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TRANSMISSION COMPANY OF NIGERIA

58km 330kV QIT – IKOT ABASI TRANSMISSION LINE

ENVIRONMENTAL IMPACT ASSESSMENT

REPORT NO.: S - 1103

FINAL DRAFT REPORT **November, 2012**

58km 330kV QIT–IKOT ABASI TRANSMISSION LINE PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT
DRAFT REPORT

by

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All references of Power Holding Company of Nigeria Limited (PHCN) in the report represent the Transmission Company of Nigeria (TCN).

All references of the Joint Venture Power Project (JVPP) in the report represents the Qua Iboe Power Project (QIPP).

All references of the QIPP-PP represents Qua Iboe Power Project Power Plant whereas all references of QIPP-TL represents Qua Iboe Power Project Power Transmission Line.

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LIST OF ACRONYMS AND ABBREVIATIONS

%		Percentage
<		Less than
=		Equals to
±		Plus or minus
$\mu g/m^3$		Microgram per cubic meter
AAS		Annual Abstract of Statistics
APHA		American Public Health Association
AKSMENV		Akwa Ibom State Ministry of Environment
ALARP		As Low As Reasonably Practicable
APRM		African Peer Review Mechanism
ASCR		Aluminium Steel Reinforced Conductor
ASTM		American Society for Testing and Materials
BAT		Best Available Technology
BOD		Biological Oxygen Demand
Ca		Calcium
Cd		Cadmium
Cl^{-1}		Chlorine ion
Cm		Centimetre
CO		Carbon Monoxide
Co		Cobalt
CO_2		Carbon Dioxide
COD		Chemical Oxygen Demand
Cr		Chromium
Cu		Copper
CWIQ		Core Welfare Indicator Questionnaire
DB		Decibels
DC		Direct Current
DO		Dissolved Oxygen
DPR		Department of Petroleum Resources
EC		Electrical Conductivity
ECN		Electric Cooperation of Nigeria
EIA		Environmental Impact Assessment
EGASPIN		Environmental Guideline and Standard for the Petroleum Industry in Nigeria
EIS		Environmental Impact Statement
EMP		Environmental Management plan
EPC		Engineering Procurements Construction
EPR		Ethylene-Propylene Rubber
FEED		Front End Engineering Design
FEPA		Federal Environmental Protection Agency
FGD		Focus Group Discussion
FGN		Federal Government of Nigeria
FMENV		Federal Ministry of Environment
GFC		Glass Fibre Reinforced Cores
GGD		General Group discussion
GIS	-	Geographic Information System
GPS	-	Global Positioning System
HDB	-	Hydrocarbon Degrading bacteria
HUB	-	Hydrocarbon Utilizing Bacteria
HUF	-	Hydrocarbon Utilizing Fungi
H_2S		Hydrogen Sulphide
IDI		In-Depth Interview
IFC		International Finance Corporation

ISO	International Standards Organization
ITCZ	Inter Tropical Convergence Zones
ITD	Inter Tropical Discontinuity
IUCN	International Union for Conservation of Nature
JVPP	Joint Venture Power Project
K	Potassium
Km	Kilometre
KV	Kilo Volts
KWH	Kilo Watts per Hour
LGA -	Local Government Area
M	Meter
Mg	Magnesium
mm	Millimetre
Mn	Manganese
MOU	Memorandum of Understanding
MPN	Mobil Producing Nigeria Limited
$mScm^{-1}$	Micro Siemens per Centimetre
MW	Mega Watts
N	Nitrogen
Na	Sodium
NERC	Nigerian Electric Regulatory Commission
NEPA	National Electric Power Authority
NESCO	Nigerian Electricity Supply Company
NGO	Non Governmental Organization
Ni	Nickel
NIMET	Nigerian Meteorological Agency
NIPP	National Integrated Power Project
NIWA	National Inland Water Ways Authority
NNPC	Nigerian National Petroleum Corporation
NOx	Nitrogen Oxides
NTU	Turbidity
^oC	Degree Celsius
O&G	Oil and Grease
OIMS	Operational Integrity Management System
OPGW	Optical Ground Wire
Pb	Lead
PCBs	Polychorobiphenyls
pH	Hydrogen Potential
PHC	Public Health Care
PHCN	Power Holding Company of Nigeria
PO_4	Phosphate
PSD	Particle Size Distribution
PTFE -	Polytetrafluoroethylene
QA	Quality Assurance
QC	Quality Control
QIT	Qua Iboe Terminal
QIPP	Qua Iboe Power Plant
ROT	Rehabilitation Operate and Transfer
ROW	Right-of-Way
SHE	Safety, Health and Environment
SiO_2	Silica
SO_4	Sulphate
SOP	Standard Operating Procedures
SO_X	Sulphur Oxides
Sp	Species

SPM	Suspended particulate matter
TCN	Transmission Company of Nigeria
TDS	Total Dissolved Solids
THC	Total Hydrocarbon Content
TL	Transmission Line
TLROW	Transmission Line Right of Way
TOC	Total Organic content
TOR	Terms of Reference
TPH	Total Petroleum Hydrocarbon
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOC	Volatile Organic compounds
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WMP	Waste Management Plan
Zn	Zinc

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The contributions of the Environmental Consultants – Fugro Nigeria Limited (FNL), commissioned to execute this EIA is also acknowledged and commended.

We are grateful to the Akwa Ibom State Government for their support for the project. We also acknowledge the support of the Paramount Rulers across the six affected Local Government Areas (LGA), private, public organisations and individuals too numerous to mention by name.

Lastly, the supervisory roles and contributions of PHCN's Chemical, Resettlement and Environment (CR&E) Division towards the success of the project are also acknowledged.

EXECUTIVE SUMMARY

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INTRODUCTION

This is the non-technical summary of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line Project Environmental Impact Assessment (EIA). It has been prepared in line with the EIA Act 86 of 1992, the Federal Ministry of Environment (FMENV) Sectoral Guidelines for Infrastructures (Power Transmission Line) projects and the World Bank / International Finance Corporation (IFC) guidelines. Fugro Nigeria Limited (FNL) prepared this report on behalf of PHCN.

Project Background

PHCN operates over ten (10) power plants, one transmission network (over 11,000Km of high voltage power lines) and several distribution lines.

The proposed approximately 58km, 330kv QIT – Ikot Abasi Transmission Line (TL) is located entirely within Akwa Ibom State, Nigeria. The TL will originate at the planned 500MW power plant in Ibeno LGA. From its source point, it will run generally westward, traversing Ibeno, Esit Eket, Eket, Onna and Mkpat Enin LGAs before terminating at National Integrated Power Project (NIPP) planned power sub-station, located near the Alscon Smelting Facility in Ikot Abasi LGA.

Administrative and Legal Framework

- The Environmental Impact Assessment Act No. 86 of 1992
- Guidelines and Standards for Environmental Pollution Control in Nigeria, 1991
- Electricity Act, Cap 106 of 1990
- Nigerian Content Act
- Federal ministry of environment;
- Akwa Ibom State Ministry of Environment Requirements
- The Land Use Act of 1978.
- The Endangered Species Act, Cap 108 of 1990
- Oil in Navigable Waters Act of 1968
- The World bank Operational Policies
- The World Heritage Convention 1978
- Other International conventions and standards to which Nigeria is signatory to.

Benefits of the Project

- Evacuate power from the NNPC/MPN 500MW QIPP Power Plant;
- Increase capacity of the transmission network; as well as
- Strengthen and improve system reliability, stability and operational efficiency of the national grid;
- Add value to the nation's economic growth;
- Provide direct and indirect employment opportunities, including training;
- Indirectly reduce/eliminate considerable percentage of air pollutants emissions due to consistent use of power generators by individuals to support irregular power supply.

Project Development Options

Transmission Line Options

- *Option 1*: Maintain the Status Quo of Power System in the State
- *Option 2*: Transmit Power from Proposed QIPP PP to Eket Substation via a New 132kV Line and Routing
- *Option 3*: Transmit Power from Proposed QIPP PP to Ikot Ekpene or Calabar Substation via a New 330kV Line and Routing
- *Option 4*: Transmit Power from Proposed QIPP to Ikot Ekpene PHCN Substation via a New Line and Routing and a new substation location
- *Option 5*: Transmit Power from Proposed QIPP to Ikot Abasi PHCN Substation via a New Line and Routing. This option was adopted due to its environmental sustainability components and cost effectiveness.

Connection to National Grid

The Ikot Abasi Substation (National Integrated Power Project (NIPP) development under Niger Delta Power Holding Company of Nigeria (NDPHCN) a subsidiary of PHCN) will be upgraded and additional busbars installed to connect the transmission line from the south-west.

Transmission Line Type Options

For this project the 330kV transmission line was chosen because it allows power generated by QIPP to be exported in accordance with national requirements by PHCN and NERC.

Tower Options

Towers shall be self supporting type of vertical / barrel configuration and are designated as suspension towers, tension towers, transposition towers and special towers. As per PHCN standard 2007 Volume 3 A the type of towers is governed by the voltage level. A similar design used for all projects in the nation allows for higher reliability and maintainability. For this project PHCN requests a 330 kV double Circuit transmission line tower design as per their standards. Therefore PHCN would not allow a different type of tower design be applied for this project.

Cable Options

High Voltage Underground Cables are more sensitive to occurring faults and in case of faults require replacement of the defect section leading to less reliability and operability of the system. Also the environmental costs (soil excavation, trenching, free corridor operations, amongst others) made this option not selected for implementation.

Overhead transmission lines allow for certain flora and fauna to grow to a certain extent as long it is not impacting the operability and maintainability of the line. It also involves less environmental impact as to when compared to laying underground high voltage cables. This option was chosen for implementation.

PROJECT DESCRIPTION

The scope of the approximately 58km 330kV QIT - Ikot Abasi transmission line will involve:

- clearing the transmission line Right of Way (~290 hectares) of all vegetation;
- construction of transmission line towers, their foundations and stringing of the line;
- development of land access (from nearby roads) to ROW to facilitate construction and maintenance in upland areas;
- construction of transmission line support towers for water-prone areas;
- filling or dredging of marsh and mangrove areas to provide water access for ROW clearing, tower installation and line maintenance activities;
- installation of additional buss bars to connect proposed transmission line at the NIPP substation in Ikot Abasi.

The transmission line ROW to be acquired for the project is approximately 58km in length and 50m wide, thereby giving a total area of about 2,900,000m2 (290Ha).

Design Basis

The design, construction and operation of this project shall be conducted in order to:

- Protect the safety, health and security of project and operations employees, suppliers' employees, customers, the public and other involved parties;
- Maintain environmental integrity;
- Comply with applicable laws and regulations;
- Apply sound geo-science, engineering, technical and commercial best practices;
- Focus on flawless execution with minimum re-works;
- Meet the reasonable aspirations of the project-impacted communities;
- Maximize Nigerian content consistent with the project objectives;
- Achieve facility performance objectives.

Transmission Line Design

The transmission line project is designed to be a 330kV double circuit, with two systems sharing one tower. The TL project is designed to run from the Ikot Abasi substation outgoing line bay to the QIPP PP substation incoming line bay, a total length of approximately 58km.

Foundation Design

The foundation design for the transmission towers is based on the principle of safety, reliability, economy and reasonability. Three foundation types (mass concrete, pad and pile foundations) shall be used in the proposed project. The mass concrete, and pad foundation types shall be used for foundations with small and large loads respectively under normal soil condition while the pile foundation shall be used in areas where the mass concrete and pad foundations are considered unsuitable.

Tower Design

The tower types are to meet the requirements of the conceptual design for a 330kV double circuit transmission line and shall be in line with the PHCN requirements. The tower design will be such of self supporting type of vertical / barrel configuration and the towers designated as suspension towers, tension towers, transposition towers and special towers. The requirement of transposition and special towers does not arise for this transmission line. 330kV DC Towers shall be provided with one galvanized steel ground wire.

Protection and Earthing System Design

In the proposed project, each transmission line structure shall be grounded so as to obtain a low resistance to ground. In recognition of the peculiar location of the project the resistance have been lowered to 5 Ohm for the facility. Digital protection system shall be applied for the new 330kV Transmission Lines with two different protection panels one for each TL system, which shall be installed in the control room of the substations.

Project Schedule

The proposed transmission line construction shall be completed within 36 months from start date. It is anticipated that once the relevant approvals have been obtained and the EPC contracts awarded, estimated project schedule will take effect.

Power Transmission Line Operations

The transmission line will be operated by PHCN. The operability philosophy is to ensure the safety requirements and avoid undue line failures by proper design for weather - lightning and wind. Additionally, the monitoring of electrical parameters and protection of the TL during operation, a quick response to emergency situations should be implementable, which is buttressed through prior training and adequate stock of replacement parts.

Maintenance of Power Transmission Line

The transmission line will be maintained by the proponent. The TL shall be designed to facilitate maintenance – e.g., climbing aids, use of wedge clamps instead of compression clamps, use of steel (and not copper) ground wires. When TL is to be maintained, the downtime should be minimal, and failed or faulty components are to be replaced as needed and expeditiously. Any component of the transmission line that appears in multiples are to be identical and from the same manufacturer. All components must be safe, of good quality, of required design capacity and readily available.

EXISTING ENVIRONMENT

The baseline information on the bio-physicochemical and socio-economic environment of the proposed project area were based on information from literature as well as findings of a two season field sampling programme, laboratory analyses and a detailed socio-economic and health assessment specifically for this EIA.

Regional Meteorology and Climate

The study area which is in the Niger delta region of Nigeria, is situated in the tropics and experiences a fluctuating climate which is characterized by two distinct conditions of wet and dry seasons. The wet season occurs between April and October with a brief break in August, while the dry season occurs between November and March.

The minimum mean annual temperature is given as 21^0C, while the maximum mean annual temperature is 35^0C. Average relative humidity ranges from 52 to 85% and typical of the Niger-delta.

Air Quality / Noise Levels

About 70% of the transmission line route is largely free of heavy industrial activities. The major sources of air emissions and noise in the area are domestic activities, automobiles, and generators. Significant industrial activities occur at Ibeno and Ikot Abasi axes where the Mobil Qua Iboe Terminal (QIT) and ALSCON plant respectively are in operations.

However, results of air quality characteristics within the proposed transmission line indicated that ambient concentrations of air pollutants (SPM, SOx, NOx, NO_2, VOC, CxHy, H_2S and NH_3) were generally below their individual equipment detection limit and within national and international air quality standards (See **Table 4.4**). Also the noise level in the area ranged from 29.4 dB(A) to 50.3 dB(A) in the wet season and 49.82 dB(A) to 73.16 dB(A) in the dry season.

Regional Geology / Hydrogeology

The generality of the project area geology belongs to the coastal sedimentary basin of Niger Delta, Nigeria. The project area (between Ikot Abasi and Ibeno) is within the elongated northwest – southeast rectangular basin known as the Imo-Kwa lbo River Basin. The basin is principally underlain by the Deltaic, Benin, Ogwashi-Asaba and Ameki formations, and then by the Imo Shales, in that order.

The major aquiferous units are the Benin and Ameki formations. The Imo-Kwa lbo Basin is confined to the northern edge by the Imo shales while the Benin formation and the alluvial deposits of the Niger Delta appear to be in hydrological contact (and thus provide combined aquiferous horizons) to the south.

Soil Characteristics

The soils from the study area are predominantly sandy in texture and brownish in colour. The pH of the surface soil samples collected from the study area was generally acidic with a pH range of 4.4 - 5.2 and 3.2 - 6.8 for the wet and dry seasons respectively. The conductivity of surface soil samples for the wet season was between 18.8 -166.0µS/cm with a mean of 71.1µS/cm. Dry season values ranged between 28.4 - 225.0 µS/cm with a mean of 94.4 µS/cm.
The recorded levels for heavy metal concentration across soils within the study area were found to be within reported values for similar environment and compliant to levels required

for optimal functioning of the ecosystem (see Table 4.10). Values also suggest that soils within the study area as at the time of the study were generally free of heavy metals contamination.

Surface Water Characteristics

A total of five (5) surface water samples were collected for physico-chemical and biological analysis. The recorded pH values in surface water samples from the study area ranged from 6.09-6.86 with a mean of 6.46 in the wet season and 5.41 - 6.53 in the dry season. These values are within established pH range of natural water (see Table 4.6). All other physico-chemical characteristics were within their natural occurring limits and consistent with baseline results of past studies within the project area.

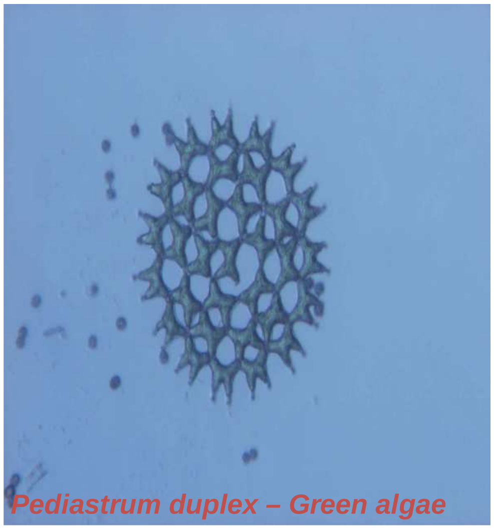
Sediment Characteristics

The pH of the sediment obtained from the study area ranged from 3.79 - 5.21 with a mean value of 4.63 in the wet season. Dry season range of values was given as 5.17 - 6.63 with a mean of 6.196.

The recorded levels of heavy metal concentration across sediment samples within the study area were found to be within reported values for similar environment and compliant to levels required for optimal functioning of a typical freshwater ecosystem.

Hydro-biological Characteristics

The Diatoms dominated the spectrum of phytoplankton species compositions during the wet and dry seasons with higher abundance representing 72% and 55% respectively. this is typical of a fresh water aquatic ecosystem and also is consistent with results of past studies conducted around the area (IPC 2005).



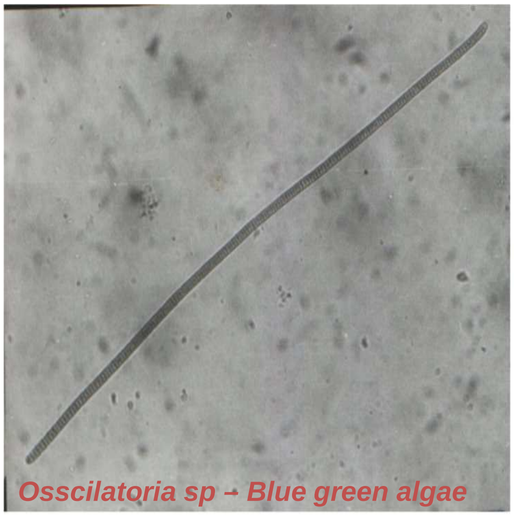


Figure E1: Phytoplankton Species within Study Area

The dominant zooplankton taxa encountered in the study area were the Arthopods / crustacean species which dominated with 71% abundance in both seasons.

Community structure and distribution of macro-benthos in the study area was evaluated and it revealed that annelids were the dominant benthos species recorded across sampling stations with the occurrence of one mollusc specie during the dry season.

Vegetation / Wildlife

The proposed power transmission line would traverse various habitats including several secondary lowland forests, seasonal freshwater swamps, cultivated farmlands, bush fallows, and mangrove forests (at Ibeno, Eket, and Ikot Abasi areas) on the left flank of Eket – Ikot Abasi road. When compare with the IUCN redbook list, three of the species were found to be endangered. However, the listed species are locally abundant.

Table E1: Features of Vegetation / Wildlife transects

Vegetation Transect	Dominant Vegetation	Nearest locality/landmark	LGA
SS 1	Predominantly Mangrove	North-West of QIT premises (proposed QIPP area)	Ibeno
SS 6	Riparian Forest	Eket Bridge Area	Eket
SS 10	Secondary Rainforest	Ukpana Rd in Ikot Edor town	Onna
SS 13	Palm Forest	Off Akwa Ibom State University (Main Campus)	Mkpat Enin
SS 16	Secondary Rainforest	Ikwa town (East)	Ikot Abasi
SS 23	Riparian Forest	East of ALSCON Plant	Ikot Abasi

The distribution of vegetation types along the proposed transmission line and its closets vicinities is shown in **Figure E2** below.

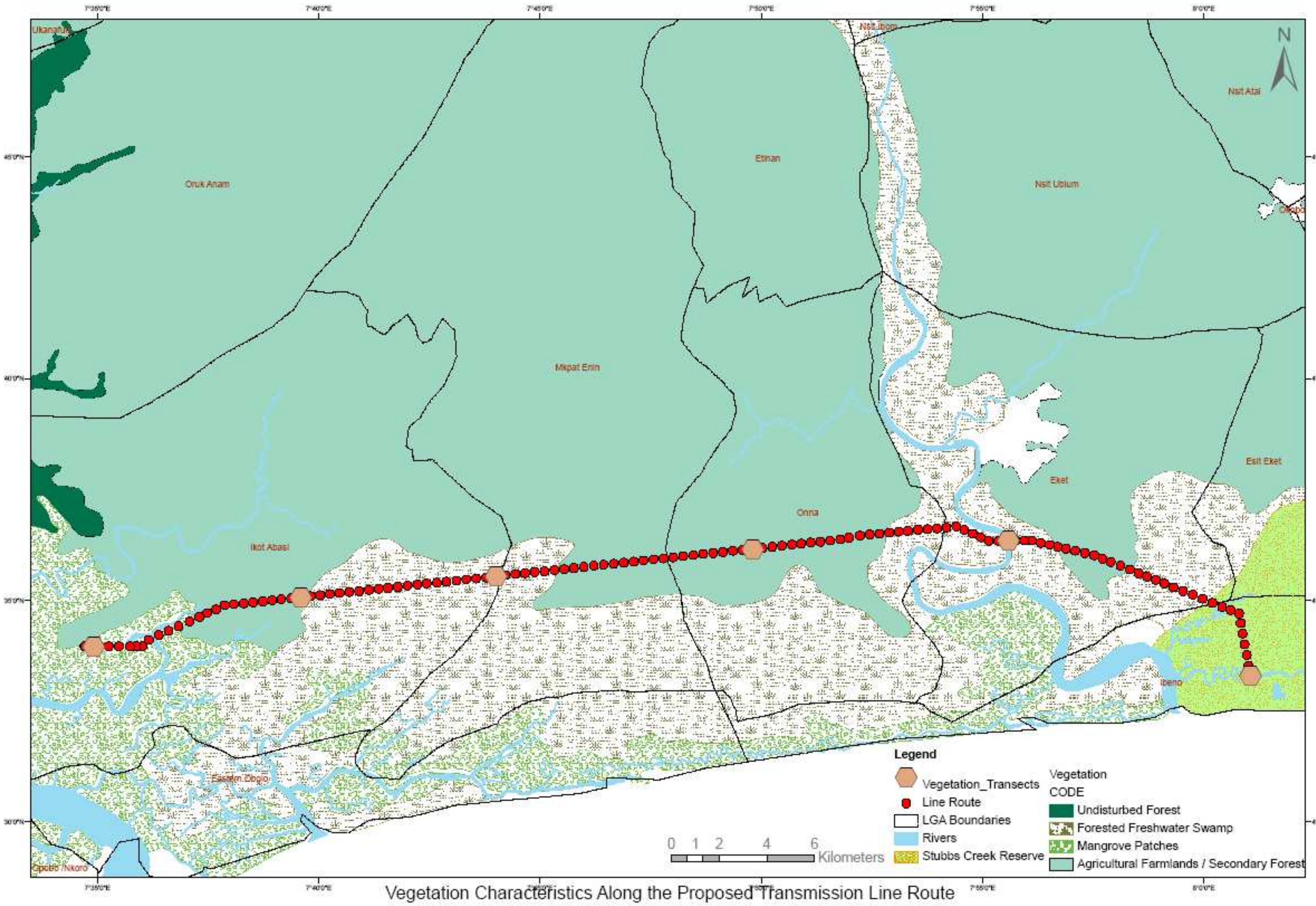


Figure E2: Vegetation Characteristics along Transmission Line Route

A breakdown of wildlife shows that approximately 24 mammalian species belonging to 11 families; 24 avian species belonging to 14 families were identified. Reptiles encountered were represented by 20 species from 10 families, while amphibians had the lowest speciation with 8 species from 5 families. No endangered wildlife species was identified along the line or in closest proximity in line with the IUCN 2006 classification. However, the sitatunga (*Tragelaphus spekei*) and the bates pygmy antelope (*Neotragus batesi)* were classified as vulnerable in line with the Nigerian local conservation classification (Act 11 of 1985).

Socio-economic and Health

The proposed transmission line will traverse through 6 LGAs of Akwa Ibom State, namely; Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot Abasi. The study however covered fifty communities; nine clan councils; and six identified Traditional Ruling Councils (TRC).

Table E2 Consulted / Surveyed Groups

S/NO	LGAs	Consulted TRC	Consulted Clan Council	Surveyed Communities	Respondents
1	Ibeno	1	1	2	24
2	Esit Eket	1	1	3	19
3	Eket	1	1	4	53
4	Onna	1	1	6	84
5	Mkpat Enin	1	2	14	88
6	Ikot Abasi	1	3	21	150
Total	**6**	**6**	**9**	**50**	**418**

The consultation programme for the proposed project consisted of a two-tier process including a public forum organised in respect of the project (See **Appendix 4.5**).

- Reconnaissance visits to key LGA and Clan level stakeholders (political leaders / traditional rulers / civic leaders).
- Direct consultation with identified stakeholders. This phase was conducted by the socio-economic/health survey (SIA/H) team between the 10th day of August to the 16th day of November, 2011 (10/08/2011 – 16/11/2011). It consisted of visits to the various communities / settlements which had been identified by PHCN as areas through which the proposed power transmission line will traverse.

At the local intra-communal level exists the village council, youth and women councils. The mean household size ranged from 7 – 11 people for all surveyed communities, while the mean number of children per household ranged from 6 - 9.

Table E3: Population Characteristics of Surveyed LGAs

S/N	LGA	Total	Male	Female	Dependency Rate	Sex Ratio
1	**Ibeno**	75,380	41,311	34069	66.47%	113.6
2	**Ikot Abasi**	132,023	70,192	61,831	49.29%	113.5
3	**Mkpat Enin**	178,036	93,927	84,109	53.82%	111.7
4	**Esit Eket**	63,701	33,942	29,759	60.51%	114.0
5	**Eket**	172,557	88,635	83,922	51.23%	105.6
6	**Onna**	123,373	59,598	63,775	40.02%	93.5
7	**Akwa Ibom**	3,920,208	2,044,510	1,875,698	53.80%	109.0

Sources: (i) Federal Republic of Nigeria Official gazette 15th May 2007, (AK-BASES) 2005

Focus group discussions with regard to prevalent mode of marriage reveal that polygamy (at least two wives husband) and monogamy were almost equally practiced in the study area.

Contentious issues may arise in the study area due to perceived neglect, marginalization and /or appropriation of family, sub-group and / or communal benefits. The youth are always at the forefront of contentious issues and agitations for restoration of infringed benefits / rights.

The people of the study area are very industrious, enterprising and resourceful and hence they identify themselves with many aspects of economic endeavour. Crop farming, oil palm harvesting and processing, and fishing with locally made canoes and nets; are major economic activities in the study area although other traditional occupations include trading, hunting, wood carving, arts and craft, raffia works, etc. Self classified poverty status in the area as at 2005 is put at 70.8%.

Major markets in the study area include Iwuoachang (Ibeno) Urua Nka (Eket), Urua Edere Obo (Onna) Ukam (Mkpat Enin), Ete (Ikot Abasi). Some of these markets are held daily or weekly.

IMPACT ASSESSMENT, MITIGATION AND MANAGEMENT

The potential and associated impacts of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line project have been identified and evaluated using standard procedures such as source reference materials: project environment baseline data, FMENV EIA sectoral guidelines for power transmission line projects, ISO 14000 guidelines, World Bank /IFC environmental assessment sourcebook/guidelines, etc. A summary of the mitigation and monitoring management process that shows the interaction of project activities on the environmental aspects to produce impacts on the baseline status is shown in **Figure E2.**
Mitigation measures which would eliminate or reduce to as low as reasonably practicable, the identified negative impacts as well as enhance the beneficial impacts have been proffered as well.

An environmental management plan (EMP) that outlines the mitigation, monitoring and institutional measures that will be taken during the project implementation and operation in order to avoid or control the identified environmental impacts has also been established for the project.

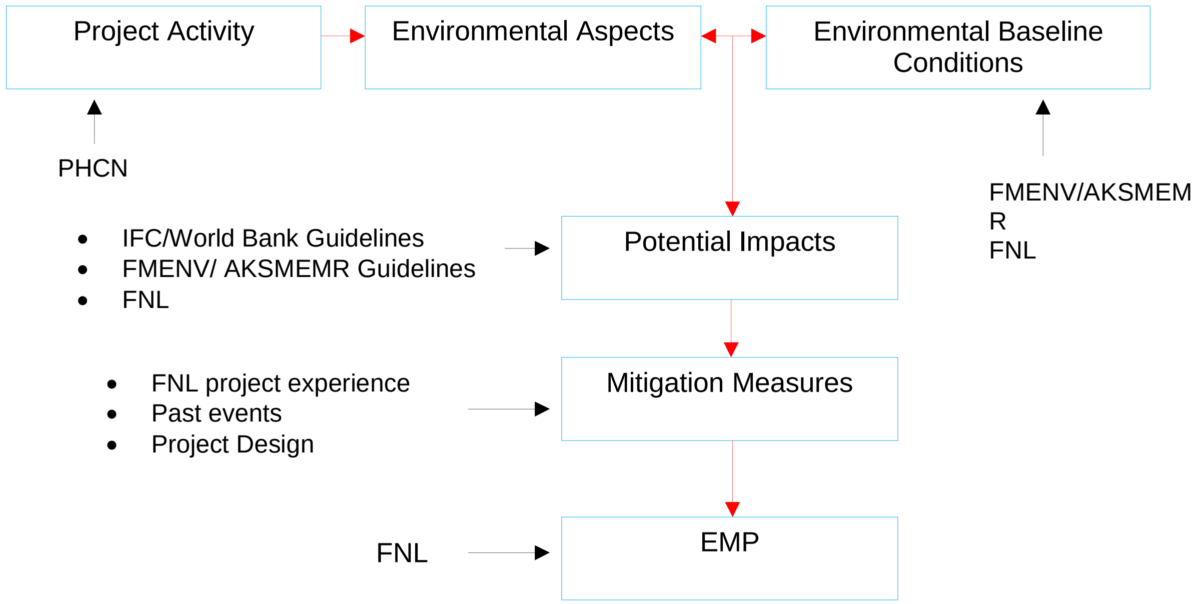


Figure E2: Impact Assessment, Mitigation and Management Process

Positive benefits of the proposed approximately 58km QIT – Ikot Abasi Transmission Line Project identified to date include but not limited to:

- Improved electricity network in Nigeria, which would stimulate much-needed local economic growth;
- The electrical reliability of the system will be improved, which will be of benefit to both PHCN and all electricity users within the national grid;
- Transfer technology and improve local know-how, through the adoption of a reliable state of art power transmission process;
- Provide direct and indirect employment opportunities, training, skills acquisition, and enhancement
- Indirectly reduce/eliminate considerable percentage of air pollutants/emissions due to consistent use of power generators by individuals to support poor power supply.

A summary of adverse potential and associated impacts as well as appropriate mitigation measures proffered are presented in **Table E4** below. Also included is the residual ranking of the impacts after mitigation.

Table E4: Potential Adverse Impacts and Mitigation

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Permitting & ROW Acquisition • Consultations • Acquisition of license to operate • Stakeholder identification • ROW Acquisition	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	Major	PHCN and EPC contractor shall: • Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities • Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • All affected stakeholders and legacy issues are identified early, clearly defined , and agreed on. • Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.	Negligible
Transport of Personnel and Construction Elements • Ikot Abasi – Eket Federal Highway • Eket – Ibeno road • Inland water ways	Interference with other road users along mobilisation route.	Medium	PHCN and its contractors shall ensure that • Equipment, materials and personnel are mobilised after due consultation with relevant transportation authorities (FRSC, NMA, NURTW, etc) and other stakeholders to minimise interference along mobilisation routes. • Travels to and from sites shall be planned to maximize each trip and minimize number of travels	Negligible
	Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset.	Major	PHCN and its contractors shall ensure; • All vehicles and boats are certified road / water worthy prior to being mobilized for work activities. • Compliance to all roads and water ways safety transport rules including speed limits • Competency training and certification of drivers before mobilisation. Limit movement to day time only	Negligible

Table E4: Potential Adverse Impacts and Mitigation Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Recruitment of Labour	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure	Medium	PHCN and EPC contractor shall: • Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Continuous consultation while project is in progress • Implementation of community relations and engagement plan • Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project to discourage preventable influx of persons • Work with contractors to ensure that specialised skill workers from outside the areas have access to proper accommodations and other basic infrastructure • Maintain medical emergency response plan so that all injured or ill personnel can promptly access appropriate care	Negligible
Fabrication and Metal works • Cutting, bending and welding tower steel components • Painting • Handling of conductor wires, strings, insulators	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	Major	PHCN and its contractors shall ensure; • All personnel are qualified and certified for their relevant works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site • Limit work activities to daytime only where practicable	Negligible
	Noise and attendant vibration effects from fabrication and associated welding equipments	Minor	PHCN and EPC contractor shall: • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible. • Ensure use of appropriate PPEs (ear plugs) by workers in areas with noise level above FMENV (90dBA) hourly work area limits. • Conduct daily SHE briefings prior to work	Negligible

Table E4: Potential Adverse Impacts and Mitigation Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	Major	PHCN and EPC contractor shall: • Plan and set on-site sanitary facilities for the disposal of wastewater. • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (lube oils, chemicals, etc.) • Ensure safe management of hazardous materials Ensure handling of fuels such as fuelling of vehicles and machinery, and fuels transfers, take place in contained areas, where sufficient measures are in place to ensure containment of spills. • Plan emergency response measures and implement for cases of accidental spill.	Low
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access roads and at tower sites	Medium	PHCN and EPC contractor shall: • Limit vegetation clearing to footprint required for construction purposes o minimize disturbances along proposed transmission line ROW. • Allow re-growth, within height restrictions, of native ground cover beneath lines (along ROW, lay-down areas and access roads)	Negligible
	Fauna disturbance and displacement as a result of migration away from construction activity area (this include impact on bird life)	Medium	PHCN and EPC contractor shall: • Plan and execute construction works to minimize interference on wildlife • Maintain construction equipments to optimal function conditions • Monitor presence of wildlife species during construction activities	Negligible
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Insulators and fittings • Conductor wire stringing	Waste Disposal • scrap metal, wood, domestic waste • used oil and replaced/obsolete equipment parts • Waste from lay-down area and tower sites from grubbing of ROW	Medium	PHCN and EPC contractor shall : • Develop and implement a waste management plan • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and PHCN waste management requirements.	Negligible
	Socio-cultural conflicts between the construction team and indigenous populace due to contrasts in believes and traditions	Medium	• Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Continuous consultation while project is in progress • Implementation of community relations and engagement plan	Negligible

Table E4: Potential Adverse Impacts and Mitigation Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Operation				
Operations • Electric power transmission using the installed lines after commissioning.	Risk of collision of low flying air planes with transmission towers and lines	Major	• Alternative analysis of the ROW options ensured minimal to no interference with air traffic • PHCN shall provide Aircraft Warning spheres and tower signs in areas where air traffic might occur in order to minimize risk of low flying aircraft colliding with towers and wires.	Negligible
	Unchecked encroachment on the ROW, leading to land-use conflicts and accident.	Medium	PHCN and EPC contractor shall : • Provide warning signs at access roads to warn against unauthorised entry • Through consultations, sensitize stakeholders and members of the communities on government policies along established ROW	Negligible
Maintenance • Tower inspection and checks • Line element replacements • ROW maintenance • Substation maintenance	Interference with local traditional festivals or activities by unscheduled maintenance work and failure to keep to management plans may lead to community strife.	Major	• Plan activities to minimize work activities during local events • Operators will obtain information about planned local activities and avoid disturbing them by shifting maintenance activities to other days whenever possible • Formal notice of any maintenance work should be given in advance to the communities along the area. Access to the line must be via the approved access roads and corridors (agreed with the host communities). • The notice shall give details of the purpose of the access, the contact person and number of people to be involved, time frames and machinery that will be used. • schedule and implement recommendations of the Community Management Plan and approved work procedures	Low
	Maintenance of towers within sensitive environments e.g. mangrove swamps, river banks may lead to disturbance of hydrological regime (micro scale) in river banks	Medium	• Appropriate flow diversion and erosion control structures i.e. earth embankments shall be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc. • Access into the riparian zone and floodplains of rivers should be prevented as far as possible. Where access into these areas is required a preferred corridor should be determined. No deviation from these corridors should be allowed. • Areas to be rehabilitated should be identified and reclaimed.	Negligible

Environmental Management Plan

The EMP outlines management strategies for security, health, safety and environmental stewardship of the proposed project implementation. In addition, monitoring ensures that the planned mitigation measures function as intended.

The primary objectives of the EMP for the proposed transmission line project are to:

- ensure that mitigation measures prescribed in the EIA document for eliminating or reducing significant adverse project impacts are fully implemented;
- present PHCN project management system that will be used for ensuring compliance with Nigerian and other relevant environmental regulations, standards, guidelines and codes of practice at all phases of the proposed project implementation;
- ensure that appropriate recovery preparedness is in place in the event of emergency during the implementation of the project; and
- provide part of the basis and standards needed for overall planning, assessment, monitoring, auditing and review of environmental performance throughout the project duration.

CONCLUSION

The EIA of the proposed approximately 58km 330kv QIT – Ikot Abasi Transmission Line Project has been carried out and documented in this report. This is in order to ensure that potential ecological, social and health impacts of the proposed projects are fully assessed and thus provide necessary data / evidence that will form the Environmental Impact Statement (EIS) and certification of the project. This EIA report has therefore documented the existing environment of the area, potential and associated impacts of the project environmental aspects, and cost effective mitigation measures for adverse impacts. A management plan has also been put in place to assure environmental sustainability of the project.

CHAPTER ONE

INTRODUCTION

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1.1 General

Nigeria has 5900 MW of installed electric power generating capacity. This consists of 1930 MW of hydroelectricity plants and the rest from thermal generation plants. Over time, the major challenges in respect to the power sector have been attributed to:

- installed generation capacity less than demand; and
- operating generation is less than installed generation.

These factors are compounded by use of obsolete equipment, inadequate maintenance, lack of spare parts, and fossil fuel supply problems (including gas pipelines vandalisation). Also, most of the power generating plants is remote from the load centres thus, requiring significant transmission systems with the associated cost and energy loss.

The existing power transmission line network in Nigeria is about 50,000km spread across over 910,000km^2 of landmass and for a population of approximately 150 million people.

Historical Overview

Historically electricity generation in Nigeria began in 1896. In 1929, Nigeria Electricity Supply Company (NESCO) commenced operations as an electric utility company with the construction of a hydroelectric power station at Kuru near Jos.

In 1951, the Electricity Corporation of Nigeria (ECN) was established while the first 132KV line linking Ijora Power Station to Ibadan Power Station was constructed.

The Niger Dams Authority (NDA) was established in 1962 with a mandate to develop the hydropower potentials for Nigeria. However, ECN and NDA were merged in 1972 to form the National Electric Power Authority (NEPA). In 1998, NEPA ceased to have an exclusive monopoly over electricity generation, transmission, distribution and sales. This led to reforms in the electricity sector.

Electricity Sector Reform

Prior to 1999, the power sector did not witness substantial investment in infrastructural development, new plants were not constructed and the existing ones were not properly maintained. Also, only nineteen out of the seventy-nine installed generating units were in operation (NIPP, 2007).

The power sector is capital intensive and government requires support from the private sector to augment the growing need for electricity in Nigeria. In line with this objective the re-structuring of the electricity sector took form of unbundling of NEPA into:

- a number of competing, privatized generation companies;
- a number of privatized distribution and retail sales (marketing) companies; and
- a company responsible for transmission and dispatch.

