP reports with authorities' requirements and expectations.

The meeting was conducted in Hausa Language as usually is the case with this group of stakeholders.

FEEDBACK FROM STAKEHOLDERS

Topic	Comments and recommendations	the comment / recommendation by
Wetland crossing	Unguwan Dodo community on the other side of the Sokoto River plains, complaint that they ought to have been invited to the meeting in Kola village with the Fadama Farmers. They claimed that they also have dry season farmlands on their side of the River. It was explained by EEMS that their non inclusion is because there was never any sign of farming activity on that side of the river. Nevertheless, it was agreed that the area in reference will be inspected the following day.	Village Chief of Unguwan Dodo

Prepared by: Engr. Mamoud Abubakar

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 14TH MARCH, Location BIRNIN KEBBI, Group LGAs & SERVICES

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	B/KEBBI L-G	ALHD USMAN AMBURSA	D/WORKS & SERVICES	08107056893	
2.	B/KEBBI L.G	HASSAN GEZARU BUNZA	D.S.D	07032990815	
3.	AREWA L/GOVT.	MUIHD DAN GIARSO	MIYASTI ALLAH	08164662154	
4	Kalgo L/G	Muhammadu R/Kalgo	Ardon Kalgo Fulani	08086255400	
5	Kalgo L/G	Garba Abdullahi R/Bauna	Director of Works and Services	09039027028	
6	Kalgo L/G	Musa Hassan Kalgo	Sole administration	08094358197	S.A. Klg.
7	Arewa Kangiwa L/Govt	Alh. Amadu S/ Noma	Farmers Associ.	08138168612	
8.	AREWA L/G	UMAR TANKO JEGA	DIRECTOR SOCIAL DEVELOPMENT	08135499805	
9	KALGO L/G	SAUBE MOH'D KAMBA	DIRECTOR SOCIAL DEVELOPMENT	08066284792	
10	KALGO LG	ABUBAKAR DAN L/L BUNZA	DIRECTOR HEALTH	08037034603	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 14TH MARCH, Location: BIRNIN KEBBI, Group: ~~STATE~~ LGA AGENCIES

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	MINISTRY OF ENVIRONMENT	MAISEGA MOHD AMEEN	DIRECTOR OF ENVIRONMENT	08035043858 ameenMayega@gmail	
12	TCN	JOSEPH TUNDE AKANDE	AGM (CR$E)	08034335257 akandejoe44@gmail.com	
13	TCN	Yusuf Babatunde	S.M (Civil)	08023274822 babas2000yus@yahoo	
14	TCN	Ruskin, I.B.A. (Mrs)	Manager (ERSU)	08099862074 inemsunday@yahoo.com	
15	B/Kebbi LGA	Shehu Muhammad	Director PHC B/KLG	08032868626 shehumuhammad4473@yahoo	
16	DSS	Ishaya Bazo	Rep. of DSS	07039897786	
17	ARewah	YAHAYA AHMED	BTNS	080-60045195	
18	EEMS	UHEGWU KELECHI. C	FIELD OPERATOR	07036760559 kuhegwu@gmail.com	
19	EEMS	Aboubakar Ahamed	COO	08099077759 ambellooeemslimited.com	

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016 STATE LEVEL

Date: 14TH MARCH, Location BIRNIN KEBBI, Group NATIONAL AGENCIES

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1.	Fed. Min of Power Works & Housing	Tiga Goni Mohd	FEDERAL CONTROLLER OF WORKS.	08037861102 taikegoni@yahoo.com	[signature]
2	Fed. Min. of Power Works & Housing	Abubakar M. Kalgo	FMWORKS Field Officer H.Q.B/Kebbi	08060217169	[signature]
3	1 Battalion Nigerian Army	2LT CC IWUALA	ADJUTANT	08134728375 cciwuala@gmail.com	[signature]
4	MWASA B/K K/B	Zubairu Bala	S.W.O.	08065911714 zubairusala@yahoo.com	[signature]
5	Min. of Land B/Kebbi	Adamu Babangida	Land Acquisition Evaluation Officer	08135824060 adamubabangida77@gmail.com	[signature]
6.	Min. of Agric. Kebbi State	Bala Mohd Giwa	Director of Agric. Services Dept	08102700794	[signature]
7	"	Kiskum Kiskuwa U. Zagga	Director Irrig. Eng. Services	08022070901	[signature]
8	MINISTRY OF ENVIRONMENT	MAISEGA MOHD AMEEN	DIRECTOR OF ENVIRONMENT	08035043858 ameenMaisega@gmail	[signature]
9	TCN	JOSEPH TUNDE AKANDE	AGM (CR$E)	08034335257 akandejoe44@gmail.com	[signature]
10	TCN	Yusuf Babatunde	S.M (Chem)	08023274822 babs2000y@yahoo	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016 STATE AGENCIES

Date: 14 TH MARCH, Location BIRNIN KEBBI, Group STATE LEV AGENCIES/SERVICES

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	TCN	RUSKIN, I.B.A.(Mrs)	Manager (ERSU)	08099862074 inemsunday@yahoo.com	[signature]
12	EEMS	Uhegwu, Kelechi	Field operator	07036760559 kuhegwu@gmail.com	[signature]
13	EEMS	Abubakar Mamoud	COO	08090027753 ambello@eemslimited.com	[signature]
14	Kalgo LG	Umar Shuma	Rep Farmers (NGO)	08073563125	[signature]
15	AREWA LGA	USMAN GORA	AREWA LGA/HEALTH	08037231400	[signature]
16	Ahmadu Ardo	Ardo - Arewa	Arewa LGA	08023143374	[signature]

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 11TH MARCH, Location: BIRNIN KEBBI, Group: VILLAGE CHIEFS

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	S/Soru village	hassan mhd	Village head S/Gari	07038310935	[signature]
2	Nayelwa District	muhammadu kabiru	District Head Nayelwa	08188835491	[signature]
3	Kutakullu	muhammed	V/head Kutukullu	08097037736	[signature]
4	Unguwan Dodo	Garba hakimi	V/head Unguwar dodo	09097736475	Gar
5	Sandare	magani sani	V/head Sandare		[signature]
6	Unguwan Labbo	Alh. Sallau	V/head Labbo Unguwar Labbo	08036299064	[signature]
7	Unguwan Maza	Usman Sani	V/head Unguwar maza	08169760756	USUMI
8	Unguwan Masoyi	Garba hakimi	V/head Unguwar masoyi	08088422025	GORBA
9	Unguwan Gaga	Garba Liman	V/head Unguwar gagga	080628958724	[signature]
10	Unguwan Danbo	muhd hakimi	V/head Unguwar danbo		MHMH

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 11TH MARCH, Location BIRNIN KEBBI, Group VILLAGE CHIEFS

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
11	Ulwan Masoyi	Bello hakimi	Ungumar masoyi	08138363248	BELLO
12	Zukuku	Ismaila talaka	Zukuku	07064341076	[signature]
13	Kola village	Usman Sarumai	Zarumai of Kola	08142839930	[signature]
14	Nassarawa 2	Mal. Shehu Hamdi	B/Nassarawa 2	08033239771	[signature]
15	Eri village	Salle m/gari	Eri		NA
16	Tudun kangiwa	Mohd Sahabi Uhegwu	Tudun wada/K		[signature]
17	EMS				

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North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 11TH MARCH, Location BIRNIN KEBBI, Group VILLAGE HEADS