The outcome of this was the:

- Creation of 100% state owned holding company and subsidiary generation and distribution companies within it.
- Incorporation of subsidiary companies vested with their assets and liabilities.
- Privatizing the subsidiary companies leaving a transmission and dispatch company plus a residual 100% state - owned holding company.
- Development of trading arrangements among these companies which will evolve into a bulk power market.
- Engagement of Rehabilitate, Operate and Transfer (ROT) and similar schemes as early privatisation options, with transfers going back to the Bureau of Public Enterprises and not NEPA;
- Commissioning of a restructuring study to provide the details of the transition from the current structure to the privatisation of the subsidiary companies

The Federal Government of Nigeria (FGN) is thus intensifying efforts at improving the electricity power generation and supply situation in the country to meet the increasing demand of its populace and ever growing industries. Consequently the FGN aside from its own efforts opened up the electricity market to the private sector for participation.

A joint venture of Nigerian National Petroleum Corporation (NNPC) and Mobil Producing Nigeria (MPN) initially addressed and registered as the Joint Venture Power Project (JVPP) and currently called the Qua Iboe Power Project (QIPP), intends to construct a 500MW thermal power plant adjacent to MPN existing Qua Iboe Terminal (QIT) in Ibeno Local Government Area, Akwa Ibom State.

In order to adequately evacuate the power that would be generated from the proposed power plant, Power Holding Company of Nigeria (PHCN) proposes to construct an approximately 58km 330kV Transmission Line (TL) from MPN's QIT to Ikot Abasi. The TL as foreseen will run within an approximate 58km long and 50m wide right-of-way (ROW) corridor, giving a total land area of 2,900,000m^2 (290Ha). It will also traverse several communities in six (6) local government areas (LGAs) namely; Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot Abasi all in Akwa Ibom State.

The key purposes of the TL project among others are to;

- evacuate power from the NNPC/MPN 500MW QIPP Power Plant;
- increase capacity of the transmission network; as well as
- strengthen and improve system reliability, stability and operational efficiency of the national grid.

In compliance with statutory requirements for environmental management in Nigeria as well as good industry practice, Environmental Impact assessment (EIA) of the proposed approximately 58km 330kv Transmission Line project has been conducted.

This document is the EIA report. It has been prepared in line with the EIA Act 86 of 1992, the Federal Ministry of Environment (FMENV) Sectoral Guidelines for Infrastructures (Power Transmission Line) projects and the World Bank / International Finance Corporation (IFC) guidelines. Fugro Nigeria Limited (FNL) prepared this report on behalf of PHCN.

1.2 Project Location

The proposed 58km 330kv QIT – Ikot Abasi Transmission Line is located entirely within Akwa Ibom State, Nigeria (**Figure 1.1**). The TL will originate at the planned 500MW power plant in Ibeno LGA. From its source point, it will run generally westward, traversing Ibeno, Esit Eket, Eket, Onna and Mkpat Enin LGAs before terminating at National Integrated Power Project (NIPP) planned power substation, located near the ALSCON Smelting Facility in Ikot Abasi LGA.

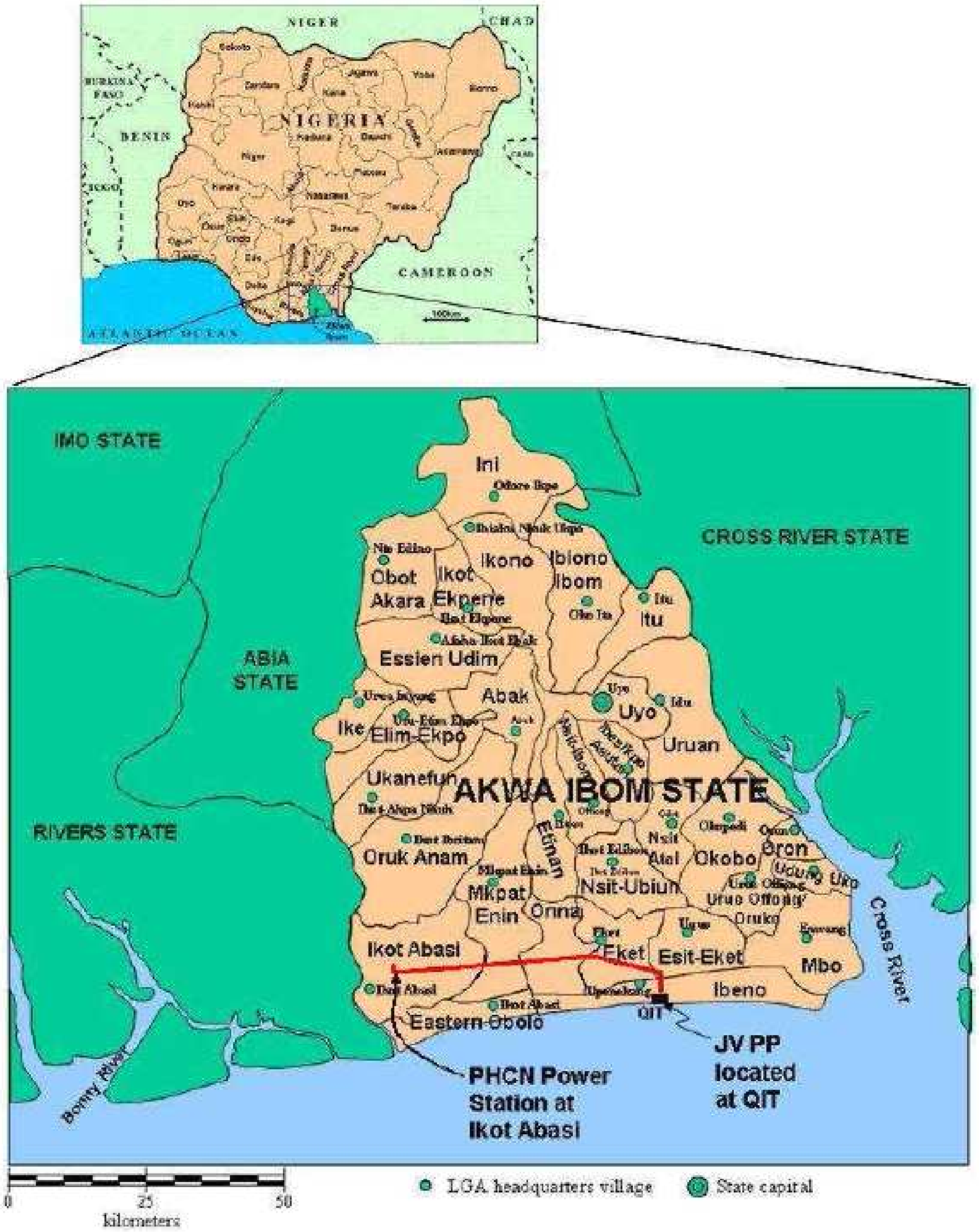


Figure 1.1: Proposed Transmission Line Route – Akwa Ibom State

The transmission line is proposed to traverse some potentially ecologically valuable and sensitive habitats. However, the design of the transmission and associated activities have been planned to limit footprint in these areas. The identified ecological areas that the line would cut through include:

- Stubbs Creek Forest Reserve as well as the Douglas Creek River system along Esit Eket / Ibeno area. MPN obtained two separate certificates of occupancy documents which jointly encompass the land tract boundary for the Power Plant and the Transmission Line facilities. Although the area was initially designated as a forest reserve, in Nigerian context, a forest reserve is not considered a conservation area. Instead, it is a reserve for timber production and therefore is not a critical natural habitat. In addition, the Land Use Act authorizes the governor to use, change use of and transfer lands. MPN acquired the lands for industrial and commercial purposes. These certificates of occupancy documents are essentially lease agreements between MPN and the Akwa Ibom state government.
- Palm forest around the Onna to Mkpat Enin axis. The palm forest along the Mkpat Enin and Onna axis serve farming purposes comprising other crops like cassava, yam and vegetables for local inhabitants. These are not considered sensitive. However the project resettlement action plan (RAP) has been developed to identify and compensate for any losses incurred as a result of the project activities.
- Pockets of mangrove habitats along the Ibom Power TL road crossing in Ikot Abasi axis. Project alternative analysis considered several routes that would limit interference with mangroves. The preferred option is a longer distance that provides the most minimal disturbance of mangroves. Detailed discussion is provided in chapter two (see Table 2.1). The International Union of Conservation of Nature (IUCN) red list was used to determine the status of the species identified in the area in **chapter four** and appropriate mitigation provided in **chapter six**.

Socio-economic impacts due to the transmission line project will range from land use conflicts/compensation issues and socio-cultural conflicts between workers and natives. Despite the fact that some of the land that will be taken up for the TLine ROW is not cultivated, the primary land use for the people of the area is for farming. Land take due to project activities therefore has the potential to affect the economic lifestyle of the indigenes who are mainly farmers. . A thorough analysis of the impacts is provided in **chapter 5**.

No cultural or archaeological structures were found along the proposed transmission line route. Subsequently no assessment of impacts, mitigation, or management measures is proposed. Health, safety and environmental considerations were incorporated in the determination of the proximity of the proposed transmission line to built up areas such as settlements, Eket Air Strip, QIT helipad, Ibom Power Tline and the Ikot Abasi-Eket Federal Highway. Detailed analyses on the above considerations are provided in **chapter two**.

The proposed transmission line has been planned to eliminate adverse impacts on the environment. Impacts that could not be eliminated have been reduced to as minimal as possible. Detailed evaluation and discussion of the impacts and mitigation of the proposed transmission line on the environment are presented in chapters five and six of this report.

1.3 Project Scope

The scope of the ~58km 330kv QIT – Ikot Abasi Transmission Line includes the construction and operation of electric power transmission line. This will include;

- clearing the transmission line ROW (~290 hectares) of all vegetation;
- construction of transmission line towers, their foundations and stringing of the line;
- development of land access (from nearby roads) to ROW to facilitate construction and maintenance in upland areas;
- construction of transmission line support towers for water-prone areas;
- limited earthworks involving access creation, ROW clearing and tower installation activities along swamp and mangrove paths;
- provision of associated digital communication facilities at the substations.

The general project scope includes construction of two bays at Ikot Abasi substation. Although this does not fall under this EIA scope, two bays shall be constructed by MPN to be handed over to, and operated by PHCN. This is subject of a different EIA which was carried out by NIPP.

The construction of a new substation at QIT is covered in the QIPP EIA scope of work currently being progressed with the Federal Ministry of Environment and the World Bank

1.4 The Proponent

PHCN is the largest producer and distributor of electrical power in Nigeria. It was formed as a result of the Electric Power Sector Reform Act, signed into law in March 2005 by the FGN. It has taken over all assets and liabilities of the former National Electric Power Authority (NEPA) and is now the centre of electricity generation, transmission, distribution and supply within Nigeria.

1.5 EIA Terms of Reference

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

- define the relevant framework of legal and administrative requirements for EIA of the proposed project;
- outline the general scope of the EIA study including the overall data requirements on the proposed project and affected environment; and.
- define the procedures and protocols for identification and assessment of associated and potential impacts and also for selecting appropriate prevention, reduction and control as well as enhancement measures for such impacts; and eventually developing an effective Environmental Management Plan (EMP) for the project.

A copy of the ToR submitted to Federal Ministry of Environment (FMENV) by PHCN is provided as **Appendix 1.1**.

1.6 EIA Objectives

EIA is an environmental management tool used to assess the potential adverse and positive impacts of a proposed activity/development on components of the environment.

The objectives of the proposed TL EIA are as follows:

- Identification of all communities within the project area and other Stakeholders for effective consultation;
- obtain and provide all necessary information and evidence needed for developing an Environmental Impact Assessment report (EIA) for the proposed project;
- satisfy regulations from federal, state and local authorities on environmental matters, by showing that a systematic assessment of the potential impacts of the proposed project has been carried out using standard procedures;
- generate the necessary data for establishing the environmental baseline conditions of the project area;
- identify and evaluate the associated and potential impacts of the proposed project on the ecological and socio-economic communities within the study area;
- establish control and cost effective strategies, procedures and practices to be followed during design, construction and operation to ensure the environmental sustainability of the project;
- develop an Environmental Management Plan (EMP) for the proposed project: and
- provide information and evidence needed for developing an Environmental Impact Statement (EIS) for the proposed Transmission Line Project.

1.7 Scope of Study

The scope of the EIA study is to:

- review national and international regulations guiding the activities to be carried out;
- carry out a comprehensive literature review to adequately describe the background condition of the environment of the study area;
- collate field data collected and analysed for effective characterisation of the area;
- identify, predict and evaluate potential impact;
- develop effective mitigation/ameliorative measures and monitoring programmes; and
- prepare updated EIA reports following current regulatory guidelines and procedures.

1.8 EIA Methodology

The approach adopted in conducting the study is illustrated in **Figure 1.2**. This approach ensures that the EIA process was in compliance with the FMENV guidelines and standards. This EIA report has been compiled in accordance with the flow scheme below

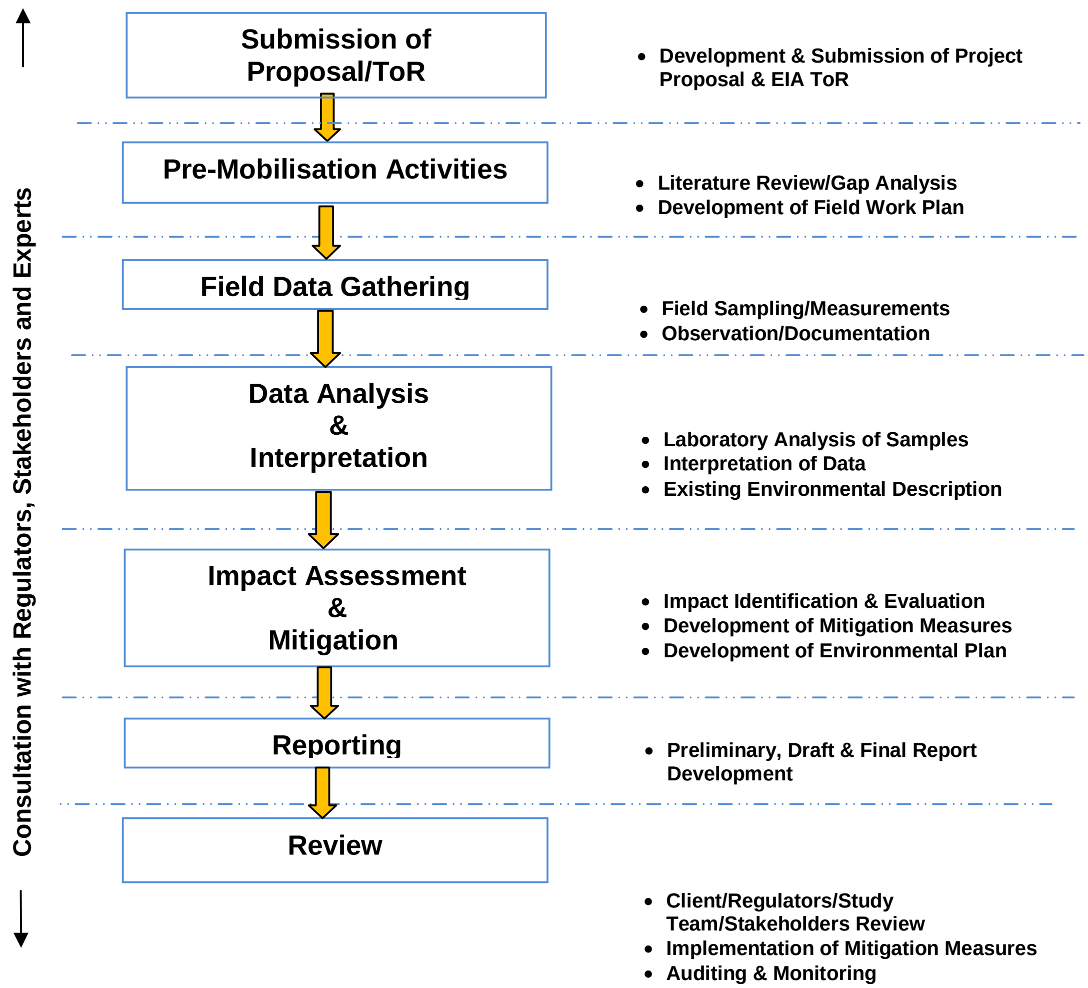


Figure 1.2: EIA Methodology Flowchart

1.9 Legal Regulatory and Administrative Framework

PHCN is committed to conducting its operations in compliance with applicable national and international legislations and with the PHCN's policies:

Existing statutes on environmental protection in Nigeria contain specific provisions designed to prohibit or control environmental pollution / degradation and also prescribe sanctions or fines to be enforced against persons or corporate entities who contravene the provisions.

The legal and regulatory framework for carrying out EIA of the proposed project are contained in relevant national statutes and international environmental conventions to which Nigeria is signatory; Consequently, the following sections present the applicable and relevant: National legislations, International Agreements, PHCN's Safety, Health and

Environment (SHE) policies, which shall ensure the protection of human health, equipment safety and the environment.

1.9.1 National Policy on the Environment

The policy states that Nigeria is committed to ensuring that the country's natural and built environment is safeguarded for the use of present and future generations. This commitment demands that efficiency in the use of resources and the minimisation of environmental impacts must be the core requirements of all developmental activities.

Accordingly, the policy seeks to promote good environmental practice through environmental awareness and education. The strategic objective of the National Policy on the Environment is to coordinate environmental protection and natural resources conservation for sustainable development. This goal is to be pursued by:

- securing a quality of environment adequate for good health and well being;
- promoting sustainable use of natural resources and the restoration and maintenance of the biological diversity of ecosystems;
- promoting an understanding of the essential linkages between the environment and economic development and encouraging individual and community participation in environmental improvement initiatives;
- raising public awareness and engendering a national culture of environmental preservation; and
- partnership among all stakeholders including government at all levels, international institutions and governments, non-governmental agencies and communities on environmental matters.

The action plans to achieve the policy objective include the following:

- that environmental aspects are considered in major economic decision making processes;
- that an integrated environmental management approach is built into major development projects;
- that economic instruments and environmental reporting are employed in the management of natural resources;
- that the best practicable environmental technology are applied in major economic activities;
- that environmental impact assessment (EIA) is mandatory before any major development project is embarked upon; and
- that environmental monitoring and auditing is routinely carried out in major economic activities.

1.9.2 National Statutes on Environmental Protection

Prior to the EIA Act of 1992, Nigeria has had provisions in a number of statutes designed to prohibit or control the pollution of water, air and land. These statutes also prescribed sanctions (in the forms of imprisonment or damages) against persons or companies that infringe these provisions. Some of these statutes and regulations most relevant to the proposed project are:

The Environmental Impact Assessment Act

The Act No. 86 of 1992 makes EIA mandatory for all new major public and private projects in Nigeria. The EIA Act sets out to:

- consider the likely impacts, and the extent of these impacts on the environment before embarking on any project or activity;
- promote the implementation of appropriate policy in all Federal Lands consistent with all laws and decision making processes through which the goal of this Act may be realised;
- encourage the development of procedures for information exchange, notification and consultation between organisations and persons when the proposed activities are likely to have significant environmental effects on boundary or trans-state or on the environment of bordering towns and villages.

The Act gives specific powers to the Federal Environmental Protection Agency (FEPA) now FMENV to facilitate environmental assessment of projects. In September 1995, FMENV published EIA Sectoral Guidelines for Infrastructure projects and Oil and Gas Industry projects. The guidelines are intended to assist in the proper and detailed execution of EIA studies of infrastructures and oil and gas projects in consonance with the EIA Act of 1992.

1.9.3 The Federal Ministry of Environment

The Federal Environmental Protection Agency (FEPA) [presently subsumed into the Federal Ministry of Environment (FMENV)] was inaugurated in 1988 by Act No. 58 of 1988 and subsequently amended through Act No. 59 of 1992.

The body is charged / empowered with the overall responsibility of environmental matters in Nigeria. It has developed instruments of intervention to halt environmental degradation in form of policies, standards, guidelines and regulations and programmes. With the initiation of these instruments, enforcement by FMENV has become the most effective tool to bring industries and regulated community into compliance through compliance promotions. The relevant policies, guidelines and regulations of the ministry are outlined below:

- *Effluent Limit*ations: Section S.I.8 of NEPR makes it mandatory for industries as waste generating facilities to install anti-pollution and pollution abatement equipment on site. The regulation is specific to each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystem.

- *Pollution Abatement* in Industries Generating Waste: Section S.I.9 of NEPR highlights restrictions on the release of toxic substances, and requirements for use of pollution monitoring equipment; requirements for use of machinery for combating pollution; development of contingency plans; and submission to FMENV of lists and characteristics (including quantity) of chemicals used by industries. It also highlights permissible limits of discharge into public drains, protection of workers, and requirements for environmental audits.
- *Management of Solid Hazardous Wastes:* Section S.I.15 of the NEPR spells out the requirements for waste piles, incinerators, etc. It also describes the hazardous chemical products and dangerous waste constituents.

1.9.4 National Inland Water Ways Authority

National Inland Water Ways Authority (NIWA) was established by Act No. 13 of 1997. The objectives of the Authority include:

- to improve and develop inland waterways for navigation;
- to provide an alternative mode of transportation for the evacuation of economic goods and persons; and
- to execute the objectives of the national transport policy as they concern inland waterways.

The statutory functions of NIWA include:

- making regulations for the inland water navigation;
- development of infrastructural facilities for a national inland waterways; and
- ensure the development of indigenous technical and managerial skills to meet the challenges of modern inland waterways transportation.

Other functions include:

- capital and maintenance dredging;
- hydrological and hydrographic surveys;
- design of ferry routes;
- remove and receive derelicts wrecks and other obstructions from inland waterways;
- approve and control all jetties, dockyard, piers within the inland waterways;
- reclaim land within the right of way;
- construction, administration and maintenance of inland river-ports and jetties;
- provide hydraulic structures for river, bed and bank stabilization, barrages, etc;
- subject to the provisions of the Environmental Impact Assessment Act 1992, carry out environmental impact assessment of navigation and other dredging activities within the inland water and its right of way;
- undertake erection and maintenance of gauges, kilometre boards, horizontal and vertical control marks; and
- clear water hyacinth and other aquatic weeds.

The Federal Ministry of Environment is the overall umbrella for the protection of coastal and marine environments in Nigeria. The State Government through the State Environmental Ministries/Protection Agencies play significant roles in the maritime states.

1.9.5 Nigerian Content Act

The Nigerian Local Content law was created to enhance utilisation of the country's human and material resources for the provision of goods and services to the petroleum industry.

- Nigerians shall be given first consideration in the award of oil blocks, oil field licenses, oil lifting license and shipping service as well as projects for which contracts are to be awarded in the industry;
- there shall be exclusive consideration for Nigerian indigenous services to the oil and gas industry subject to the fulfilment of specified conditions;
- every multinational oil company operating in Nigeria is to domicile a minimum of 10% of its annual profit in Nigerian banks;
- Nigerian insurance companies are to do all aspect of insurance in the oil and gas sector except where local capacity has been exhausted;
- one percent of every contract awarded in Nigeria's oil and gas sector to be set aside for capacity building;
- at least 50% of the asset of any company seeking to execute oil and gas contract in Nigeria must be domicile in Nigeria, among others.

1.9.6 Other National Regulations

Other national regulations on environmental protection relevant to the proposed project are:

Land Use Act

The Land Use Act of 1978 states that " it is public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families be assured, protected and preserved".

Endangered Species Act

The Endangered Species Act (Control of International Trade and Traffic) Cap.108 Law of Nigeria, 1990 prohibits the hunting, capture and trade of endangered species.

Criminal Code

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

- violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carry on business in the neighbourhood, or passing along a public way; or
- does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, whether human or animal.

There are also other regulations including:

- Wild Animals Preservation Act Cap 132 LFN 1990;
- River Basins Development Authority Act, 1987; and
- Natural Resources Conservation Act Cap 286 LFN 1990.

1.9.7 Nigeria Electricity Regulatory Commission (NERC)

This is an independent regulation agency for electricity in the form of a regulatory commission. It has many functions some of which include:

- electricity regulation for grid connected services.
- Issuing of licenses to the companies operating in the Nigeria Electricity Supply Industry.

1.9.8 National Statutes on Electrical Installation and Electricity Supply

The relevant Nigerian laws on electrical installation and electricity supply governing the proposed project including penalties for breaches of regulations are:

Electricity Act

The Electricity Act, Cap 106 of 1990 contains regulations pertaining to permit for electrical installations, placement of overhead lines, construction of substations and switching stations, penalties for breaches of licenses and regulations etc. The specific part and sub parts relevant to the Transmission Line project are:

- Part VI: Regulations appertaining to overhead lines and restrictions to placing electric lines above ground. This section stipulates that:
  - Except under and in accordance with the terms of a written authority granted by the Minister no electric lines (other than service lines) shall be placed above the ground and no support carrying electric lines shall be erected unless such line or support complies with the provisions of these regulations.
  - Any electric line or support so placed or erected shall be so maintained that it complies with the provisions of these Regulations
  - Every support carrying electric lines shall be made of wood, steel or reinforced concrete or any combination of any of such materials or any other approved materials and in the case in which wood or steel is used in the construction of the support, such wood or steel or any other approved materials shall be, so far as is reasonably practicable, protected against decay, corrosion or other deterioration
  - Every support shall be so constructed and placed as to withstand the transverse, horizontal and vertical loads calculated in accordance with Regulation 48 without exceeding the materials strength limits as set out in Regulations 53.
  - In no case shall the strength of a support in a direction parallel to the overhead line be less than one quarter of the strength in a direction transverse to the said line.
  - All overhead electric lines shall be attached to suitable insulators carried on cross-arms or brackets of suitable materials and cross-section, and they shall be so attached to the insulators, or guarded, that they cannot fall away from the supports in case they become detached from the insulator, but will fall on the cross-arm or insulator support.
  - All lines at angles shall be attached to the insulator so that the insulator, and not the binding wire takes the strain.
  - The transverse load on any support carrying an electric line shall be calculated in accordance with the requirements of Regulation 47(2) and the appropriate wind pressure on any electric line shall be calculated in accordance with its average

height above ground throughout its span, and the wind pressure on the leeside, side of lattice steel or other compound structures shall be deemed to be one half of the pressure on the leeward side. The vertical loads on supports shall comprise the weight of the supports themselves and any insulators and fittings attached thereto, together with the loads imposed by the electric lines and their fittings.

- The foundations shall be so constructed and placed, taking into account the reaction of the soil at times of the year in which they are embedded to the load that they are to carry, as to withstand the transverse, horizontal and vertical loads calculated in accordance with Regulation 48 without exceeding the material strength limits set out in Regulation 53.
- Every electric line shall be made of copper, aluminium or steel, or any alloy or combination of any of such materials, subject to the approval of the Minister.
- Every electric line shall have a copper equivalent cross-section area of not less than 16 square millimetres and an ultimate tensile strength of not less than 4 kilo Newtons.
- Every electric line, other than an earth wire permanently connected with earth, shall be:
  - Insulated by glass, porcelain, or composite insulators to support, suspend or terminate the electric lines and designed and constructed for the voltage at which it is to operate.
  - Effectively insulated with respect to any part thereof, which is ordinarily accessible from the ground or from a building or structure.
- Overhead electric line supports, in conjunction with stays and struts, if provided, shall withstand the longitudinal, transverse and vertical loads due to fittings, conductors and wind loadings under the most adverse temperature conditions and with the factors of safety specified below;
  - Live and earth conductors based on the ultimate tensile strength of the material;
  - Mid-span joints and termination based on the ultimate tensile strength of the conductor (comparative safety factor between the ultimate tensile strength of the mid-span joint and the ultimate tensile strength of the mid-span joint and the ultimate tensile strength of the conductor);
  - Complete insulator units based upon the electro-mechanical strength of the material (comparative safety factor between the ultimate tensile strength of the mid-span joint and the ultimate tensile strength of the insulator string and the ultimate tensile strength of the conductor);
  - Stay wires and auxiliary materials based on ultimate tensile strength;
  - Insulator metal fitting based upon elastic limit;
  - Lattice steel supports (or other compound structures) based on the crimpling load of members in compression, the elastic limit of members in tension and the shear bearing deformation at joints;
  - Steel tubular poles based on the ultimate breaking strength in handling of the material;

- Impregnated wood poles in accordance with Nigerian Standard No. 43 based on 90% of the strength of corresponding to the ultimate extreme fibers stress or for the poles supported with stays 90% of the crippling strength
- Impregnated wood poles in accordance with Nigerian Standard No. 43 and supported with stays based on 90% of crippling strength;
- All untreated poles based on 90% of the strength corresponding to the extreme fiber stress;
- All untreated poles supported with stays based on 90% of crippling strength;
- All types of concrete poles based on the strength corresponding to failure;
- Foundation for supports against overturning lateral shearing, toe compression and uprooting under maximum simultaneous working loads based on soil bearing strength;
- Under a single broken electric line or earth wire condition the factors of safety for supports and foundations shall not be less than –
- Support: 50% of the factors of safety given in Regulations 53(f) to 53(l),
- Foundations: 50% of the factors of safety given in (m) above.

o For design purposes the average minimum and maximum ambient temperatures shall be 5^0C and 45^0C respectively.

o Unless otherwise authorized by the Minister in writing the following working conditions shall be assumed for design purposes –

- Minimum ambient temperature of overhead line conductors 5^0C
- Maximum temperature of overhead line conductors 100^0C
- Average ambient temperature of overhead line conductors 35^0C
- For all design purposes the reference temperature shall be the minimum temperature 5^0C.

Regulations appertaining to permits for installation, requirements for safety, substations and switching stations as well as penalties for breaches of licenses and regulations are detailed in Part II, Part III, Part VII and Part XVI respectively.

1.9.9 Akwa Ibom State Ministry of Environment and Mineral Resources (AKSMEMR)

The State Ministry of Environment have the responsibility of environmental protection within the state. The functions of the Ministry include:

- Routine liaison with FMENV in order to achieve the National Policy on Environment.
- Co-operation with FMENV and other relevant National Directorates/Agencies in the promotion of environmental education of the citizenry.
- Responsibility for monitoring compliance with waste management standards.
- Responsibility for general environmental matters in the state including the negative effects of soil degradation due to flooding and erosion, mineral and oil exploitation and exploration, deforestation, physical planning (amusement parks, gardens and beautification programmes, sewage matters, water quality and pollution control).
- Monitoring of the implementation of the EIA and the Environmental Audit Report (EAR) guidelines and procedures on all development policies and projects within the state.

The provision of AKSMEMR Law No. 8 of 200 that relates to environmental protection in respect to the proposed transmission line project states that:

- No person shall cause any waste generated in the process of manufacturing or business operation to be discharged without treating or purifying it in accordance with the standards approved by the ministry;
- No person shall discharge or cause to be discharged untreated human waste into any public drain, watercourse, gorge storm water, drainage or into Any land or water;
- No person shall discharge into air inadequately filtered and purified industrial gaseous waste containing substances injurious to life and property, such as sulphur dioxide, oxides of metallic dust, particulate and injurious gases;
- No person shall dump or burn or cause or allow to be buried in any land or water any toxic, hazardous substance or harmful waste.

1.10 PHCN Safety, Health and Environment (SHE) Policies

Transmission Company of Nigeria Policy on Occupational Health and Safety

- employ and provide proper resources to ensure competent advice on occupational Health and Safety matters;
- continue to develop and implement procedures and safe working practices;
- maintain systems for reporting and controlling safety performance and for monitoring and accessing health in the workplace;
- continue to provide standard personal protective wears and equipment for members of staff that are deemed exposed to hazards in the work place;
- continue to maintain a system of sensitizing both staff and the public on health and safety matters;
- continue to maintain an appropriate framework for joint consultation with employees, representatives on effective measures for promoting healthy working conditions for employees at all levels so as to ensure their effective participation and contribution on measures for promoting health and safety in the workplace.
- it is also the company's policy to ensure that its contractors abide by similar standards in respect of their employees working on the company's sites.

PHCN Environment Policy

The mission is to harness natural resources on which our operations depend with utmost possible care. Achieve environmental excellence in our operations as well as satisfy customers demand for electric energy in a safe and environmentally friendly manner. This can be achieved through the following strategies:

- ensure openness and commitment to environmental issues related to power development;
- enhance environmental protection by taking the future generations into consideration when carrying out development projects;
- continuously train and motivate all employees to perform their duties in an environmentally responsible manner;

- create and enjoy the confidence of staff, customers and other stake holders in our actions and operations.

1.11 International Policies, Guidelines and Conventions

In addition to the national laws/regulations, Nigeria is signatory or party to several international conventions and treaties that support the use of EIA as the key tool for achieving sustainable development. Some of these include:

World Bank Group Environmental, Health and Safety Guidelines

The World Bank Group Environmental, Health and Safety Standards emphasises the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management). It provides operational procedures for a project's social and environmental management system as a dynamic, continuous process initiated by management and involving communication between the client, its workers, and the local communities directly affected by the project (the affected communities). The standard therefore applies to projects with social or environmental risks and impacts that should be managed, in the early stages of project development, and on an ongoing basis.

The primary objectives are:

- to identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;
- to avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities , and the environment;
- to ensure that affected communities are appropriately engaged on issues that could potentially affect them;
- to promote improved social and environment performance of companies through the effective use of management systems

In addition, the World Bank has developed specific safeguard operational policies that identify various aspects of the environment that a developmental project may likely impact. The policies applicable to this project and the potential impacts are discussed below.

Operational Policy/Bank Procedure 4.01: Environmental Assessment

This policy helps ensure the environmental and social soundness and sustainability of investment projects. It supports the integration of environmental and social aspects of projects in the overall decision-making process.

Environmental assessment is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. It evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation.

An environmental assessment takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. The assessment considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements.

The Bank does not finance project activities that would contravene such country obligations, as identified during the assessment. An environmental assessment is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

An Environmental Impact Assessment (EIA) of the proposed transmission line project has been carried out in order to identify and evaluate potential environmental impacts of the project on its environment, examine project alternatives, choose options with the least adverse impacts on the environment, proffer mitigation measures for the impacts that cannot be eliminated or avoided, and possibly enhance positive impacts as well as document the process of managing adverse environmental impacts throughout project implementation.

Operational Policy 4.04: Natural Habitats

This safe guard policy seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present).

Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- legally protected,
- officially proposed for protection, or
- un-protected but of known high conservation value.

None of above listed areas was identified in the course of this study. It is therefore not anticipated that the proposed transmission line would pass through or affect any critical natural habitat.

Operational Policy/Bank Procedure 4.36: Forests

The Bank's current forests policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development.

In line with the Bank's current and anticipated approach to forest issues, and in recognition of the fact that forests play an increasingly important role in poverty alleviation, economic development, and for providing local as well as global environmental benefit and services, the proposed project impact on forest resources was planned to be as minimal as possible. The routing and project activities were determined after thorough environmental evaluations that were targeted to minimize impacts on forests and the environment at large. Details of the environmental alternative analysis are provided in **chapter two**.

Operational Policy/Bank Procedure 4.11: Physical Cultural Resources

Cultural resources are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The loss of such resources is irreversible, but fortunately, it is often avoidable.

The objective of the Physical Cultural Resources policy is to avoid, or mitigate, adverse impacts on cultural resources from development projects that the World Bank finances. No physical or cultural resources were identified along the proposed project route. The project will therefore have no impact on such resources.

Operational Policy/Bank Procedure 4.10: Indigenous Peoples

The World Bank policy on indigenous peoples underscores the need for Borrowers and Bank staff to identify indigenous peoples, consult with them, ensure that they participate in, and benefit from Bank-funded operations in a culturally appropriate way and that adverse impacts on them are avoided, or where not feasible, minimized or mitigated.

The people along the proposed transmission line route are of the Ibibio ethnicity - of Akwa Ibom State in the Niger Delta area of Nigeria. Their ethnicities are traceable to the Ekid, Ibibio and the Andoni / Obolo origins. These people have lived in their present locality as far as pre-colonial era.

Consultations with these people have been ongoing to ensure that they are aware of the project and familiar with its prospects and aspects. Consultation progressed from the highest recognized authorities in communities' administrations to the individuals that will be directly affected by the proposed project. Detailed discussions on consultations are included in **Chapter four** and evidence of the meetings attached in **Appendix 4.5**.

Operational Policy/Bank Procedure 4.12: Involuntary Resettlement

This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement.

The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

The proposed project route was chosen after a thorough alternative analysis of various options to ensure that indigenous people are not displaced in the course of the project and its execution. The chosen routing was approved because it provides the path of the most minimal disturbance to the indigenous people. Consequently the project will not involve involuntary resettlement.

IFC Environment, Health and Safety Guidelines

The 2007 version of this guideline provides general technical approach towards achieving Good International Industry Practice (GIIP) in the implementation of environmental, health and safety risk potential projects. The guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities / projects by existing technology at reasonable cost.

United Nations Guiding Principles on the Human Environment

The United Nations (UN), concerned about negative environmental trends since its formation, published two major concept documents: Guiding Principles on the Human Environment, 1972 and the Rio Declaration on Environment and Development. Ten of these Guiding Principles were defined as formal declarations that express the basis on which an environmental policy can be built and which provide a foundation for action. The principles relevant to the proposed Project are summarised below.

Principle Two

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

Principle Three

The capacity of the earth to produce vital renewable resources must be maintained or improved/restored as the case may be.

Principle Six

The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon the ecosystems.

Principle Seven

States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

The Rio Declaration on Environment and Development

The UN Conference on Environment and Development met at Rio de Janeiro in June 1992, at which time it reaffirmed the 1972 declaration on the Human Environment, and sought to build upon it. This is with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people. It is also to aid work towards international agreements, which respect the interests of all, protect the integrity of the global environmental developmental system, and recognise the integral and interdependent nature of the earth. The UN thus added additional principles to the originals, the more relevant being:

Principle Ten

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes.

States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle Thirteen

States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

Principle Seventeen

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

World Heritage Convention

The World Heritage Convention (1978), which seeks to set aside areas of cultural and natural heritage, the latter defined as areas with outstanding universal value from the aesthetic, scientific and conservation points of view.

Other Conventions to Which Nigeria is Signatory

Other international conventions to which Nigeria is signatory to include but not limited to:

- 1985 Vienna Convention on the Protection of the Ozone Layer;
- 1987 Montreal Protocol on Substances that deplete the Ozone Layer;
- 1973 Washington Convention on International trade in Endangered Species of Wild Fauna and Flora (CITES),
- 1974 Convention on International Trade on Endangered Species of Wild Fauna and Flora
- 1979 Convention on Conservation of Migratory Species of Wild Animals
- 1972 United Nations Guiding Principles on the Human Environment
- 1996 International Union for Conservation of nature and Natural Resources (IUCN) Guidelines
- 1989 Basel Convention on the Control of Tran boundary Movements of Hazardous Wastes and their disposal;
- 1996 Protocol on the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
- 1992 Convention on Biological Diversity; and the
- 1992 United Nations' Convention on Climate Change.

1.12 FMENV EIA Approval Process in Nigeria

The Federal Ministry of Environment (FMENV) is statutorily responsible for the processing and approval of EIA reports. The EIA Act stipulates that no major project shall be undertaken without prior consideration, at early stages, of their environmental effects. Appropriate mitigation measures for potential significant impacts shall be stated before the commencement of the project.

The formal approval process for the project would follow the normal procedures, which will involve the following steps:

- Finalisation of the baseline and environmental impact studies.
- Proponent's Management informs the communities about the extent and processes of the project.
- Proponent submits required copies of the EIA report to FMENV for assessment.
- FMENV appoints an independent review panel, comprising academicians and professionals to review the EIA report.
- FMENV distribute the EIA report to the review panel members.
- FMENV publicly displays the EIA report in Abuja, Uyo and five (5) affected Local Governments to enable any interested members of the public to read and comment upon.
- FMENV places advertisement in some National Dailies to inform the public about the display of EIA report.

- FMENV convenes a public hearing in Uyo after the display of the EIA reports, backed by state-wide radio announcement.
- Proponent gives a presentation to the public at the review session giving details about the project and its environmental management, followed by a questions and answers session.
- The review panel members, and representatives present their comments on the EIA report.
- Proponent responds to all comments and takes note of the public and panel member's observations for incorporation in to the final EIA report.
- Upon fulfilment of the environmental requirements, recommendation for provisional approval will be made by the review panel members.
- FMENV will communicate the granting of a provisional approval to proponent and requests the incorporation of the panel's comments into the final EIA report before a final approval of the EIA report. After that the permit is granted.

1.13 EIA Report Structure

This EIA report is presented in eight chapters preceded by an executive summary.

- **Chapter one** contains the introductory part: project background, and outlines the objectives, scope and EIA methodology, and legal framework / data sources.
- **Chapter two** discusses the project setting, and presents the need / benefits, sustainability as well as the project alternatives and options.
- **Chapter three** describes the technical elements, components and processes of the proposed Transmission Line activities from design through construction and operation as well as scheduling.
- **Chapter four** describes the existing ecological (climatic, bio-physical and biological) and Socio-economic baseline condition of the area.
- **Chapter five** describes the associated and potential environmental, social and health impacts of the proposed project on the environment.
- **Chapter six** documents the mitigation measures accrued to the identified potential and associated impacts of the project on the environment.
- **Chapter seven** presents the environmental management plan to be adopted throughout the project life cycle. It also recommends the environmental monitoring program and the waste management plan.
- **Chapter eight** summarises and concludes on the study findings, making appropriate recommendations.

CHAPTER TWO

PROJECT JUSTIFICATION

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 General

The need for, benefits of, and sustainability of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line Project are presented in this chapter. Also included is a summary of the various project alternatives that were considered during project planning.

2.2 Need for the Project

Electricity plays a very important role in the socio-economic and technological development of every nation. The electricity demand in Nigeria far outstrips the supply. It is widely accepted that there is a strong correlation between socio-economic development and the availability of electricity.

For over twenty years prior to 1999, the power sector did not witness substantial investment in infrastructural development. During that period, new plants were not constructed and the existing ones were not properly maintained. In 2001, generation went down from the installed capacity of about 5,600MW to an average of about 1,750MW, as compared to a load demand of 6,000MW. Also, only nineteen out of the seventy-nine installed generating units were in operation (Sambo, A. S., 2008).

To alleviate this situation and to further support the future vision 2020 plan which will greatly require adequate and effective electricity supply to be matched by demand, the Federal Government of Nigeria (FGN) has decided to explore and capitalise on gas utilisation as alternative source of electricity generation. In this regard, the FGN is embarking on the construction of number of gas power plants in partnership with major oil and gas multinational companies around the country. The power plants as conceived will support the achievement of governments' target of 20,000MW by the year 2020.

The proposed 58km 330kv QIT – Ikot Abasi Transmission Line Project is therefore being undertaken as part of the governments power scheme and is specifically required to adequately evacuate power that will be generated at the planned QIPP Power Plant in Ibeno to the national grid via connection at a power substation to be constructed at Ikot Abasi.

2.3 Project Development Concepts and Alternatives

This section describes the various project concepts that were considered and the rationale for the selected alternatives. This section also discusses the alternatives with respect to facility locations. The development options considered for the proposed QIT – Ikot Abasi Transmission Line including the extension of the Ikot Abasi 330kV/132kV are hereby discussed.

2.3.1 Transmission Line Alternatives

The various transmission line route alternatives considered for implementation in this project as well as the selected option are discussed below.

"Option 1: Maintain the Status Quo of Power System in the State"

The existing power network in Akwa Ibom State consists of three 132kV/33kV substations in Itu, Uyo and Eket, and two 132kV "single circuit" transmission lines from Itu substation to Uyo substation and then to Eket substation. One 330kV / 132kV substation is under construction since 2011 and shall be ready in 2012 together with the feeding 330kV transmission line from Ikot Ekpene. Also, the existing power system in the State is of four voltage classes (132kV, 33kV, 11kV, and 415V).

There is presently one power plant in the state, run by Ibom Power Company Ltd. (IPC) in Ikot Abasi which is connected via an 132kV Transmission Line to the 132 kV Substation in Eket. The power plant is planned to be expanded and connected to the new 330kV Ikot Abasi Substation. Also the needed power is supplied from Abia State in the north and Cross River State in the east through 132kV transmission lines to the substation in Uyo and then to Eket substation. The power acquired from these States is stepped down to 33kV at the two substations and then transmitted to 415V users via 33kV and 11kV power distribution networks. Also, the existing "single circuit" radiating power network is known to have a pronounced vulnerable framework with limited operational reliability.

Maintaining the existing power transmission infrastructure would retain the associated limited operational reliability. It would also mean that the planned QIPP Power Plant at QIT would not be optimally utilized to boost the power generation and supply system in the State. Other implications include the fact that land will not be acquired; there will be no disturbance of the people and structures as a result of the proposed project. This would also be at variance with the industrial development initiative of the State and is therefore not a favourable project option / alternative.

"Option 2: Transmit Power from Proposed QIPP PP to Eket Substation via a New 132kV Line and Routing"

The planned power project would on completion have a total power generation capacity of 500MW. This option would entail the installation of a new transmission line that would transmit the excess power from the Proposed Power Plant at QIT to the PHCN substation at Eket for distribution. The new line would be a "double circuit" radiating system with self-supporting transmission towers. It would be 132kV which is the operating voltage of the Eket substation and would require significant upgrades and new installations of the facility operating since 1970. Also the power generated cannot be exported with only one line, the current carrying capacity is not sufficient for that and this would require a second 132kV Transmission line to be installed in parallel.

It would run along a new right of way (ROW), either going through Eket or around Eket. This option would result in fresh land take, and significant socio-economic impacts especially with respect to disturbance and displacement of persons. It was also found that the existing 132kV lines via Itu and Uyo substations to Calabar do not have the capability and reliability to export the power to the Nigerian grid. **Figure 2.1** shows the overall layout of the Nigerian grid status quo with circuits in vicinity of the project location

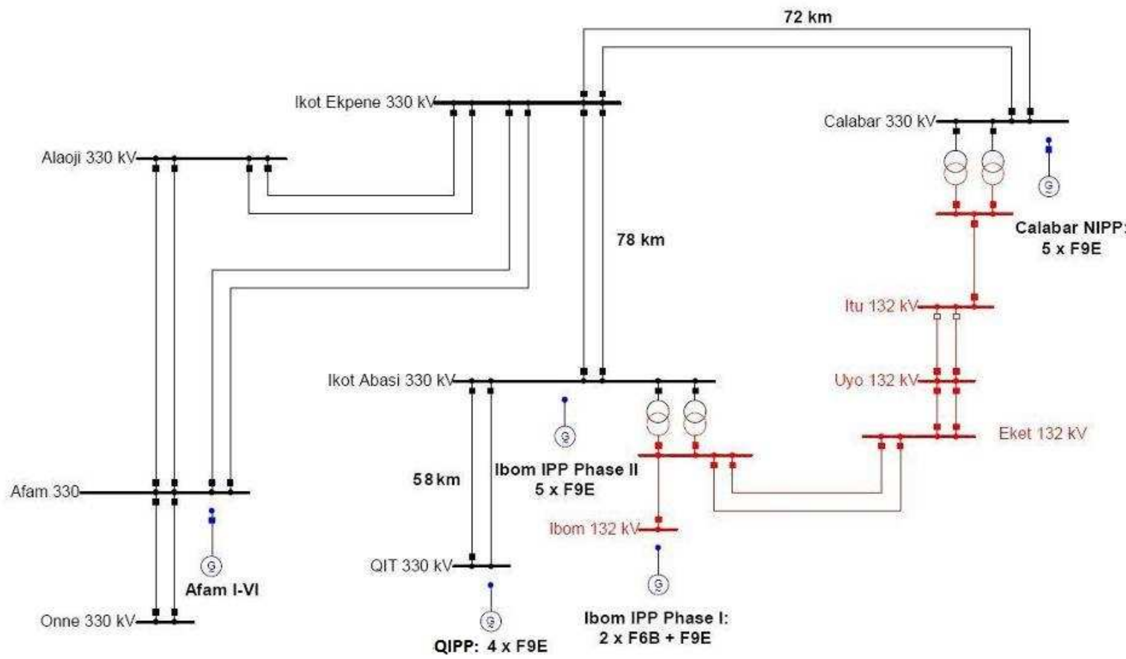


Figure 2.1: Nigeria Grid - Circuits in Vicinity of the Project Location

Also the transmission system from Calabar is on its limits and could not export the power to the consumers. Therefore due to size of the proposed power plant, it is necessary to connect directly to the Transmission Company of Nigeria (TCN) 330 kV grid and in order to comply with TCN's security of supply requirements; a double circuit connection is required. This option using 132kV transmission lines has therefore been rejected.

"Option 3: Transmit Power from Proposed QIPP PP to Ikot Ekpene or Calabar Substation via a New 330kV Line and Routing"

Calabar 330 kV substation was suggested as a point of connection. The reason for considering this alternative connection location is that there is a risk that Ikot Abasi 330 kV substation and the associated transmission lines to Ikot Ekpene would not be completed.

The 132 kV circuits between Ikot Abasi and Calabar will not be capable of supporting the output from the proposed power plant and therefore it would be necessary to build 330 kV circuits between QIPP and Calabar. The straight line distance between QIPP and Calabar is estimated at 60 km. However, the terrain is swampy and there are major rivers that would need to be crossed. The route by road between QIPP and Calabar goes via Eket, Uyo and Itu, which is also the route of the 132 kV circuits. The circuit distance via this route is approximately 135 km. Evacuation of the QIPP output via Calabar would be contingent on completion of the Ikot Ekpene-Calabar 330 kV circuits. Also there is limited scope for absorbing power at Calabar and therefore most of the output from QIPP would flow back to Ikot Ekpene. Furthermore, the capacity of the Ikot Ekpene - Calabar circuits will become stretched once both the QIPP and Calabar NIPP power plants are operating. With either option, the output from QIPP will flow into the network via Ikot Ekpene. Under while for the Calabar connection this distance increases to 213 km. For the above reasons, it seems that Calabar does not represent a rational alternative point of connection for the QIPP.

The most viable alternative would be a direct connection from QIT to Ikot Ekpene over a distance of 120 km. This option would entail the installation of a new transmission line that would transmit the excess power from the proposed power plant at QIT to the PHCN substation at Ikot Ekpene for distribution. The new line would be a "double circuit" radiating system with self-supporting transmission towers. It would run along a new right of way (ROW), adjacent to and to the south of the existing Ikot Abasi - Eket Federal road and then in the vicinity of Ikot Abasi turn north to Ikot Ekpene. This option would result in fresh land take, but would assure a stable power transmission framework as well as optimal utilisation of the excess power to be generated from the proposed power plant at QIT. Due to the potential for significant environmental and socioeconomic adverse impacts among others, his option was not adopted.

"Option 4: Transmit Power from Proposed QIPP PP to Ikot Ekpene PHCN Substation via a New Line and Routing and a New Substation Location"

Regarding an alternative routing, various routes in the vicinity of Ikot Abasi have been considered shown in **Figure 2.2**.

Figure 2.2: Existing 132 kV T - line Eket to Ibom (blue), Recommended 330 kV T-line QIT – Ikot Abasi SS Alternatives (red)

Analysis revealed that route C with a possible tie-in location north east of Ikot Abasi would result in less environmental and socioeconomic impacts as follows:

- having to construct shorter transmission lines means less construction schedule durations.
- Environmental and social impact reduced since it is a shorter distance, transverse through less environmentally sensitive areas such as mangroves, and affects less persons than the others

Grid study alternatives showed that there was no possibility of a tie in, so it was not reviewed or considered as a possible alternative by PHCN. Hence at the time of the grid study, the exact routing of the NIPP 330 kV TL from Ikot Ekpene to Ikot Abasi and its substations was not known, this has not been taken into consideration. Accordingly, the potential tie-in location northeast of Ikot Abasi was neither known nor studied.

It was found that it is not possible to tie-in along the Ikot Ekpene Line to Ikot Abasi TL because of the following reasons:

- Due to fault level protection considerations for the TL. It would require a complete switchgear protection system at the new tie-in location including a manned control room and associated civil works.
- Since PHCN did not endorse the practice of unmanned substations this would entail a separate manned substation at the new tie-in location. Two substations in close proximity to each other (approx. 10 KM) were not deemed a practical solution.
- The land for the NIPP 330kV substation being built to the southeast of Ikot Abasi (proximity to Ibom Power and ALSCON) had already been purchased February 2009. Land acquisition alternatives including resettlement constraints and socio-economic impacts of land take were considered in the NIPP EIA where the Ikot Abasi substation was accommodated. Construction works on that site had already commenced.

The idea was brought up to acquire the land for the new tie-in substation to be located to the northeast of Ikot Abasi and that the under-construction substation at Ikot Abasi could be moved to the new proposed tie-in location. However, since the substation was being built under NIPP projects the procedural difficulties in relocating the substation from the current southwest of Ikot Abasi location to the northeast of Ikot Abasi far outweighed the cost savings as the completion time of the NIPP project was a major consideration for FGN.

Also PHCN opined that because of possible connections of industrial stakeholders in the future (ALSCON, Ibom Power Phase II), there would be little to no support within the NIPP project, PHCN or the FGN to move the 330kV substation from its current location on the southwest side of Ikot Abasi to the northeast.

Accordingly, PHCN advised to connect the TL to the NIPP Ikot Abasi substation. It was agreed that it would be the best to tie into the planned NIPP Ikot Abasi substation thereby reducing land take in terms of resettlement constraints and socio-economic impacts.

"Option 5: Transmit Power from Proposed QIPP PP to Ikot Abasi PHCN Substation via a New Line and Routing"

The most viable alternative was determined as a direct connection from QIT to Ikot Abasi over a distance of 58 km. This option would entail the installation of a new 330kV transmission line that would transmit the excess power from the proposed power plant at QIT to the PHCN substation at Ikot Abasi for distribution. The new line would be a 330kV "double circuit" radiating system with self-supporting transmission towers.

It would run over approximate 58 km from the power plant in western direction to Ikot Abasi. The foreseen route departs at the Power Plant in northern direction for about 4km, continues in west-north-western direction where is traverses a little portion of the Stubbs creek forest reserve and crossing over the Douglas Creek, passing south of Eket and Eket airfield in greater distance and crossing Qua Ibo river, before turning west in order to reach Ikot Abasi after approximately 40km. The proposed transmission line is expected to traverse through some ecologically important areas like the Stubbs creek forest reserve as earlier mentioned. Also secondary palm forests around Onna and Mkpat Enin axis are expected to be traversed, Minor River system around Ikot Abasi, where pockets of mangrove vegetation have been identified have also been enlisted to be traversed by the transmission line. In comparison with the other options considered, it provides the path with least impacts on the environment and on the people.

The TL shall go straight for a big part of the route. It meets the existing 132kV Eket to Ibom Power TL and to be built 330kV Ikot Ekpene – Ikot Abasi TL at a corner of the route corridor. The TL run parallel and the Ikot Ekpene TL turns first north into Ikot Abasi SS, close to Alscon Smelter.

The 330kV QIT - Ikot Abasi has to cross the 132kV Eket- Ibom Power TL by turning north and follows parallel, the 330kV Ikot Ekpene Line into the SS. Both lines will enter Ikot Abasi SS from the west **Figure 2.3**.

Figure 2.3: Preliminary 330kV Transmission Line Route QIT – Ikot Abasi

The route runs across mainly flat but densely vegetated and swampy terrain, which may be difficult to access by vehicle or by foot.

This option would result in fresh land take, but would assure a stable power transmission framework as well as optimal utilisation of the excess power to be generated from the proposed power plant at QIT. It reduces impact by utilizing and sharing the same routing corridor with the existing 132kV and under construction 330kV Lines.

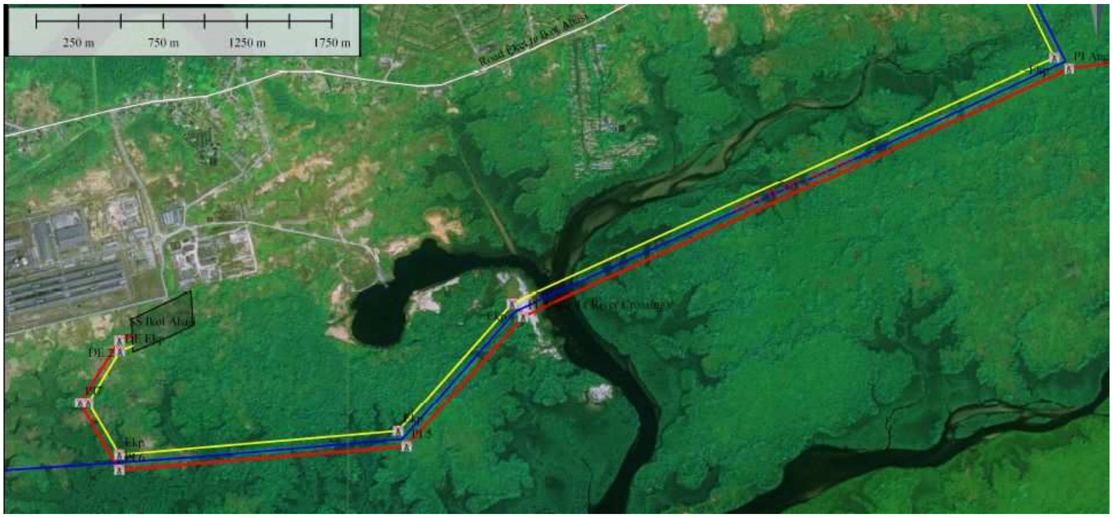


Figure 2.4: Preliminary Route - Crossing Location near Alscon Smelter in Ikot Abasi

The 330kV TL from QIT – Ikot Abasi is shown in red. The existing 132kV TL in blue will be crossed. The yellow line is a second 330kV TL to be build from Ikot Ekpene to the Ikot Abasi Substation. This option was chosen because it uses synergies and existing facilities to a maximum extent possible and therefore has the least socio-economic and environmental impacts..

"Option 6: Transmit Power from Proposed QIPP PP to Ikot Abasi via the existing 132kV corridor"

Although, this option appears to require a fairly new and short ROW from QIPP to Eket, and at Eket, the 330 kV line could follow the existing 132 kV corridor, this approach goes contrary to the recommendations of PHCN. According to PHCN/TCN Nigeria Transmission Line specifications, the 330 kV Right-of-Way (ROW) corridor must be at least 50 meters wide. The existing 132 kV ROW is 30 meters wide, and therefore more ROW (20 meter width) would have to be acquired down the length of the existing corridor. In any case, 330 kV towers would not be allowed to share the same centerline as the 132 kV towers, unless the 132 kV line was decommissioned and removed. In reality therefore, the ROW would have to be widened by 50 meters (plus a safety margin buffer) to install the 330 kV line alongside the 132 kV routing.

It will not be possible to raise 330 kV towers through (higher than) the existing energized 132 kV lines because of clearance requirements and safety concerns.

The proposed project endeavored to roughly follow the existing 132 kV routing with the proposed 330 kV ROW for most of its length, though a few kilometers south. For the last 5+ kilometers, the 330 kV line is immediately parallel to the existing 132 kV ROW, with a modest 10 meter buffer to allow construction and maintenance safety. High population areas, such as where the 132 kV traverses Eket, were avoided in designing the 330 kV route.

The existing 132 kV routing contains many angle towers and shorter distances between towers. To utilize the existing 132 kV ROW, adding 20 meter width, and raising 330 kV towers much higher, would necessarily add several more 330 kV towers than the current design, and complicate the construction process hence the rejection of this option. The proposed 330 kV line routing, is largely a straight line and allows greater distances between the towers with fewer angle towers. To reroute alongside the 132 kV line would add several more kilometers in length and subsequently more towers. Figure 2.3 shows the relationship between QIPP, Eket, Ikot Abasi, and the existing 132 kV line and the proposed 33kV ROW.

2.4 Environmental and Socio-economic Considerations of Preferred Options

The approximately 58 km new transmission line from QIT – Ikot Abasi would have a total of 13 tower turnings. The various environmental and socio-economic as well as carried on board in the routing of the new line at various points are presented in this section. Generally, the main principles adopted in the selection of the transmission line route were to:

- stay south of the Ikot Abasi – Eket Federal highway
- stay south of the IBOM Power – Eket 132 kV transmission line
- avoid villages and isolated buildings;
- minimise the number of road crossings;
- minimise the number of turning points; and
- minimise the number of rivers, creeks and open water crossings and the use of marshy and water logged areas.
- avoid swamps and wet area where feasible to avoid impacts on biodiversity, natural habitats, forests, etc (as stated in the world bank safeguard policies for environmental protection, see chapter one);
- avoid the approach zone of the Eket Airport

All the constraints have been summarized in a constraint map (**Figure 2.5**) after the option was selected showing the restricted areas. This lead to a defined corridor where the transmission line would run without significant impacts to the above constraints (ecological, physical structures, existing infrastructures, etc).

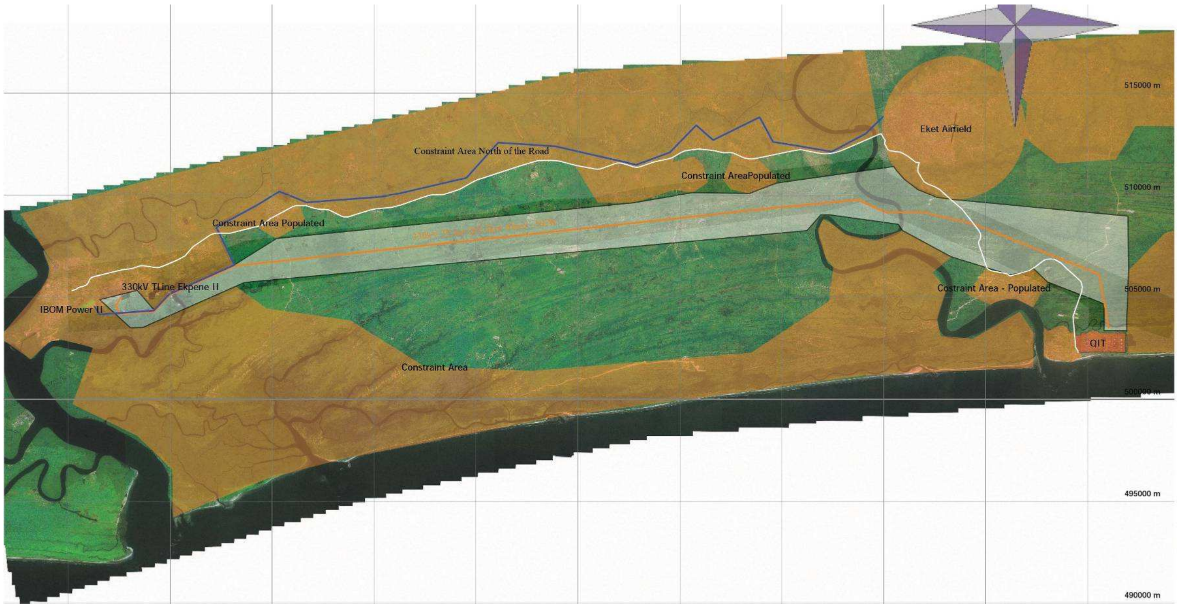


Figure 2.5: Transmission Line – Constraints Map

Details of the incorporation of these considerations at various sections along the new TL route are presented below. With the help of detailed satellite images of the region and later in the project detailed photogrammetric pictures it was possible to optimize the route and refine it to a very high level of details considered. The photogrammetric pictures have been taken by overflying the transmission line route corridor with a plane during the project and geo-referencing the recorded pictures.

This new pictures helped to mitigate a lot of environmental and socio-economic impacts during the design phase as highlighted below.

Rain Forest, Swamp, Water Ponds, Streams, Rivers, Ditches, and Undulating Terrain North of QIPP

The aerial survey showed that the land north of QIPP and south of Eket is hilly with swampy and ponding areas as well as plenty of river channels and luxuriant trees and bushes. However, to avoid villages and buildings along the preferred run the routing has been adjusted from the preliminary routing. Several Houses and small settlements have been found on the detailed pictures and therefore avoided. PHCN requirement is that no structure is in a radius of 50m from the tower legs and 25 meter to either side of the centerline. The old preliminary routing has been optimized and updated to reflect this during the design phase of the transmission line.

Settlements / Structures on Southern Side of Highway

Detailed aerial survey revealed the presence of settlements / structures on the southern side of existing Federal highway where the preliminary routing was planned to go. This has been considered. The old preliminary routing has been optimized and updated to reflect this during the design phase of the transmission line **Figure 2.6.**

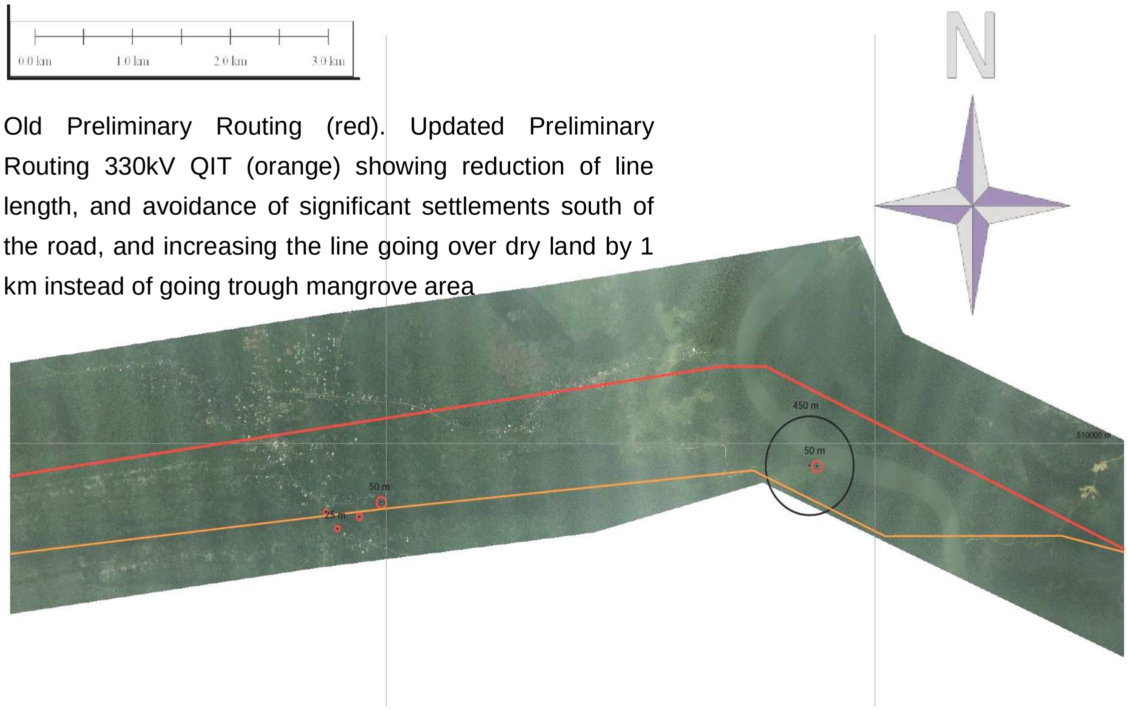


Figure 2.6: Preliminary Route – Settlements and Structures Avoided

Rain Forest, Swamp, Water Ponds, Streams, Rivers, Ditches, and Undulating Terrain South of Alscon Smelter in the Ikot Abasi Area

Detailed aerial survey revealed the presence of swamps, ponds, streams and Rivers on the southern side of the existing Alscon Smelter facility where the existing 132kV Line is running. This has been considered by routing the line in parallel with the existing 132 kV line and therefore utilizing synergies by running in the same routing corridor **Figure 2.7**.

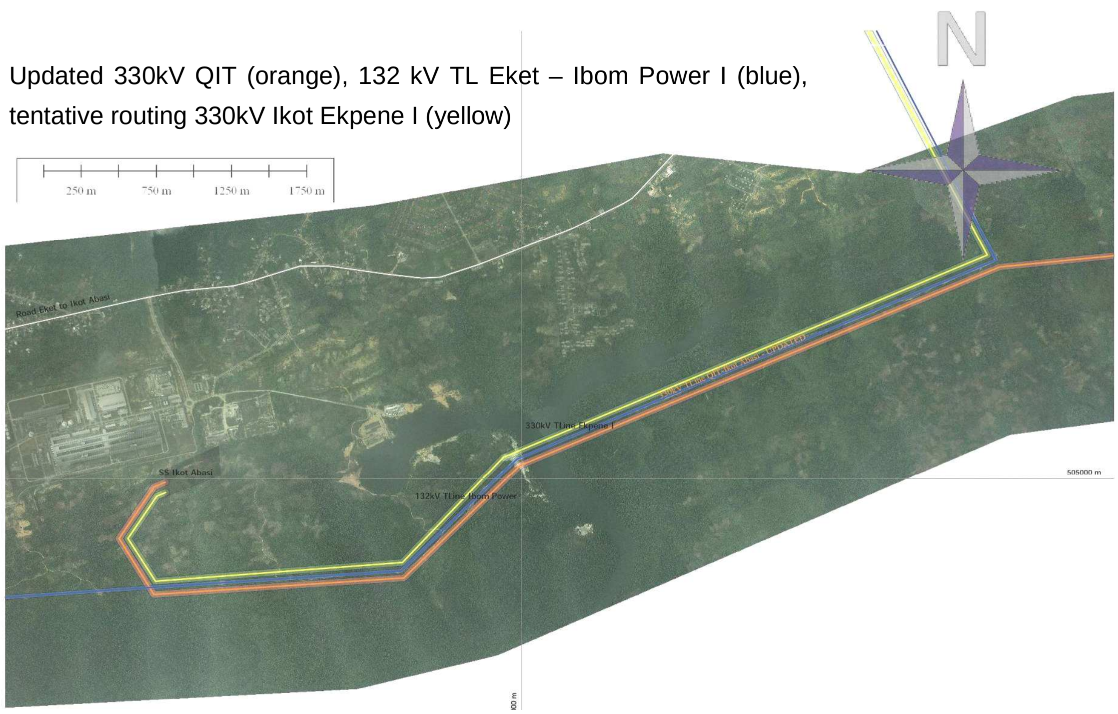


Figure 2.7: Updated Routing – Approaching Substation near Alscon Smelter

The objective was not to have too much impact on the environment by having the route going to swamp and mangrove areas, therefore the dry land has been chosen for tower locations as much as feasible.

Ease and Convenience of Line Construction, Operation and Maintenance
The need to minimise difficulties in construction as well as operation and maintenance activities was of major consideration in the decision to route the proposed line to south of the existing road. The TL will terminate at the existing Ikot Abasi Power Substation. The various options considered in the substation upgrade are therefore discussed in the following subsection.

In total, the following has been optimized and considered already during the preliminary design phase for the project:

- Transmission line route of the project was changed to reduce potential significant impacts on humans and houses, wildlife, mangroves and other vegetations.
- In addition to the significant reduction of environmental impacts due to the change in route, the initiative also reduced the transmission line distance and especially the distance going trough wet lands resulting in noticeable economic savings.
- The reduced numbers of tower sites in wet lands reduced the requirement for pile foundation which have significant health, safety and environmental impact.
- After receiving sophisticated imagery data, it was feasible to optimize the route to run in a corridor having no impact on local buildings and structures to be relocated or demolished.
- The usage of existing access roads to the tower site and the transmission line route was increased to the maximum feasible, to avoid new bush cutting and therefore destruction of flora and fauna.

2.5. Summary of Transmission Line Route Alternatives

Table 2.1 summarizes the major impacts highlighted with different colours. Red highlights not feasible or high impact, orange represents feasible or medium impact and green feasible or no impact.

Table 2.1: Route Alternative Summary

	Option 1	Option 2	Option 3	Option 4	Option 5
Power export feasible	No	No	Yes	No	Yes
Distance of fresh landtake	0	Approx. 20km	213km / 120km	43km	58km
Major Rivers crossed	0	0	3 / 0	0	0
Major Communities crossed	0	1	several / several	0	0
Shares existing TLine corridor	-	0km	135km / 78km	0km	7,5km

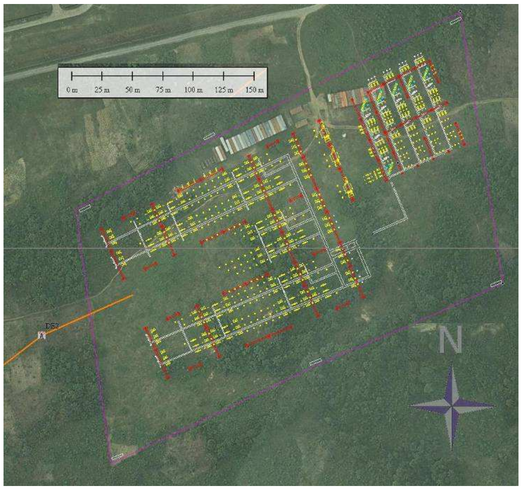
Based on this summary it can be seen that the option with the least overall impact is option 5. With option 5 it is feasible to export the power, it has medium impact to fresh land take, no impact due to major river crossings, no major communities to be crossed and the benefit of some distance routed in a shared route corridor with an existing Transmission Line.

2.5.1 Connection to National Grid

The Ikot Abasi Substation is a National Integrated Power Project (NIPP) development under Niger Delta Power Holding Company of Nigeria (NDPHCN) a subsidiary of PHCN.

The Substation will be upgraded and additional busbars will be installed in the existing Substation. This activity has been covered in the NIPP Ikot Abasi Substation EIA. Therefore the termination point of the transmission line will be the gantry structure in Ikot Abasi.

Figure 2.8: Preliminary Route – Connection to Ikot Abasi Substation



Ikot Abasi substation layout, with the QIPP 330kV line (orange) joining in from the south west.

Figure 2.9: Proposed Ikot Abasi Substation

2.5.2 Transmission Line Type Options

PHCN has two different voltage level to evacuate power above longer distances, these are 132kV and 330kV.

To evacuate the power with two transmission lines with 132kV voltage level could be considered as alternative, however due to the doubled impact on the environment and no significant benefit to the project in terms of reliability and maintainability it was not selected for implementation.

For this project the 330kV transmission line allows to export the power generated by QIPP-PP in accordance with national requirements by PHCN and NERC. This alternative was chosen for implementation.

2.5.3 Tower Options

Towers shall be self supporting type of vertical / barrel configuration and are designated as suspension towers, tension towers, transposition towers and special towers.

As per PHCN standard 2007 volume 3A, the type of towers is governed by the voltage level. A similar design used for all projects in the nation allows for higher reliability and maintainability. For this project PHCN requests a 330 kV double circuit transmission line tower design as per their standards. Therefore PHCN would not allow a different type of tower design be applied for this project.

2.5.4 Cable Options

Underground High Voltage Cables buried in a defined corridor as alternative for Energy Transmission via Overhead Transmission Lines has not been considered due to the fact that Overhead Transmission Lines are widely used and proven technology in Nigeria, with low maintenance and long operational experiences. Overhead lines are much more effective in case of occurring faults. The Transmission line can operate after a fault as before, however might require none or small maintenance. High Voltage Cables are more sensitive to occurring faults and in case of faults require replacement of the defect section, leading to less reliability and operability of the system. Also the impact to the environment is higher, hence the cable need a free corridor in which they are laid in soil which has to be kept free during operation. In contrary to Transmission Lines, under which certain flora and fauna can grow to a certain extent as long it is not impacting the operability and maintainability of the line.

2.6 No Development Option

The “no development” option will result in zero land take, zero health, safety and environmental impacts. No development options are usually considered in cases where the proposed development will have significant negative impact that cannot be effectively or satisfactorily mitigated.

To maintain the status quo is the do-nothing approach. By not taking any action, PHCN will not effectively evacuate power that will be generated from the proposed QIPP-PP. This can pose a major setback on the federal government’s plans to increase power generation and transmission as well as its vision 2020 of being amongst the top economies. This option is therefore ruled out because it would neither supply the projected demand for electricity nor optimise the existing infrastructure. PHCN has taken all measures to date to ensure that the existing transmission line network will be utilised to its full capacity. If the approximately 58km QIT-Ikot Abasi transmission line is not constructed, PHCN will be unable to meet load demand requirements or maintain quality of supply.

Most impacts of the proposed transmission line can be effectively mitigated to reduce their significance to acceptable levels and in view of the need for more power supply to support economic growth and development in the country, these impacts are not of sufficient import to prevent the implementation of the project.

2.7 Development Option

The construction of approximately 58km QIT-Ikot Abasi line is a major development project that could have negative impacts on the biophysical and social environments. However, if duly mitigated and planned the project will enhance the economic potential of the country, while impacting minimally on the affected environment.

All the significant impacts identified have been thoroughly investigated during the impact assessment phase. None of these impacts are impossible to mitigate and manage with a detailed EMP in place. The approximately 58km QIT-Ikot Abasi, i.e. Option 5, is the 'preferred option in terms of environmental, social and economic impacts and it is recommended that this project be approved due to the obvious benefits as highlighted below:

- Accommodate an increase of national power generation capacity;
- Provide for improvement of electrical transmission in the country as a whole;
- Add value to the nation's economic growth;
- Transfer technology and improve local know-how, through the adoption of a reliable state of art power transmission process;
- Provide direct and indirect employment opportunities, including training;
- Improve the socio-economic standing of the host communities;
- Indirectly reduce/eliminate considerable percentage of air pollutants emissions due to consistent use of power generators by individuals to support poor state of power supply; and
- Reduce/eliminate noise generation in cities and local communities associated with power generators by individuals and industries.

Besides the above benefits the project would indirectly facilitate other positive benefits, including the commercialisation of Nigerian natural gas resources for the benefit of the Nigerian population, skills development and enhancement, and increase in tax revenues to the national and state government.

2.8 Envisaged Sustainability

Sustainability can be viewed in terms of economic, environmental protection and social stability as well as technical viability. These aspects are further discussed below:

Environmental Protection and Social Stability

Early in the EIA process several visits to the study area were undertaken during which the proposed ROW were thoroughly examined in order to obtain a detailed understanding of the potential impacts and key issues associated with the construction and operation of the transmission line. Issues associated with the construction and operational phases were identified separately (see chapter five).

These impacts (adverse and beneficial) were addressed in consultation with identified stakeholders, through an investigative process based on past similar projects, environmental screening process (using GIS among other tools), as well as an environmental evaluation based on knowledge of the study area. Detailed impact identification, evaluation, and mitigation is provided in **chapters 5** and **chapter 6**.

As highlighted above, the project in some ways will impact negatively on the environment. However incorporating the findings of this EIA, and effectively implementing the environmental management plan (EMP) at the planning, design, construction, operation and decommissioning stages of the project will ensure undesirable impacts are mitigated and managed to extents reasonably practicable.

PHCN the owner and operator of the transmission line will make efforts to enhance its relationship with the communities that are in proximity of the planned project. Consultations will be maintained with the local communities during the engineering (e.g. site visits and surveys) and construction efforts as well as during the operational phase to identify concerns as they arise and address these concerns with appropriate remedies.

Economic and Employment Growth

Economic growth and structure of the economy are major driving parameters in electricity demand projections of a country. The transmission line project should help to ease immediate power supply constraint on economic growth and will contribute to a new restructured power sector, reversing the current drain on the national budget.

The project will also provide employment and skill acquisition opportunities for Nigerians through direct and indirect involvement of contractors, consultants, suppliers and other professionals during the permitting, construction and operational phases of the project. Direct employment opportunities will likely include a large portion of the estimated 200 worker positions that will be needed to construct the transmission line towers and to string the lines. Additional direct employment will go to persons that will be employed to provide security at tower sites and other work areas. Indirect employment and associated economic effects will be derived from the fabrication and coating of transmission line tower components in Nigeria.

Contracting for other goods and services required for the construction will be consistent with good business practices, transparent and in line with the Nigerian local content law. Overall the project when operational will stimulate the growth of small, medium and large scale industries in the gridded communities and Nigeria as a whole.