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
17	TCN	JOSEPH TUNDE AKANDE	AGM(CR$E)	08034335257 akandejoe44@gmail.com	[signature]
18	TCN	Yusuf Babatunde	Senior Mgr (Chem)	08025274322 babs2young@yahoo.co.uk	[signature]
19	TCN	RUSKIN, I.B.A (Mrs)	Manager (ERSU)	08099862074 inemsunday@yahoo.com	[signature]
20	EEMS	Abubakar Mamood	COO	08099027753 ambello@eemslimited.com	[signature]
21	EEMS	UHEGWU KELECHI CHIOMA	FIELD OPERATOR	07036760519 kuhegwu@gmail.com	[signature]

North Core 330 kV Power Interconnection Project Environmental and Social Impact Assessment (ESIA)

Consultation of Project Stakeholders, March 2016

Date: 13/03/2016, Location: Unguwan Dodo, Group: Fadama Farmers (U/Dodo)

S/N	Organization	NAME, surname	Position/Designation	Phone No/E-Mail	Signature
1	Nasarawa	Muhammadu Rabiu	District Head	08188885491	
2	Ung. Dodo	Umar Kane	Village Head		
3	Ung-Dodo	Bello Bacanike	Farmers U/Dodo		
4	Nasarawa	Malam Abuwa	"	09086445787	ABN
5	Ung-Dodo	Muhammadu Altine	"	08137966310	
6	Ung-Dodo	Umaru Bawa	"		WSJMAU
7	EEMS	Abubakar Jibrin Ramonu	COO	08099027755	
8	TCN	Ruskin, I.B.A (Mrs)	Manager (ERSU)	08099862074	
9	TCN	Aminu Haruna	PM (TC)	08143133669	
10	TCN	J.T. Akande	AGM (CR$E)	08034335257	
11.	TCN	Yusuf Babatunde	S.M (Chem)	08023274312	

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Appendix 8

ESIA CLEARANCE

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

MANAGING DIRECTOR
TRANSMISSION COMPANY OF NIGERIA
(TCN)
20 JUL 2017
272
RECEIVED

Ref: FMEnv/EA/EIA/2489/Vol.II/216
Date: 19th July, 2017

The Managing Director,
Transmission Company of Nigeria (TCN),
Power House,
Aguiyi Ironsi Street, Maitama.
Abuja FCT

TECHNICAL REVIEW ON THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF THE PROPOSED WEST AFRICA POWER POOL NORTH CORE 330KV TRANSMISSION LINE PROJECT AT KEBBI STATE

Please refer to your request for an ESIA permit for the proposed West Africa Power Pool 330KV Project.

2. Following the due Technical Evaluation of ESIA report, I am directed to inform you that the ESIA was adjudged satisfactory for disclosure and also to inform you as follows:

(a) That the ESIA passed through the various stages in the Procedural and Sectoral Guidelines.
(b) The ESIA report adequately reviewed all relevant regulations, laws, Acts.
(c) The project location including maps, design and size (capacity, area covered) was adequately described.
(d) The purpose and rationale of the project is clearly presented.
(e) The description of the existing environment including baseline data was adequately presented and are relevant to assess the main environmental effects from the project and associated and cumulative impacts.
(f) The ESIA report also presented the potential significant environmental impacts of the project including ecological, cultural and socio-economic impacts.
(g) Finally there is evidence that local regulatory bodies, NGOs, CBOs, communities and statutory Agencies and other Stakeholders likely to be affected by the project have been identified and interacted/consulted with.

3 In view of the foregoing, the Federal Ministry of Environment hereby recommends that you may wish to send the ESIA to the West African Power Pool (WAPP) for onward disclosure.

4. I am also to inform you that all other stakeholders engagement issues shall be ratified after the ESIA Panel review exercise scheduled to hold amongst the relevant stakeholders, project affected persons, identified project host community as well as Environmental regulators at State and Local Government levels, community in Kebbi State. The Panel review exercise is scheduled to hold 1st - 4th August, 2017.

5. Thank you for your co-operation.

J A Alonge
Director of Environmental Assessment
For: Honourable Minister.

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

Ref: FMEnv/EA/EIA/2489/T/86
Date: 5th September, 2017.

The Managing Director/CEO,
Transmission Company of Nigeria (TCN)
Plot 441, Zambezi Crescent,
Maitama,
Abuja

INVOICE

FINAL ASSESSED CHARGE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED WAPP NORTH CORE 330KV DC (NIGERIA SEGMENT) INTER-CONNECTION PROJECT AT KEBBI STATE.

S/NO	ITEM DESCRIPTION	AMOUNT (₦)
i.	Impact Mitigation Monitoring (IMM) For the first exercise (Operational)	500,000.00
ii.	Assessed Charge for the proposed 330kV substation and 65Km transmission line traversing Birnin Kebbi, Kalgo and Arewa Local Government Areas, Kebbi State:- Revenue Charges: ₦1,125,000.00 Operational Charges: ₦375,000.00	1,500,000.00
	Final Assessed Charge	**₦2,000,000.00**

2. The total amount to be paid to the Federal Ministry of Environment for issuance of Environmental Impact Statement (EIS) and Environmental Impact Assessment (EIA) Certificate for the proposed project is Two Million Naira (₦2,000,000.00) only. This should be paid as follows:-

   a) **EIA Operational Charge:** Eight Hundred and Seventy-Five Thousand Naira (₦875,000.00)

   b) **EIA Government Revenue:** One Million, One Hundred and Twenty-Five Thousand Naira (₦1,125,000.00)

   c) Payments are expected to be made into the Federal Government's Treasury Single Account (TSA) platform (www.remita.net)

3. Kindly note that the **Revenue** and **Operational** payments shall be made separately.

4. The evidence of respective payments shall be forwarded to the Ministry's Headquarters, Abuja.

J. A. Alonge
Director, Environmental Assessment Dept.
For: Honourable Minister.

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

MANAGING DIRECTOR/CEO
TRANSMISSION COMPANY OF (TCN)
11 SEP 2017
RECEIVED

Ref: FMEnv/EA/EIA/2489/T/85
Date: 5th September, 2017.

The Managing Director/CEO,
Transmission Company of Nigeria (TCN)
Plot 441, Zambezi Crescent,
Maitama,
Abuja

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED WAPP NORTH CORE 330KV DC (NIGERIA SEGMENT) INTER-CONNECTION PROJECT AT KEBBI STATE

Please refer to the panel review meeting conducted for the above named project on 3rd August, 2017.

2. Following the conclusion of the panel review exercise, I am directed to inform you that the ESIA draft report was considered good.

3. I am further directed to convey the following matters to be handled by your Organization:-

a) Submission of five (5) hard copies and two (2) electronic (in PDF) copies of the final ESIA report having addressed the panel harmonized comments (herewith attached) within three (3) months on receipt of this letter
b) Payment of the final assessed charge to the Ministry as per the attached invoice.

4. Kindly note that this is not an Approval Letter and that the EIA approval letter shall only be issued on confirmation that items 3 (a) and (b) above have been satisfactorily complied with.

5. Thank you for your co-operation.

J. A. Alonge
Director, Environmental Assessment Dept.
For: Honourable Minister.

FMEnv. COMMENTS ON THE ESIA OF THE PROPOSED NORTH CORE PROJECT IN NIGERIA-NIGER-BURKINA FASO-TOGO/BENIN.