Technical Sustainability

PHCN is Nigeria's sole leader in power generation, transmission and distribution with robust experience in power evacuation design, construction and operation in diverse environmental conditions. Egbin power project in Nigeria as well as the Ajaokuta and other proven and operating assets are some of the facilities operated by the PHCN.

The design of the proposed Transmission Line is tailored with technology, which would facilitate simple operation and maintenance. Also, the proposed project is sustainable in view of the proven power line technology and strict adherence to internationally and nationally accepted engineering practices that shall be adopted at all stages of the development.

CHAPTER THREE

PROJECT DESCRIPTION

CHAPTER THREE

PROJECT DESCRIPTION

3.1 General

The value and need as well as technical, economic and environmental sustainability together with several project development alternatives of the proposed transmission line project have been justified, established and discussed in **Chapter two** of this report.

This chapter thus describes the key elements and planned activities of the proposed project. These include but not limited to: design requirement, project overview and layout, construction, operation requirement and associated utilities. The understanding of the project activities scope and extent will enable comprehensive identification of the environmental aspects for the associated and potential impact analysis in **Chapter five**.

3.2 Project Scope

The construction of the approximately 58km 330kV QIT - Ikot Abasi transmission line will involve:

- clearing of vegetation from essential parts of the ~290 hectares for the Transmission Line Right of Way. Vegetation shall be cleared as required for safe construction/operation as well as erosion control (e.g. trees shall be cut off at max 30cm above ground level);
  In dry land areas, clearing and grubbing shall be performed prior to any construction works. After removal of topsoil, the underground shall be checked on wet or soft spots or any other areas unfavourable for foundation and construction works. Wet and/or soft spots shall be excavated and refilled.

- construction of transmission line towers, their foundations and stringing of the line;
  The determination of type and size of a tower foundation uses soil details from geotechnical investigations, complemented with additional investigations where required. All foundations shall make adequate provision for horizontal shear forces at the ground line. Towers of overhead power lines consist of tower body, earth wire peaks and cross-arms. The towers dominate the aesthetic impact of an overhead line, and govern the operational reliability. They need to withstand reliably the conductor forces and external loads. The transmission line is going to be a 330 kV two to four circuit TL. Each pair of circuits comprises of twin Bison conductors, ACSR 380/50, 431 mm2 or any other as approved by PHCN.

- development of land access (from nearby roads) to ROW to facilitate construction and maintenance in upland areas;
  Road access to the construction site shall be provided on the shortest way from public roads to avoid creating a travel route along the TLine towers. For temporary road construction, clearing and grubbing shall be performed only for the actual width of the road.

- construction of transmission line support towers for water-prone areas;
  Foundations shall be designed according to PHCN standards. Pile foundations or (combined pile and) raft foundations are required in swampy areas. Soil bearing capacity shall be checked.

- filling or dredging of marsh and mangrove areas to provide water access for ROW clearing, tower installation and line maintenance activities;
  Where a wetland that must be traversed is located across the TLine right-of-way, the access way shall be located so as to provide the narrowest practical crossing. Multiple access ways shall be established only to avoid environmental impact to specific areas of the right-of-way.

- provision of associated digital communication facilities at the substations;
  Effective and functional communication systems shall be installed to facilitate supervision of the operation of the project and communication between Ikot Abasi and QIPP substations.

  The Transmission Line Right of Way to be acquired for the project is approximately 58km in length and 50m wide, thereby giving a total area of about 2,900,000m2 (290Ha).

3.2.1 General Facilities Layout

The blueprint showing the main transmission single line with interconnection to PHCN facility as well as the existing substation is **attached overleaf on A3**.

3.3 Design Basis

The design intent of the proposed power transmission facilities is to develop environmentally sustainable facilities that satisfy applicable regulations, industry standards and codes.

Furthermore, the design, construction and operation of this project shall be conducted in order to:

- protect the safety, health and security of project and operations employees, suppliers' employees, customers, the public and other involved parties;
- maintain environmental integrity;
- comply with applicable laws and regulations;
- apply sound geo-science, engineering, technical and commercial best practices;
- focus on flawless execution with minimum re-works;
- meet the reasonable aspirations of the project-impacted communities;
- maximize Nigerian content consistent with the project objectives;
- achieve facility performance objectives.

The project objectives can be summarized as follows:

- Safety and security - nobody gets hurt during project planning and execution. Safety and security are the project's highest priorities and are everyone's responsibility;
- Quality - quality is the foundation of safe, operable & reliable facilities;
- Business Conduct and Controls - we will conduct our business with the highest level of integrity;
- Environment / Regulatory / Permitting - project design and work are performed in a manner that meets the high performance expectations of Nigeria;
- Community Relations - foster an effective, productive relationship with communities;
- Operability & Reliability - ensure facilities meet business objectives (O&M Costs, operating performance, plant durability, operational flexibility, reliability, and availability) to ensure safe, environmentally sound, and cost effective operations;
- Nigerian Content – foster continued development of Nigerian-based industry with a view to meet FGN requirements outlined in the applicable Nigerian Content Legislation;
- Stakeholder - stakeholder alignment is necessary for project success;
- Commercial Agreements - execute commercial agreements and secure fiscal terms to achieve project schedule.

3.3.1 Design Conditions

The Environmental, as well as the actual design conditions, considered for the proposed transmission line and ancillary facilities are presented in **Table 3.1**.

Table 3.1: Environmental Design Conditions

Environmental Conditions	
Altitude	10m
Climate	Outdoor desert / tropical environment
Maximum Ambient Temperature	35^0C
Minimum Ambient Temperature	21^0C
Average Maximum Temperature	25^0C
Air Cooler Approach Temperature	10^0C
Mean Annual Rainfall	193mm
Relative Humidity (Maximum)	85%
Relative Humidity (Average)	72%
Maximum Hourly Wind Speed	25m/s
Maximum 3 Seconds Gust Wind Speed	35m/s
Actual Design Conditions	
Minimum Temperature	10 ℃
Maximum Temperature (For the calculation of the conductors sag)	45 ℃
Average Temperature	25 ℃
Maximum design wind speed	32 m/sec
Wind Pressure	96.614 daN/m²

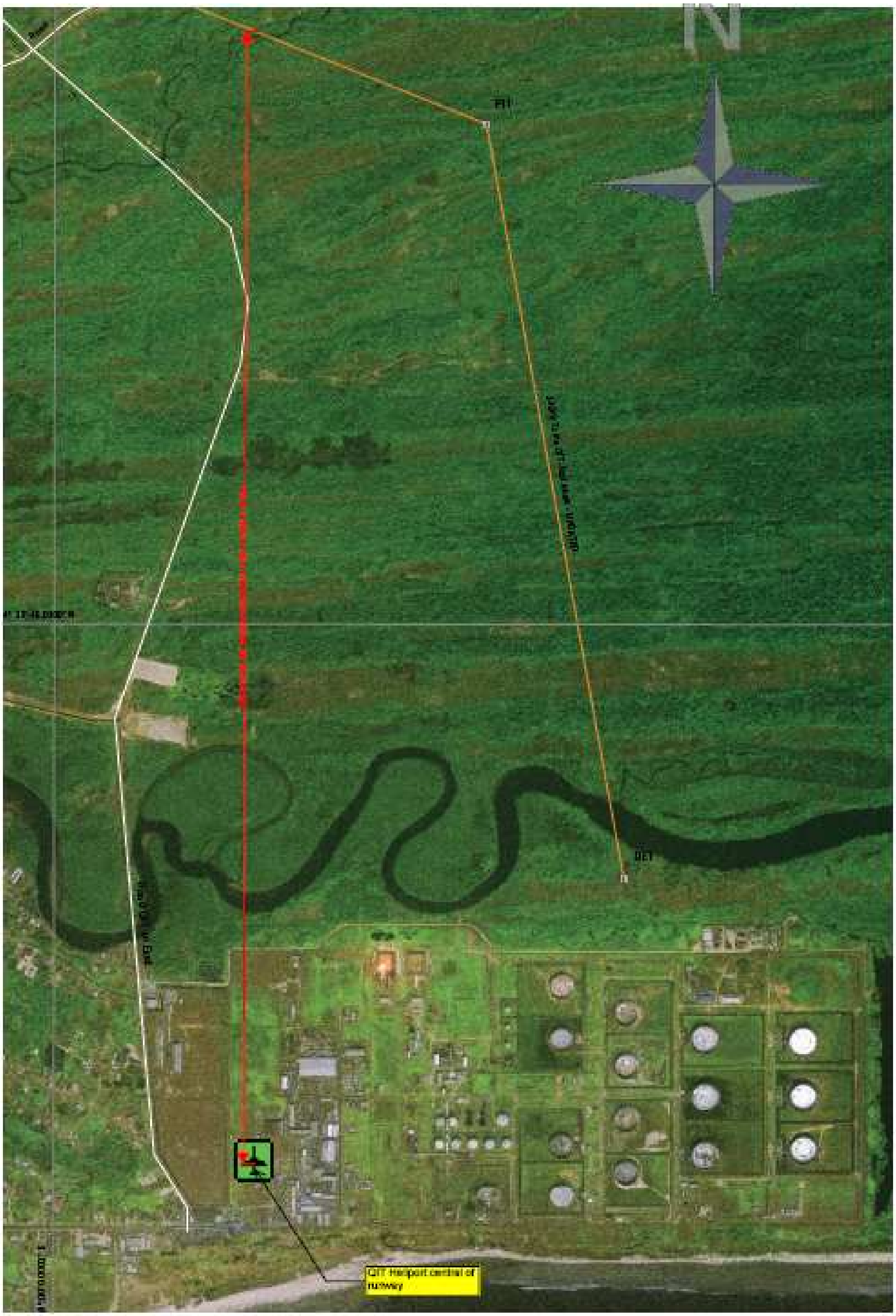
3.4 Applicable Codes and Standards

The concept and basic design of the proposed TL facilities and system are based on PHCN specifications and are in line with national and international standards/codes. These cover various aspects as electrical, mechanical, civil, transmission and distribution lines. Some of the codes and standards applied to the proposed project are detailed in **Appendix 3.1**.

3.5 Transmission Line Design

The transmission line project is designed to be a 330kV double circuit, with two systems sharing one tower. The TL project is designed to run from the Ikot Abasi substation outgoing line bay to the QIPP substation incoming line bay, a total length of about 58km.

The design of the transmission line took into consideration several constraints along the proposed route. These constraints have been summarised in a general constraints map (Figure 2.5, chapter two). Specifically the detailed constraints areas for the QIT heliport and the Eket field and their distances to the proposed transmission line are shown in Figure 3.1 below.


QIT Heliport central of
runway

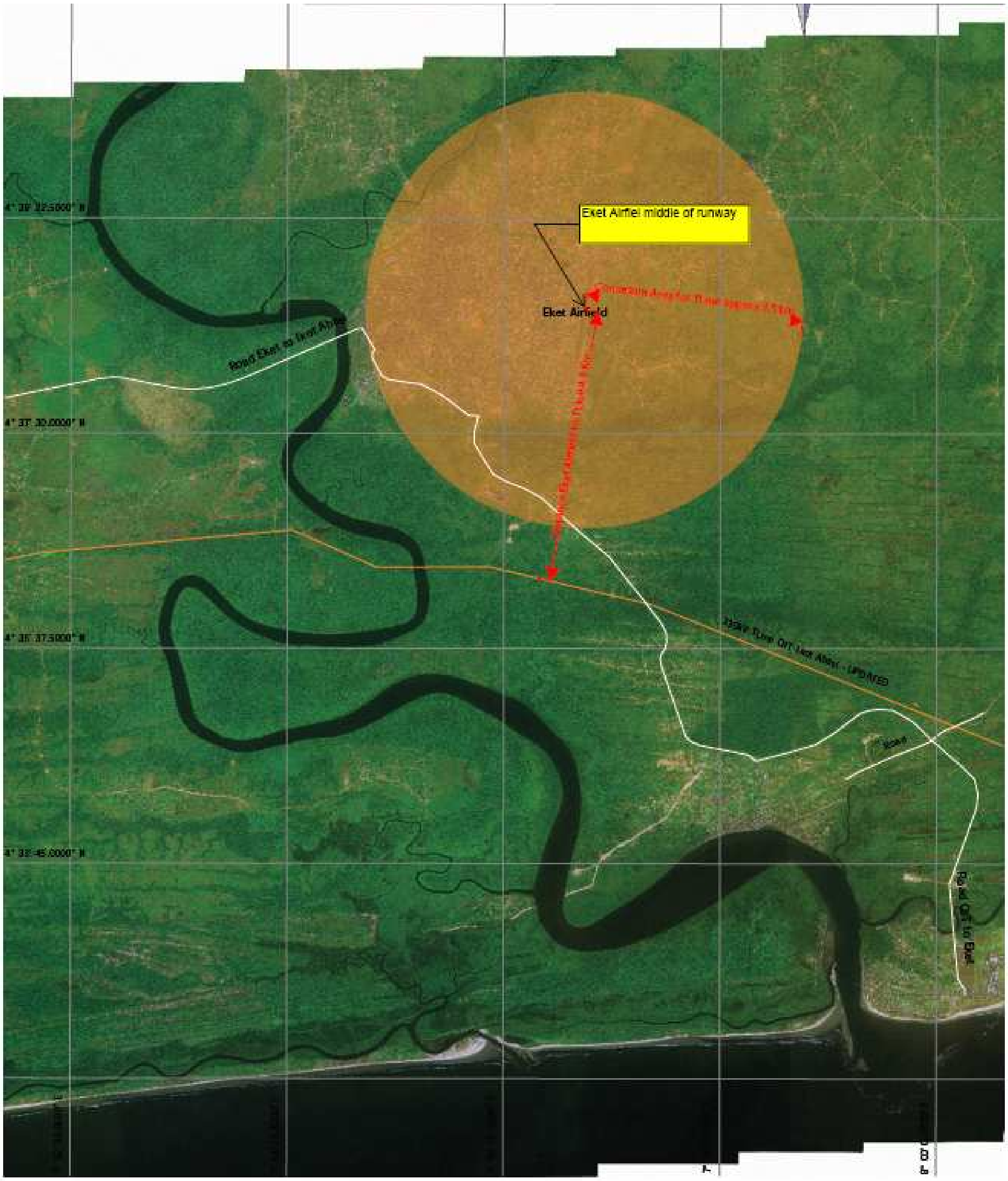


Figure 3.1: T-Line Route Design – QIT Heliport and Eket Field Constraints

3.5.1 Foundation Design

The foundation design for the transmission towers is based on the principle of safety, reliability, economy and reasonability. Three foundation types (mass concrete, pad and pile foundations) shall be used in the proposed project. The mass concrete, and pad foundation types shall be used for foundations with small and large loads respectively under normal soil condition while the pile foundation shall be used in areas where the mass concrete and pad foundations are considered unsuitable.

3.5.2 Tower Design

The tower types are designed to meet the requirements of the conceptual design for a 330kV double circuit transmission line and shall be in line with the PHCN requirements. The standard tower type from experiences of local operation shall be used in view of economy, suitability and short completion schedule.

The tower design will be such of self supporting type of vertical / barrel configuration and the towers designated as suspension towers, tension towers, transposition towers and special towers. The requirement of transposition and special towers does not arise for this transmission line.

A summary of design parameters provided for the towers are presented in **Table 3.**2 below.

Table 3.2: Tower Design Parameters

Tower Type	Angle	Insulator type
AAH	0-2°	Suspension
BBH	0-10°	Tension
CCH	10-30°	Tension
DDH	30-60°	Tension
EEH	60-90°	Tension
FFH	0-90	Tension

Note:

The angle (in degrees) is the degree deviated from the forwarding line.

3.5.3 Steel Class and Strength for Towers

Rolled steel section, flats, plates, bolt and nut bars will, consist of steel. High strength (tensile) steel where approved shall be used where required.

3.5.4 Protection and Earthing System Design

In the proposed project, each transmission line structure shall be grounded so as to obtain a low resistance to ground. The resistance permitted at each tower is 10 Ohms in accordance with the PHCN standard. In recognition of the peculiar location of the project (tropical zone with frequent lightening), the values have been lowered to 5 Ohm for the facility.

An Isokeraunic Level (strokes/ year) of 150 is stated at an altitude of 1000 m in Nigeria. Based on the information provided by Meteorological Department, Nigeria.

Digital protection system shall be applied for the new 330kV transmission lines with two different protection panels one for each TL system, which shall be installed in the control room of the substations.

3.6 Project Activity Sequence

The project activity order for the proposed QIT – Ikot Abasi transmission line is given below. This does not however show the interdependencies of the activities.

- EPC contract award
- Mobilisation
- Check survey of EPC contractor
- Transmission line detail design
- Material production (conductor, insulator, line hardware)
- Material testing
- Material shipment
- Tower production
- Tower testing
- Tower shipment
- Clear and grub site along transmission line corridor
- Foundations for tower installation
- Tower erection
- Conductor stringing
- Commissioning and testing
- Reinstating and clean up
- Demobilization
- Ready for handing over

3.6.1 Pre-Construction Engineering Studies and ROW Acquisition programme

During FEED (Front End Engineering Design) Phase 1, several site studies have been performed to be used as indicators and basis for engineering works. These studies shall be considered as preliminary studies and no claim on completeness of these documents can be raised. For detailed engineering, information given herein and described in the reports will be considered during detail design and construction works.

- FEED
- Topographic Survey
- Crossing Study
- Conceptual Design of Transmission Line

3.6.2 Centre - line and Topographical Survey

Topographical survey has been performed on site. The site is generally flat, with a gentle gradient from the coast line at QIPP Power Plant site (elevation approximately 3 masl) to Eket (elevation approximately 13 masl) and Ikot Abasi (elevation approximately 18 masl).
According to the results of the topographic survey the TL route and ROW are determined. River crossings, TL crossing and determination of structures in the area of the TL have been performed according to topographic survey results.

All topographical survey works included the establishment of any survey control, needed in addition to the existing survey control.

The complete topographic information for the survey areas use a maximum point interval / grid spacing of 25 m to describe the current local conditions in acceptable accuracy. The locations and elevations of the following minimum scope of data have been determined:

- all topographic surface information and features (high / low points, break lines, streams, river banks, swamps, vegetation, etc.);
- all manmade, civil structures (roads, tracks, buildings, foundations, walls, fences, etc.);
- all existing third party facilities (piping, cabling, process installations, telecom, power lines, utility markers etc.);
- all geotechnical points to be set out / surveyed;
- temporary access roads, camp sites, fabrication-/storage yards and the MPN airfield, as required.

A routing team consisting of environmental, a geotechnical engineer, an ROW expert have explored the area of the presently foreseen route. Upon their identification of the area's suitability a preliminary route got marked by navigational positioning.

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

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

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

3.6.3 Geotechnical Survey

Geotechnical investigation for the project is proposed to be carried out side by side with the construction activities.

3.6.4 Foundation Construction

For this project the determination of type and size of a tower foundation soil details from geotechnical investigations shall be used and complemented with additional investigations where required. All foundations shall make adequate provision for horizontal shear forces at the ground line.

The foundation types chosen for the proposed TL project shall be constructed using concrete and reinforcement as major materials. Due to the possibility of the corrosion of foundation materials by underground water, surface water and soil, the following shall be used:

The foundation protection thickness shall be enlarged to over 50mm while the top of the foundation shall be minimum 500mm above ground level.

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

Standard Foundations

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

Special Foundations

In areas of low soil bearing capacity, special foundations will be required for the set-up of TL towers. Special foundations comprise but are not restricted to:

- Pad and chimney with enlarged pad (soil bearing capacity!)
- Raft foundations (soil bearing capacity!)
- Pile foundations,
- Combined pile and raft foundations

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

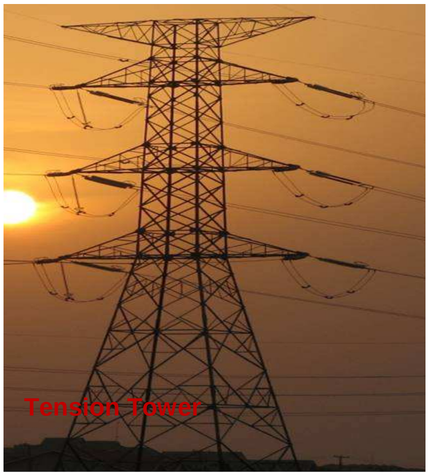
3.6.5 Tower Construction

For this project the hexagonal (or drum type) tower type shall be used. The conductors are vertically arranged, and the earthing conductors are above conductors.

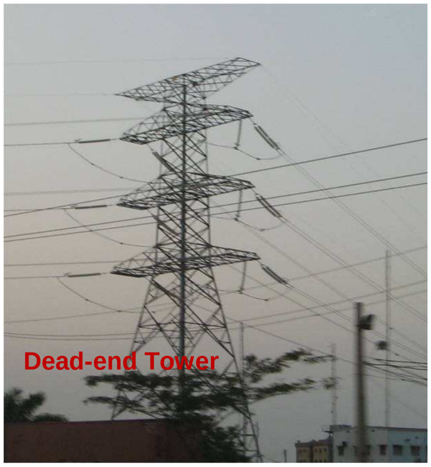
Towers of overhead power lines consist of tower body, earth wire peaks and cross-arms. The transmission voltage, the number of circuits, the height of the towers and other aspects determine the tower design and material, whereby galvanized steel is used. The towers dominate the aesthetic impact of an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

- ***Suspension towers*** carry the conductors in a straight line. They are equipped with suspension insulator sets. During normal operation, they do not transfer conductor tensile forces to the towers and, therefore, the suspension towers can be designed relatively light-weight. Since they represent the most favorable conductor support so far investment is concerned, line sections as long as possible equipped with suspension towers are aimed at;

- ***Strain and Angle-strain towers*** carry the conductor tensile forces in line direction or in the resultant direction, respectively, and serve additionally as rigid points in the line. It is common practice to use angle-strain towers at practically each angle point of the line. This eases the conductor installation as well. In case of long straight line sections strain towers should be arranged in distances from 5km to 10km (according to TCN standard) to provide rigid points in the line thus limiting cascading failures; which might start at suspension towers. They are equipped with tension insulator sets;



- ***Dead-end towers*** carry the total conductor tensile forces in line direction on one side. Frequently, dead-end towers are additionally loaded by the conductors leading to the substation portals which act often under a large angle to the horizontal and with conductor tensile forces caused by the short distances to the portal. These load conditions may lead to unfavorable loads of individual members of lattice steel towers and need to be considered during design.



Bolts and Nuts

All tower members shall be connected by bolts and nuts. Tightening and flat washers shall be used for all nuts. The minimum bolt diameter shall be 12mm. The bolt hole diameter made in members shall not be over 1.5mm of respective bolt diameter. The thread part shall not enter the shearing section between supports. The allowable shearing stress for bolts for mild steel, and for high tensile steel shall be observed during construction for this project.

In order to prevent theft/sabotage, the threads of all bolts with their parts beyond the nuts shall be hit three times for tightening, from the ground level to the place of 3m above the ground.

Galvanisation

Galvanisation shall be made for all steel supports upon completion of sawing, shearing, boring, punching, filing and blending. All exposed ferrous materials and at least the top seven hundred and fifty millimetres (750 mm) of stub (embedded in concrete) shall be hot-dip galvanized after fabrication according to BS729. Galvanized metal shall be free from burrs, sharp edges, lumps and dross and shall be smooth so that interconnecting parts will fit properly and parts may be assembled and disassembled readily. Threaded parts shall be galvanized after being threaded and excessive zinc shall be removed from the threads. Nuts and locknuts shall be re-tapped after being galvanized and shall be capable of being threaded the entire length of the threads without the use of tools.

The preparation for galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material. The coat of galvanisation shall be bright, of even thickness, and without faults.

Hot galvanisation or other accepted workmanship shall be made for all bolts, rods of bolts (including the thread area), and nuts. The thread area shall be oiled.

Anti-climbing Guards and Step Bolts

Anti-climbing guards shall be provided for all towers, and fixed at 3m above the ground level. Step bolts shall also be provided for one leg of each tower, with 380mm intermediate distance, fixed at both sides of the member one after each other from the anti-climbing guards to the top of the tower. In case of reasonable arrangement of bracing and members, step bolts cannot be used. Below the anti-climbing guards, holes shall be arranged for removing the step bolt at both sides of tower members, with distance of not over 380mm. As a further measure to check vandalisation, the bolts and their threads shall be tack welded with their parts at 3m above ground.

Warning and marking plates shall be designed and fixed as per PHCN requirement.

Insulator and Fittings

The insulators are overhead line components installed between live conductors and earthed parts of the structures, being simultaneously subjected to mechanical and electric stresses. The insulation performance needs, therefore, to be designed for the most adverse operating conditions resulting from climatic impacts, such as ambient temperatures, humidity, dew, fog, rain, as well as pollution by deposits of dusts, salts, firing residuals and industrial gases. The mechanical resistance should be so high that every incident load is carried with enough operational security. Disruptive strength and electrical arc resistance should be large enough to withstand the resulting stresses.

Cap and Pin Insulators

In the past cap-and-pin toughened glass insulators have been used in Nigeria as an alternative to porcelain insulators for overhead lines. The insulating body is made of molten silica oxide and other mineral salts. The glass dielectric part is obtained through melting the raw materials by a continuous process which guarantees homogeneity of the chemical composition of the insulating unit. Glass cap-and-pin insulators are produced at a fully automatic production line by means of completion cementing between the socket or clevis caps and the pins or tongues to the glass bodies.

The caps are made of galvanized malleable cast iron, the pins or tongues are made of galvanized heat treatable steel. The highly automated production of the glass cap-and-pin insulators has proved to be commercially profitable. When it is deemed necessary for applications in polluted areas, the pin is protected against corrosion by pressing around with a zinc alloy sleeve to form a sacrificial electrode.

After completion of the production process including hardening of the cementing and a mechanical routine test, the insulators are stored for some weeks, since the heterogeneous distribution of the stresses within the insulator bodies leads to noticeable self breaking during the subsequent weeks. However, the fragments within the cap, due to their increased volume, keep the cemented pin within the cap with a force of about 90 % of its original value, which would practically prevent separation of the insulator strings whenever damage occurred during operation. Cap and Pin insulators are designed to be put together in insulator strings with other accessories to reach the values for the mandatory creepage distance.

Long-rod Composite Insulators

For this proposed project it is foreseen to use a different insulator material, so called long-rod composite insulators due to certain advantages as described below.

For many years, plastic or synthetic resins of diverse compositions have been used, besides ceramic and glass, for the insulation of electric installations. Insulating materials such as aromatic and aliphatic epoxide reactive resins, teflon (PTFE - polytetrafluoroethylene) as well as silicone rubbers are used. Besides the usual insulating characteristics necessary in case of overhead applications, high resistance against ultraviolet radiation is required for the plastic or synthetic resins. Insulation for higher voltages is also highly stressed from the mechanical standpoint, thus requiring composite insulators with glass fibre reinforced cores (GFC) of cast resin to be used. In order to obtain the necessary creepage path, sheds of diverse materials such as resin-epoxy, polytetrafluoroethylene (PTFE), ethylene-propylene rubber (EPR) or silicone rubber are arranged around the cores.

Composite insulators can be formed by individual sheds fixed on a core rod with or without an intermediate layer or alternatively by a cover of sheds applied on the core rod in one or several production steps. The composition of materials used and the production process vary from manufacturer to manufacturer

Composite insulators present several advantages, such as low weight, high mechanical strength, considerable reduction of required creepage distance through a hydrophobic surface, durability especially under critical pollution conditions, high resistance against vandalism and optimum ability to comply with project requirements by means of their modular fabrication system; in view of such outstanding characteristics, composite insulators have been more and more accepted by users. Due to their insulating capacity, composite insulators have been often used to replace conventional insulators in critical areas.

Composite insulators can be manufactured as a unit piece to replace existing long insulator sets, thus: reducing the total length of the insulator set and making them especially appropriate for up-rating of lines, without the need to modify tower dimensions or rights-of-way whenever higher system voltages are adopted.

The advantage presented by composite insulators with respect to their weight is prevalent at the High voltage level and higher. Composite long rod insulators:

Advantages:

- Low weight
- Hydrophobic insulator surface
- Creepage path, insulator length and load capacity can be adapted easily to the project requirements

Disadvantages:

- Mechanically sensitive silicone surface of the GFC rod
- High technical production efforts, silicone materials are expensive
- Higher sensitivity to ageing

Insulators Hardware

- ***Suspension insulator*** sets will consist of one or more insulator strings composed of Suspension insulators and accessories. Multiple insulator sets are applied where required by the operational loads as well as in other cases when a higher security is desired, e. g. at crossings. Double insulator sets are commonly used, in particular in densely populated areas. Transversally arranged double insulator sets result in lower dynamic stresses to the remaining sound string in case of failure of the other one. Due to the advantage, double insulator sets are preferably arranged in line direction particularly when frequently loaded by high wind. The individual insulator strings should be attached directly to the cross-arms. The U-bolts, shackles or hinges used to attach the strings result in a universal mobility. To protect the insulators from power arcs with temperatures ranging up to 12,000 K, the insulator strings can be equipped at both ends with protective arcing fittings, starting sometimes at voltages of 36 kV. The arcing protection horns should be installed at suspension sets such that the final burning positions are directed outwards from the tower.

- ***Tension insulator sets,*** to attach the conductors to angle-strain, strain, section or dead-end towers, multiple insulator sets are used, whose insulator strings should be directly connected to the cross-arm by means of hinges or shackles.

The information presented in the context of suspension insulator sets concerning load transfer after failure of an individual string applies as well for tension insulator sets. The dimension of the yoke plate in direction of the insulator set axis should be so large as to reduce impact loads after failing of an individual string. In case of triangular yoke plates, the height should be larger than the width. A connection between conductor bundle and insulator set by one pivot only is advisable for bundle conductors since the failure of one insulator string will not alter the geometry of the bundle.

On the other hand, a trapezoidal yoke plate leads to shorter design lengths of insulator sets and might be advantageous with regard to the load transfer. The insulators are transported in standardized boxes to the installation sites and should be stored there on wood supports and adequately protected. For assembling the insulator strings, special care should be taken, such as:

- The insulator sets should be assembled in accordance with the design drawings.
- Pins of shackles and clamps, when installed vertically, should be inserted from top to bottom such that they cannot get lost.

The suspension insulator sets are lifted and installed before conductor stringing. Protective cradles should be used for multiple insulator sets to avoid clashing of individual strings. The stringing blocks are fixed to the insulator sets to prepare the conductor stringing. The insulator sets should be in a vertical position after the conductor sagging.

Suspension Clamps

To attach conductors to suspension insulator sets fittings are adopted. Within the suspension clamp and in its vicinity, the conductor is subjected to mechanical stresses higher than in the free span, static tensile stress due to conductor tensile forces and dead weight are superimposed by static bending stresses due to the conductor curvature, static compression stresses resulting from conductor clamping and alternating bending stresses due to conductor vibration. To keep the dynamic strain of the conductor low in the range of the suspension clamps, the body of the clamps should be light-weighted and pivoted to be able to follow asymmetrical modes of conductor vibrations as far as possible unhindered. A clamp body suspended articulately at a pair of straps supports the conductor, which is fixed by means of the clamp cover. Radius and length of the groove have to be designed such that also in case of large conductor down strain angles the conductor will not be bent sharply at the end of the body. The pivot of the articulation should be arranged approximately at the same level as the conductor axis to keep the alternating bending strain low when the clamp is swiveling.

Tension Clamps

Conductors will be terminated by dead-end clamps. Attachments of conductors at tension insulator sets must be able to carry the conductor tensile force occurring at the individual line or support. The requirements on the mechanical performance depend on the type of clamp, on the TCN standards or on the project specification.

- **Compression-type or wedge-type** clamps are predominantly adopted for phase conductors of high- voltage lines. Wedge-type clamps do not require special tools for installation and are relatively simply to be fitted. A correction of conductor sag can be achieved by shifting the clamp. Wedge-type clamps are in particular suited to single-material conductors and to compound conductors with more than one aluminum or aluminum alloy layer and, therefore, low steel content.
- **Compression dead-end clamps** are suited to terminate all standard types of conductors available in the market. They are designed to achieve ultimate terminating forces up to the rated tensile strength (RTS) of the conductors. Shifting of the clamp after installation is not anymore possible. Special tools, namely a hydraulic press and corresponding dies, are required for installation of compression dead-end clamps. They are designed with one metal sleeve for single material conductors and with two sleeves for composite conductors. In our case with compound conductor Bison, at first the steel sleeve is crimped onto the steel core on a corresponding length after cutting back the aluminum strands. Afterwards, the outer sleeve made of aluminum alloy is crimped on one end with steel terminal of the clamp and on the other end with the entire conductor consisting of aluminum and steel layers. The manufacturer's instructions should be followed when installing compression clamps. The length, thickness and material of the sleeve, as well as the position and number of crimps, affect the ultimate terminating force to a great extent. After terminated the conductor an adjustment of sag is only possible by the use of a turn buckle.

Turn buckles are arranged in dead-end insulator sets to compensate tolerances in lengths of elements in parallel or of sub-conductors in bundles. They have been standardized according to their characteristic forces. Due to the notch sensitivity of the threaded spindle, special requirements apply for the partial factors according to. Turn buckles may not be loaded by bending.

According to PHCN/TCN standards, compression dead end clamps shall be used for termination of conductor. However during the project the request came up to use Wedge-

Type Dead End Clamps which was acceptable and so a change of the specification for compression Dead-End Clamps to Wedge type Dead-End Clamps was made. Using the Wedge type instead of the Compression clamps will provide the following advantages:

- no special tools for installation are needed (hydraulic compression gripper with diesel and power engine)
- easy correction of conductor sag, which Dead End clamps do not allow
- improved maintainability during conductor replacement in the future
- low conductor deformation by safe conductor embedding in between the wedge and its connected opposing part (will be permanently deformed with other clamps)
- increased safety for Line-men at work, easier assembling, higher operability and maintainability, with a marginal increase in cost.

In summary the Wedge-type Clamps provides a higher assembling, operating and maintaining advantages over and above the compression clamps. Also the possibility of oil and diesel spills get reduced significantly hence no hydraulic compression tools are required for installation of dead-end clamps.

Connectors (Joints)

Connectors are fittings jointing one of more phase conductors or earth-wires (ground-wires) to each other or producing a conductor branch-off. Tension-proof and non-tension-proof connectors can be discerned. For mid-span joints, the voltage drop and the electrical resistance along the connector may not exceed that of an equivalent conductor length.

The same requirements apply for tension-loaded conductor joints as for dead-end clamps. Compression-type connectors are predominantly adopted today, the design, function and installation of which are equal to those of compression dead-end clamps. In particular, for medium-voltage lines preformed splices are used made of preformed rods having the same function as preformed dead-end rods.


Pressing of Connector (Mid Span Joints)


Hydraulic Pressing Machine

Figure 3.2: Typical Connectors Pressing

Spacers for Bundle Conductors

Bundle conductors, consisting of two sub-conductors, are adopted for transmission lines with high voltages. The spacers keep the subconductors within a span and in jumper loops at designed spacing to avoid damage caused by clashing, twisting or entwining. The number of spacers and their spacing should be adjusted to the span length and the damping requirements, if any. twisting or entwining of subconductors will be less probable and the retaining moment will be enhanced if the subspan length starting with for example 15 m at the towers increases in steps of 5 m up to 70 m in midspan. According to their function, it is discerned between rigid spacers, keeping the subconductors at a constant distance at the location of installation, flexible spacers, permitting small relative displacements of the subconductors at the location of installation, and spacer dampers, which reduce the vibration level by energy dissipation in rubber-elastic elements, thus avoiding fatigue damage of conductors.

Spacers should ensure the designed subconductor spacing at the location of installation in all operational conditions, also during wind action. In case of a short circuit, they have to withstand high dynamic loads and to limit the damage of subconductors without being themselves permanently deformed. Hinges and insulating elements cannot conduct currents between subconductors in normal operation. The distancing element of a spacer, therefore, does not suit as a fixing point for earthing devices in case of maintenance. The corresponding design should ensure that no inadmissible discharges or radio interference occur and audible noise is avoided.

Spacer Dampers for Bundle Conductors

Spacers for bundle conductors can be designed such that they suppress vortex-induced conductor vibrations. Usually, the spacer consists of a rigid frame, at the corners of which the connection with the conductors is provided by means of hinges with clamps. The hinges are lined with rubber-elastic cushions made of silicon or ethylene-propylene rubber (EPDM), thus providing a remarkable damping capacity. They enable the clamp to follow the conductor movements and dissipate energy to an amplitude-depending extent. The amount of damping power of one hinge can correspond roughly to that of 100 m of conductor. The oscillating movement of the sub-conductors is reduced by the dissipation of energy. Number and location of spacer dampers should be optimized and verified by a study for each individual application. The optimum distribution of spacer dampers along the span varies depending on span length, wind velocity regime and local topography.

OPGW Accessories

The special functions of OPGW require also corresponding special accessories for their attachment at suspension and strain towers. The fittings should prevent damage or deformation, harming the function of the optical fibers. Damping fittings, in particular, should take care of the optical fibers. Preformed dead-end rods distribute the radial compression forces required for the friction locking on a longer section than dead-end clamps and, therefore, are in particular suitable for terminating metal-reinforced cables with optical fibers (OPGW). Preformed dead-end rods comply with all the requirements on conductor terminations. They can be simply installed bare hand without tools and are widely used worldwide. They consist of several helically-formed circular metal rods, the inner diameter being somewhat smaller than the outer diameter of the conductor to be terminated. The tensile forces are transferred onto the conductor through the helices by means of friction generated by radial pressure. Length and shape of the preformed dead-end rods keep the radial pressures at a low level and thus avoid any damage of the conductor. The inner surface of the preformed dead-end rods is sand-covered to increase the ultimate terminating forces.

3.6.6 Arching Devise

Arcing device is used for the insulation strings of suspension and tension type to avoid electric discharge along the insulator skirt so the insulator string is protected. This shall be used in the project

3.6.7 Lighting protection and Earthing System

The earth wire conductor shall be used as lightning protection measure for the 330kV transmission line. One earth wire conductor and one OPGW shall be installed for the entire line of this project. To protect the line and towers against lightning, the angle of shield for 330kV double circuit towers shall be 0°. The mid span clearance between upper conductor and ground wire for 330kV lines shall be 6.5m respectively.

Earthing System for Towers

The Towers and the ground-wires are a major part of the earthing TLine system. The ground wires are clamped electrically to the towers. The towers are connected with the earth in and around the foundations. The system is used for lightning protection, earthing faults and during maintenance works to earthen the individual electrical circuits.

Earthing holes shall be arranged for the four legs of a tower, with bolt diameter of 12mm. Four earthing devices made of galvanized steel wire with 7/3.25 specification or copper wire with 7/2.97 would be used. 7/3.25 steel wire is preferred due to the predominant swamp environment of the line route with lower soil resistance as well as cheapness of the wire. The earthing devices shall be buried in ditches with depth of over 750mm, dug in a straight line and backfilled.

Earthing System for Foundations

Where necessary, TL towers are equipped with earthing installations to conduct failure and induction currents as well as currents from lightning strikes into the earth. For this purpose, horizontally arranged electrodes, named counterpoises or earthing rods will be installed in the soil. Horizontally arranged electrodes will be installed radial or as rings in manually or tool assisted excavated trenches in depths between 0.6 m and 1.0 m. The earthing conductor or strap is conductive connected to the tower leg members. Earthing straps should be installed end up in the trench such that the backfilled soil touches the earthing strap on both sides. Low earthing resistance is achieved in cohesive soil. Stones or coarse gravel directly at the earth electrode increase the earthing resistance to a large extent. Earthing rods are driven manually or by tools as deeply as possible into the soil. In case of shallow foundations, they can be driven into the soil from the excavation pit sub face before starting of concrete placing.

The earthing of both Dead End Towers will be connected with the earthing system at the substation. The ground-wire and the OPGW will be connected to the gantry and the foundation earthing of the Dead End Towers will be connected to the foundation earthing of the substation.

The earthing resistance is measured by means of an earth tester. If the required earthing resistance is exceeded, the earthing properties need to be improved by additional earth-electrodes. To achieve low transition resistance, metallic bright connections between earth connectors and towers should be envisaged and supervised.

3.6.8 Transmission Line Construction

The transmission line shall be a double circuit 330kV type with a total length of about 58km, between the existing PHCN substation at Ikot Abasi and the substation at QIPP.

The proposed line route (**Figure 3.3**) is on the southern side of the existing road from Ikot Abasi to Eket. Impact on buildings and other properties shall be avoided and minimized, the line shall be constructed within swamp and large waters. However, efforts shall be made to avoid land of swamp and large waters as much as possible while also avoiding buildings and other properties.

The route of the TL runs over approximate 58 km from the power plant in Westerly direction to Ikot Abasi. The outgoing line shall begin from the gantry of QIPP substation to the terminal tower at a distance of 80m from the gantry. The foreseen route departs from the power plant in Northern direction for about 4 km, continues then in west-north-westerly direction for about 14 km, passing the city of Eket in greater distance at the South and crossing the Qua Iboe River, before turning West in order to reach Ikot Abasi after approximately 40 km. The route runs across mainly flat but densely vegetated and swampy terrain, which may difficult to access by vehicle or by foot. The line shall traverse ALSCON land, village lands, ditches, valleys and rivers, swamps and ponding areas and shall terminate in the terminal tower approx. 80m from the Ikot Abasi substation.

3.6.9 Fault Detection, Response System and Control

The Ikot Abasi and QIPP substations use protective devices which have the ability to instantly detect a fault on the transmission line. The control switch, indication light, ammeter, voltage meter and alarm window will be on the control panels in the substations. A control panel will be located in the control rooms of both stations. For the new 330kV overhead lines, a set of kWh metering will be in the substations. An audio; and visual alarm system will be on the control panel in the Ikot Abasi and QIPP substations. Premonition and fault signal for all equipment will be at the Ikot Abasi and QIPP substation to synchronise the 330kV line from Ikot Ekpene with the 330kV line from QIPP.

Safety Criteria

The design of the TL system (routes and layouts) have been carried out taking into consideration corporate safety rules to assure safety, prevent accidents and reduce risks level to as low as practicable. Further safety and operability studies would be carried out on final transmission route, tower foundations and general technical drawings to verify safety systems and integrity of installations to possible changes in environmental conditions.

Supervision and Communication

Effective and functional communication system shall be installed to facilitate supervision of the operation of the project and communication between Ikot Abasi and QIPP substation. One set of power carrier system will be installed for communication between the Eket substation and Ikot Abasi Power Station. Also PHCN requires a Fibre Optical Ground Wire (OPGW) which will serve as additional communication channel.

3.7 Procurement of Materials and Fabrication Summary

The Materials and Equipment will be procured with respective reliable suppliers, locally or internationally. Depending on the location the Materials and Equipment will be manufactured in their plants according to the required standards. Factory acceptance test will be performed to prove the quality and compliance with the standards.

For tower test, a prototype tower test shall mean successful loading test of a completed prototype tower first to verify that the tower will meet without failure the specified loads, and second to ascertain the maximum withstand loads prior to tower failure. The Test should validate that the static calculations are correct and any shortcomings potentially given in the structure be recognized.

If the material and equipment is sourced abroad it will be imported to Nigeria to a possible international harbor.

The equipment has to be transported either

- from the Customs Yard/Storage in Nigeria or
- from the manufacturer in Nigeria (if material was sourced in country and did not need to be transported, stored, repacked etc. in the Customs Yard/Storage) to site.

No heavy weight equipment has to be transported for the TL, for which transport by waterway is necessary. Moreover the transport of normal load equipment and bulk material by waterway should be avoided. Therefore it is expected that all equipment for the TL will be transported per truck to site.

For the transport by road already existing roads can be used (existing main road along TL see **Figure 3.3** below).

Figure 3.3: Alignment of Existing Major Road and the Transmission Line Corridor

Furthermore connection roads to the actual sites have to be built and existing roads have to be reinforced respectively.

The party which does the transport to site has to be responsible for all related issues including the following (applies for transport by waterway and road):

- Loading equipment on transport device
- Dimension and the selection of the suitable transportation device (e.g. amounts of axles)
  - o Transport device can either be a device (Trailer) which is pulled by another vehicle or which is self-propelling
- Fastening of load
- Get permission and authorization for transport according to local regulations (e.g. roadblock for transport, night transport etc.)
- The particular local regulations have to been considered
- Security issues and insurance (e.g. community issues, noise disturbance)
- Seasonal constraints - make provision for meeting his needs without detriment to the program or disruption to public services and highway
- Routing to site
  - o E.g. identify potential obstacles like railway crossing, highway crossing, bridges etc.
  - o E.g. critical truck curves turning radius
  - o E.g. load carrying capacity of particular streets
- Constructing and maintaining all access ways and temporary roads necessary for transporting of equipment (will require to undertake a full logistics evaluation, to ensure only suitable access roads are used)

3.8 Mobilisation

The following items and personnel will be mobilized during the process:

- Fence and Security provision
- Construction of marshalling yards and lay-down areas set-up
- Construction and setup of office
- Construction vehicles / machines / equipment mobilization
- Construction material provision
- Infrastructure for operation of construction site
- Drainage set-up
- Communication provision
- Manpower mobilization
- Coordination between the power projects

Personnel to be mobilized will include:

- National labour
- Local National labour
- National experts
- Foreign experts´

There will be opportunities of engagement and development of community members, and the community at large via the project. It is anticipated to employ local labor as much as feasible. The construction labor force for Transmission Line is expected to average about 70 professional staff consisting of EPC construction management, expatriate construction supervisors, project team representatives and owner representatives including about 280 national labor personnel.

EPC Contractor will develop a 'Community Relations and Engagement Plan' which will detail strategies for fair and representative engagement of local labour from the affected communities. This plan will be reviewed and approved by PHCN in line with the Nigerian Local Content Act and labour laws before approval. The approved plan will also be used to monitor activities of the EPC in this regard. Also consultation between the EPC and the respective stakeholders (local leaders, youths, etc.), to be mediated by PHCN will be held to reach agreements on the employment of local labour. A Community Liaison Officer (CLO) will be engaged to liaise between the EPC, the Communities and PHCN.

Efforts will be made to accommodate non-indigenous project personnel to as close to the work site as possible and they will be bussed to and from the project site each day. At a minimum, a security convoy will be provided for the buses travelling to and from the workers' camp. These movements will be coordinated by the logistics team of the project. The CLO shall be responsible for coordinating local labour activities.

Working hours will normally be daylight hours from 7:00 a.m. - 7:00 p.m. In the event that evening hours are worked, emphasis will be placed on proper lighting, safe job procedure and overall safety.

During the project Stop Aids and Malaria program will be implemented to ensure safe and healthy practices at site. These are enlightenment programs that educate personnel on preventive and management strategies as well as on the use of repellents, nets, and other preventive measures. Malaria is recognized as one of the major causes of deaths in the country. Although these are not legal requirements, they have been included to safeguard the health of personnel.

3.9 Site Preparation

Clearing and grubbing of all vegetation will only be carried out for access roads and tower footprints while selective clearing will be utilized for the rest of the ROW. After removal of topsoil, the underground shall be checked for wet or soft spots or any other areas unfavorable for foundation and construction works. Wet and/or soft spots shall be over excavated and refilled. Refill shall be placed and compacted thoroughly in layers to acceptable standards.

The construction area shall be filled with appropriate material to relevant construction level and shall be compacted to required density. In dry land areas a slight inclination of the ground line from the center of the foundation towards the outer edges is considered sufficient for drainage of precipitation. Around the foundation a small ditch shall be for the discharge of surface water to an artificial basin or runoff.

After clearing and grubbing works, ditches shall be dug around the individual construction site and across the area to drain the surface. Where the natural gradient is not sufficient for gravitational discharge, a pump sump shall be dug in few meters distance to the work site.

After removal of topsoil, the site shall be kept dry and dewatering systems shall be checked regularly on water flow and the area shall be checked on moist content. Soft spots or any other areas unfavorable for construction works shall be excavated and refilled before construction of any foundation. Refill shall be placed and compacted thoroughly in layers to acceptable standards.

Brush and vegetation will be piled and discarded into local disposal sites in accordance with applicable Nigerian regulations and Projects waste management standards and practices. Woody debris and cut trees may be placed at the edge of the Project site with access provided to the local community members to remove the material for their personal use.

For pile construction the work area around the foundation shall be stabilized by the use of geostructures (e.g. Durabase, Geowebs, wood etc) for heavy equipment access. After pile construction the area shall be filled with appropriate material and compacted to relevant construction level. Around the foundation a small ditch shall be foreseen for discharge of surface water from the foundation and water from the surrounding area to an artificial basin or runoff.

3.10 ROW and Access Corridor Clearing

Prior to construction works, selective clearing will ensure that only trees, vegetation, debris, roots, and other material interfering with the construction process are cleared from the site. Vegetation shall be cleared only along ROW and areas marked for construction of access roads.

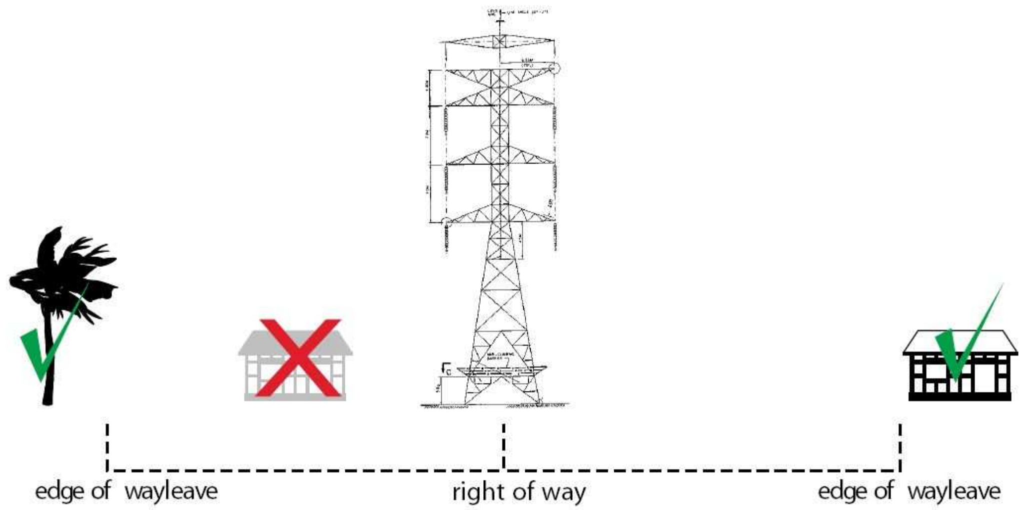


Figure 3.4: ROW Clearance along the Transmission Line

Trees shall be cut off at max 30cm above ground level and the stumps left in place for erosion control. The following shall be considered:

- No interference with the line from tree bending, growing, swinging, or falling toward the conductor
- No interference from vertical or horizontal conductor movement and increased sag as a result of thermal and wind impact
- No deterioration or physical damage to the root system, trunk, stem or limbs, and/or the direction and lean of the tree
- Fire risk

Organic material shall be classified into following categories and piled respectively.

- For structural use
- Fire wood (to be given to locals)
- To be disposed off

Any debris shall be collected and disposed of through the use of an approved waste disposal contractor. Topsoil shall only be stripped in the areas of tower foundations, associated access roads, and marshalling yards. Care shall be taken to avoid mixing topsoil and subsoil.

Site Reclamation after Completion

After completion of all construction works all temporary structures, laydown areas, temporary roads, temporary drains and ditches, etc. shall be removed. Material used for these structures shall be recycled or disposed off. Temporary erosion controls shall be maintained (or replaced if necessary) until vegetation covers approximately 70% of disturbed areas.

After the site has been cleared of construction material and other debris, topsoil shall be reapplied and watered. Where subsoil's are severely compacted, the underlying layers shall be loosened or scarified with a plough or rake before applying topsoil.
Re-vegetation plan shall be based on federal, state, and local guidelines and specifications for site stabilization.

The effectiveness of the reclamation work will be evaluated after initial seeding and when planting works are finished. Areas where seeding is not effective or where further planting works are required will be identified and remediated also.

3.11 Construction / Installation Strategy

Utilities

Throughout the construction period, bottled drinking water will be imported to the job site by means of a tractor trailer truck for use by construction labor. Non-potable water for construction purposes will be obtained from the onsite wells at the adjacent Power Project site which will be installed.

Temporary portable sanitation units will be employed for construction labor. The Project will be responsible for pump-out and disposal of all sanitary waste. The Project will also be responsible for the management and disposal of all office wastes, construction wastes and construction labor camp wastes generated as a result of the Project.

The management and disposal of all construction generated waste streams will be conducted in accordance with all applicable Nigerian waste management regulations including project waste management and disposal standards. To ensure compliance with this commitment, the Project will contractually require its EPC contractor to develop and implement a waste management plan (WMP) consistent with its waste management standards and practices. The EPC contractor's WMP and any subsequent revisions will require approval from the Project. To further ensure compliance, the Project will conduct periodic assessments of the EPC contractor's waste management activities. The EPC Contractor will be required to promptly resolve any findings from these assessments to the Project's satisfaction.

Construction lighting will be accomplished by relying on mobile light towers, mainly required to illuminate the site each night for security.

Temporary diesel electric generators will be used to provide office lighting and service other light loads. It is expected that temporary construction power will be provided by the EPC contractor using tow behind diesel generators for the construction period.

Temporary Site Facilities

Temporary offices facilities essentially construction trailers will be established. Connex boxes will be used to store, dispense and secure consumables, small tools and small equipment.

The Transmission Line laydown area will be about 30,000 m^2. This area will be used during all the stages of the Project. It will aid in keeping materials dry and to provide a surface suitable for vehicle traffic. Later during the construction phase, construction materials and equipment like foundation reinforcement steel or steel tower metal bars will be stored in the area.

Figure 3.5: Lay-down Tower Materials Storage

Security at the lay-down area is expected to consist of a combination of expatriate security managers and local national guards some of whom will be recruited from the host communities. Perimeter security, entry control points as well as roving security patrols will likely be used.

Towers

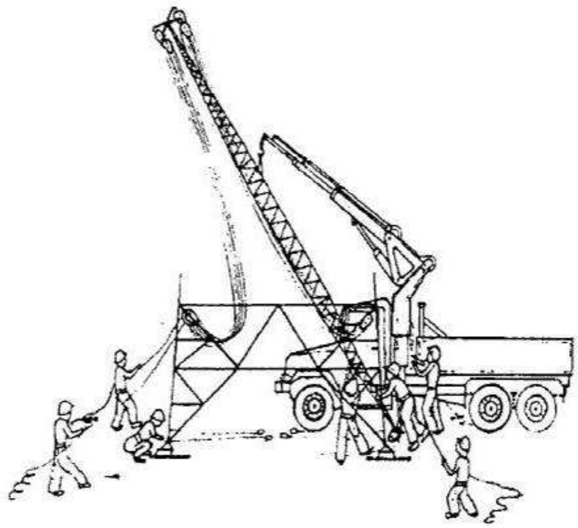
Lattice steel structured towers consist of galvanized angle-profiles and plates of different dimensions with drilled or punched holes to be connected by galvanized bolts, spacers, washers, snap rings and nuts with different dimensions and performances. Bolts and Nuts should be ordered tower wise packed.

To meet the timeframe for each tower to be erected activities have to be done before erection. A large area has to be rented to store the delivered materials. Packing is optimized for over-sea freight. The tower material is not arriving tower by tower or tower-section by tower-section. For each type of tower the bill of materials and the workshop drawings have to be studied and all parts for a specific tower type have to be picked and separately stored and marked per tower type.

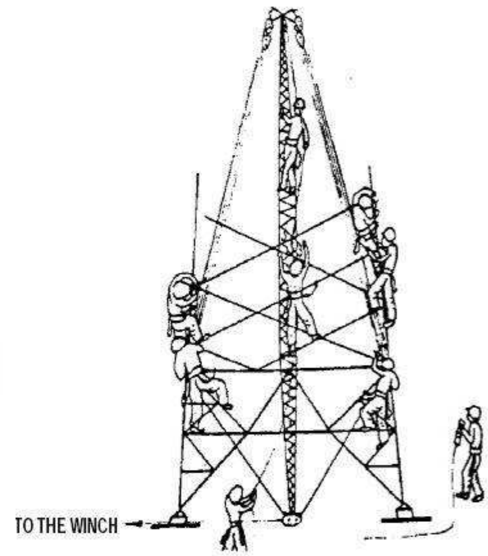
After all material for tower types is sorted out, the specific tower of specific type has to be sorted out. If body extensions or leg extensions are needed the material has to be picked and stored the same way. The completed material of one tower has to leave the store not before the tower erection gang has been established on the specific tower site No X. During picking and sorting tower related materials should be stored on wood supports in yard and on site. Bolts and nuts delivered per tower should be unpacked and prepared so that bolt, washer, snap-ring and nut are screwed together and packed again to be carried with tower No X to site.

3.11.1 Tower Erection Method

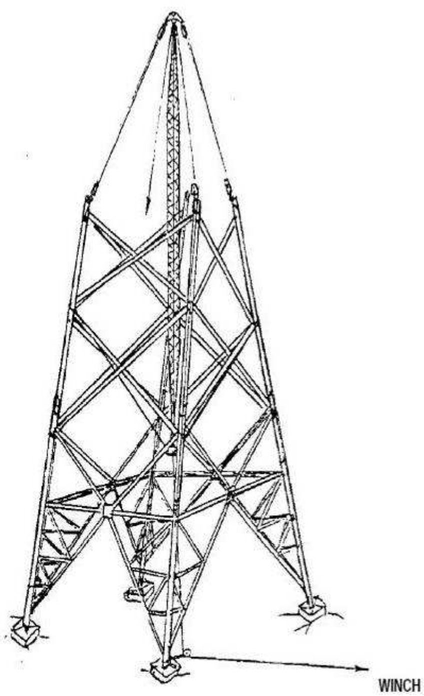
- Erecting by mobile hydraulic cranes
- If cranes are available (330 kV: 120 ton crane required minimum size) and the access roads are sufficient to drive on site the use of hydraulic cranes to erect towers in parts/sections is the most effective way
- Erecting by means of helicopters
- Helicopters to carry loads for non military use might not be available in Nigeria. The costs for helicopters are very high. Method is used in high mountain areas and at very critical locations.
- Erecting by winch and derrick (gin-pole)
- The winch and derrick method can be used at most of the locations. Small winches are needed for lifting the materials and the derrick itself. Anchors, guying ropes and tirfors are used to position the derrick. Towers will be erected in parts/panels/sections.
    - Use of derrick inside the tower base - If the tower base on the ground leaves enough space to handle and attach the derrick in a proper way, the derrick will be centered in the middle of the tower and attached to all tower-corners by steel-guying ropes. See Figure 3.6.
    - Use of derrick at one corner of the tower - To be used only if the tower base at the ground is too small to leave enough space to handle the derrick. For this use the top of the derrick has to be connected to anchors in four directions each by 90 degrees around the tower.
    - Erecting piece by piece - This method is the oldest method and can be used at every location. It is the most time consuming method.



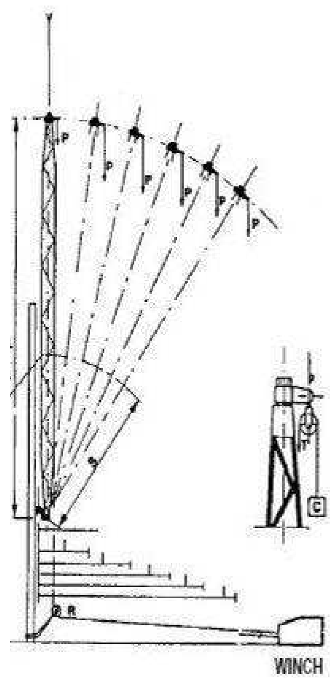
Setting of the Swinging Gin-Pole inside the tower base



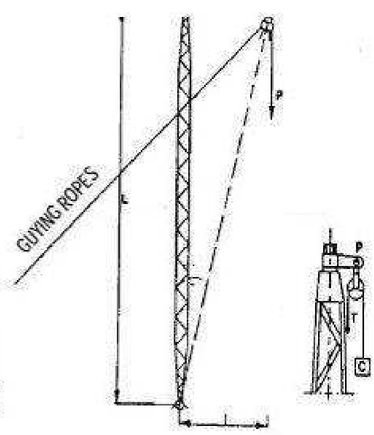
Tower Erection by Gin-Pole



Setting of the Swinging Gin-Pole



Guying Ropes



Gin-Pole with High Yielding Resistance Made of Aluminum Alloy

Figure 3.6: Tower Erection Process

3.11.2 Tower Erecting Standard

All towers shall be vertical within a tolerance at the tower top of 0.3% of the tower height before conductor erection.

The bolt tightening torque shall be submitted to the assigned engineer for approval. Wrenches used for the bolt tightening shall be subject to the approval of the assigned engineer. The use of a wrench which may deform the nut or cut or flake the galvanization will not be permitted.

In order to prevent pilfering, all bolts and nuts which are not anti vandal type at less than 3 meters above ground shall be secured by means of punching the bolts threads 3 times at the emergence from the nut.

After erection of all towers, the steelwork within 150mm of the upper surface of the concrete, or other encasing materials and the upper surface of the concrete itself within 150mm of the projecting steel shall be painted with two coats of bituminous or other approved paint.

Proper precautions shall be taken to ensure that towers are not strained or damaged in any way during erection. Whenever wire slings or ropes are liable to abrade a support member, the member shall be suitably protected by heavy Hessian bags or strips, pieces of wood or by some other approved method.

Where derricks (gin-poles) are used for lifting panels they shall be securely guyed and shall be supported only at approved locations on the legs. Suitable ladders shall be used whenever necessary during erection of the towers. All ladders and removable step bolts shall be removed when erection work is not in progress.

After erection all towers shall be cleaned of all foreign matter.

3.12 Stringing of Conductors and Shield Wires

3.12.1 Conductor

All the power will be evacuated to the 330kV Ikot Abasi Substation via the 330kV transmission line from QIPP Power Plant.

The transmission line is going to be a 330 kV two to four circuit TL. Each pair of circuits comprises of twin Bison conductors, ACSR 380/50, 431 mm2 or any other as approved by PHCN.

3.12.2 Stringing Methods

Stringing of conductor shall not be performed until 28 days after finished concrete works for foundations or as approved. The tightening of the tower bolts has to be completed and inspected.

Stringing of conductor and related operations shall be performed during daylight hours.

During stringing (and sagging) a reliable radio connection or some other approved means of communication shall be kept to coordinate operations within the group of line-men and operator of puller- tensioners.

When the stringing of the conductor / earth-wire is about to be carried out the requisite notice to the appropriate authorities of the date and time at which the work shall be conducted will be made (Road authorities, Telecommunication utility, Power distribution utilities, Water authorities, Power Plant operators, private power distribution utilities, etc.). If necessary the traffic shall be controlled and guided.

By appropriate routing and earthing and by protective measures it shall be ensured, that neither persons nor animals, nor installations are endangered by the inductive effect from the TL. This applies equally to construction, undisturbed normal operation and to disturbed faulty operation of a TL.

All necessary arrangements with communities or landowners before entering private land for the transport of materials, and access to the site from the road shall be made. Clearance shall be provided by trimming of trees and other vegetation to obtain enough clearance from the nearest conductors in order to protect them from damages during construction and later operation of the TL.

Clearing operations shall be conducted in such a way as to prevent damage to existing structures and installations and to those under construction, as well as to provide for the safety of employees and the public and avoid any risk during crossing process.

Where necessary, scaffolding shall be provided at such times as may be convenient to the requisite authorities.

Conductors shall not be pre-stressed above sagging tension during the pulling operation. The puller- tensioners should be set to maintain sufficient tensions to clear all obstructions by 2 to 3 m yet remaining considerably below the sagging tension. This clearance shall be confirmed by observation. Conductor joints are not permitted at spans crossing over TL.

The placing of tensioning and pulling equipment during the stringing operation shall be such that the combination of loads on a tower cross-arms multiplied by the appropriate overload factor, shall not be more than the maximum design load of the tower.

Stringing Preparations

Before conductor stringing, the tension towers should be properly anchored. Each cross-arm and the tops of the towers should be anchored at both sides. The anchor ropes shall be fixed on the cross-arms and the tops of the tower and fixed on the anchor bore. The anchor bore are connected to concrete blocks, these blocks are in addition to their weight partly dug into the ground to stand tension force of anchor rope. The distance between the tower and the anchor bore should be such that the angle between rope and the ground is 30° at maximum. Anchors should be taken off after finishing erection works.

The wheels (pulley-block for bundle, see **Figure 3.7**) guiding the pilot wire and later on the conductors will be put on cross-arms and single ones at the tops (for pilot, earth-wire and OPGW) of every suspension tower in the section.

Figure 3.7: Pulley - Block

Wheels for tension stringing shall be neoprene or teflon lined (coated) bull wheel-type. The design shall be such that when the designed tension is obtained, the same constant tension will be held as long as the brakes are left at this setting.

Start of Stringing

The first pilot rope should be stringed by hand or helicopter, beginning from the first reel and through the wheels on every following tower. After the first pilot rope has arrived at the end of the section a stronger pilot wire will be connected and pulled to the other side. The other end of the rope should be fixed to the puller tensioner. The bigger sizes will go from the reels through the puller- tensioners and be pulled by the machines not by hand. If a pilot wire has arrived that can take the tensile forces of the double bison a running board (see **Figure 3.8**) will be connected to the pilot wire.

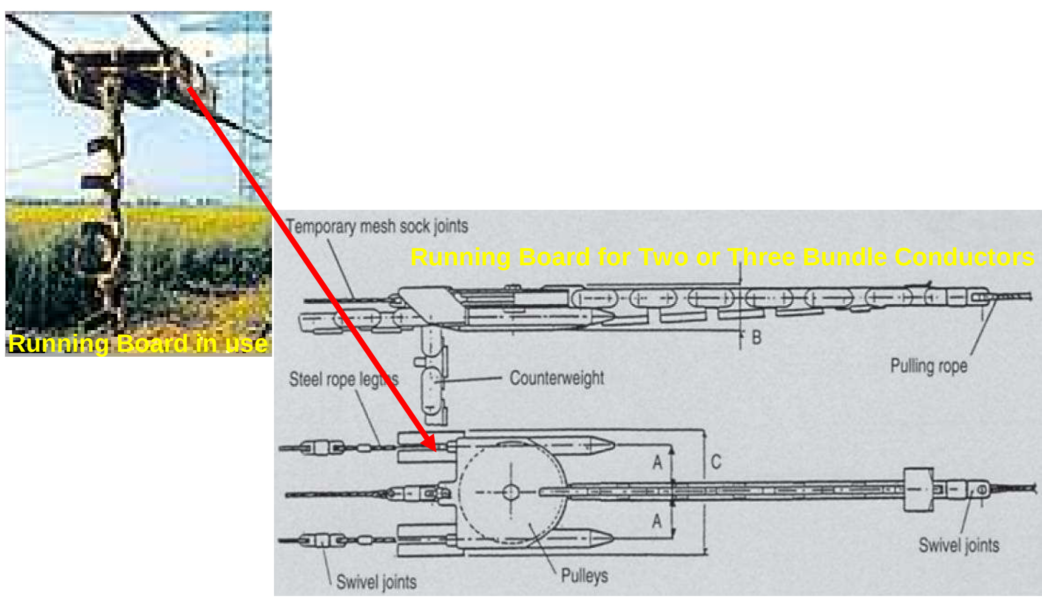


Figure 3.8: Running Board

Start of Stringing with a Helicopter

If the time frame (window) is tight, it is feasible to string the pilot wires by helicopter. Use of helicopter guarantees better timing and transfer of the first pilot wire. However this special way of pilot wire stringing is more cost intensive. But it is also the safest way to string the pilot wire over a live operating TL.

Figure 3.9: Helicopter Pulling a Pilot Wire

The helicopter starts at the drum-stand with the rope and flies backwards. The drums are not heavy and the resistance is not high. The pilot flies right or left of the tower. If he comes closer to the first tower, he passes the tower on right or left side to have a secure distance of the tower. If pulley blocks with an open frame and helicopter pull-in aid are available, the pilot moves the helicopter more to the center-line and pushes the rope into the center wheel of the pulley block. If only closed blocks are available a line-man will open the block and push the rope in the center wheel. During this action the helicopter shall not move. When the line man has closed the block again, he gives a signal to the pilot and the pilot moves to the next tower.

Pilot and line-men should have experience in doing the stringing job of pilot-ropes.

Stringing of Conductors

The empty reels (for pilot-wire) will be taken out of the two hydraulically tensioned / driven drum-stands or out of reel-stands positioned near the puller- tensioner working on this side of section as a tensioner. Two conductor drums will then be loaded to the drumstands.

Figure 3.10: Drum- Stand with Hydraulic Drive and Disc Break

The position of the drum on the drum-stand should enable unwinding of the conductors on the upper side. The conductors will be guided through the puller- tensioner (see Figure 3.10) always on the upper side and connected with mush sockets (cable-grips) and swivels to the running board.

Figure 3.11: Puller- Tensioner during Stringing of 3 Bundle Conductors

The stringing of the first phase with two Bison conductors can start. The puller-tensioner on the other side will start to pull. The puller-tensioner connected to the drum- stands will be used as a break, to safeguard that the conductors will be stringed so strongly that touching the ground and / or other objects is prevented.

Clamping of Conductors

When the bundle arrives at the puller's side and the running board goes through the last pulley block, working clamps are installed to tighten the conductors to the cross-arm. Lines-men will then drain the pulley block to the ground, lift and attach the insulator strings on cross-arm, install conductors to final tension clamps at the insulator tension strings and release the working clamps to be removed.

The conductors will be cut with long ends for the jumper-loops (electrical connection from one section to another). After the conductors are clamped into the tension clamp the puller- tensioner that has been used as a break will now be used as a puller and re-tension the conductors close to the sag that shall be finally adjusted. Working clamps will be set by the lines-men and the same process will start according to the other side of the section.

Figure 3.12: Strain Tower, Clamping 3 Bundle Conductors - Jumper Loops Unfinished

Five (5) additional phase bundles have to be strung and pre-sagged in the same way while clamping operations are done on other phases simultaneously.

Stringing of OPGW and Earth-wire

Steel ground-wire has to be strung and pre-sagged like the conductors using a single wheel instead a pulley-block.

Installation of the OPGW shall be performed like all stringing activities. Supervisor shall confirm stringing method. Free length of OPGW, corresponding to the tower height of +10 m, shall be left onto the tension towers, to enable the connection / splicing of the optical fibre cable. This length shall be taken into account during determination of OPGW lengths in the design stage of the project. Special precautions should be taken to prevent twisting or scratching of OPGW during installation. At all times during stringing, sagging and clamping operations, the conductors, reels, drums and hauling equipment shall be effectively grounded, movable earthing (travelling grounds) shall be put onto the OPGW in front of the machines. Puller- tensioner on the pulling side has to be equipped with tensile force recorder to capture the data needed as evidence in a warranty case. Tolerable tensile forces are mentioned in the manufacturer’s documentation.

The strung wire shall be adequately grounded at the tower and shall stay grounded until finishing the construction works. All such grounds have been removed before the TLines are offered for provisional acceptance. Working personal shall be protected through the individual ground connecting on every working place.

At all times during stringing, sagging and clamping operations, the conductors, reels, drums and hauling equipment shall be effectively grounded, movable earthing (travelling grounds) shall be put onto the conductors in front of the machines and the operators stand on conductive ground mats, every third pulley-block has to be grounded to the tower.

Sagging of Conductors

When stringing is finished, final tensioning (sagging) will start. During this process, the air temperature at 5m above ground should be measured. If the day is hot, wire temperature is higher than the air temperature and this should be taken into account. The best measuring instrument is a contact thermometer. For each section the sag values will be taken out of the sag template for the specific situation. Sagging should be done by sighting and by theodolite.

To avoid loss of minimum ground clearance, the conductors shall be tensioned to a higher tension than the nominal design tension. On a stringing chart this is reflected in selecting a tension corresponding to a lower temperature. For example, when the air temperature is 30 C, the tensions/forces and sags shall be taken from the stringing chart for 20 C. This means that the conductor is over-tensioned by 10 C and this difference is called “temperature shift”.

Sagging spans shall be selected so that one span length is as close to the equivalent span as practicable. Spans shall be selected so that one is near the tension tower and one or two near the centre of the section. When sagging of all wires is finished, the wires should stay on wheels for another 24hours in order to equalize the straining on all spans (not needed if crossing is between two strain towers). Before putting the wires into suspension clamps, the sags shall be checked again. After fixing the wires into suspension clamps, suspension insulator assembly shall be in the vertical position. The spacers for the bundle conductors will be installed using line-cars or line-bicycles.

Sagging of OPGW should be done according to data from sagging templates and approved span method. The instructions of the manufacturer are to be taken into account during the installation of OPGW itself and associated equipment.

Crossing of other Transmission Lines

Scaffolds are installed to protect crossed objects during conductor stringing. Low-duty scaffolds made of wood are suited to protect or fences small structures etc. They need not to withstand the stresses due to conductor failure because the damage to objects would be limited in such an event. Scaffolds for protecting roads, railway lines, low- and medium-voltage lines, telephone-lines etc. should withstand the loads that might occur after failure of a conductor or of a connector during stringing activities, thus excluding any contact with objects under the line. In special cases, e. g. if motorways cannot be blocked for a longer period, plastic or metallic nets are in-stalled over the crossed object.

A Transmission Line will be crossed in the vicinity of Ikot Abasi Substation, namely the existing 132 kV Transmission Line from IBOM Power generating facility to Eket. This has been considered in the conceptual design.

3.13 Embankments, Levelling and Drainage

The top surface of the concrete slabs for single or raft foundations shall be slightly inclined to the outer edge to drain off water. Ditches for rain water shall surround every structure and shall be designed to drain water away from the structure (e.g. into the next available natural pond) or into a small basin erected close by.

3.14 Power Transmission Line Operations

The transmission line will be operated by PHCN. The operability philosophy is to ensure the safety requirements and avoid undue line failures by proper design for weather - lightning and wind. Additionally, the monitoring of electrical parameters and protection of the TL during operation, a quick response to emergency situations should be implementable, which is buttressed through prior training and adequate stock of replacement parts.

The operations of the transmission line should be such that the system can function or perform satisfactorily even when prevalent conditions are off-design such as component malfunction on one of the circuits and/or high electrical currents.

The various parameters that can cause system failure should be monitored in a way that they are easy to understand. Best practices are to be considered in evaluating access to and viewing of operating data, manipulation of controls, removal and replacement of equipment and components of the TL.

3.15 Maintenance

The Transmission Line will be maintained by the proponent. The TLine shall be designed to facilitate maintenance – e.g., climbing aids, use of wedge clamps instead of compression clamps, use of steel (and not copper) ground wires.

When TLine is to be maintained, the downtime should be minimal, and failed or faulty components are to be replaced as needed and expeditiously. Any component of the transmission line that appears in multiples are to be identical and from the same manufacturer. All components must be safe, of good quality, of required design capacity and readily available.

The tower structures and foundations are to be safe and easily accessible by any means employed. Access to the line (conductors, insulators and line hardware) and its accessories has to be safe and easy, but restricted to avoid undue access.

3.16 Commissioning

Commissioning shall be in accordance with national standards of the Transmission Company of Nigeria (TCN) standard 2007 edition, or latest version. The line shall be energized at full working voltage before acceptance. Approved procedures and tests shall be completed accordingly and certified.

The following Performance Tests shall be carried out:

- Measurements of tower earthing resistance
- Power losses and electrical resistance of conductors
- Line energizing test
- Other tests as defined in the national standards

3.17 Turnover

The transmission line shall be considered complete for acceptance and turnover when:

- All the material for the project has been shipped and all the installation is completed.
- The Towers, Foundation, Conductors, OPGW and accessories have been successfully tested.
- All the Mandatory Spare Parts have been delivered to the designated yard.
- The clean-up and final inspection is completed.
- All the regulatory / obligatory approvals from the designated authorities for commercial operation of lines are secured (ROW, Access roads).
- All system commissioning requirements have been completed and documented as evidenced by the approval of System Turnover Notices
- All outstanding punch list items are cleared
- All manuals, calculations, drawings, documentation, software, licenses, as-built documentation, etc. are delivered

3.18 Project Supervision and Surveillance

There will be different stages during the whole project; the first part is the engineering and then the construction activities. Therefore the surveillance or supervision is split up in these two parts.

Engineering Surveillance

The objectives of the Engineering Surveillance and Supervision are to:

- Confirm that detailed engineering complies with the Contract, and all applicable government regulations,
- Confirm that the engineering is executed according to the Quality Plan
- Assess compliance with its engineering plans and procedures,
- Verify engineering in accordance with PHCN standards and expectations expectations,
- Guide Project Team engineers conducting surveillance work,
- Outline a procedure for the initial and periodic assessment of the engineering processes and performance.

Construction Surveillance

The objective of the Construction Surveillance is to:

- Verify that the constructed facilities are according to the Contractual engineering basis (e.g., Project Specifications, Industry Standards and Codes, and applicable regional government regulations).
- Manage changes that are made at site to ensure that the design intent is not compromised and ensure that Coordination Procedures (e.g., Management of Change, Design Verification, etc.) for the site are functioning effectively.

- Guide the Site Engineering Team conducting surveillance work.
- Provide engineering expertise and oversight to support the Construction and System Completion Teams to achieve the project execution objective (e.g., safety, quality, schedule, cost, operability and handover).
- Provide a framework for defining EMDC Function and other third party involvement in site engineering surveillance.

3.19 Safety, Health, Environment and Security Issues

Particular consideration shall be given to the Safety, Health, Environment, Security (SHE&S) and Regulatory (SHES&R) of all project personnel at all stages of planning, execution and management of the project. The following sections identify how the project shall be planned to achieve SHE&S objectives, through the implementation of procedures relating to SHE&S Planning and Execution.

SHE&S is the Project's highest priorities and the responsibility of every individual associated with the Project.

The SHE&S Philosophy is:

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

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

- OHSAS18001:2007 Occupational Health and Safety Management Systems Requirements;
- ISO9001:2008 Quality management systems: Requirements
- ISO14001:2004 Environmental management systems: Requirements with guidance for use;
- Local Norms, Rules and Regulations for Health, Safety and Environmental Protection;
- Environmental Guidelines and Standards for Petroleum Industry in Nigeria, Ministry of Petroleum Resources- "Revised Edition 2002";
- Workmen's Compensation Decree/1987;
- Electrical Regulations/1988.

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

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

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

These objectives will be achieved through:

- Effective collaboration within the Project Team
- Involvement of all Project Team members as active participants in, contributors to, and owners of the process
- Ownership and stewardship by specific project team members
- Inclusion of the Program as an integral part of the culture and work processes for the Project
- Early use of construction knowledge and experience during planning and design to ensure the Construction Execution Plan is consistent with design, practical, cost effective and conforms to the overall project goals of safety, quality, cost, schedule, execution and site-management resources.
- A systematic approach for incorporating construction expertise in detailed engineering, procurement and other execution activities to:
    - Foster interface communications
    - Reduce project cost by fostering a fit-for-purpose construction philosophy
    - Forecast labor requirements, assess availability and produce proactive plans around the forecast
    - Actively promote preassembly and modularization
    - Identify and resolve issues, as well as identify and capture opportunities

Special attention shall be given to work at height and during tower erection and conductor stringing.

3.20 Fuel Transport, Storage and Dispensing Programme

Fuel shall be purchased locally at fuel stations and suppliers. Shortages in the local market shall be taken into consideration and planning shall avoid any shortage. All sorts of fuels used in TLine construction processes will be stored at specified equipment staging areas. Where practical, refueling will be conducted at the staging areas. Fuel shall be stored in special protected storage areas, such as shelters, protected against rain, with restricted personnel access, good illumination, concrete foundation and bunds to avoid any unexpected spills and soil contamination.