PRELIMINARY PAGES

- Pg. iii; Project Team; Please include the qualification of the team in the final report.
- The final report should include the acknowledgement

EXECUTIVE SUMMARY

- EIA Act No. 86 of 1992 – should be cited in its original nomenclature EIA Act Cap E12 LF, 2004.
- Page vi - Under project description; statement 'The line route area which is made from a 5 km **buffer** from the central axis…' this statement is not clear? Please provide clarification if
- Page viii – under social environment;
  - Para.2 References were made to Arewa Dandi LGA, please note that Arewa and Dandi are now in separate LGAs, Danli LGA has its HQ in Kamba therefore this should be corrected throughout the report.
  - Para. statement that the HQ of Arewa Dandi LGA is in the town of Arewa Dandi. This is not correct, the HQ of Arewa LGA is Kangiwa therefore should be corrected.
  - Para.2 stated that Birnin Kebbi LGA falls within the line, this should be corrected to 'the line traverse B/Kebbi LGA'
  - Para.6 on public infrastructure, the information provided is very scanty and limited to springs and wells. E.g. '…most of the Kebbi State population uses protected and unprotected springs and wells…' are there no other public infrastructure in Kebbi State? Particularly for water supply. This section should be rephrased to reflect the state of public infrastructure in the affected area.
  - Much of the information provided on the social environment is generalized for the entire state. Water, education facilities, health

facilities ect; the section should be revised to provide specific information relevant to the affected LGAs.

- Page ix under stakeholders engagement; bullet point 5 – please note that Birnin Kebbi is not a state, It should be corrected to Kebbi State while Kola is not LGA as stated (Birnin Kebbi, Area and Kola) and should be corrected.
- Pages xi-xvi tables A-B titled 'summary of residual impacts…'
  - The contents are not actually on residual impacts
  - The table is silent of the key project activities and their specific impacts. It should be revised and made specific to the project activities
- Page xv Management measures; completely silent on the specific mitigation measures to address the impacts identified.

The entire report should be revised to comply with the EIA report writing standard in Nigeria hence the need for procedural guidelines.

- The non-technical summary should be a non-technical summary of all the project void of tables and diagrams.
- Include the sampling dates, name and full address of the laboratory used.
- Include the project life span in the revised executive summary?

<u>CHAPTER TWO – PROJECT JUSTIFICATION</u>

- Section 2.1; Need for the project; please state the current generation capacity of power to further justify the need of the project.
- Section 2.2 Value of the project; Please reconcile the local currency with the international currency as presented.
- Section 2.3; Envisaged Sustainability; The sustainability should be discussed on the following sub-head; Technological, Environmental and Social and Economic sustainability.
- What are the project benefits

The revised chapter should include;

- The project option
- The project alternatives

CHAPTER THREE - PROJECT DESCRIPTION

- Pg. 3-5; Section 3.1.4, 3.1.5, is not relevant to Nigeria and thereby be expunged from the population.
- Pg. 3-22; section 3.6 Project schedule and cost; The project schedule should capture the project phases, key project activities and timeline for each. The schedule should also be presented in a Gantt Chart.

The revised chapter three should also include the following: -

- Highlights description of the civil structures including switchyard access roads amongst others.
- The acquisition status and the dimension of the proposed transmission line corridor.
- Detailed description of the waste stream and management for the project. This should capture proper identification, characterization and quantification of wastes and their management.
- Detailed description of other project facilities such as transformers, temporary storage and accommodation facilities.

Pictorial presentation/ prototype of some facilities such as substation and switchyard amongst others.

CHAPTER FOUR - DESCRIPTION OF ENVIRORNMENTAL AND SOCIAL BASELINE

- Section 4.2.1 Climate and Meteorology; The ten years climatic data used in the report is not adequate. This should be revised to 20-25 years.
- Section 4.2.2 Topography, under para. 2 last line (see next map); please include the title of the map and its source.
- Pg. 4-12; Plate 3; Gully Erosion long the line route; The titles should be corrected to read **along** the line route.
- Pg. 4-18; Section 4.2.4.1 Methodology; 13th and 17th of October, 2015 for the wet season. This date contradicts the wet season identifies in section 4.2.1. Please reconcile.
- Laboratory Analysis; The full name and address of the laboratory used for analysis should be included in the final report for QA/QC assurance.
- Pg. 4-73; Section 4.5.1.4 Demography; The different demographics studied should be represented in chats and diagrams for better understanding.

- This Chapter should be updated to address the following :-
  - ✓ Include the research methodology adopted for these studies.
  - ✓ Include a sample picture of some of the fauna species observed during the study.
  - ✓ The sampling map showing sampling points should be included in the updated report.
  - ✓ Pictorial evidence of consultation with the stakeholders
  - ✓ The major concerns of the communities as articulated during the consultation meeting (If any)
  - ✓ The total number of questionnaires administered and the methodology adopted in the administration

<u>CHAPTER FIVE – ALTERNATIVE ANALYSIS</u>

- Pg. 5-4; Built Environment; '' This criterion indicates that the line route will cause the relocation of households, resulting in compensation costs''. Specify the countries affected and the total number of household affected.
- What are the methodology to be used in the value process of each affected household
- Section 5.2; Alternatives Description; An alternative route was identified by Fichtner. Please State clearly which alternative design is adopted and separate the alternative route from the project option.

<u>CHAPTER SEVEN: ASSOCIATED AND POTENTIAL IMPACT ANALYSIS</u>

- Waste generation and management was not identified as part of the identified and potential impact in this section.
- Pg 7-31, section **7.7.3.4 QUALITY OF LIFE, HEALTH AND SAFETY: Injury to workers during the site preparation, construction and also its mitigation measures were not identified.**

<u>CHAPTER EIGHT: RISK ANALYSIS OF TECHNOLOGICAL ACCIDENTS AND EMERGENCY RESPONSE PLAN</u>

- Pg 8-1, section 8.2.2 SPILLS OF PETROLEUM PRODUCTS: in point 8 , it was stated that "the storage and use of intervention materials in case of a spill close to the handling areas of petroleum products" What are the intervention materials material you intend to use , please specify.
  - ✓ Bullet 6: it was stated that "continuous training of the operating staff" The specific kind of training should be specified i.e Safety Training.

- Pg 8-3 section 8.2.3 USE OF ELECTRIC TRANSFORMERS: Electrocution should also be listed as part of hazard associated with electric transformers.
- Pg 8-4 section 8.2.3: in bullet 4 , “protection against lightning” was stated as a mitigation measure against spills of dielectric oil.

CHAPTER TEN: ENVIRONMENTAL AND SOCIAL PRELIMINARY MANAGEMENT PLAN

- Pg 10-6, Table 10-1 Specific Environmental and Social Compliance Measures: Under the responsibility party TCN and contractor's Environmental specialists” was only listed. Please include Federal Ministry of Environment, The affected state Ministry and the affected local government regulators as responsible parties.
- 10.4.2 Cost Summary: The source of funding for the project should be indicated too since breakdown of the estimated budget was presented in this section.

FMEnv. COMMENTS ON THE ESIA OF THE PROPOSED NORTH CORE PROJECT IN NIGERIA-NIGER-BURKINA FASO-TOGO/BENIN.