If refueling along the right-of-way is required, fuel will be trucked in using appropriate equipment.

Gases for welding are supplied to site in steel bottles and must be stored open air in a safe, sun protected bottle holder secured at all times by chains / restraining straps.

3.21 Site Decommissioning / Environmental Restoration

Site Clean up

Upon completion of the construction/installation and pre-commissioning tests of the proposed TL project, all work sites shall be thoroughly cleaned with the complete dismantling and removal of every temporary facility. In addition, de-vegetated areas that are not required for operations and maintenance works shall be re-vegetated

Site Decommissioning

The proposed project has a lifespan of 25 years.

Equipment and structures that are certified safe will be reused. The transmission line and facilities shall be decommissioned and abandoned in accordance with FMENV Guidelines for infrastructures with particular reference to power transmission lines as at the time of decommissioning. The transmission wires, towers and substation facilities shall be dismantled and removed from positions. Adequate re-vegetation shall also be carried out along the transmission route, access roads and substations where applicable.

Generally, decommissioning activities shall be planned and executed with a combined team to be drawn from FMENV, PHCN and other relevant bodies and/or as practiced during the time of decommissioning.

3.22 Project Waste Management Plan

A project specific waste management plan (WMP) has been developed for the transmission line project and is discussed under the WMP section in **chapter seven** of this report.

3.23 Project Schedule

The proposed transmission line construction shall be completed within 36 months. A Gnatt chart showing a schedule of activities for the project is shown in **Figure 3.13** below

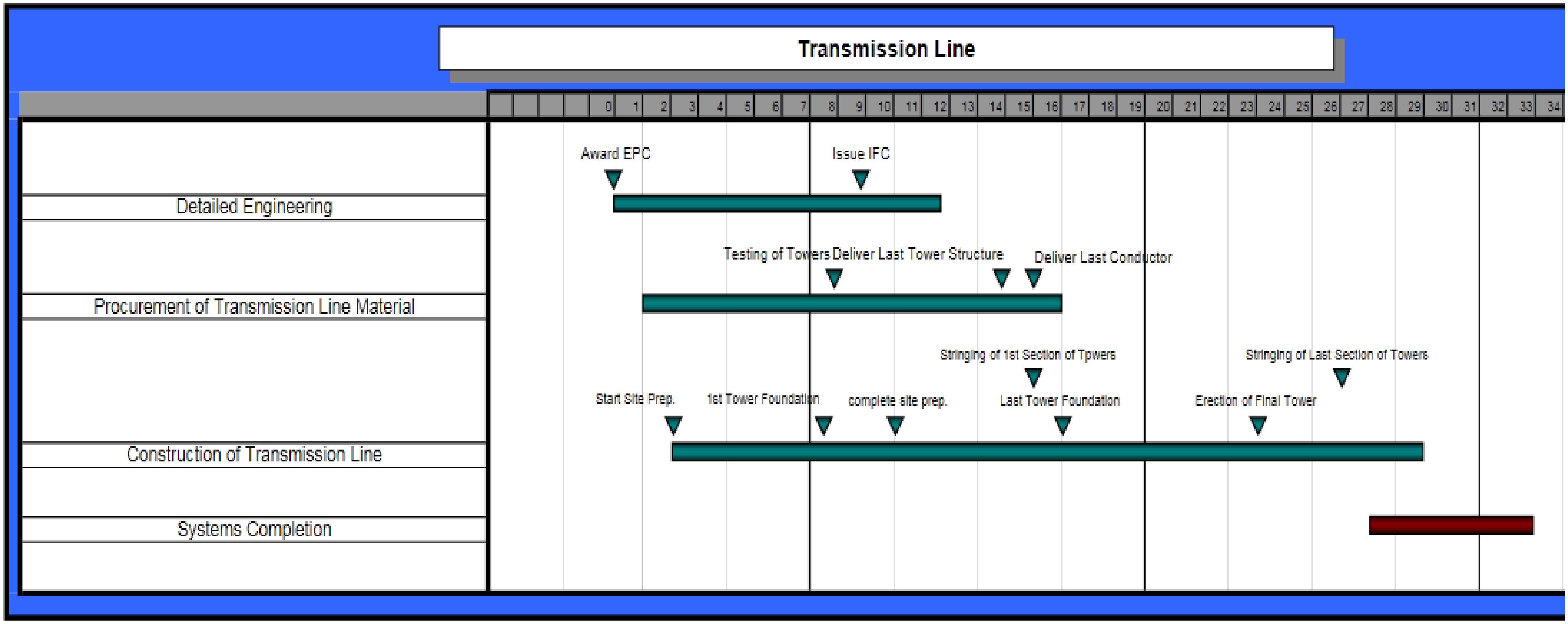
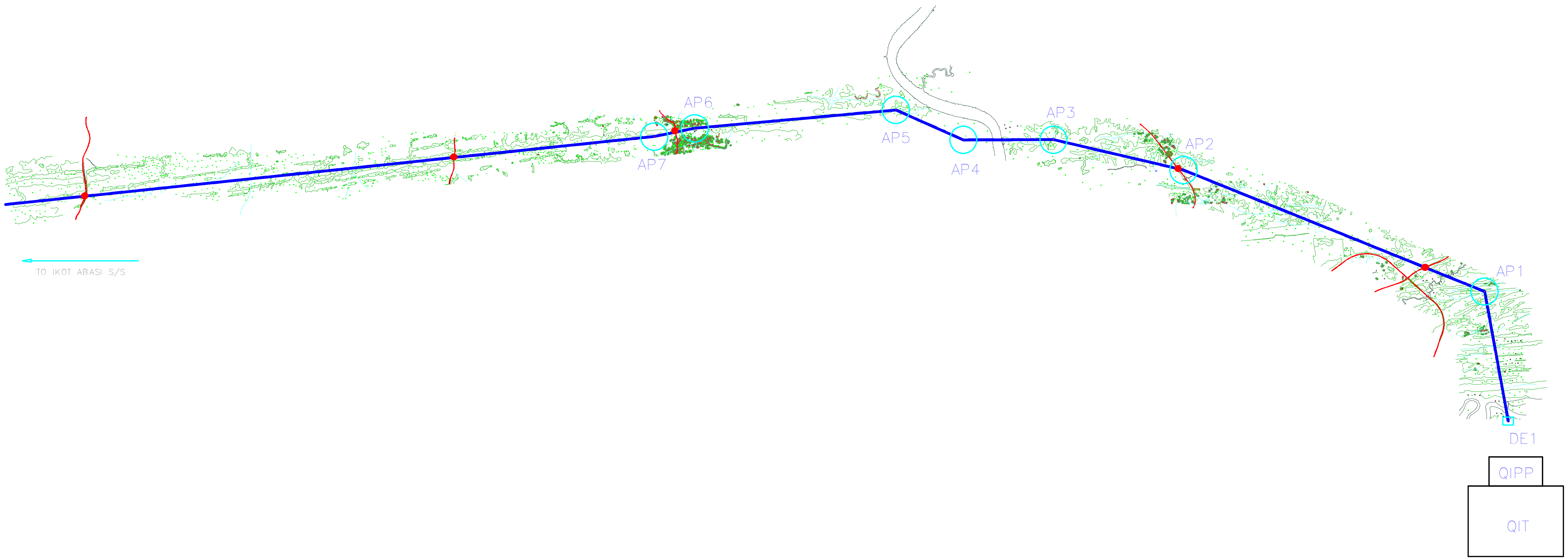


Figure 3.13: Project Schedule



%%ULEGEND

TLINE PRELIMINARY ROUTE
RIGHT OF WAY CORRIDOR

ANGLE POINT			CHAINAGE (m)	
DE1	391031	503516	0.0	UNKNOWN
AP1	390560	506112	2638.4	57° 45'59''(L)
AP2	384518	508547	9152.6	8° 47'7''(L)
AP3	381910	509157	11830.9	13° 15'34''(L)
AP4	380102	509154	13638.9	24° 0'23''(R)
AP5	378751	509753	15116.8	29° 6'29''(L)
AP6	374716	509386	19168.5	6° 21'25''(L)
AP7	373904	509220	19997.3	5° 34'36''(R)

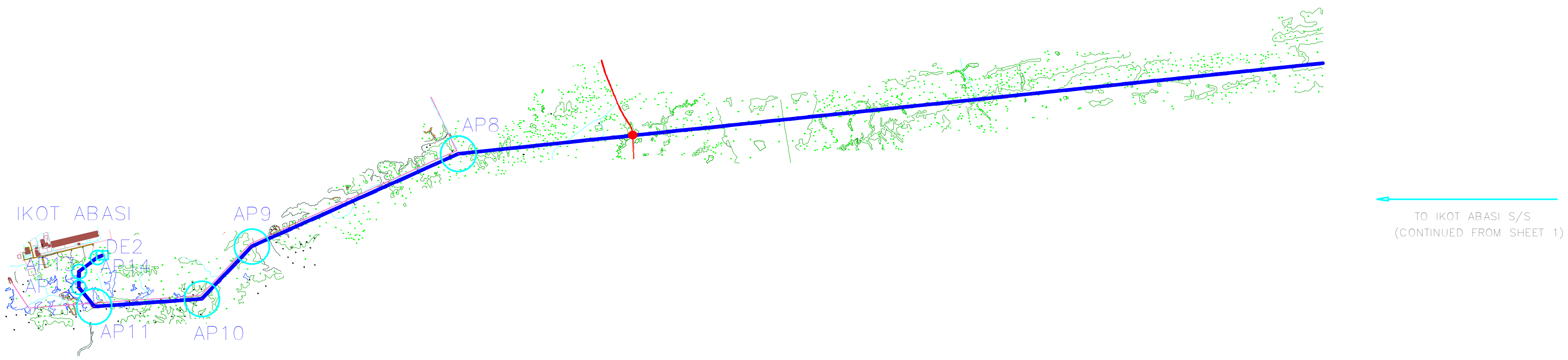
10	28.02.11	IB	ISSUED FOR USE

QUA IBOE POWER PROJECT

TRANSMISSION LINE

ELECTRICAL
PRELIMINARY TLINE CONCEPTUAL DESIGN F
ATTACHMENT 1
ROUTE OF LINE IN SCALE 1:50000 (SHEET

C658 P04500596437



%%ULEGEND

TLINE PRELIMINARY ROUTE
RIGHT OF WAY CORRIDOR

ANGLE POINT			CHAINAGE (m)	
AP8	348174	506526	45867.9	18° 10'48''(L)
AP9	344988	505097	49359.7	22° 8'52''(L)
AP10	344216	504289	50477.2	42° 14'21''(R)
AP11	342556	504171	52141.4	54° 56'8''(R)
AP12	342316	504466	52521.7	40° 17'41''(R)
AP13	342321	504712	52767.8	51° 27'9''(R)
DE2	342605	504929	53125.2	13° 38'0''(R)

10	28.02.11	IB	ISSUED FOR USE

QUA IBOE POWER PROJECT

TRANSMISSION LINE

ELECTRICAL
PRELIMINARY TLINE CONCEPTUAL DESIGN
ATTACHMENT 1
ROUTE OF LINE IN SCALE 1:50000 (SHEET

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CHAPTER FOUR

EXISTING ENVIRONMENTAL CONDITION

CHAPTER FOUR

EXISTING ENVIRONMENT

4.1 General

This chapter describes the characteristics of the ecological environment along which the proposed 58km 330kv QIT – Ikot Abasi transmission line project activities described in **chapter three** will be carried out. The socio-economic profiles of the communities closest to the proposed project are also presented in this chapter.

The discussion below describes the environment in the study area in terms of prevalent:

- **Physical and chemical environment**, e.g., meteorology, geology, sediment type distribution, surface water characteristics etc;
- **Biotic environment**, geographical location and distribution of e.g., plankton, benthos, fish, birds, vegetation and wildlife etc;
- **Socio-economic and health conditions,** of communities close to the project activities (describes the demographic structure, culture, social and economic health conditions as well as results of consultation processes within the communities during the EIA studies).

The summary of conditions (baseline) presented in this chapter is based on information from literature as well as findings of a two season field sampling programme, laboratory analyses and socio-economic and health surveys specifically for this EIA. The data acquired will be used in the project design, operation and in making general management decisions as well as in the assessment of the potential and associated impacts of the proposed project activities on the host environment (ecological and socio-economic).

4.2 Baseline Data Acquisition methods

Baseline data acquisition involved a multidisciplinary approach and was executed within the framework of Fugro Nigeria Limited (FNL) management system approach. Elements of this approach include literature research, designing and development of field sampling strategy to meet regulatory requirements; confirmation of the sampling design and locations by PHCN; pre-mobilization activities (job hazard analysis, sampling equipment/materials calibrations and checks) and mobilization to field; fieldwork implementation, sample collection (including field observations), handling, documentation and storage protocols and procedures, demobilization from field, transfer of sample custody to the laboratory for analysis. A detailed description of baseline data acquisition including sample collection and handling methodologies and laboratory processes are presented in **Appendix 4.1**.

4.2.1 Literature Research

This was carried out prior to field data gathering campaign in order to obtain relevant background information on the soil, water, and air of the study area. Further research was also conducted at the end of the field data gathering exercise in order to compare literature information with generated field data and for additional information on the study area. Generally, literature research involved consulting relevant textbooks (e.g Edmunds, J. 1978; Prescot et al., 1999), research environment as well as technical presentations. Specific examples of previous studies consulted in generating comparative based data for describing the existing environment of the project area include but not limited to the following:

- Environmental Impact Assessment of Ibom Power Plant (2005): Ibom Power Company Limited.
- Environmental Impact Assessment of 46km Ikot Abasi – Eket Transmission Line (2005): Ibom Power Company Limited.
- Environmental Impact Assessment of Qua Iboe Field Development Project (2005): Network E&P Nigeria Limited.
- Environmental Impact Assessment of 78km Ikot Abasi – Ikot Ekpene Transmission Line (2007): National Inteegrated Power Project.

4.2.2 Environmental Field Survey

In order to effectively characterize the ecology of the study area, a two season comprehensive field data gathering exercise was carried. The wet season field exercise was carried out between August 4th and September 9th 2011, while the dry season field exercise was between the November 11th and 15th December 2011. The overall goal of the field exercise was to generate environmental baseline data that would be sufficient to characterize the ecological, socio-economics and health status of the project area and provide sound basis for the EIA of the proposed project. The specific objectives and scope of the fieldwork ensured that all aspects of the environment within the project area were completely characterized.

Sampling Design

The sampling design and methods were selected in the context of the project objectives, relevant (FMENV, 1995, ASTM 2005, etc.) regulations and guidelines, environmental sensitivities, and with consideration to expected surface, sub-surface / geologic conditions, access constraints and local equipment availability and costs.

The QIT – Ikot Abasi field sampling design is in line with the FMENV guidelines for EIA. A total of 23 (SS1 to SS23) sampling stations were designated for samples collection. These stations were distributed to adequately cover the entire study area (**Attachment I).** The coordinates of sampling stations, sampling requirements and codes are presented in **Table 4.1**.

Table 4.1: Sampling Co-ordinates and Requirements

Station	X	Y	Requirement
SS1	8.017689	4.5547	soil, air quality, surface water, sediment, plankton, benthos and vegetation/wildlife
SS2	8.014072	4.574551	soil
SS3	8.00702	4.580751	soil, air quality, surface water, sediment, plankton and benthos
SS4	7.975522	4.593437	soil
SS5	7.951704	4.601806	soil
SS6	7.926443	4.605578	soil, air quality, surface water, sediment, plankton, benthos and vegetation/wildlife
SS7	7.903185	4.610608	soil
SS8	7.877946	4.608265	soil
SS9	7.855727	4.605264	soil
SS10	7.830177	4.602537	soil, air quality and vegetation / wildlife
SS11	7.804106	4.599754	soil
SS12	7.781543	4.597345	soil
SS13	7.755541	4.594568	soil, air quality and vegetation / wildlife
SS14	7.73346	4.592209	soil
SS15	7.707511	4.589435	soil
SS16	7.685672	4.5871	soil, air quality and vegetation / wildlife
SS17	7.660048	4.58436	soil
SS18	7.634816	4.58166	soil, air quality
SS19	7.606547	4.570064	soil, air quality, surface water, sediment, plankton and benthos
SS20	7.591482	4.565826	soil, air quality, surface water, sediment, plankton and benthos
SS21	7.581876	4.565826	soil
SS22	8.017601	4.55901	soil
SS23	7.578101	4.566132	soil, air quality and vegetation / wildlife

During the sampling exercise, field observations were made and documented in field notebooks and still photographs (details of these are presented in subsequent sections of this chapter). Features observed include water and soil characteristics, biodiversity, and socio-economic setting. The environmental components sampled include soil, surface water, sediment, air, and biodiversity and socio cultural features.

Soil sampling stations were established to ensure the major soil types that characterize the TL corridor were adequately covered. Also surface water and sediment sampling as well as hydro-biological studies were carried out in line with applicable procedures. Air quality / noise were sampled along chosen sensitive sampling points. Furthermore, socio-economic and health surveys were conducted within identified host communities along the TL corridor in all six affected local government areas (LGA) in Akwa Ibom State (details of the sampling methodology are presented in **Appendix 4.1**, Overall, sampling in 23 soil stations, 5 surface water / sediment stations, 10 air quality / noise level stations as well as socio-economic, health and public consultations in six (6) Traditional Ruling Councils, nine (9) Clan Councils and fifty (50) Villages.

Sampling Location

The various sample stations (on land and water) were located by the aid of hand held Global Positioning System (GPS). The sampling points were logged into the GPS prior to mobilization.

Sampling Procedures

Sample collection was done in line with recommended procedures and practices for environmental data collection in Nigeria. An overview of sampling procedures for each parameter and observation made are discussed in the following sub-sections (see **Appendix 4.1** for more details).

Vegetation

A reconnaissance survey provided insight into the selection of appropriate location, number, size, position and orientation of the transects. The study was conducted in the 6 belt transects, 1000m x 10m = 10,000 m^2, each. Transects were established at intervals of approximately 10 km, alternating on the right and left flanks of the proposed route and including, as much as possible, all vegetation types along the proposed route

Within each transect the associated vegetation was characterized using the segmented belt transect techniques (Oosting 1956; Odu *et al*, 1985; Okpon *et al* 1998), to ensure maximum chances of finding most of the component species in the area. Blocks of 5m x 5m were laid on randomly chosen sides of each transect for detailed studies. Such alternately spaced observation points which cover the entire area as demarcated by these transects are generally more efficient statistically, than the contiguous or 100% assessment on smaller length of transect (Odu, *et al* 1985). Among the parameters investigated in each transect were floristic composition, community structure, relative density and percentage frequency of occurrence, maximum tree height (using an altimeter), stocking density, pathological conditions and percentage litter cover. For each transects, there followed photographic records of representative segments.

After assessing the general condition and status of the vegetation, all the plant species were, as much as possible, identified and listed on the field. The taxonomically difficult forms that could not be identified with certainty were collected with a secateur (including the twig, flower, fruits, etc.), properly labeled and taken to the Herbarium, Rivers State University of Science & Technology, Port Harcourt, in black polythene bags, for further keying and identification. All identification followed the keys of Hutchinson and Dalziel (1968) and Keay *et al* (1964) for trees, and Akobundu and Agyakwa (1998) for weeds.

Wildlife

Studies on the wildlife diversity occurring along the proposed transmission line were conducted between 7am and 6.00pm local time by a consortium of herpetologists, ornithologists and mammalogists. Thus, various conventional techniques; both direct and indirect methods (Moshby 1974; Dasmann 1964; Sutherland 2000; Davies 2002, etc) were adopted. Pricipal objectives were to produce a comprehensive checklist of fauna, determine their distribution and conservation status (prior to commencement of the project), against which future changes and magnitude of change in wildlife populations would be detected. Considering the dependence of wildlife on vegetation for shelter, food, perching, nesting site, etc, sampling stations were established along vegetation transects.

Critical habitats and microhabitats such as log, litter, forest undergrowth, crevices and burrows were ransacked with the aid of 1m long probe to dislodge any hiding herpetofauna and mammals (Heinen, 1992). To increase the chances of sighting wild animals or their evidence of presence, the search was carried out radially, along the northern, southern, eastern and western axis of each transect. With respect to amphibians, Visual Encounter surveys (VES), Dip-netting (DN), Acoustic encounter surveys (AES), were applied, while Pitfall traps with drift fence were used for reptiles, and ground-running mammals such as rodents (in the way of Heyer, et al, 1994; Rodel and Ernst, 2004, Nago et al, 2006, and Akani, 2008).

Each transect was sampled for about two hours, five times (once in two days) during the period, between 7am and 6pm local time.

All dislodged and sighted animal were identified to possible taxonomic levels, using the exquisite field guides and Keys of Happold (1987), Kingdon (1997), and Powell (1995) for mammals; Peterson (1980) and Borrow and Demey (2001) for birds; Branch (1988) and Spawls and Branch (1995) for reptiles; and Schiotz (1963,1969), and Rodel (2000) for amphibians. When and wherever possible, photographs were taken to demonstrate field observations.

Further information on diversity and conservation status of wildlife in the prospect area were acquired from (i) biodiversity reports of tertiary institutions and forestry departments in Akwa Ibom state, (ii) previous biodiversity reports of environmental assessments within the area and of similar habitats (iii) through inspection of animals displayed for sale in bushmeat markets at Onna, Mkpat-Enin and Ikot Abasi areas etc. and (iv) by interviewing hunters concerning the variety of wildlife captured in the area, local names, dates of last kill or sighting, sites of high faunal density, seasonal abundance, hunting techniques and degrees of success. At their homes hunters were urged to present for examination and identification any preserved animal remains or trophies such as – skin, skull/skeleton, horn, hoof, scale, shell, etc - in their bags, caught in the area, as well say the last time they sighted or killed each animal discussed.

Soil

Composite soil samples were collected at designated soil stations with the aid of hand auger. Samples were collected from 0-15cm and 15-30cm depth at each sampling point. Sub-samples for microbial analysis were taken in sterilized 100ml McCartney bottles and stored in a cool box. Samples for physico-chemical parameters were stored in polythene bags. Details of sampling approach and procedures are documented in Appendix 4.1.

Surface water / Sediment

Surface water samples were gotten from the river surface using a beaker. The beaker was lowered into the river, and water was drawn to the surface. Water samples were transferred directly into appropriate containers for preservation and subsequent analysis. In-situ analyses were immediately carried out to determine the following parameters with short holding time; pH, turbidity, conductivity, total dissolved solids and dissolved oxygen. Water samples for heavy metal analysis were collected in 2ml plastic bottles and acidified with 10% HNO_3.

Sediment samples from the river bed were collected in corresponding surface water stations along the transmission line route using an Eckman grab (ASTM 2005).

Zooplankton samples were collected by dropping and pulling plankton net with mesh size of 0.063mm vertically on the surface of the river. A weight (iron rod) was attached to the cord holding the net; it was lowered into the river and then pulled back to the surface for collection.

Phytoplankton sample collection was done by lowering the plankton net to about 0.5m on the water surface and towed (horizontally) on the waterway at a speed of about 1.5knots per hour for 5 minutes.

Benthic macro fauna samples were obtained by washing residual sediment samples through a 1 mm-mesh sieve using water obtained from the river on board the sampling boat. The benthos samples obtained were placed in a plastic container and preserved in 20% buffered formal saline and stored in the ice coolers.

Air Quality / Noise

Air quality and ambient noise studies were conducted at 10 desiganated air quality / noise stations along the proposed transmission line route. Measurement methods and principles adopted for each parameter were based on sensitivity, stability, repeatability and capability for calibration during analysis. The methods adopted for ambient air quality measurements along the study area are tabulated below.

S/N	Parameter	Measurement Method
1	Suspended Particulate Matter (SPM)	In situ source pointer probe (Aerocet)
2	Volatile Organic Compounds (VOC)	In situ PID probe
3	Hydrocarbons (CxHy)	In- situ Protassen probe
4	Hydrogen Sulphide (H_2S)	In- situ Protassen probe
5	Nitrogen Oxide (NO_x)	Ogawa pad absorbents
6	Nitrogen Diooxide (NO_2)	Ogawa pad absorbents
7	Ammonia (NH_3)	Ogawa pad absorbents
8	Sulphur Oxide (SO_x)	Ogawa pad absorbents
8	Noise	Pulsar II Leq / percentile frequencies

Socio-economics / Health Studies

Socio-economic and health assessment involves studying affected host communities in the six identified LGA (Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot – Abasi). Information on socio-economics and community health data was acquired using household questionnaires as well as other relevant socio-economic and health survey tools (**Appendix 4.7**). Key informant interviews and focus group discussions, physical evaluation of health status as well as consultations with the various sections of the host communities provided relevant information on socio-economics and health profile of the area.

Laboratory Analysis

Laboratory analysis was generally in line with international American Society for Testing and Material (ASTM) and American Public Health Association (APHA) as well as FMENV Standard protocols. Quality Assurance/ Quality Control (QA/QC) measures adopted for laboratory analyses are in Accordance with FMENV recommendations. Other QA/QC measures adopted are:

- the use of trained personnel at all phases of the study;
- written analytical standard operating procedures were followed during analyses and
- routine auditing and checking of analyses results, including control solutions and mid-point standards, were introduced into every batch or ten samples as applicable, and analyses for which deviation of these quality control / mid –point standards are outside 90 to 110% of expected value were repeated.

A summary of data collection and analytical methods together with test equipments employed for the study are shown in **Table 4.2** below, while discussions and details are provided in **Appendix 4.1**.

Table 4.2: Ecological Components, Analytical Methods and Test Equipment

Sample Matrix	Parameter	Test Method	Test Equipment
Water	pH	APHA 4500H+B	multi 340i/set Meter
Water	Temperature (oC)	APHA 2550B	multi 340i/set Meter
Water	Chloride	APHA 4500 Cl^-	Titration
Water	Nitrate	EPA 352.1	Uv/ Visible light
Water	Sulphate	APHA 4500-SO^4	Uv/ Visible light
Water	Magnesium	APHA 3111B/ASTM D 3561	FAAS
Water	Potassium	APHA 3111B/ASTM D 3561	FAAS
Water	Sodium	APHA 3111B/ASTM D 3561	FAAS
Water	Calcium	APHA 3111D	FAAS
Water	Cadmium	APHA 3111B	FAAS
Water	Total Chromium	APHA 3111C	FAAS
Water	Copper	APHA 3111B	FAAS
Water	Total Iron	APHA 3111B	FAAS
Water	Lead	APHA 3111B	FAAS
Water	Nickel	APHA 3111B	FAAS
Water	Zinc	APHA 3111B	FAAS
Water	Silver	APHA 3111B	FAAS
Water	Manganese	APHA 3111B	FAAS
Water	Mercury	APHA 3112B	AAS / Hydrite unit
Water	Vanadium	APHA 3111D	FAAS
Water	salinity	APHA 2520	multi 340i/set Meter
Water	DO	APHA 4500-OG	multi 340i/set Meter
Water	Turbidity	APHA 2130B	Dr / 890 colorimeter
Water	Redox Potential	ASTM D1498	HANNA Multimeter
Water	TOC	BS 1377	Titration
Water	TDS	APHA 2510A	multi 340i/set Meter
Water	TSS	APHA 2540D	Gravimetry
Water	BOD_5	APHA 5220D	WTW oxitop
Water	COD	APHA 5220D	Titration
Water	Total Hardness	APHA 2340C	Titration
Water	Oil & Grease	ASTM D 3921	FTIR
Water/Soil/Sediment	BTEX	EPA 8240	GC/MS
Water	Microbiology	ASTM D5465-93	Microscope
Water	Zooplankton	APHA 10200 G	Counting (microscope)
Water	Phytoplankton	APHA 10200 F	Counting (microscope)
Soil/Sediment	pH	ASTM D 4972	multi 340i/set Meter
Sediment	PSD	ASTM D 422	Hydrometer / water bath
Soil/Sediment	All heavy metals	USEPA 6200	XRF
Soil/Sediment	Extractable Sulphate	CAEM/APHA 4500 SO_4^{2-}E	UV /visible spectrphoto
Soil/Sediment	Extractable Phosphate	CAEM/APHA 4500 PD	UV /visible spectrphoto
Soil/Sediment	Microbiology	ASTM D5465-93	Microscope
Sediment	Macrobenthos	APHA 10500C	Microscope
Soil/Sediment	TOC	BS 1377	Titration
Soil/Sediment	THC	ASTM D 3921	FTIR
Soil	Microbiology	ASTM D5465-93	Microscope
Assessment Methods			
Vegetation	floristic composition, relative density and percentage frequency etc	Segmented belt transect techniques	As required
Wildlife	checklist distribution & conservation status	Direct and indirect methods	As required
Socio-economics & health	Socio-economic and health status of affected communities along the route	Sampling procedure based on convenience samples. Primary (FGD, GGD, IDI), secondary (literature research)	As required

Source: FNL Laboratory 2010;
FAAS – Flame Atomic Absorption Spectrophotometer, GC – Gas Chromatography, UV – Ultra violet / Visible Spectrophotometer, ASTM = American Society for Testing and Material (1999 Edition), APHA = American Public Health Association (20th Edition 1998), EPA = Environmental Protection Agency (2nd Edition 1996), BS = British Standard, CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989, FGD = Focus Group Discussions.

4.3 Description of Ecological Baseline Conditions

Ecological baseline conditions studies covered climate / meteorology geology, and hydrology, as well as surface water, soil and sediment physical, chemical and biology characteristics.

4.3.1 Climate and Meteorology

An overview of the climate and meteorological data (relative humidity, ambient air temperature, rainfall and wind) of the study area are presented in the subsequent sections. Climatic and meteorological information described are primarily on literature/desktop research and climatic data information obtained for Uyo Town from Nigerian meteorological Agency (NIMET) as well as MPN Qua Iboe Terminal (QIT) Meteorological Observations.

The study area which is in the Niger delta region of Nigeria, is situated in the tropics and experiences a fluctuating climate which is characterized by two distinct conditions of wet and dry seasons. The wet season occurs between April and October with a brief break in August, while the dry season occurs between November and March.

4.3.2 Air Temperature

Temperature is a dominant climate factor that varies from place to place over a period of time at a given location. The spatial distribution of temperature over the earth is influenced by; amount of insulation received, nature of surface, distance from water bodies, relief, nature of the prevailing winds and ocean current.

The minimum mean annual temperature (lowest temperature measured for a day) is given as 21^{0}C, while the maximum mean annual temperature (highest temperature measured for a day was 35^{0}C. Data on average air temperature obtained for the area (between 1991 and 2009) is presented in **Figure 4.1**.

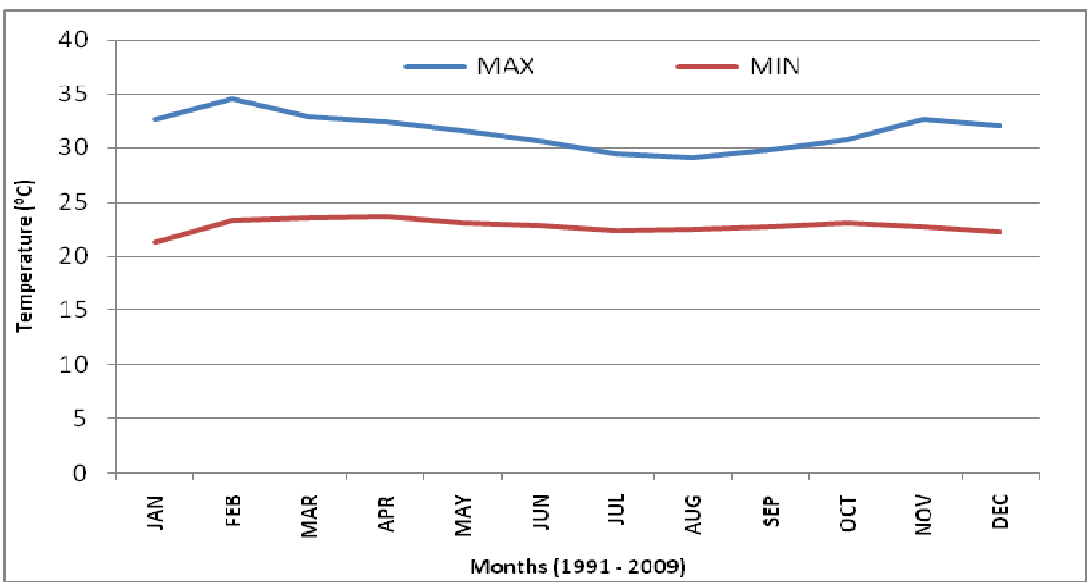


Figure 4.1: Minimum and Maximum Temperature

Ambient Air Temperature

Ambient air temperature values measured (range of 22-27^{0}C) for both seasons were slightly higher than the minimum values obtained from NIMET and QIT, but were lower than the maximum values. The temperature measured in-situ is presented in **Table 4.3.**

Table 4.3.Ambient Air Temperature

Parameter	Sample Station Result									
	Wet Season									
	SS1	SS3	SS6	SS10	SS13	SS16	SS18	SS 19	SS20	SS23
Ambient Temperature (^oC)	22.4	23.5	25.4	27.9	24.5	25.4	24.3	26.0	25.3	25.4
	Dry Season									
	26.4	25.4	27.4	30.0	30.1	30.0	31.4	33.2	31.0	30.1

Source: FNL Field Survey 2011

From the results of ambient air temperature measurements, it is observed that there were recorded differences along the sampling stations. This can be attributed to the seasonal regimes of the area (the cool and rainy wet season characterised by low temperature values and the dry and often hot dry season characterised by higher temperatures).

4.3.3 Relative Humidity

Relative humidity is popularly used to measure air humidity. The recorded value for the study area indicated high relative humidity in the early hours and evening time. This could be attributed to: occurrence of cloud cover; and influence of the south-west trade winds which dominate the area (Derek and Oguntoyinbo, 1987).

Average relative humidity values obtained from NIMET and QIT a period of 1991 - 2009 is presented below in **Figure 4.2**.

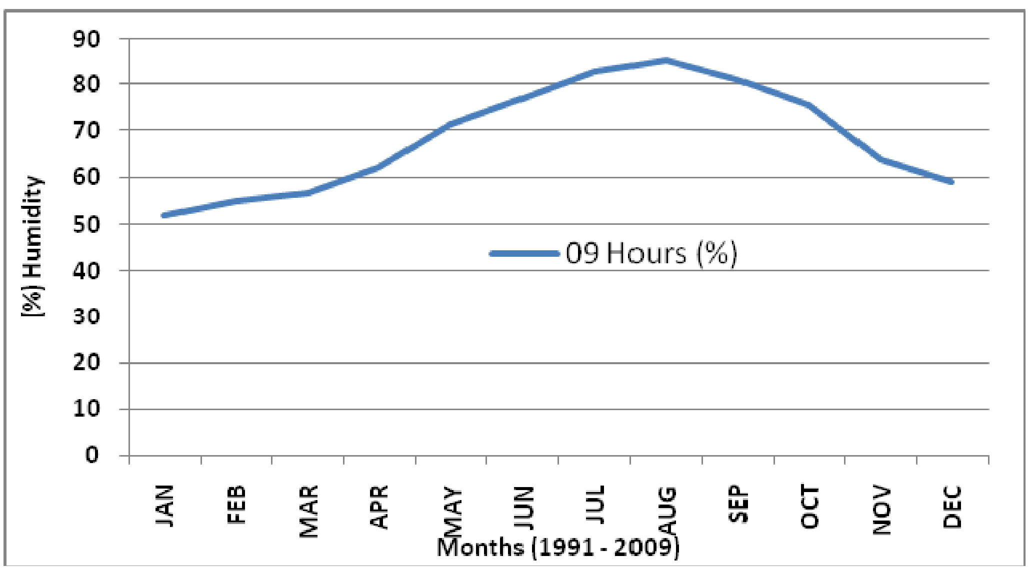


Figure 4.2: Relative Humidity

Average RH values from the figure above ranges from 52 to 85%. This percentage is typical of the Niger-delta regional humidity.

4.3.4 Rainfall

The hydrological cycle depends fundamentally on the inter-relationship between the circulation of the ocean, terrestrial water bodies and the atmosphere. Water is withdrawn from these water bodies into the atmosphere by the process of evaporation which is dependent on factors such as air/ temperature, wind strength and humidity.

Rainy season commences in the study area around April and extends to October with June as the peak month, while the dry season occurs between November and March, reaching its peak in January when the harmattan wind sweeps across the entire area (Ayoade, 1988). Rainfall data obtained from NIMET over a period of 1991 – 2009 shows the same pattern as shown in **Figure 4.3.**

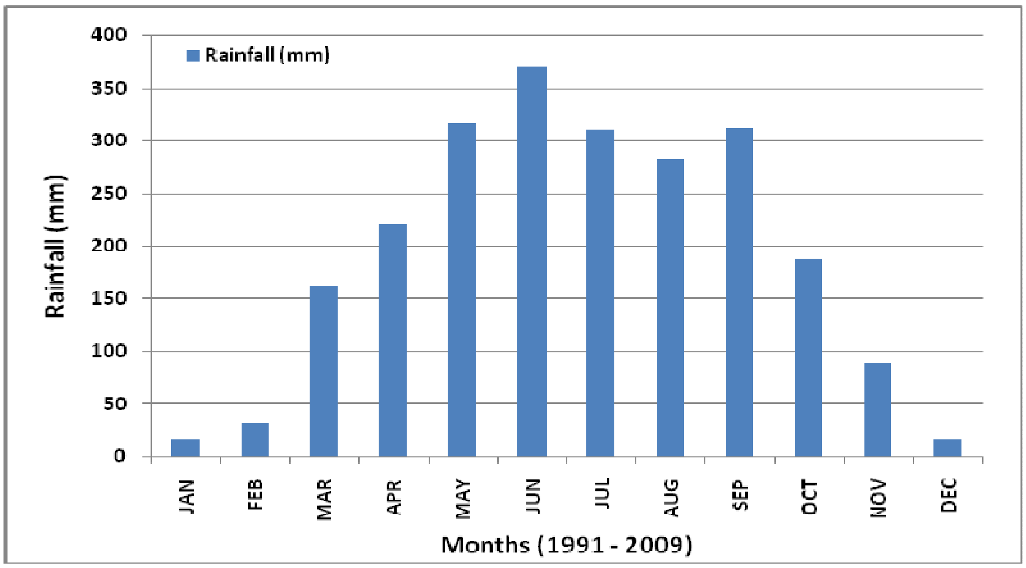


Figure 4.3: Rainfall

Steady increase in rainfall was noticed from March till June, followed by a sharp drop in July - August which regained impetus between September and October (wet season), and a steady decline from November to February which coincided with the dry season period.

4.3.5 Wind

The average wind speed data obtained for from NIMET (Uyo) over a period of 1991 - 2009 is given as 4Knots **Figure 4.4**.