FMEnv Comments	WSP Answers 2017-10
PRELIMINARY PAGES	
➢ Pg. iii; Project Team; Please include the qualification of the team in the final report.	➢ Qualification of the team has been added.
➢ The final report should include the acknowledgement	➢ Acknowledgement have been included.
EXECUTIVE SUMMARY	
➢ EIA Act No. 86 of 1992 – should be cited in its original nomenclature EIA Act Cap E12 LF, 2004.	➢ The modification has been made. ➢ The modification has also been made in Chapter 1 Introduction, section 1.2 Legal Framework
➢ Page vi - Under project description; statement 'The line route area which is made from a 5 km **buffer** from the central axis…' this statement is not clear? Please provide clarification if	➢ Clarification has been provided. ➢ The clarification has also been made in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE, section 4.1
➢ Page viii – under social environment;	
• Para.2 References were made to Arewa Dandi LGA, please note that Arewa and Dandi are now in separate LGAs, Danli LGA has its HQ in Kamba therefore this should be corrected throughout the report.	➢ The modification has been made ➢ The modification has also been made in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE, chapter 4.3
• Para. statement that the HQ of Arewa Dandi LGA is in the town of Arewa Dandi. This is not correct,	➢ The modification has been made ➢ The modification has also been made in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND

FMEnv Comments	WSP Answers 2017-10
the HQ of Arewa LGA is Kangiwa therefore should be corrected.	SOCIAL BASELINE, chapter 4.3
• Para.2 stated that Birnin Kebbi LGA falls within the line, this should be corrected to 'the line traverse B/Kebbi LGA'	➢ The modification has been made ➢ The modification has also been made in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE, chapter 4.3
• Para.6 on public infrastructure, the information provided is very scanty and limited to springs and wells. E.g. '…most of the Kebbi State population uses protected and unprotected springs and wells…' are there no other public infrastructure in Kebbi State? Particularly for water supply. This section should be rephrased to reflect the state of public infrastructure in the affected area.	➢ The modification has been made ➢ The modification has also been made in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE, chapter 4.3
• Much of the information provided on the social environment is generalized for the entire state. Water, education facilities, health facilities ect; the section should be revised to provide specific information relevant to the affected LGAs.	➢ Community Infrastructures in Villages Crossed by the Wayleave are presented in Chapter 4 DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE, Section 4.3

FMEnv Comments	**WSP Answers 2017-10**
➢ Page ix under stakeholders engagement; bullet point 5 – please note that Birnin Kebbi is not a state, It should be corrected to Kebbi State while Kola is not LGA as stated (Birnin Kebbi, Area and Kola) and should be corrected.	➢ Modifications have been made
➢ Pages xi-xvi tables A-B titled 'summary of residual impacts…'	➢ Modifications have been made
• The contents are not actually on residual impacts	➢ Content has been modified
• The table is silent of the key project activities and their specific impacts. It should be revised and made specific to the project activities	➢ Impacts sources have been added
➢ Page xv Management measures; completely silent on the specific mitigation measures to address the impacts identified.	➢ The Management measures are presented but summarized. We considered not pertinent to provide 40 pages of mitigation measures
The entire report should be revised to comply with the EIA report writing standard in Nigeria hence the need for procedural guidelines.	➢ The content of the EIA report, while comprising the requested components as stipulated in the procedural guidelines, has been modified to also comply with World Bank, African development Bank and European Union requirements.
➢ The non-technical summary should be a non-technical summary of all the project void of tables and diagrams.	➢ The non-technical summary provide a summary of all the report sections. Tables

FMEnv Comments	WSP Answers 2017-10
	are used to summarize the information
➢ Include the sampling dates, name and full address of the laboratory used.	➢ Information are provided inside the baseline characterization (Chapter 4)
➢ Include the project life span in the revised executive summary?	➢ Lifespan is now provided in the executive summary in the project description section.
CHAPTER TWO – PROJECT JUSTIFICATION	
• Section 2.1; Need for the project; please state the current generation capacity of power to further justify the need of the project.	➢ Information has been added
• Section 2.2 Value of the project; Please reconcile the local currency with the international currency as presented.	➢ Exchange rate has been provided
• Section 2.3; Envisaged Sustainability; The sustainability should be discussed on the following sub-head; Technological, Environmental and Social and Economic sustainability.	➢ The sub-head has been modified
• What are the project benefits	➢ Project benefits have been discussed
The revised chapter should include;	
• The project option	➢ Project option are discussed in chapter 5. A no project option has been added.
• The project alternatives	➢ Alternatives analysis is provided in chapter 5 where analysis are fully described.
CHAPTER THREE - PROJECT DESCRIPTION	
• Pg. 3-5; Section 3.1.4, 3.1.5, is not relevant to Nigeria and thereby be expunged from the population.	➢ It has been requested, in order to insure homogeneity in between reports associated to the North Core, to maintain the same project description

FMEnv Comments	WSP Answers 2017-10
	for all the involved countries.
• Pg. 3-22; section 3.6 Project schedule and cost; The project schedule should capture the project phases, key project activities and timeline for each. The schedule should also be presented in a Gantt Chart.	➢ As the project is at feasibility stage, this is the information we can provide.
The revised chapter three should also include the following: -	
➢ Highlights description of the civil structures including switchyard access roads amongst others.	➢ Project description has been provided by the engineering consultant. This information hasn't been provided.
➢ The acquisition status and the dimension of the proposed transmission line corridor.	➢ Steps for RoW public utility registry are provided in the RAP. ➢ The dimension of the transmission line RoW is provided in section 3.5.7
➢ Detailed description of the waste stream and management for the project. This should capture proper identification, characterization and quantification of wastes and their management.	➢ This information will be provided at later stage. It will be part of the Waste management plan for construction phase that will be submitted by the contractor.
➢ Detailed description of other project facilities such as transformers, temporary storage and accommodation facilities.	➢ Project description has been provided by the engineering consultant. This information hasn't been provided.
Pictorial presentation/ prototype of some facilities such as substation and switchyard amongst others.	➢ Substation scheme in Birnin Kebbi has been added
CHAPTER FOUR - DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE	

FMEnv Comments	**WSP Answers 2017-10**
• Section 4.2.1 Climate and Meteorology; The ten years climatic data used in the report is not adequate. This should be revised to 20-25 years.	➢ Average rainfall at Birnin Kebbi has been provided based on a 92 years data serie
• Section 4.2.2 Topography, under para. 2 last line (see next map); please include the title of the map and its source.	➢ Title and sources are provided
• Pg. 4-12; Plate 3; Gully Erosion long the line route; The titles should be corrected to read **along** the line route.	➢ Orthography has been corrected
• Pg. 4-18; Section 4.2.4.1 Methodology; 13th and 17th of October, 2015 for the wet season. This date contradicts the wet season identifies in section 4.2.1. Please reconcile.	➢ Wet season last up to October as stated in section 4.1.1. The wet season last up to this date in 2015.
• Laboratory Analysis; The full name and address of the laboratory used for analysis should be included in the final report for QA/QC assurance.	➢ Information about laboratory has been provided
• Pg. 4-73; Section 4.5.1.4 Demography; The different demographics studied should be represented in chats and diagrams for better understanding.	➢ Charts and diagrams have been provided
• This Chapter should be updated to address the following :-	
✓ Include the research methodology adopted for these studies.	➢ Methodologies are provided
✓ Include a sample picture of some of the fauna species observed during the study.	➢ Pictures of species has been added
✓ The sampling map showing sampling points should be included in the updated report.	➢ Maps of sampling points are now provided
✓ Pictorial evidence of consultation with the stakeholders	➢ Pictures are already provided in appendix 3
✓ The major concerns of the communities as articulated during the consultation meeting (If any)	➢ Major concerns are provided in section 6.3
✓ The total number of questionnaires administered and the methodology adopted in the administration	➢ Details have been provided