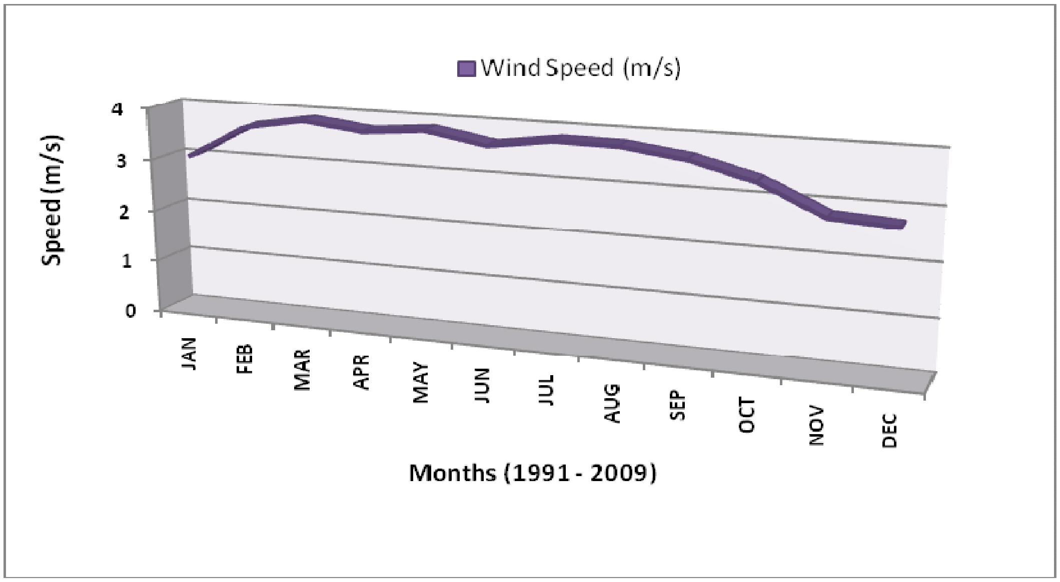


Figure 4.4: Wind Speed

The study area is characterized by two major winds: (North –easterly and South- easterly) separated by a continuous belt of low pressure called Equatorial Trough, also known as inter Tropical Convergence Zones (ITCZ). The North-easterly trade wind blows from the northeast in the Northern hemisphere bringing harmattan to the region between December and March, while the South-easterly wind comes from the southeast in the Southern hemisphere, bringing rainfall for most part of year.

The strongest winds (referred to as the South-West Trade Winds), with mean monthly speed of about 5 m/s and the weakest Winds (referred to as the North-East Trade Winds), with mean monthly speed of about 2.5 m/s, occur in the wet and dry seasons respectively.

4.4 Air Quality Characteristics

Air makes up the Earth's atmosphere-the gaseous envelope surrounding the Earth-and represents a mixture of several gases up to altitudes of approximately 90 km, fluctuating winds and general atmospheric turbulence in all directions keep the air mixed in nearly the same proportions.

Air pollution is a major environmental health problem affecting developed and developing countries around the world. Increasing amounts of potentially harmful gases and particles are being emitted into the atmosphere on a global scale resulting to effects on human health and the environment. It is therefore important to establish the ambient atmospheric condition of an area prior to development in order to monitor any changes.

The ambient concentrations of the air pollutants (SPM, SOx, NOx, NO_2, VOC, CxHy, H_2S and NH_3) measured in the study area are presented in **Table 4.4**. Generally, recorded measurements indicated that the ambient air was free from pollution by these measured parameters as at the time of study as well as compared well with national limits for air quality standards.

Table 4.4: Ambient Air Quality Characteristics

Parameter	Sample Station Result											WHO Limits	FMENV Limits
	SS1	SS3	SS6	SS10	SS13	SS16	SS18	SS 19	SS20	SS23	Mean		
SPM (mg/m^3) Wet	0.048	0.031	0.021	0.029	0.025	0.028	0.028	0.058	0.024	0.021	0.03	0.10-0.25	0.25
Dry Season	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.03	0.023		
Temperature (^oC)	22.4	23.5	25.4	27.9	24.5	25.4	24.3	26.0	25.3	25.4	25.01	NL	NL
	26.4	25.4	27.4	30.0	30.1	30.0	31.4	33.2	31.0	30.1	29.5		
RH (%)	82.4	87.3	87.5	74.6	85.4	86.0	86.4	78.0	86.4	87.5	84.15	NL	NL
	69.0	89.3	89.7	69.7	69.8	64.8	65.9	64.8	74.3	74.3	73.16		
VOC (ppm)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NL	0.06
	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01		
C_xH_y (%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NL	NL
	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01		
H_2S (ppm)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.15	NL
	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01		
NO_x (ppm)	<0.00001	0.00144	NA	<0.00001	<0.00001	0.00047	<0.00001	NA	<0.00001	0.00062	0.00026	0.04	0.04-0.06
	<0.00001	0.00062	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000071		
NO_2 (ppm)	<0.00001	<0.00001	NA	0.00015	<0.00001	0.00023	<0.00001	NA	<0.00001	<0.00001	0.0004	0.04	0.04-0.06
	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001		
NH_3 (ppm)	<0.00002	<0.00002	NA	0.00009	<0.00002	0.00018	<0.00002	NA	<0.00002	<0.00002	0.00004	25	0.0002
	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	0.00002		
SO_x (ppm)	0.00153	0.00069	NA	0.00176	0.00262	0.00267	0.00156	NA	0.00053	0.00222	0.00136	NL	0.01
	0.00082	0.00044	0.00030	0.00070	0.00120	0.00185	0.00055	0.00028	0.00037	0.00180	0.00083		

Source: FNL Field Survey 2011
NL: No Limit

	Dry Season Data		Wet Season Data

Suspended Particulates

Particulates are tiny solid or liquid particles in the air. These particles are seen as smoke or haze. Other pollutants as gas or vapour are not visible except in the case of nitrogen dioxide which is a brownish gas. Particles may carry any or all of the other pollutants dissolved in or adhering to their surfaces (Bernard 1990). Particles raging from aggregate of a few molecules to pieces of dust, readily visible to the naked eye are commonly found in the atmosphere. High concentrations of suspended particulate matter (SPM) are known to irritate the mucous membranes and may initiate a variety of respiratory diseases. Fine particulates may cause cancer and aggravate morbidity and mortality from respiratory dysfunctions (CCDI, 2001).

The mean SPM levels recorded in the study was 0.03 mg/m^3 for the wet season and 0.023 mg/m^3 for the dry season. This value was within the FMENV guideline (daily mean of hourly values) concentration of 0.25 mg/m^3. The proposed transmission line project may result in exhaust emission during the constructions and mobilisation phases, which may lead to increase in SPM levels of the area.

Sulphur Oxide

It is also produce from the combustion of sulphur-containing fuels, smelting, and manufacture of sulphuric acid, incineration of refuse as well as production of elemental sulphur. The gas is known to be a harsh irritant, and is capable of aggravating asthma, bronchitis and emphysema. It can also cause coughing and promote impaired functions in the human system (CCDI, 2001).

Also sulphuric acid aerosols (formed from dissolved sulphur dioxide) will readily attack the insulators to be installed on the towers, especially those containing carbonates such as marble, limestone, and mortar. This might pose a problem to the proper functioning of the transmission line in areas with high concentrations. Recorded values were however, consistent with their natural environment and compared well with the FMENV limits for air quality pollution.

Nitrogen Oxides

Nitrogen oxides are a family of highly reactive gases called nitrogen oxides or oxides of nitrogen, which are formed during combustion processes. Nitrogen oxides (NOx) are produced from natural sources, motor vehicles and other fuel combustion processes in the air to produce photochemical smog.

NO_2 results when fuel is combusted at high temperatures and occurs mainly from motor exhaust and stationary sources such as electric utilities and industrial boilers (SIEP, 1995). It is the only oxide of nitrogen that has been shown to have significant human health effects, with exposure to concentrations higher than 0.5ppm (1mg/m^3) triggering changes in pulmonary function in human health (SIEP, 1995). NO_2 levels in the study area for both seasons were generally below equipment detection limit and compliant with FMENV regulatory limit for human exposure.

Hydrocarbons

Hydrocarbons (CxHy) are organic compound consisting entirely of carbon and hydrogen, they can be straight-chain, branched chain, or cyclic molecules. They are mainly grouped into aliphatic and aromatic organic compounds. The majority of hydrocarbons found naturally occur in crude oil, where decomposed organic matter (fossil) provides an abundance of carbon and hydrogen which when bonded can catenate to form limitless chains.

Hydrocarbon vapour in the atmosphere arises from fugitive emissions, vents organic chemical production, and distribution of natural gas, transportation and processing of crude oil. Others are incomplete combustion of fuels, particularly where fuel to air ratios are too high. Most members of this group are significantly toxic and exposure to high concentrations in the atmosphere (about 100ppm or more) could result in interference with oxygen intake (Canter, 1977) and acute leukaemia (SIEP, 1995). Hydrocarbon concentrations were below equipment detection limit of <0.01% for both seasons in the study area. This implies that the atmospheric environment is free of hydrocarbon pollution.

Hydrogen Sulphide

Hydrogen sulphide (H_2S) is a toxic, odorous and corrosive gas, which is rapidly oxidized to SO_2 in the atmosphere. Its presence in the atmosphere could result from storage tank and process vents. Exposure to concentrations in excess of 500 ppm can be fatal (SIEP, 1995). Data indicates that exposures to even relatively low concentrations of H_2S are hazardous.

The recorded level of H_2S within study area was below equipment detection limit of <0.1ppm for both seasons indicating absence of the pollutant gas.

Ammonia

Ammonia is a colourless, pungent gas that is highly soluble in water. It is an important by-product of the manufacture and combustion of fuel gases. Ammonia is found in trace quantities in the atmosphere, being produced from the putrefaction (decay process) of nitrogenous animal and vegetable matter.

Ammonia is used to scrub SO_2 from the burning of fossil fuels, and the resulting product is converted to ammonium sulphate for use as fertilizer. Ammonia neutralizes the nitrogen oxides (NOx) pollutants emitted by diesel engines.

The recorded level of NH_3 within the study area for both seasons were generally below equipment detection limit and compliant with the FMENV regulatory limit of 0.0002ppm.

4.4.1 Noise Characteristics

Noise is a periodic fluctuation of air pressure. The range of sound pressures encountered is very large and to keep numbers in manageable proportion, noise levels are measured in decibels (dB), which has a logarithmic scale.

In addition to causing disturbances, excessive noise can damage health and have physiological effects. Environmental noise concerns in the study area are related to disturbances to personnel and terrestrial life. Effects on personnel generally relate to annoyance / nuisance and negative effects on health caused by both short and long-term sound levels. Prolonged exposure to noise frequencies higher than regulatory limits can either cause temporary hearing loss (temporary threshold shift), which disappears in a few hours or days, or permanent loss (permanent threshold shift) SIEP, 1995). Noise can also be stressfull and cause stress related damage on health. Disturbance of terrestrial life (fauna) by noise may be of significance particularly where noise sensitive species are present. The major source of noise expected in the study on course the proposed project will be generated by automobile engine, noise producing work equipment, human noise and noise from other mechanical equipments and processes.

The mean energy equivalent sound level (Leq) as well as the other noise percentile levels (L_{10}, L_{50} and L_{100}) along the sampling stations showed seasonal variations which may be attributed to meteorological factors such as wind intensity (see **Table 4.5**). However mean noise levels are in line with reported values for the area and conducive for human health.

Table 4.5: Noise Levels Along Study Area

Parameter	Sample Station Result										Mean
	SS1	SS3	SS6	SS10	SS13	SS16	SS18	SS 19	SS20	SS23	
Wet Season - Noise dB(A)											
Leq	68.8	-	53.4	59.3	38.5	50.1	35.6	47.8	46.1	53.4	50.3
L10	50.8	-	51.0	47.2	36.1	49.9	33.8	35.7	32.6	44.1	42.3
L50	43.2	-	45.8	43.8	33.7	47.4	32.4	32.1	28.5	30.4	37.4
L90	34.3	-	36.3	34.9	32.1	44.3	31.5	26.6	26.0	28.2	29.4
Dry Season - Noise dB(A)											
Leq	75.7	87.8	77.9	72.2	74.3	70.7	78.2	64.7	62.3	67.8	73.1
L10	72.9	85.8	72.7	68.5	69.3	67.0	73.8	61.2	58.5	64.1	69.3
L50	68.5	73.6	57.1	57.3	55.8	97.2	59.1	49.5	46.0	57.3	62.1
L90	65.4	61.5	46.7	47.5	47.0	50.3	42.6	41.3	41.0	54.9	49.8

Leq is a measurement unit applied to an average number of decibels over a specified period of time. The noise measurement carried out for each station was over a 3omins frequency range period.

Noise levels as recorded along the route were below FMENV permissible noise level (industrial areas) of 110 dB (A) for a 30mins working period (FMENV, 1991). However apart from stations SS1, SS3 (QIT/Ibeno Bridge Area) and SS20 (Alson Facility/NIIP Substation Construction Area) which can be termed industrial areas, Leq noise values during the dry season was relatively above both the FMENV and WHO values of 55 dB (A) for residential areas.

Also it should be noted that there are no settlements apart from temporary farm structures in the vicinity of the ROW. In addition, intense lumbering activities with the use of high noise producing motor-saws during the dry season are considered to have played a significant factor in the spikes recorded for Leq measurement along SS6, SS10, SS13, SS16, SS18 and SS19. However percentile records for L50 and L90 in both wet and dry seasons were relatively compliant to limits set for non-industrial areas. The FMENV permissible noise limits are listed below

Duration per day, hour	Permissible limit dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1Hr	105
30mins	110
15mins or less	115

Noise impact is dependent on the proximity to the source and sensitivity of the receptor. The WHO has recommended (level to prevent community annoyance) a limit value of 55dB for 16 hours exposure. However the design of the transmission line route avoided built up areas and settlements thereby mitigating noise impact on humans during project activities (see **Figure 2.6**). The closest the route is to any built up area is approximately between 150m to 300m along some sections in Eket and Onna. However all other settlements and built up areas are about 1km to 2.5km away from the ROW.

Noise level along the transmission line route is expected to increase on a short term during the construction period (from piling, foundation, and other construction activities). The WHO guideline value for community noise in industrial, commercial, traffic and outdoor areas is set at 70dB–110dB for 24 hour exposure. It is not expected to have significant impact on the public as there are no residential houses or settlements close to the route. Noise from construction works may however, disturb sensitive fauna groups within the construction site, which may disperse away from the source but return at the end of construction activities. Typical noise level for some equipment to be used during the construction phase of the transmission line is shown below.

Equipment	**Noise level dB(A) at Operator's position**
Cranes	78 – 103
Backhoes	85 – 104
Loaders	77 – 106
Dozers	86 – 106
Scrapers	97 - 112
Trenchers	95 – 99
*Pile drivers	119 – 125
Compactors	90 – 112
Chainsaws	100 – 115
Concrete saw	97 – 103
Compressors	85 - 104
Generally, newer equipment is quieter than older equipment. + Pile drivers generate intermittent or 'impulse' sound.	

Source: Construction Health and Safety Manual (2008): Construction Safety Association of Ontario

4.5 Regional Geology of the Niger-delta

Many major depositional episodes can be distinguished in Nigeria; among this is the: Cenozoic Niger Delta complex (**Figure 4.5**) which developed as a regressive off-lap sequence.

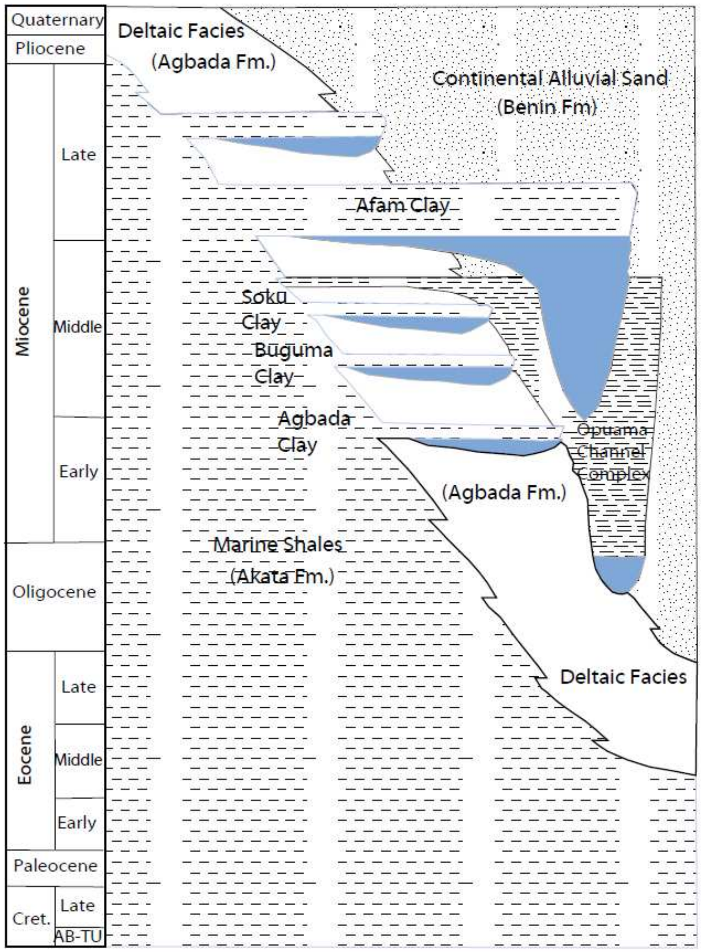


Figure 4.5: Niger-delta Sedimentary Basins

The land portion of the Niger Delta province is delineated by the geology of southern Nigeria and south-western Cameroon. The northern boundary is the Benin flank-an east-northeast trending hinge line south of the West Africa basement massif. The north-eastern boundary is defined by outcrop of the Cretaceous on the Abakaliki High and further east-south-east by the Calabar flank—a hinge line bordering the adjacent Precambrian.

Beginning in the Paleocene and through the recent, the Akata Formation formed during lowstands in the terrestrial organic matter and clays were transported to deep water areas characterized by low energy conditions and oxygen deficiency it is estimated that the formation is up to 7,000 meters thick. The formation underlies the entire delta, and is typically over-pressured.

Deposition of the overlying Agbada formation, the major petroleum-bearing unit, began in the Eocene and continues into Recent. The formation consists of paralic siliciclastics over 3700 meter thick and represents the actual deltaic portion of the sequence. The clastics accumulated in delta-front, delta-topset, and fluvio-deltaic environments. In the lower Agbada Formation, shawl and sandstone beds were deposited in equal proportions, however, upper portion is mostly sand with only minor shale interbeds. The Agbada

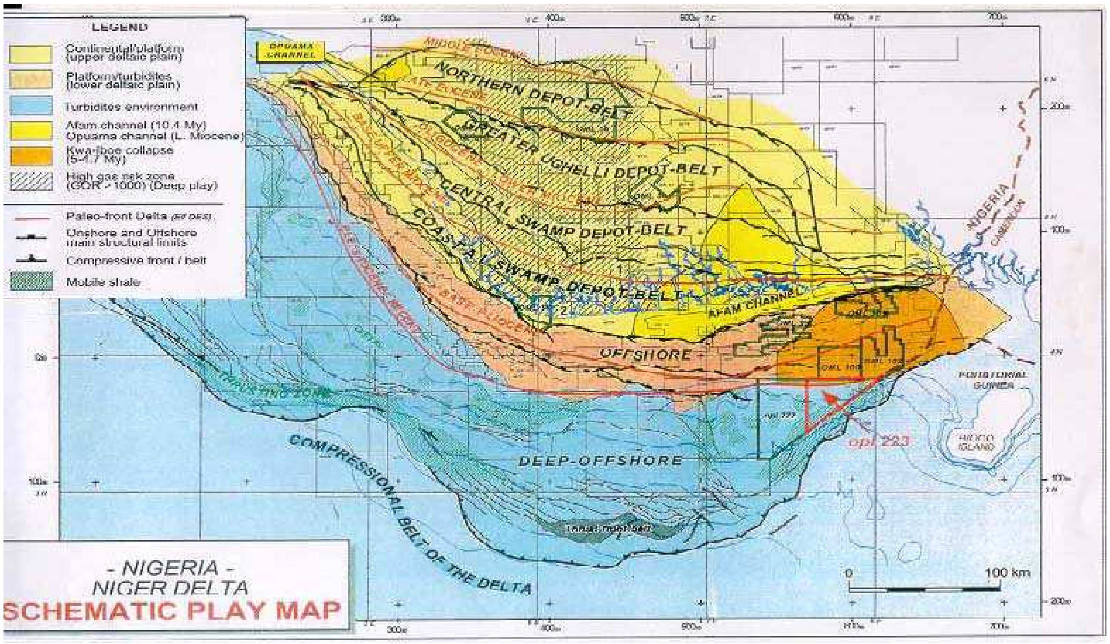


Figure 4.6: Niger-delta Depobelts

Formation is overlain by the third formation, the Benin Formation, a continental latest Eocene to Recent deposit of alluvial and coastal plain sands that are up to 2000 m thick (Wright et al, 1985).

4.5.1 Hydrogeology

The project area (between Ikot Abasi and Ibeno) is within the elongated northwest – southeast rectangular basin known as the Imo-Kwa lbo River Basin. The basin is principally underlain by the Deltaic, Benin, Ogwashi-Asaba and Ameki formations, and then by the Imo Shales, in that order (Offodile, 1992). The major aquiferous units are the Benin and Ameki formations. The Imo-Kwa lbo Basin is confined to the northern edge by the Imo Shales while the Benin formation and the alluvial deposits of the Niger Delta appear to be in hydrological contact (and thus provide combined aquiferous horizons) to the south.

Generally, the depth to water table in the area ranges between 1.5m and 6.0m below ground level (IPC, 2005). The aquifer extends to depths of about 220m below ground level with yields of up to 6,480lit/hr/m. This is attributed to the permeability of the soil in the project area, and recharge of the aquifer by groundwater as it flows continuously in a seaward regional pattern (Offodile, 1992).

Drainage

There are two permanent river systems within the project area namely Qua Iboe and Imo River systems. Qua Iboe River is located at the Eket - Ibeno end of the proposed TL route while Imo River is located at the Ikot Abasi end. Both rivers are fed by a complex network of numerous creeks and fresh (white) and black water streams. The other remarkable features of the natural drainage system in the project area are the pockets of low-lying swamps that dot the landscape.

The proposed TL route would cross Qua Iboe River. However, this portion of the Qua Iboe River is quite far from the Atlantic Ocean and is fed only by a few major creeks. The proposed TL route would not traverse Imo River but would cross a number of small creeks that ultimately drain into the river. Most of these creeks are seasonal (i.e. do not exist in the dry season) but are all influenced by tide. The frequency of occurrence of these tiny creeks at the Ikot Abasi end of the route is high. The fraction of land submerged under water in the project area typically increases by as much as 5 - 10% at the peak of the wet season and some of the creeks and creeklets are subsumed into the flooded swamps.

As one travels away from the coast (towards Eket) the frequency of occurrence of creeks reduces rapidly and the drainage system is characterised mainly by black water streams. All the streams are permanent water systems and ultimately drain into either Imo or Qua Iboe Rivers.

The hydrodynamics of the entire area is greatly influenced by tidal regimes. Data from hydrographic measurements showed that current velocities range between 0.1 and 1.6m/s in the rivers and major creeks. These values are within the range of 0.5 to 2.4m/s reported as typical of onshore waters in the Niger Delta region (Nwankwo et al 1998).

4.6 Surface Water

4.6.1 Surface Water Physico-chemistry

A total of five (5) surface water samples were collected for physico-chemical and biological analysis. Surface water sampling was carried out using a water sampler.

A summary of surface water samples physico-chemical characteristics for both seasons from the study area are presented in **Table 4.6** while detailed result are in **Appendix 4.2**. There are no established limits for physico-chemical parameters, hence the use of natural limits where available and baseline from previous studies around the area for comparison.

Table 4.6: Surface water Physico-chemistry

Parameter	Wet Season		Dry Season		EIA – IPC 48km TL (2005)		Natural Limits (Allen, et al)
	Range	Mean	Range	Mean	Range	Range	
pH	6.09 - 6.86	6.46	5.41 - 6.53	6.16	4.86-5.29	5.14-5.73	6.50-7.40
Temperature (^oC)	25.8 -27.6	26.64	28.3 - 30.1	29.16	26-26.6	25.0-26.1	-
Elect Cond (µS/cm)	12.1 -439	117.46	7.71 - 543	136.14	11-1018	10.3-22.6	-
Salinity (ppt)	0.1 -0.1	0.1	0.1 - 4.4	1.10	-	5.20-12.2	-
DO (mg/l)	5.56 -5.95	5.76	3.6 - 5.46	4.50	2.80-5.80	4.00-5.60	5.0
Turbidity (NTU)	15 -34	25	12 - 39	24.00	2.00-8.00	3.00-7.00	-
Redox Potential	1.55 -168	113.31	125 - 170	147.20	1.00-241	238-276	-
TOC (g/l)	1 -1	1	1 - 1	1.00	-	-	-
TDS (g/l)	7.25 -235	63.69	6.6 - 4620	1004.78	5.00-552	5.67-12.4	-
TSS (mg/l)	2 -7	5	3 - 17	10.20	2.00-6.00	10.0-24.0	25
BOD_5 (mg/l)	0.5 -20	6.3	0.5 - 80	32.20	0.50-1.23	<1.00-3.33	-
COD (mg/l)	0.8 -30.8	9.82	0.8 - 112	48.32	0.80-1.84	<1.00-5.00	-
Total Hardness (mg/l)	1.92 -42.2	13.05	1 - 176	74.35	-	-	-
Oil & Grease (mg/l)	1 -1	1	1 - 1	1.00	-	-	-
Chloride (mg/l)	1.76 -120	29.99	1 - 2421	509.42	-	-	-
Nitrate (mg/l)	0.14 -0.33	0.23	0.02 - 0.17	0.06	0.95-1.13	0.71-2.53	0.05-3.0
Sulphate (mg/l)	0.12 -9.25	2.31	0.1 - 13.5	3.05	-	-	2.0-150
Magnesium (mg/l)	0.36 -6.46	1.85	0.15 - 161	34.34	<0.10	0.01-0.41	10.5-20
Potassium (mg/l)	0.73 -3.46	1.54	0.4 - 94.6	21.82	0.13-0.68	0.26-1.43	0.5-10
Sodium (mg/l)	1.69 -41.6	13.26	0.55 - 1761	370.47	0.44-0.63	0.45-0.96	-
Calcium (mg/l)	0.8 -2.7	1.34	0.71 - 34.6	9.16	<0.10-0.98	0.24-0.48	1-100
Cadmium (mg/l)	<0.02	<0.02	<0.02	<0.02	-	-	-
Total Chromium (mg/l)	0.1 -0.1	0.1	0.1 - 0.1	0.10	-	-	-
Copper (mg/l)	0.05 -0.05	0.05	0.05 - 0.05	0.05	-	-	0.002-0.05
Total Iron (mg/l)	0.84 -4.18	2.17	0.44 - 2.46	1.67	0.34-1.31	0.06-2.67	0.05-1.00
Lead (mg/l)	<0.2	<0.2	<0.2	<0.2	-	-	0.002-0.2
Nickel (mg/l)	<0.1	<0.1	<0.1	<0.1	-	-	0.05-0.1
Zinc (mg/l)	<0.05	<0.05	<0.05	<0.05	-	-	0.005-0.05
Silver (mg/l	<0.1	<0.1	<0.1	<0.1	-	-	-
Manganese (mg/l)	<0.1	<0.1	<0.1	<0.1	-	-	0.001-0.1
Mercury (mg/l)	<0.0002	0.0002	<0.0002	0.002	-	-	0.0003-0.003
Vanadium (mg/l)	<0.2	<0.2	<0.2	<0.2	-	-	0.0001-0.003

Source: FNL (PHCN QIT – Ikot Abasi TL) Field Survey 2011
EIA – IPC 48km TL (2005) = Ibom Power Company Limited EIA 48km Ikot Abasi Eket Transmission Line, 2005.
Allen et a.,l (1974): Chemical Analysis of Ecological Materials.

pH

pH is an important variable in water quality assessment as it influences many biological and chemical processes within a water body and all processes associated with water supply and treatment. It is a measure of the acid balance of a solution and is defined as the negative of the logarithm to the base 10 of the hydrogen ion concentration. The pH scale runs from 0 to 8 (i.e., very acidic to alkaline), with pH7 representing a neutral condition. At a given temperature, pH (or the hydrogen ion activity) indicates the internist of the acidic or basic character of a solution and is controlled by the dissolved chemical compounds and biochemical processes in the solution.

In unpolluted waters, pH is principally controlled by the balance between the carbon dioxide, carbonate and bicarbonate ions as well as other natural compound such as humic fulvic acids. The nature acid-base balance of a water body can be affected by industrial effluents and atmospheric deposition of acid-forming substances. Change in pH can indicate the presence of certain effluents, particularly when continuously measured and recorded, together with the conductivity of a water body. The pH of most natural water is between 6.0 and 8.5, although lower can occur in dilute water high in organic content, and high values in eutrophic waters, groundwater brines and salt lakes (UNEP, 1992).

The recorded pH values in surface water samples from the study area ranged from 6.09-6.86 with a mean of 6.46 in the wet season and 5.41 - 6.53 in the dry season. These values are within established pH range for fresh waters and compared well with previous baseline studies within the study area.

Temperature

Temperature influences the rate of chemical reaction, buoyancy mechanism (density/viscosity), stability of water column, and toxicity of many parameters. The temperature of the surface water measured in-situ across the stations averaged 26.64 and 29.16 (^{o}C) for the wet and dry seasons respectively.

Total Dissolved Solids (TDS) and Conductivity

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. There is a direct relationship between TDS and conductivity as they are both a measure of the dissolved inorganic compounds unfavourable physiological reactions in aquatic organisms. The recorded TDS levels in surface water sample varied between 7.25 -235g/l with a mean of 63.69g/l for the wet season and 6.6 – 4620g/l and a mean of 1004.78g/l for the dry season. The variation in values from the wet and dry season can be attributed to the dilution factor of surface water bodies experienced during the wet season across the study area.The values were within the natural limits and consistent with reported values from previous studies around the project area.

Conductivity, or specific conductance, is a measure of the ability of water of conduct an electric current. It is sensitive to variations in dissolved solids, mostly mineral salts. The degree to which 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. Conductivity is expressed as microsiemens per centimetre (µS/cm) and for a given water body, is related to the concentration of total dissolved solids and major ions.

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. In addition to being a rough indicator of mineral content when other methods cannot easily be use, conductivity can be measured to establish a pollution zone, e.g. around an effluent discharge, or the extent of influence of run-off waters.

The conductivity of surface water samples from the study area ranged from 12.1 - 439µS/cm with a recorded mean of 117.46µS/cm in the wet season. The range for dry season conductivity values was recorded as 7.71 – 543 µS/cm with a mean value of 136.14µS/cm. Conductivity values also were in compliance with the natural limits and compared well with previous baseline values around the area. **Figure 4.7** shows the interrelationship between conductivity and TDS in surface water collected from the study area for both seasons.

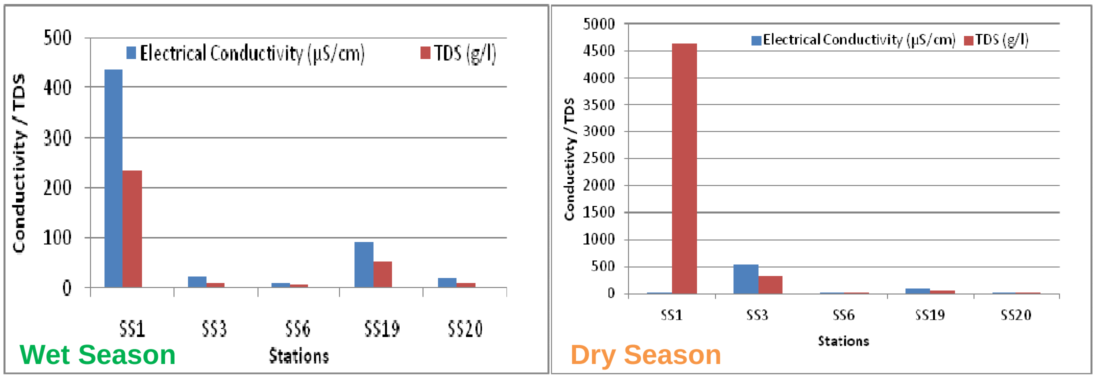


Figure 4.7: TDS / Conductivity Correlation

From the graph above it can be deduced that there is a correlation between the TDS and conductivity characteristics across surface water samples within the study area.

Salinity

Salinity is a measure of the amount of dissolved inorganic (salts) in an aquatic medium. Salinity affects vapour and osmotic pressure, viscosity and temperature (http://icp.giss.nasa.gov.htm). Salinity concentration measured for wet season was 0.1ppt across the samples stations as at the time of study. Dry season salinity values ranged from 0.1 - 4.4. This suggests that the generality of water bodies encountered along the study area are fresh water bodies. Also the salinity values were within the natural limits for fresh water bodies and compared well with provious baseline data across the study area.

Dissolved oxygen

Dissolved oxygen (DO) measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Dissolved oxygen averaged between 5.56 -5.95mg/l during the wet season. Dry season values of dissolved oxygen ranged from 3.6 - 5.46. These values compared well with natural limits expected for fresh water bodies and were consistent with reported baseline values for the area.

Turbidity / TSS

Turbidity is a measure of the extent to which light passing through water is reduced by scattering, induced by suspended and colloidal materials. It is of general concern in water due to aesthetic considerations, filterability and disinfection. As turbidity level increases, the aesthetic value decreases, and filtration of water is rendered more difficult and costly, reducing the effectiveness of disinfection procedure. The mean turbidity level of surface water samples collected in the area was 25NTU for the wet season and 24NTU for the dry season.

Total suspended solids (TSS) are made up of inorganic fraction (silts, clays, calcium, potassium, calcium, bicarbonates, chlorides etc.) and an organic fraction (algae, zooplankton, bacteria and detritus) that are within the water column (GEMS, 1992). TSS can clog fish gills which could consequently kill them or reduce their growth rate. They also reduce light penetration, thus reducing the ability of algae to produce food and oxygen. A positive effect of the presence of suspended solids in water is that toxic chemicals (pesticides and metals) tend to adsorb to them or from complexes with them, thus making the toxics less available to be absorbed by living organisms (Kentucky water watch, 2001). The mean level of TSS in water samples from the study area was recorded as 5mg/l during the wet season and 10.20mg/l during the dry season. This result was found to be within natural limits of fresh water ecosystems and consistent with baseline values for previous studies around the area.

The correlation between turbidity and total suspended solids across surface water in the study area is presented in **Figure 4.8**.

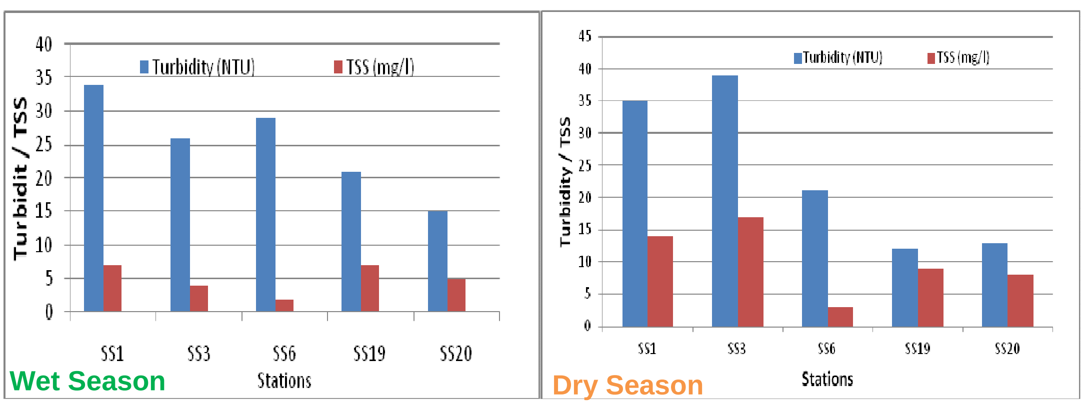


Figure 4.8: Turbidity / TSS Correlation

Biological 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 (Kielly, 1998; Nebel, 1990). Excess BOD in water therefore could adversely affect aquatic organisms and by extension humans. BOD level in surface water samples from the study area ranged from 0.5 -20mg/l with a mean of 6.3mg/l in the wet season and 0.5 – 80mg/l with a mean of

32.20 in the dry season. The values of 80mg/l and 60mg/l representing SS1 and SS2 respectively might have been influenced by anthropogenic activities (e.g clothe washing or possible indiscriminate waste disposal by residents along the Douglas creek area in Mkpanak town) along the banks of these stations. Moreso seasonal variation from high rainfall dilution experienced in the wet season around this part of the Niger-delta could be responsible.Values from other stations were however within natural limits and compliant to limits set by the WHO and Fmenv. These values were also consistent with previous baseline data and are as required for proper functioning of natural water habitats.

Total Hydrocarbon Content (Oil and Grease)

Amongst the source of hydrocarbon in the river system are spills arising from inland water transportation using ferries and speedboats. Other major sources include the atmosphere and municipal/municipal/industrial waste (municipal wastes, refineries, non-refining industrial waste, urban run-off, river run-off and river dumping). Hydrocarbons were not detected in the surface waters of the area (detection limit was <1.00mg/1) for both seasons. This suggests that the water body was not contaminated with hydrocarbon as at the time of the survey.

Nutrients

Sulphate ions (SO_4^{2-}) and nitrate ions (NO_3^-) are the ionic forms of the essential nutrients of sulphur, nitrogen respectively.

Sulphate

Sulphate is naturally present in surface waters as SO_4^{2-}. It rises from atmospheric deposition of oceanic aerosols and the leaching of sulphur compounds, either sulphate minerals such as gypsum or sulphide mineral such as pyrite, from sedimentary rocks. It is the 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 precipitation can also add significant amounts of sulphate to surface waters. Sulphate can be used as an oxygen source by bacteria which convert it to hydrogen sulphide (H_2S, HS^-) under anaerobic conditions.

Sulphate concentration in surface water samples ranged from 0.12 -9.25mg/l with mean of 2.31mg/l in the wet season. Dry season values were reported with a range of 0.1 - 13.5 and a mean of 3.05. These values are within report values for natural waters around and within the study area.

Nitrate

The nitrate ion (NO_3^-) is the common form of combined nitrogen found in natural waters. It may be biochemically reduced to nitrite NO_2^-) by denitrification possesses, usually under anaerobic conditions. The nitrite ion is rapidly oxidized to nitrate. Natural sources of nitrate to surface waters include igneous rocks, land drainage and plant and animal debris. Nitrate is an essential nutrient for aquatic plants and seasonal flutuations can be caused by plant growth and decay. Natural concentrations, which seldom exceed 0.1 mg/1 NO_3^- N, may be enhanced by municipal and industrial waste-waters, including leachate from waste disposal sites and sanitary landfills. In rural and suburban areas, the use of inorganic nitrate fertilizers can be significant source.

The nitrate concentration in water samples from the study area were 0.14 -0.33mg/l with a mean of 0.23mg/l for the wet season. The dry season values ranged from 0.02 - 0.17mg/l and a mean of 0.06mg/l. These values showed that samples surface water body was free from pollution as at the time of survey.

Heavy Metals

The heavy metals analyzed for surface water samples from the area were Cadmium (Cd), chromium (Cr), copper (Cu), Iron (Fe), lead (Pb), nickel (Ni), Zinc (Zn), silver (Ag), manganese (Mn), mercury (Hg), and vanadium (V). The availability of trace metal in water are controlled by physical and chemical interactions which is affected by factors like pH, redox potential, temperature, CO_2 level, the type of concentration ligands and chelating agents, as well as type and concentration of the metal ions. Trace or heavy metals in an environmental perspective have potential of bio-accumulation and concentration in aquatic organisms. These may enter the food chain in the process and can affect man (GEMS, 1992).

The mean concentrations of all heavy metals (except for total iron in both seasons) were all below their respective detection limits. These values recorded showed that the surface water within the study area as at the time of sampling was free of heavy metal contamination. Heavy metal concentration were within natural ranges for fresh water and compared well with previous baseline data around the project area.

4.6.2 Surface Water Microbiological Characteristics

Micro-organisms are essential components of the aquatic ecosystem and are involved in the synthesis of new organic matter from carbon dioxide and other inorganic compounds during primary production as well as the decomposition of this accumulated organic matter. They are constantly in competition for available nutrients hence; their presence in the aquatic environment is limited by factors such as energy in the form of light and chemical compounds, temperature, nutrients, pressure, pH and salinity. In response to oligotrophic environments (low nutrient level) and intense competition, many microorganisms become more competitive in nutrient capture and exploitation of available resources (Prescott, et.al., 1999).

Surface water microbial analyses of the study area is summarised in **Table 4.7** below, while details of results are presented in **Appendix 4.2**.