FMEnv Comments	**WSP Answers 2017-10**
CHAPTER FIVE – ALTERNATIVE ANALYSIS	
• Pg. 5-4; Built Environment; ‘‘ This criterion indicates that the line route will cause the relocation of households, resulting in compensation costs’’. Specify the countries affected and the total number of household affected.	➢ The total number of household affected are presented in section 7.3.3 Impacts on Human Environment.
• What are the methodology to be used in the value process of each affected household	➢ This detail has been considered in the comparative analysis
• Section 5.2; Alternatives Description; An alternative route was identified by Fichtner. Please State clearly which alternative design is adopted and separate the alternative route from the project option.	➢ A map clearly shows the alternative and the project location
CHAPTER SEVEN: ASSOCIATED AND POTENTIAL IMPACT ANALYSIS	
• Waste generation and management was not identified as part of the identified and potential impact in this section.	➢ Impacts of waste have been detailed
• Pg 7-31, section **7.7.3.4 QUALITY OF LIFE, HEALTH AND SAFETY: Injury to workers during the site preparation, construction and also its mitigation measures were not identified.**	➢ This impact is discussed and mitigation measures are provided
CHAPTER EIGHT: RISK ANALYSIS OF TECHNOLOGICAL ACCIDENTS AND EMERGENCY RESPONSE PLAN	
• Pg 8-1, section 8.2.2 SPILLS OF PETROLEUM PRODUCTS: in point 8 , it was stated that “the storage and use of intervention materials in case of a spill close to the handling areas of petroleum products” What are the intervention materials material you intend to use , please specify.	➢ This information is now provided
✓ Bullet 6: it was stated that “continuous training of the operating staff” The specific kind	➢ Safety aspects of the training have been added

FMEnv Comments	WSP Answers 2017-10
of training should be specified i.e Safety Training.	
• Pg 8-3 section 8.2.3 USE OF ELECTRIC TRANSFORMERS: Electrocution should also be listed as part of hazard associated with electric transformers.	➢ This section is about technological accidents
• Pg 8-4 section 8.2.3: in bullet 4 , "protection against lightning" was stated as a mitigation measure against spills of dielectric oil.	➢ This measure has been removed
CHAPTER TEN: ENVIRONMENTAL AND SOCIAL PRELIMINARY MANAGEMENT PLAN	
• Pg 10-6, Table 10-1 Specific Environmental and Social Compliance Measures: Under the responsibility party TCN and contractor's Environmental specialists" was only listed. Please include Federal Ministry of Environment, The affected state Ministry and the affected local government regulators as responsible parties.	➢ As per described on page 10-2, these stakeholders are part of the PMU's Environmental committee. This is why they are not specifically identified in tables as responsible even if they are
• 10.4.2 Cost Summary: The source of funding for the project should be indicated too since breakdown of the estimated budget was presented in this section.	➢ Funding of the project is not confirmed yet

Appendix 9

LIST OF VILLAGES TO BE ELECTRIFIED

List of communities within rural electrification zone (10 km strip on either side of the line) - Nigeria

Name	Distance from nearest Station M	Distance from the Line route M	X	Y	Latitude	Longitude	Electrified* (Yes/No)	Population**
			UTM zone 31N WGS 84					
Damana	28448	2775	578244	1387223	12.548	3.720	no	2000
Rafin Tafki	26930	44	578624	1390045	12.573	3.724	no	1500
Gorun Gora	33991	430	585474	1387469	12.550	3.787	no	1500
Gidderi	30605	6713	585648	1394910	12.617	3.789	no	500
Zugurawa	34568	331	586437	1387881	12.553	3.796	no	536
Falade	32960	5200	587297	1392797	12.598	3.804	no	1000
Kawara	37613	366	589322	1386748	12.543	3.822	no	731
Ungwan Tuwo	35866	5111	589884	1391468	12.586	3.827	no	826
Tunari Bangawa	37998	976	590075	1387249	12.548	3.829	no	858
Tungar Giwa	40894	4137	590103	1382072	12.501	3.829	no	816
Bayara	36430	5779	590744	1392006	12.591	3.835	no	500
Gadanga	36946	5382	591107	1391548	12.586	3.839	no	730
Kure Baba	38814	6842	593581	1392645	12.596	3.862	no	1000
Ungwan Chufa	42962	2020	593695	1383652	12.515	3.862	no	1500
Nassarawa	42040	594	594148	1386232	12.538	3.867	no	1530
Aile	42084	624	594207	1386249	12.538	3.867	no	2000
Zukuku	41173	5097	595296	1390587	12.578	3.877	no	1148
Kowa Sala	41473	7865	596582	1393121	12.601	3.889	no	2000
Kwalaye	42750	5676	597066	1390748	12.579	3.894	yes	1500
Machere	44605	3918	598203	1388658	12.560	3.904	no	1000
Ungwan Mairago	45664	2394	598606	1386990	12.545	3.908	no	641
Ungwan Muza	47226	258	598934	1384178	12.520	3.911	no	2500
Ungwan Maizubi	46318	1944	599056	1386416	12.540	3.912	no	1000
Ungwan Shika	44311	7085	599092	1391701	12.588	3.912	no	500
Ungwan Busare	45401	5977	599772	1390393	12.576	3.918	no	2000
Ungwan Labbo	48539	1072	599850	1383114	12.510	3.919	no	2000
Ungwan Zarmakwoi	50119	2739	600588	1381216	12.493	3.926	no	1000
Ungwan Megusaye	51198	4486	600738	1379380	12.476	3.927	no	1000
Ungwan Zamakway	50151	1406	601304	1382413	12.504	3.932	no	1000
Ungwan Narba	48044	3572	601450	1387504	12.550	3.934	no	1004
Ungwan Kalgo	48041	3583	601452	1387514	12.550	3.934	no	2000
Ungwan Noma	48125	3695	601579	1387598	12.550	3.935	no	720
Ungwan Mauri	48403	3077	601603	1386956	12.545	3.935	no	2500
Baraya Tudu	48253	3720	601715	1387591	12.550	3.936	no	1190
Ungwan Kade	48530	4276	602206	1388042	12.554	3.941	no	1500
	48709	5988	603011	1389607	12.569	3.948	no	500
Ungwan Toho	49747	4743	603577	1388186	12.556	3.953	no	1000
Jodu Zabarmawa	49804	4759	603638	1388187	12.556	3.954	no	532
Turimi Dutse	56223	7645	604026	1375216	12.438	3.957	no	500
Unguwan Sani	55874	3055	606170	1379386	12.476	3.977	no	520
Galaro Kongoro	59707	9387	606540	1372717	12.416	3.980	no	500

Goran Bagage	53578	9030	608684	1391229	12.583	4.001	no	500
Birnin Kuka	59691	5015	608968	1376585	12.451	4.003	yes	1200
Unguwan Dan Ba'Are	61359	3378	611447	1377606	12.460	4.025	no	664
Nasarawa	61549	3461	611594	1377479	12.459	4.027	no	839
Bani Zumbu	59527	1260	611723	1382338	12.503	4.028	no	718
Kutukulu	59557	1291	611766	1382358	12.503	4.029	no	2500
	62901	5184	612081	1375560	12.441	4.031	no	500
Sabon Garingoru	60719	89	612321	1380776	12.488	4.034	no	1483
Madinka Hausawa	62908	3659	612844	1376933	12.454	4.038	no	1000
Nayilwa	63027	1887	613790	1378511	12.468	4.047	no	559
Kwaratagi	63087	1830	613875	1378548	12.468	4.048	no	784
Tuanari	61869	1783	614219	1382199	12.501	4.051	no	791
Old Badariya	63371	194	614864	1379954	12.481	4.057	no	673
Sandare Babba	63802	678	615059	1379354	12.475	4.059	no	790
Babursa	62979	1992	615381	1382096	12.500	4.062	no	634
Ungwan Sule	63027	2039	615445	1382125	12.500	4.062	no	1000
Yamama	63680	637	615494	1380596	12.487	4.063	no	602
Wuro Nori	64167	102	615726	1379925	12.481	4.065	no	567
Gomozo Yari	62707	3593	615724	1383664	12.514	4.065	no	1129
Mashekarin Fullani	62847	3365	615776	1383412	12.512	4.066	no	682
Wuro Maliki	63167	3460	616112	1383391	12.512	4.069	yes	2455
Madinka Hausawa	64340	1266	616360	1380925	12.490	4.071	no	1490
Alfagai	63431	3521	616379	1383349	12.511	4.071	no	995
Wabbaku	64595	999	616490	1380585	12.486	4.072	no	677
Mulgu	63667	3810	616702	1383530	12.513	4.074	yes	1068
Zuguru	68944	6846	616982	1371959	12.408	4.076	no	600
Mazubi	64019	4308	617208	1383863	12.516	4.079	no	935
Ungwan Danyakua	64969	3139	617665	1382419	12.503	4.083	yes	1300
Danyaku	64981	3185	617693	1382457	12.503	4.083	no	775
Ungwan Gamau	64492	4979	617881	1384315	12.520	4.085	no	1238
Ungwan Tudu	69660	4896	618622	1373421	12.422	4.091	no	1438
Unguwan Kibiya	66127	3200	618762	1382045	12.500	4.093	no	950
Unguwan Gwarko	65915	3906	618823	1382779	12.506	4.094	no	720
Bangwa	66002	5028	619299	1383797	12.515	4.098	no	1000
Mashekarin Daja	66134	5159	619468	1383873	12.516	4.100	no	657
Unguwan Dole	66498	4769	619672	1383375	12.512	4.101	no	527
Dugama	65293	8576	619774	1387430	12.548	4.102	no	1000
Sabon Gari	67094	4191	620024	1382618	12.505	4.105	no	1195
Yelwa	67505	4453	620500	1382714	12.506	4.109	no	758
Jajage	69249	9142	623636	1386533	12.540	4.138	no	500
Ungwan Kaye	70899	8240	624914	1385083	12.527	4.150	no	500
Duko	71594	6963	625166	1383621	12.514	4.152	no	500
Ungwan Jeji	81265	8464	625973	1363029	12.327	4.159	yes	2000
Kuka	71833	9330	626112	1385794	12.533	4.161	no	800
	72567	8575	626574	1384801	12.524	4.165	no	500
Alumadi	72915	7887	626681	1383993	12.517	4.166	no	1500
Takatsaba	75023	3714	626809	1378214	12.465	4.167	no	1792

Ungwan Ardua	81359	6760	627091	1364663	12.342	4.169	yes	1500
Ungwan Sale	80834	5505	627225	1365920	12.353	4.170	yes	1000
	77845	705	627271	1372344	12.412	4.171	no	1000
	78141	289	627296	1371727	12.406	4.171	no	1000
	78893	687	627657	1370771	12.397	4.174	no	500
	73857	9742	628089	1385340	12.529	4.179	no	500
	79255	416	628217	1371077	12.400	4.180	no	500
Eri	77113	2173	628224	1376178	12.446	4.180	no	1250
Akwaira	74636	9623	628734	1384782	12.524	4.185	no	500
Ungwan Lona	82174	2843	630321	1368776	12.379	4.199	no	2000
Goru	81294	847	630344	1370777	12.397	4.199	yes	2000
Ungwan Nakalgo	82784	3855	630483	1367772	12.370	4.200	yes	500
Kwamawa	79199	1660	630672	1376626	12.450	4.202	no	1461
Marafaka	85051	7025	631360	1364655	12.342	4.208	no	500
	83218	2534	631798	1369377	12.385	4.212	yes	600
Ungwan Dikko	86759	8283	632740	1363626	12.333	4.221	yes	1000
	82697	2071	632809	1372732	12.415	4.222	no	500
Wurohezo	83136	2004	632821	1371696	12.405	4.222	no	1000
	85754	4915	633926	1367964	12.372	4.232	no	500
Jambaki	87468	7542	634344	1365059	12.345	4.236	yes	2500
Ungwan Yakubu	86059	4984	634530	1368492	12.376	4.237	no	500
	84270	4250	634862	1373500	12.422	4.241	no	500
Harasawa	84645	5023	635512	1374079	12.427	4.247	yes	1000
	85212	7267	637168	1376733	12.451	4.262	no	500
Wasada	90387	9190	639266	1368360	12.375	4.281	yes	1000

** Information provided by Kebbi State Rural Electrification Board (REB).*

*** Data from the Final results of the National Population Commission (NPC) Census 1991 in Kebbi State published in 1996 (figures were projected from 1991 to 1996 in the report using 2% NPC rate). A projection was made for 2015 using 2% NPC rate. Villages in bold were not included in the NPC report and population was estimated.*

Appendix 10

ENVIRONMENTAL CLAUSES

ENVIRONMENTAL CLAUSES TO BE INSERTED IN BIDS - NIGERIA

The purpose of the present clauses is to help those in charge of producing bidding or work contracts for the high-voltage 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo interconnection power line (Bids, Special Requirements or Technical Requirements), to enable them to incorporate into these documents provisions for optimizing environmental and socio-economic protection. The clauses also deal with safety measures for hazard and risk prevention.

The clauses are applicable to all project activities which could be a source of negative environmental and social impacts. It however remains that not all possible cases can be foreseen and that the proposed clauses must serve as guidelines and in no way replace the recommendations set forth in the environmental impact assessment and the suggestions made by neighbouring populations.

ENVIRONMENTAL AND SOCIAL ASPECTS IN THE BIDS

In the bid, the bidder shall propose:

- an activity implementation plan
- measures that will be taken to protect the environment
- rehabilitation work and a methodological presentation, describing how negative effects will be avoided and unavoidable effects minimized

In addition, the bidders shall present, upon submission of their bid, the detailed program for environmental and social management, including an Environmental Protection Plan and a Hygiene, Health and Safety H&S Management Plan according to OHSAS 18001: 2007 international standards, essentially inspired from the environmental and social management plan (ESMP).

ENVIRONMENTAL ASPECTS IN THE SPECIAL REQUIREMENTS

General Requirements

The holder of a work contract for the 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo Interconnection project shall follow and apply the existing environmental laws and regulations in force in Nigeria. In everyday worksite operations, the contractor must take all appropriate measures to minimize environmental damage, by applying the contract specifications and ensuring that his personnel, the persons in charge of said personnel and his local employees, also follow and apply them.

Implementation Program

Within sixty days from notification of the awarding of the contract, the contractor in charge of completing the 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo Interconnection project shall establish and submit, for approval to the TCN representative, a final detailed Environmental and Social Management Plan (ESMP) and the Site Environmental Management Plan, which will include the following:

- an organizational chart of management staff with clear identification of the person(s) responsible for the project's environmental and social management
- an environmental and social management plan for the worksite including:
  - a worksite waste management plan (type of waste expected, collection method, storage method and location, disposal method and location, etc.)
  - a water management plan (supply method and source, flow used, discharge, etc.), the treatment system planned for worksite wastewater, the discharge location and the planned controls, etc.
- a general description of methods proposed by the holder to reduce the impacts of each work phase on the physical and biological environment

- a general description of measures proposed by the Holder to improve the positive socio-economic impacts and avoid negative impacts

Contract Holder's Plans

Throughout the execution of the contract, the Holder establishes and submits for approval by the supervisor in charge (Consulting Engineer) or TCN, the following documents:

One month before setting up the worksites and storage areas:

- land location to be used
- the list of agreements reached with current owners and users of these areas and proof that these users have been able to find similar spots to pursue their activities
- a detailed report on the state of the various sites
- an Environmental Policy;
- an Hygiene, Health and Safety Policy;
- a general plan indicating the various worksite areas, the planned layout and a description of planned development
- a detailed site environmental protection plan for the base camp, prior to its construction
- the amended waste management plan
- the description of planned measures to avoid and fight pollution and accidents such as soil, groundwater and surface water pollution, bush and other fires, worksite accidents, etc.
- the description of a planned sanitary infrastructure and its organization
- the list of planned measures to ensure the supply of food (meat, fish, etc.) and wood for workers, as well as measures planned to promote the purchase of local products within the project area, except for game
- the redevelopment plan for areas at the end of the work
- the worksite regulation articles regarding the respect of the environment, waste, actions planned in case of accident, requirements in terms of vehicle driving, vehicle repair and maintenance

One month before the tree felling phase:

- a felling plan and the planned use of felled trees, with the objective of minimizing felling as much as possible
- a work plan involving competent technical services in charge of this aspect

Monthly:

- a report on the safety level of the worksite and the measures implemented to maintain a high level of safety
- a report on preventive measures put in place at worksites

At the end of the work:

- a map of the 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo Interconnection power line route illustrating the work carried out with indications of any environmental improvements implemented

Worksite Safety

The Contract holder will be subject to the specific hygiene and safety schemes defined by the regulations in force in Nigeria. The Contract holder will implement a Hygiene, Health and Safety Plan according to OHSAS 18001: 2007 international standards. The contract holder will organize a standard and emergency medical service at the base camp, adapted to the size of his staff. Further, his team shall include a safety coordinator who will ensure maximum safety at the worksite and at the base camp, both for workers and for the population and other persons in contact with the worksite. Involved companies will also be required to submit a copy of their insurance, especially for their employees in the event of serious or fatal accidents. All employees will be required to sign a code of conduct that clearly states the behaviors to be avoided, such as sexual contact with minors.

Safeguarding of Surrounding Properties

The contractor shall, under the control of the consulting engineer, clean and eliminate at his expense any form of pollution resulting from activities, and compensate those having suffered the effects of this pollution.

Traffic Impediments

The contractor shall maintain traffic and access to neighbours at all times throughout the work. The concerned neighbours are those whose habitat existed before the contract notification. Nighttime activity at the worksites will be subject to authorization from TCN.

If the contractor has received authorization or an order to work during the night, it will be with the commitment that it will be carried out so as not to disturb surrounding inhabitants and establishments. The lighting used must be approved by the consulting engineer. The contractor will ensure that no trenches or excavated areas remain open at night, between 6 pm and 6 am, without adequate signage approved by the consulting engineer.

The contractor shall impose a speed limit for all of its vehicles travelling on public roads, in the corridor and in the right-of-way.

Work Register

The work register shall contain data on any deficiencies or incidents, having had a significant incidence on the environment or an accident or incident with the population and the specific corrective measures.

Warranty Obligations

The contractor for the present contract is required to carry out routine maintenance of the completed works, throughout the project's warranty period, as well as correct any negative impacts noted.

Environmental aspects, such as, vegetation regrowth, restoration of watercourse flows and hydraulic regimes, and return of agricultural land to cultivation, are also covered by this one-year warranty.

Sanctions and Penalties

In application of the provisions of the special conditions of contract, non-compliance with environmental and social clauses is grounds for sanctions and/or penalties. Moreover, a company that is guilty of repeatedly ignoring the environmental clauses could be subject to more severe sanctions up to it losing (for a five-year period) its right to bid.

Work Acceptance (provisional acceptance – final acceptance)

As per the contractual provisions, non-compliance with the present clauses during the 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo Interconnection project, the refusal to sign the minutes of the provisional or final work acceptance, will lead to the deficiency guarantee being blocked. The implementation of each environmental measure shall be the subject of a partial acceptance. The holder's obligations last until the final acceptance of the work which will only occur after all the environmental improvement work included in the contract has been completed, and after regrowth of the vegetation and/or plantings have been confirmed.

Notification

Any infraction of the prescriptions duly reported to the company, by the supervisor, must be corrected. Any repeating of work or additional work deriving from non-compliance with the clauses will be at the expense of the contractor.

ENVIRONMENTAL ASPECTS IN THE TECHNICAL REQUIREMENTS

Worksite Facilities

The contractor will propose to the supervisor in charge (Consulting Engineer) the location of his worksite facilities and will present within a month of the work start notification date, a site environment protection plan including:

- a worksite waste management plan (type of waste expected, collection method, storage method and location, disposal method and location, etc.)
- a water management plan (supply method and source, flow used, discharge, etc.), the planned purification system for the worksites' sanitary and industrial water, the discharge location and the planned controls
- an overall management plan for the exploitation and restoration of borrow pits (anti-erosion, anti-flood and anti-landslide actions, planned redevelopment)

Storage areas shall be selected so as not to impede the normal water flow and shall have erosion protection. The contractor shall obtain the approval of the controller for the storage areas. Uncovered surfaces must be limited to the strict minimum and quality trees shall be preserved and protected.

Establishment of Structures

The size of the facilities is determined by the volume and nature of work to be carried out, the number of workers, the number and type of machinery. The worksite layout shall take into account the following development and protection measures: (i) the site to be chosen must be located at least 500 m from water points, and far enough from dwellings to avoid nuisances; (ii) the site shall be chosen so as to limit the felling of trees, the destruction of dwellings, stores, businesses, workshops, agricultural areas or gardens; (iii) the site must be chosen outside of sensitive areas; (iv) areas for storing or handling dangerous, toxic, flammable or polluting products shall be developed so as to properly protect the soil and subsoil; (v) at the end of the work, the contractor shall restore all areas used, most notably by removing the remaining materials, disposing waste, evening out and levelling the worksites, dismantling and removing the facilities.

Internal Regulation

An internal regulation covering the installation of the worksite must specifically mention:

- the safety rules (vehicle speed limited to 80 km/h on rural roads and 40 km/h in urban areas)
- a ban on hunting, eating game meat, the abusive use of firewood
- a ban on the transporting of bush meat by construction vehicles
- the respect of the populations' traditions and customs and of human relations in general
- the measures to be taken so as to minimize the risk of contracting STDs and AIDS

There shall be regular information and awareness sessions and the regulation will be displayed visibly in the various facilities.

Equipment

Office and lodging areas shall be equipped with sanitary facilities (latrines, septic tanks, drainage wells, sinks and showers) according to the number of workers present on site. Water reservoirs shall be installed in sufficient quantity and quality and be adapted to the needs.

Kick-off Meeting

During the site visit with the company in charge of carrying out the work, representatives of the environmental assessment department shall be present, as well as experts from TCN's "environment" department.

The authorities, regional and local technical services as well as the populations shall be informed on the work to be carried out and this will be the opportunity to gather any eventual observations from their part. The information regarding the work shall specify itineraries and locations likely to be affected by the work and its duration. More information shall be given to the populations who will be made aware of eventual resettlements and compensation terms. Regardless of the reasons given, no activity can begin on the properties before expropriation indemnities have been paid.

Following this meeting, the company shall set, if necessary, a date for an adversarial meeting with local agents from nature conservation, to identify protected plant species found within the work right-of-way and determine related solutions.

Use of Local Labour

The contractor is required to hire (outside of his management technical staff) as many workers as possible from neighbouring villages and the area where the work will be carried out. If qualified personnel cannot be found on site, he is authorized to hire workers from outside the project area. Child labour is strictly prohibited.

To enhance the positive impact of job creation for local communities, the company will have to adopt a communication and exchange strategy with local communities and local authorities in order to find the best ways of recruiting local staff. This strategy should focus on the following approach:

- with equal qualifications and for unskilled jobs, the priority of recruitment will be given to workers who are from communities and districts crossed by the line route;

  for qualified jobs, recruitment will be carried out according to the administrative and regulatory procedures required, and under the responsibility and prescription of the promoter.

Protection *of Worksite Personnel*

The contractor must provide the necessary and adapted safety equipment to its workers, most notably personal or collective protection equipment.

Company Internal Briefing Note

The company shall issue an internal briefing note to raise awareness among workers regarding the following subjects:

- awareness among workers regarding respect of the traditions and customs of the populations in the area where the work will be carried out
- awareness among workers and sub-contractors regarding the risk of contracting STDs and AIDS

Demolition of Workshops and Various Infrastructure

The contractor shall inform the affected populations before any demolition of dwellings, workshops, garages, etc., required as part of the 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo Interconnection project, so as to define and set the compensation terms. It shall ensure that compensation is indeed set and paid to rights holders before any demolition, in agreement with the project’s consulting engineer.

Protecting the Environment against Noise

The contractor is required to limit worksite noise likely to seriously bother neighbours, either by being of excessively long duration, or by lasting beyond normal work hours. All operations which could be a source of noise must be the subject of an agreement with the consulting engineer before they can begin, so as to minimize any possible disturbance to neighbours.

Protection against Exhaust Gas and Hydrocarbons

Depots and other eventual means of storage of fuel, lubricants or hydrocarbons, as well as the maintenance facilities for the contractor’s equipment, shall comply with the prescriptions related to these types of facilities.

Protection against Solid Waste

The contractor is required to take all necessary measures to avoid sullying the areas around worksites, roadways, shoulders and sidewalks with mud, excavated material or other material generated by the work. In case of the demolition of existing structures, measures will be taken by the contractor to avoid generating and spreading dust.

Protection of Surface Waters and Groundwater

The contractor shall avoid any spill or discharge of wastewater, mud, hydrocarbons, and pollutants of any kind, in surface or ground water, in the sewers, drainage ditches or in the river.

Waste Management

Waste receptacles shall be installed near the various activity locations. These receptacles need to be emptied periodically and the waste disposed of in an appropriate leak proof container, which shall be regularly emptied. The location of the containers should not cause any specific nuisance to the surrounding environment. Machinery maintenance and cleaning areas shall be concreted and equipped with an oil and grease recovery sump. This maintenance area shall be sloped towards the sump and towards the inside of the platform to avoid having polluting products flow onto non-protected soil. Used oils will be kept in drums which will be stored in a secure place awaiting their recuperation for other uses. Used oil filters and batteries will be stored in leak proof containers and disposed of in an authorized dump.

Burning of Waste

The contractor is asked at the beginning of the work to identify users of so-called waste among the neighbours (fodder for livestock, construction wood, firewood, etc.). It is strictly forbidden to burn cut plant waste on site, especially in the sahelian zone, to avoid the risk of spreading bush fires.

Work Signage

The company must install signage in accordance with the plans and indications provided and put in place signage related to work in progress (flag-bearers, panels, reflectorized strips) on obstacles, materials and machinery placed along the power line.

Loading and Transport of Materials and Equipment

When sending materials and equipment to the site, the contractor must:

- take the necessary measures to limit vehicle speed
- ensure that trucks and worksite machinery maintain a maximum speed of 40 km/h, especially when crossing villages and cities
- load trucks so as to avoid losing materials during transport

Site Cleanup and End of Work

There should be provisions for adequate water drainage throughout the site. At the end of the work, the contractor shall carry out all work necessary to restore the site. The contractor shall remove all of his equipment, machinery and materials. It will not be allowed to abandon any equipment or materials at the site or in the surrounding area. After the material has been removed, a certificate noting the restoration of the site shall be drafted and joined to the work acceptance certificate.

REPORTING SYSTEM TO BE PUT IN PLACE

To make impact monitoring and surveillance easier and to highlight the evolution of the implementation of environmental and social measures, the company shall produce the following work documents:

Environmental Protection Plan (EPP)

This plan covers construction activities, the establishment and operation of facilities for monitoring and coordination of works, maintenance or maintenance, and production of materials (borrowing). The objectives of this plan are to:

- Avoid or mitigate negative impacts and offset irreversible impacts on the site of activities under the direct responsibility and control of the company;
- Provide adequate and effective responses to impacts on components of the biophysical environment;
- Facilitate the dialogue between the Promotor and the Company on topics related to the Project environmental management;
- Provide the information required to the Promotor regarding the environmental aspects of the work of the Company.

Also, this plan will give details of the means deployed:

- the liability of the members of the Company in the application of the measures,
- the environmental approach on the site by the Company associated with the risks management,
- -modalities for the implementation of environmental measures (operational procedures, control means / plan) ...

The EPP will comprise a daily environmental register on site. The register will underline the potential and current environmental issues and associated measures to avoid or reduce them. It will provide more details regarding the means used by the Company to implement each environmental measure as well as its daily implementation. It is the register at the site regarding bio-physical environment and it also comprises environmental surveillance and monitoring sheets as well as the adaptation of measures and intensity of impacts on site.

Hygiene, Health and Safety Management Plan (HHSMP)

Through this plan, the Company will commit to take precautions to ensure hygiene, health and safety at the work sites. To this end, it will implement a plan integrating the effective participation of its staff in the management of the risks related to the execution of the said works. This document is developed as a basis for the Health, Safety and Hygiene component. It will include these actions:

- Prevention;
- Training;
- Safety result of "zero accident";
- Promotion of respect for safety as a priority in the workplace and even outside it.

Its development is based not only on the application of the laws and regulations governing these three areas in Nigeria and the contractual provisions.

This plan should provide details on:

- responsibility of the members of the Company in the management of hygiene, health and safety on site,
- resolution of conflicts between the safety objectives and those of the works,
- performance evaluation,
- mechanism for managing the hygiene, health and safety aspects,
- training of personnel and the implementation for the uses of Individual and collective protection equipment,
- methods and means of monitoring and control of performance,
- safe procedures,
- mechanism for managing conflicts in between workers.

The Hygiene, Health and Safety Management Plan will come with an Incident register. This register will keep a record of all incidents (work accidents: burns, cuts, intoxication, fires, etc.) occurring during each project activity. It is the site's daily register. This document will allow the company to determine the factors, periods and frequency of risk related to its activity. It also can be used to identify additional and/or corrective measures.

The EPP and the HSSMP will have to trace the ESMP grievances by giving more details on the means used by the Company to take charge of environmental and social measures in order to mitigate and compensate for the negative impacts on the one hand and on the other hand, to enhance the positive impacts.

In order to be effective application documents, the company must take into account requirements based on environmental management systems (ISO 14001), quality (ISO 9001) and health and safety at work (OHSAS 18001). Therefore, in each document, must be easily identifiable:

- mechanisms for recording health and safety incidents and environmental accidents;
- performance evaluation programs, real-time identification of residual impacts and non-conformities in the application of the measures;
- a detailed procedure for managing non-conformities.

Environmental Monthly Report

At the end of each month, the environmentalist shall make available a report retracing all efforts deployed by the Company in terms of management and measures. It will describe the activities carried out, the actors involved, the relevance of the activity, the results obtained and the prospects.

Besides all of these concerns required for a better management of project-related environmental aspects, the company must have its own environmental policy and a hygiene, health and safety policy. As an electrical equipment construction company, these policies must have an influence on all of its activities and provide broad guidelines for meeting the company's objectives.