Table 4.7: Summary of Surface Water Microbiology Characteristics

Parameter	Dominant Species	Concentration Range (cfu/ml)
Wet Season		
Heterotrophic bacteria (HB)	*Pseudomonas* and *Bacillus sp*	6.40×10^2– 1.59×10^3
Hydrocarbon utilising bacteria (HUB)	*Pseudomonas sp*	3.7×10^1– 1.24×10^2
Heterotrophic fungi (HF)	*Mucor sp, Candida sp Rhodotorula sp, Aspergillus sp*	1.1×10^1 – 6.7×10^1
Hydrocarbon utilising fungi (HUF)	*Candida* and *Mucor*	7 – 6.2×10^1
Dry Season		
Heterotrophic bacteria (HB)	*Pseudomonas* and *Bacillus sp*	$8.00\text{x}10^2$ –$1.56\text{x}10^3$
Hydrocarbon utilising bacteria (HUB)	*Pseudomonas sp*	$2.5\text{x}10^1$ – $6.5\text{x}10^1$
Heterotrophic fungi (HF)	*Mucor sp, Candida sp Rhodotorula sp, Aspergillus sp*	4.0 - $1.3\text{x}10^1$
Hydrocarbon utilising fungi (HUF)	*Candida* and *Mucor*	3.0 – 9.0

Source: FNL (PHCN QIT – Ikot Abasi TL) Field Survey 2011

HB are non-coliform species of bacteria that utilize an organic substance for its development. HB can be widespread along a water system but does not serve as an indicator that the water presents a health risk (Sharon O *et al*, 2008). However they are naturally occurring microbes in water and their relative presence suggest a healthy state of the aquatic environment (Kelly A, 1999).

The results as deduced from the table suggests that the surface water bodies as sampled from along the transmission line route also compared well with preveious baseline (EIA, IPC 48km TL; 2005, EIA, NIPP 78km TL:2007) surfacewater micribiolofgical characteriastics in the area.

4.7 Sediment Physico-chemical Characteristics

Samples were obtained from corresponding surface water stations using an Eckman grab. The results of the sediment physico-chemical characteristics are summarised in **Table 4.8** below while detailed results are presented in **Appendix 4.2**. There are no established limits for physico-chemical parameters, hence the use of baseline from previous studies around the area for comparison.

Table 4.8: Summary of Sediment Physico-chemical Characteristics

Parameters	Wet Season		Dry Season		EIA–NIPP 78km TL (2007)
	Range	Mean	Range	Mean	Range
pH @ 22.7^{o}C	3.79 - 5.21	4.63	5.17 - 6.63	6.196	3.59-6.52
Electrical Conductivity (µS/cm)	20.7 -2330	934.14	101 - 202	144.4	-
TOC (g/kg)	0.53 -25	11.23	8.91-40.6	26.222	5.98-66.7
THC (mg/kg)	<10	<10	<10	<10	<10.0-72.6
Redox Potential (mV)	-81 --22	-44	-75 --25.6	-49.32	
PSD Clay (%)	2 -30	19	5 -10	8	0-25
Silt (%)	10 -44	19.2	10 -25	14	0-33
Sand (%)	31 -82	61.8	70 -80	78	42-100
Nitrate (mg/kg)	1.28 -1.84	1.626	0.9 -1.18	1.0025	-
Ext Sulphate (mg/kg)	100 -1325	470	169 -224	198.6	-
Ext Phosphate (mg/kg)	1.49 -3.64	2.618	1.37 -17.2	7.91	-
Magnesium (mg/kg)	347 -3914	2552.2	637 -3919	2458	214-1,174
Potassium (mg/kg)	4680 -12250	8366	4731 -13400	8487.6	40.2-814
Sodium (mg/kg)	3000 -7320	4884	2700 -7660	4182	388-2,323
Calcium (mg/kg)	10 -2620	916.6	10 -3558	1204.2	13.1-1,370
Cadmium (mg/kg)	2 -2.6	2.12	2 -2	2	<0.02
Total Chromium (mg/kg)	7.8 -22.3	15.04	2.5 -99	45.68	<0.10-12.9
Copper (mg/kg)	2.3 -8.1	5.12	0.5 -0.5	0.5	0.23-7.98
Total Iron (mg/kg)	9674 -32610	21052.8	10010 -30200	21576	334-29,810
Lead (mg/kg)	7 -11.3	9.46	3.9 -8.9	5.94	0.57-11.12
Nickel (mg/kg)	3.1 -24.3	13.14	20.6 -52.3	34.22	0.61-9.75
Zinc (mg/kg)	6 -28.9	18.5	5.5 -87.5	29.12	0.42-22.1
Barium (mg/kg)	2 -350	114.46	2 -161	55.6	<0.03-82.3
Silver (mg/kg)	1.9 -2	1.98	2 -2	2	<0.10
Manganese (mg/kg)	79.2 -306	149.28	89.7 -375	197.74	<0.10-234
Mercury (mg/kg)	1 -1.3	1.06	1 -1	1	-
Vanadium (mg/kg)	1 -56.3	27.46	1 -76.3	34.18	-

Source: FNL (PHCN QIT – Ikot Abasi TL) Field Survey 2011
EIA – NIPP 78km TL (2007) = National Integrated Power Project EIA 78km Ikot Abasi – Ikot Ekpene Transmission Line, 2005.

pH

The pH of the sediment obtained from the study area ranged from 3.79 - 5.21 with a mean value of 4.63 in the wet season. Dry season range of values was given as 5.17 - 6.63 with a mean of 6.196. The pH value obtained for the study area indicates a moderate acidic riverbed.

THC

The total hydrocarbon concentration in sediment samples from the study area was below equipment detection limit of <10.mg/kg for both seasons. This implies that as at the time of the study, sediment as sampled from corresponding surfacewater stations were free of hydrocarbon contamination. The results also compared well with previous baseline data of studies around the project area.

Sediment Particle Size Distribution

The sediment particle size distribution (PSD) was found to be consistent across the sampling stations with sand and silt dominating, followed by clay. **Figure 4.9** shows the sediment particle size distribution across the study area.

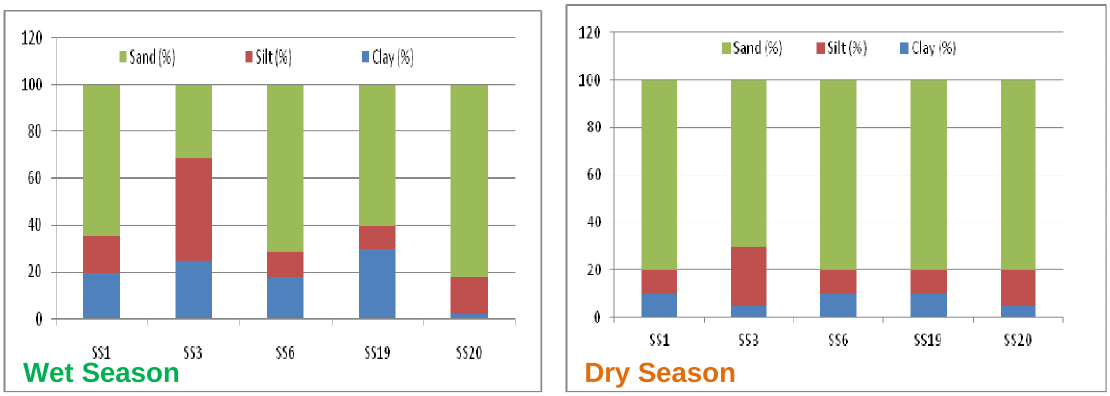


Figure 4.9: Sediment – Particle Size Distribution (PSD).

The particle size distribution suggests that the river bed of streams and surface water systems along the transmission line route are basiclally sandy-silt. This is typical of this environment and consistend with previous PSD data around the project area.

Nutrients

The range value obtained for nitrate (NO_3^-), sulphate (SO_4^{2-}) and phosphate (PO_4^{3-}) in the sediment samples are given as: 1.28 -1.84mg/kg, 100 -1325mg/kg, and 1.49 -3.64mg/kg respectively for the wet season. Dry season were given as 0.9 -1.18mg/kg, 169 -224mg/kg, 1.37 -17.2mg/kg. These values are typical of fresh water systems within the Niger-delta as reported in previous baseline studies (IPC, 2005).

Heavy Metals

The heavy metals analysed for sediment samples from the area were cadmium, chromium, copper, iron, lead, nickel, zinc, barium, silver, manganese, mercury and vanadium.

The recorded levels of heavy metal concentration across sediment samples within the study area were found to be within reported values (see **Table 4.8**) for similar environment and compliant to levels required for optimal functioning of a typical freshwater ecosystem.

4.7.1 Sediment Microbiological Characteristics

Sediment microbial analyses of the study area is summarised in **Table 4.9** below, while details of results are presented in **Appendix 4.2**. There are no established limits for microbiological parameters, hence the use of baseline from previous studies around the area for comparison.

Table 4.9: Summary of Sediment Microbiology Characteristics

Parameter	Dominant Species	Concentration Range (cfu/g)
Wet Season		
Heterotrophic bacteria (HB)	*Pseudomonas sp*	$2.00 \times 10^4 – 6.40 \times 10^5$
Hydrocarbon utilising bacteria (HUB)	*Pseudomonas sp*	$1.80 \times 10^2 – 9.60 \times 10^2$
Heterotrophic fungi (HF)	*Mucor sp, Aspergillus sp, Candida sp*	$2.0 \times 10^1 – 9.10 \times 10^2$
Hydrocarbon utilising fungi (HUF)	*Mucor sp Aspergillus sp Candida sp*	$4 – 4.00 \times 10^2$
Dry Season		
Heterotrophic bacteria (HB)	*Pseudomonas sp, Chromobacterium sp*	$1.34 \times 10^5 – 9.10 \times 10^5$
Hydrocarbon utilising bacteria (HUB)	*Pseudomonas sp*	$2.20 \times 10^2 – 1.28 \times 10^3$
Heterotrophic fungi (HF)	*Mucor sp*	$4.0 \times 10^1 – 3.50 \times 10^2$
Hydrocarbon utilising fungi (HUF)	*Mucor sp* and *Candida sp*	$4.0 \times 10^1 – 1.80 \times 10^2$

Source: FNL (PHCN QIT – Ikot Abasi TL) Field Survey 2011

Bacteria

Heterotrophic bacterial (HB) population and Hydrocarbon utilising bacteria (HUB) in the sediment samples obtained from the study area were predominantly *Pseudomonas spp*.

Fungi

Heterotrophic fungi (HF) and Hydrocarbon utilising fungi (HUF) in study area were dominantly *Mucor* and *Candida spp*.

These results suggest that these water bodies may not have been significantly affected by industrial activities in the area. Microbial composition and load values are also consistent with baseline data reported around the project area (Network E&P, 2005).

4.8 Soil Physico-chemical Characteristics

The soils from the study area are predominantly sandy in texture and brownish in colour. A summary of the physico-chemical characteristics of surface soil samples (0 – 15cm) collected from the study area is presented in **Table 4.10** below while detailed results for surface and subsurface soils are presented in **Appendix 4.3**. There are no established limits for physico-chemical parameters, hence the use of natural limits where available and baseline from previous studies around the area for comparison.

Table 4.10: Summary of Surface Soil Physico-chemical Characteristics

Parameter	Wet Season		Dry Season		EIA – IPC 48km TL (2005)		Natural Limits
	Range	Mean	Range	Mean	Range	Range	(Allen, et al)
pH @ 23.0°C	4.4 - 5.2	4.7	3.2 - 6.8	5.7	3.58-5.8	4.05-7.51	6.00 – 9.50
Elect. Cond (µS/cm)	18.8 -166.0	71.1	28.4 - 225.0	94.4	11.1-2220	30.6-218	-
TOC (g/kg)	3.2 -28.2	9.6	1.0 - 33.6	11.7	1.68-49.5	93.0-105	-
THC (mg/kg)	0.0 -40.0	10.9	10.0 - 10.0	10.0			-
Redox Potential (mV)	11.0 -102.0	53.3	14.0 - 104.0	56.7	51.0-163.0		-
PSD Clay (%)	0.0 -28.0	5.0	0.0 - 19.0	3.7	-	-	-
PSD Silt (%)	0.0 -21.0	7.3	0.0 - 20.0	5.8	0-10.1	-	-
PSD Sand (%)	65.0 -100.0	87.7	70.0 - 100.0	90.3	89.9-100.0	100	-
Nitrate (mg/kg)	0.2 -1.8	0.9	0.0 - 5.2	1.4	4.55-7.77	3.54-6.69	1 - 20
Ext. Sulphate (mg/kg)	10.0 -18.7	12.6	0.0 - 24.3	1.1	-	-	-
Ext. Phosphate (mg/kg)	0.7 -17.0	5.2	0.2 - 11.4	4.7	-	-	-
Magnesium (mg/kg)	271.0 -2839.0	840.7	299.0 - 1469.0	770.3	8.0-74.0	48-271	400-5000
Potassium (mg/kg)	1277.0 -12180	5648.9	1461.0 - 10830	5053.0	16.0-118.0	0.10-578	500-5000
Sodium (mg/kg)	1860.0 -6950.	3495.2	1570.0 - 4800.0	3440.9	5.0-79.0	69.9-255	200-2000
Calcium (mg/kg)	10.0 -2910.0	435.1	10.0 - 2320.	446.6	1.0-181.0	0.10-32.9	100-2000
Cadmium (mg/kg)	2.0 -2.4	2.0	2.0 - 2.0	2.0	0.02-0.02	<0.02	3-30
Tot Chromium (mg/kg)	2.5 -23.4	11.0	1.0 - 139.0	42.0	0.1-4	1.0-13.0	10 - 200
Copper (mg/kg)	0.5 -13.1	4.4	0.5 - 15.1	2.9	1.0-6.0	<0.05-6.0	1-30
Total Iron (mg/kg)	3331.0 -28350	12473.0	4627 - 34630.	13493.3	1,435-3,827	3,863-26,230	-
Lead (mg/kg)	3.4 -14.6	6.9	1.0 - 11.4	4.1	1.0-31.0	<0.20-9.0	2 - 20
Nickel (mg/kg)	0.5 -29.3	9.6	18.2 - 58.0	31.1	0.1-690	<0.10-4.0	
Zinc (mg/kg)	3.3 -46.1	14.6	0.5 - 73.4	23.8	6-117	0.05-66.0	1-40000
Barium (mg/kg)	2.0 -241.0	30.1	2.0 - 2.0	2.0	0.03-13.0	<0.03	-
Silver (mg/kg)	2.0 -2.0	2.0	2.0 - 2.0	2.0	-	-	-
Manganese (mg/kg)	49.0 -281.0	121.7	53.4 - 297.0	131.6	-	-	-
Mercury (mg/kg)	1.0 -1.6	1.0	1.0 - 1.0	1.0	0.0002-0.55	-	1-10
Vanadium (mg/kg)	1.0 -81.0	16.2	1.0 - 92.6	23.1	0.2-64	0.20-23.0	2-100

Source: FNL (PHCN QIT – Ikot Abasi TL) Field Survey 2011
EIA – IPC 48km TL (2005) = Ibom Power Company Limited EIA 48km Ikot Abasi Eket Transmission Line, 2005.
Allen eta al (1974): Chemical Analysis of Ecological Materials.

pH

pH is a most commonly measured soil quality parameter. It shows the acidity, neutrality or alkalinity of a particular soil and indicates the availability of exchangeable cations (e.g., Ca^{2+}, Mg^{2+}, K^+ etc). The pH of the surface soil samples collected from the study area was generally acidic with a pH range of 4.4 - 5.2 and 3.2 - 6.8 for the wet and dry seasons respectively. The values were within the natural limits and consistent with reported values from previous studies around the project area.

Particle Size Distribution

PSD showed that the particle size varied in relation to heterogeneity of the soils along the ROW. Also not much seasonal differences were recorded in the particle size distribution of the soils sampled along the transmission line.

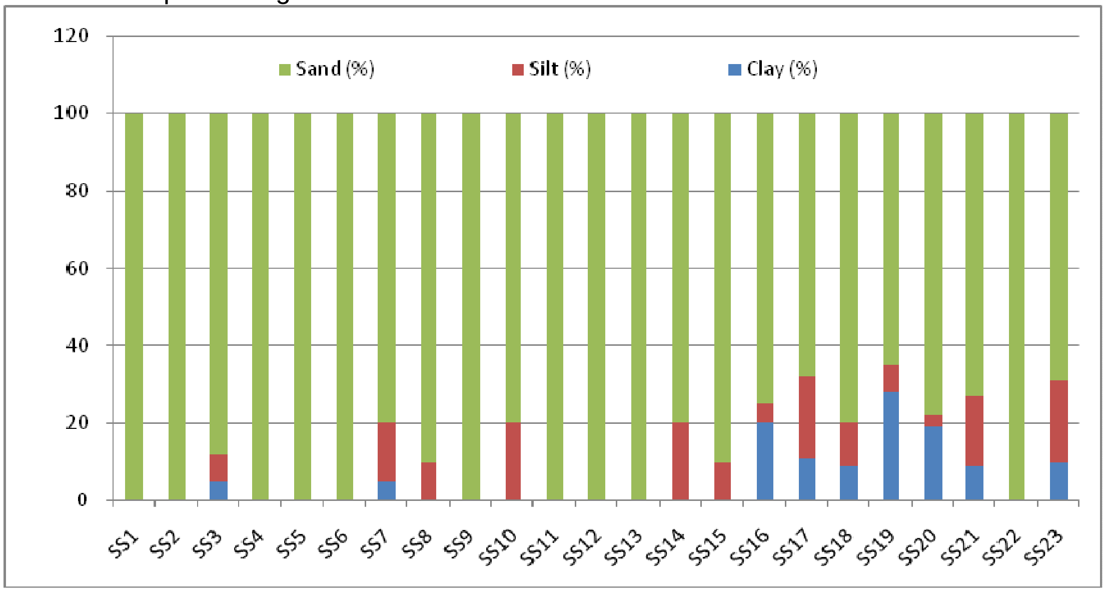


Figure 4.10: Soil – Particle Size Distribution

Conductivity

The measurement of electrical conductivity (EC) is used as a means of appraising soil salinity. EC increases with soluble salt content of the soil. The EC of 4000µS/cm which corresponds to an osmotic pressure of 3 – 5 atmosphere in the soil solution at field capacity, is generally accepted as the limit above which the yield of most sensitive crops start to be affected (Odu et al, 1985).

The conductivity of surface soil samples for the wet season was between 18.8 - 166.0µS/cm with a mean of 71.1µS/cm. Dry season values ranged between 28.4 - 225.0 µS/cm with a mean of 94.4 µS/cm. Conductivity values were within natural limit ranges and consistent with results from previous studies around the area.

Total Organic Carbon

Total organic carbon (TOC) is the amount of carbon containing compounds in a medium and provides a means for determining the degree of organic contamination.

The TOC level obtained from the study area during the wet season ranged between 3.2 - 28.2g/kg, with a mean of 9.6g/kg. The dry season TOC range of values was given as 1.0 - 33.6g/kg with a mean of 11.7g/kg. TOC ranges for both seasons were within natural limits and results were found to be consistent with previous studies in similar ecosystem.

Macro Nutrients

Phosphates and Nitrates

Amongst the essential nutrients in the soil, required for plant growth are phosphorus and nitrogen. They are represented in the form of phosphate (PO_4^{3-}) and nitrate (NO_3^-) respectively.

Chlorophyll, plant proteins and nucleic acids are nitrogen compounds which play a major role in plant growth. Phosphorus compounds form an essential part of nucleo-proteins that control cell division and growth and are major constituents of deoxyribonucleic acid (DNA) molecules (Donahue et.al, 1990). They are also essential in energy storage and chemicals transfer in plants. Sulphur occurs in proteins and is required for plant vitamins.

The nitrate and phosphate concentration in soil samples collected from the study area ranged from 0.2 -1.8mg/kg and 0.7 -17.0mg/kg respectively for the wet season and 0.0 - 5.2 mg/kg and 0.2 - 11.4 mg/kg for dry season. These values were consistent with typical levels for Niger-delta soils and were within natural nutrient ranges permissible for tropical soils.

Heavy Metals

The recorded levels of heavy metal concentration across soils within the study area were found to be within reported values for similar environment and compliant to levels required for optimal functioning of the ecosystem. Values also suggest that soils within the study area as at the time of the study were generally free of heavy metals contamination. Heavy metal levels in soils along the transmission line were within their respective natural limits indicating non-contamination of soils by heavy metals. These values were also consistent with results of previous baseline studies in similar areas.

4.8.1 Soil Microbiological Characteristics

Bacteria

Heterotrophic bacteria (HB) population in the soil samples obtained from the study area ranged between 1.74×10^4 cfu/g and 1.13×10^6cfu/g during the wet season and 6.00×10^4 cfu/g and 1.98×10^6 cfu/g for the dry season.

The bacterial species encountered in the soil samples obtained from the area were *Pseudomonas*, *Bacillus* and *Actinomyces* and *Chromobacterium*.

Fungi

Hydrocarbon utilising fungi (HUF) ranged from 4 to 7.30×10^3cfu/g during the wet season and 1.0×10^1 to 7.90×10^2cfu/g during the dry season. The three predominant fungal species in the soil samples from the study area were *Mucor*, *Candida* and *Aspergillus* species.

4.9 Hydrobiology Studies

The analyses and assessment of biological structures of water bodies within the study area as well as their interconnection with the internal and external cycle of materials are discussed in the following sub-sections.

4.9.1 Planktons

Plankton are small animals/ plants which live in water and driven about by prevailing wind and currents. The numbers and forms of planktonic animals (zooplankton) and planktonic plants (phytoplankton) are used as indices of polluted water and also as very useful indices of primary productivity of water. Plankton was collected from all surface water sampling stations within the study area.

The detailed result of plankton diversity as well as abundance is presented in **Appendix 4.4**.

Phytoplankton

The plant community is the basis of life in the aquatic ecosystems. Phytoplankton includes all drifting or floating marine plants, which are usually, single celled and autotrophic. As primary producers, they contribute appreciably to total production within aquatic systems (Canter and Hill, 1977) the proliferation of phytoplankton depends on water temperature, light penetration and the supply of nutrient salts to the surface layer. However, biomass of plankto decreases with depth and distance from the coastline.

The Diatoms dominated the spectrum of phytoplankton species compositions during the wet and dry seasons with higher abundance representing 72% and 55% respectively. Phytoplankton composition and abundance has also been found to be consistent with previous results of phytoplankton survey around the project area (IPC 2005, Network E&P 2005 and NIPP 2007).

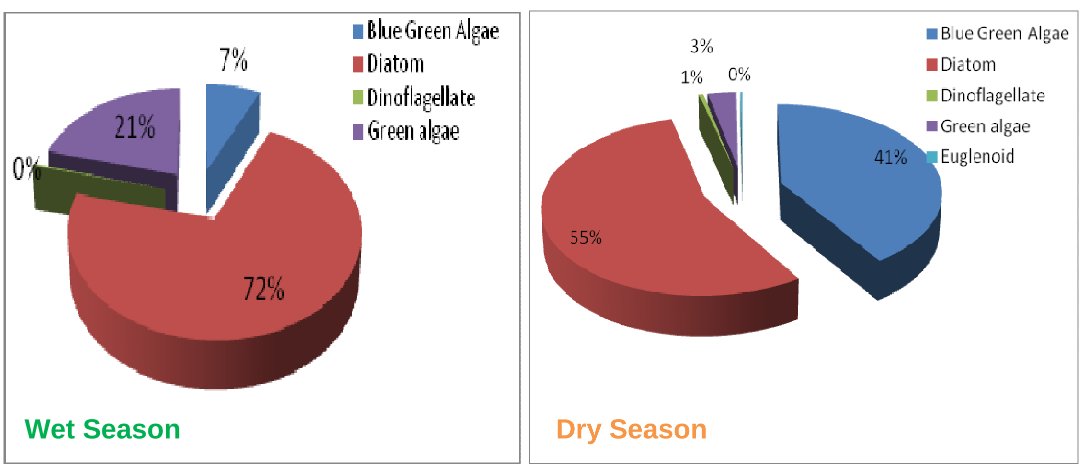


Figure 4.11: Percentage Abundance of Phytoplankton

The dominance of Diatoms in the water bodies is similar to what obtains in many Nigerian Rivers. Ecologically, diatoms are significant not only as important ultimate source of food for zooplankton and fish but also serve as indicators of water quality and pollution. Cross sections of phytoplankton species from the study area as observed from an investigative microscope are shown below.

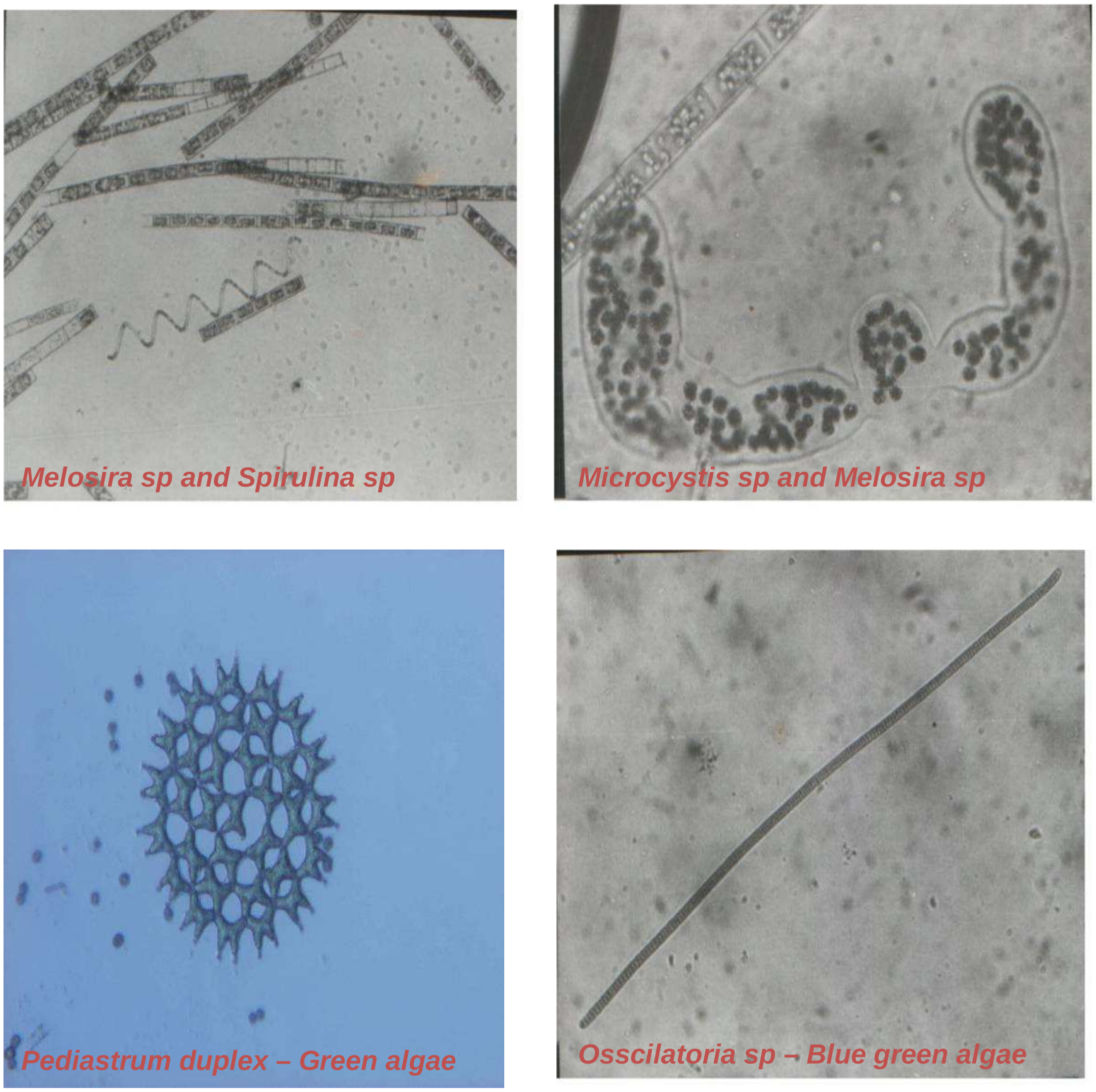


Figure 4.12: Phytoplankton Species along Study Area

Zooplankton

These include small animals of weak or no swimming ability that are free flowing or drifting biota. They include the holoplankton (e.g., copepods) and the meroplankton (such as the larval stages of invertebrates and the eggs and larvae of most fish species). In the aquatic food web, zooplankton are the initial consumer of energy fixed by the phytoplankton and by themselves, and they provide a link between primary production following fertilization usually results in greater zooplankton abundance.

The dominant zooplankton taxa encountered in the study area were the Arthopods/crustacean species which dominated with 71% abundance in both seasons. Rotifers followed with 20% to 24% for the dry and wet seasons respectively, while least occurrence with 4% to 2% are represented by the chordates, molluscs and nematode species. These values correlate with previous zooplankton baseline survey (IPC, 2005) and is characteristic of a typical freshwater environment in the Niger-delta region.

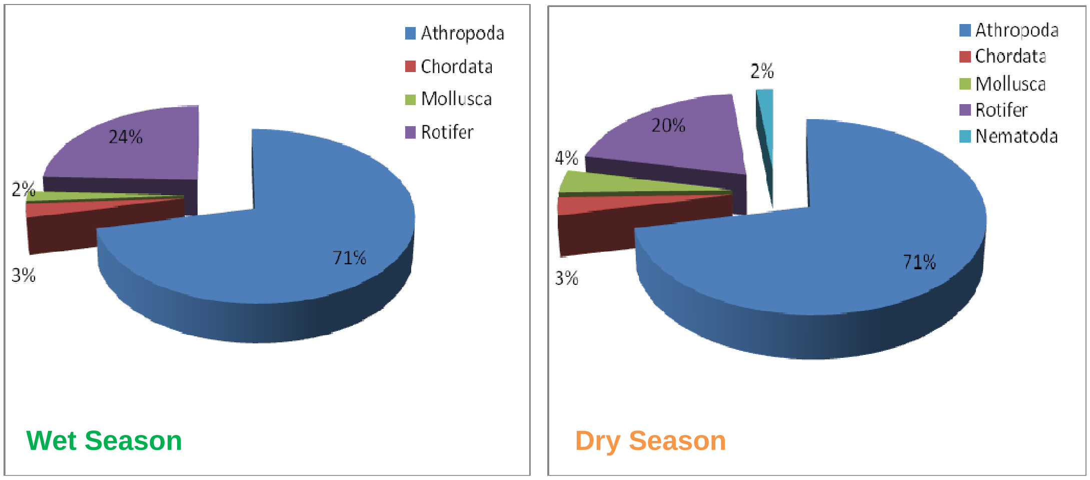


Figure 4.13: Percentage Abundance of Zooplankton

The dominance of the arthropod zooplankton community in both seasons is in conformity with findings of previous researchers and reports that have in the past shown the dominance of crustaceans amongst the zooplankton community of aquatic ecosystems Waiffe and Frid (2001), and hallegraff (1995). **Figure 4.14** below shows some zooplankton species observed within the study area.

Figure 4.14: Zooplankton Species along Study Area

4.9.2 Benthic Communities

Riverbed sediments consist of rock particles and organic remain at varying composition depending on depth, distance from coastline and local variant (biological and geological activities). Organisms that live on the bottom of riverbed include some fish, clams, oysters, crustaceans, sponges, sea anemones etc. These organisms together with their surrounding water and sediment make up the benthic ecosystem.

Sediment type of an area is very important in determining the kind of benthic community that develops, sediments tends to shift and move, making it difficult for large plants or algae to become established, clams, burrowing worms, and small crustaceans however, make use of sediments as suitable habitat (Sanders and Hessler, 1969).

Benthic macro-invertebrates or benthos are those organisms that lack vertebrae and occupy the bottom layer of water body for all or part of their life cycle (Roseenberg and Resh, 1993). Generally, they are visible to the naked eyes and play a variety of crucial roles in aquatic ecosystem. Benthic deposits are bottom sediments that originate from dead or decaying organic materials. They are biological indicators of water quality or habitat condition in aquatic environment since the bed collects the sediment from the water. Most macro-benthic communities are sedentary and reflect the quality of their immediate environment.

Community structure and distribution of macro-benthos in the study area was evaluated and it revealed that annelids were the dominant benthos species recorded across sampling stations with the occurrence of one mollusc specie during the dry season.

4.10 Vegetation and Wildlife

The synopsis of vegetation characteristics as well as wildlife studies carried out across the project area during the sampling exercise is presented in the subsections below.

4.10.1 Vegetation

The proposed power transmission line would traverse various habitats including several secondary lowland forests, seasonal freshwater swamps, cultivated farmlands, bush fallows, and mangrove forests (at Ibeno, Eket, and Ikot Abasi areas) on the left flank of Eket – Ikot Abasi road.

A map showing the general vegetation characteristics along and in the immediate vicinity of the proposed transmission line route is presented in **Figure 4.15**.

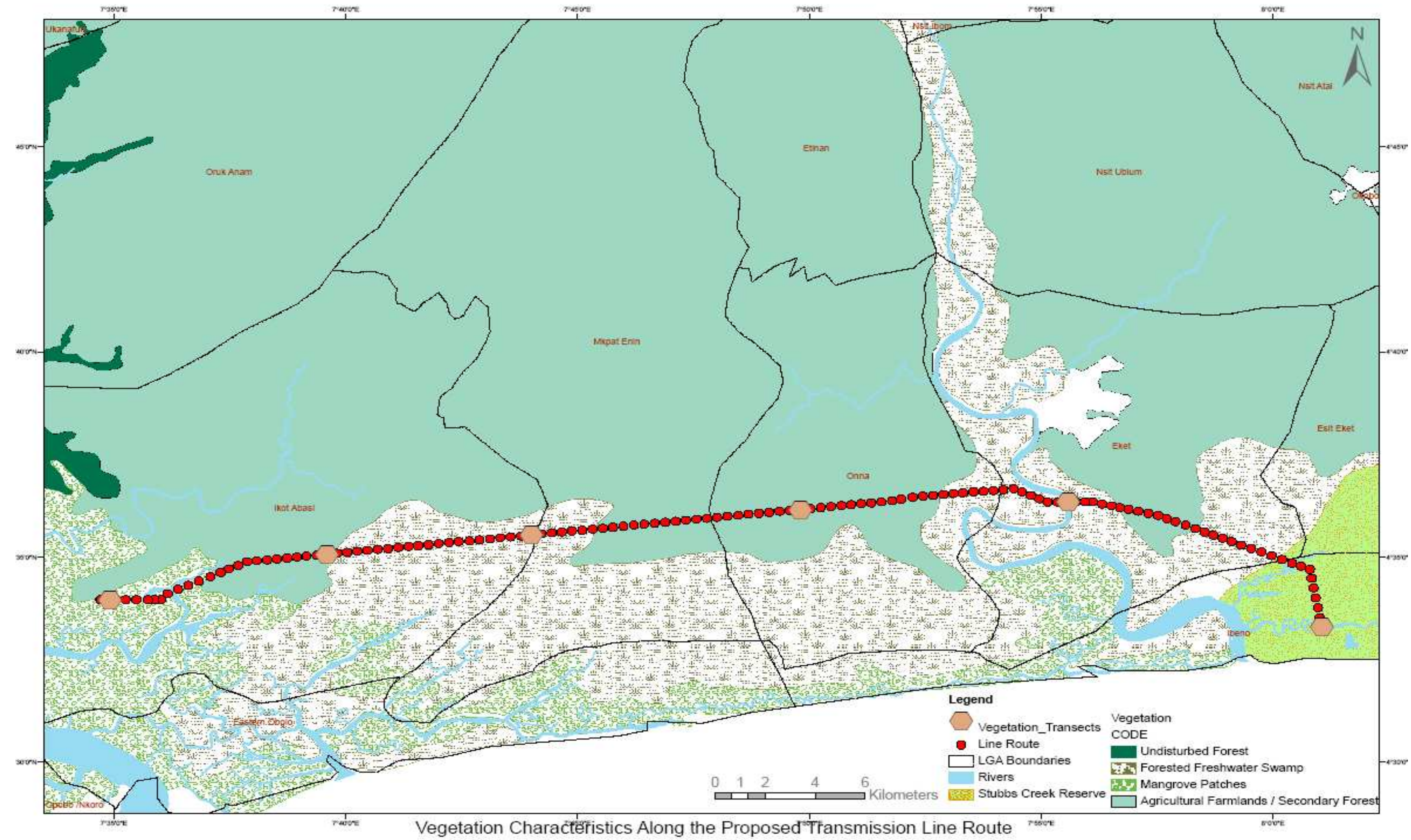


Figure 4.15: Vegetation Characteristics

Also delineated on the map are areas where the vegetation and wildlife transects were designated during the biodiversity studies.

Table 4.11: Features of Vegetation / Wildlife transects

Vegetation Transect	Transect size	Nearest locality/landmark	LGA
SS 1	1000m X 10m	North-West of QIT premises (proposed QIPP area)	Ibeno
SS 6	1000m X 10m	Eket Bridge Area	Eket
SS 10	1000m X 10m	Ukpana Rd in Ikot Edor town	Onna
SS 13	1000m X 10m	Off Akwa Ibom State University (Main Campus)	Mkpat Enin
SS 16	1000m X 10m	Ikwa town (East)	Ikot Abasi
SS 23	1000m X 10m	East of ALSCON Plant	Ikot Abasi

The transmission line right of way cuts through the Stubbs Creek forest reserve (see **Figure 4.15**). The Stubbs Creek Reserve from the vegetation field survey falls within Transect 1 (around the QIT area, east of the transmission line route). However planned project activities (during construction) have put in place mitigation and management practices to reduce loss of habitat as well as disturbances to vegetation cover to the bearest minimum taking into consideration the Worldbank operational policies on natural habitats and forests. An edict on MPN's (Mobil Producing Nigeria Limited, an international oil company and operator of the Qua Iboe Terminal) occupancy and status of the Stubbs Creek Forest Reserve is presented below.

Stubbs Creek Forest Reserve – Current Status

The Stubbs Creek Forest Reserve was established in 1931 under Order 45 and subsequently amended in 1941, 1955 and 1962. This Reserve is one of the last remaining significant, but highly disturbed forest reserves in the Niger Delta region. The proposed QIPP-PP will be located in the southwestern corner of the Reserve, while the QIPP-Transmission Line will cut across the reserve approximately 4.9km NW. The Akwa Ibom state government is responsible for managing the Stubbs Creek Forest Reserve in accordance with Order 45. The Order allows local inhabitants access to the reserve so as not to deprive them of their historical use of the associated forest such as hunting, fishing, and extracting water.

Project Site Boundaries

MPN has certificates of occupancy documents which jointly encompass the land tract boundary for the QIPP-PP and some part of the QIPP-Transmission Line facilities. As stated earlier despite the fact that the area was initially designated as a forest, the Nigerian context does not consider a forest reserve as a conservation area. It is rather utilised for for timber production. The area is therefore not a critical natural habitat.

SS 1

This transect is accessible through Ukpenekang Road and traverses a mangrove swamp situated on the eastern flank of Exxon-Mobil's QIT premises. The transect is largely dominated by the exotic Nipa palm, (*Nypa fructicans*), with a frequency of occurrence of over 95%. Interspersed in the luxuriant Nypa community are few scattered stands of *Rhizophora sp*, *Avicennia africana* and *Phoenix reclinata* (a wild date palm with prickly pinnate leaves). Although the Nypa palm community generally attained a height of 3.7m, the transect's maximum tree height of 5.2m was recorded on the red mangrove, *Rhizophora racemosa*. At the periphery of the swamp were clusters of the mangrove-associated forbs like *Dalbergia ecastaphyllum*, *Drepanocarpus lunatus*, the fern, *Achrosticeum aureum* and sedges such as *Paspalum vaginatum* and *Cyperus sp*. The stocking density estimate was 7 plants /m2 and litter cover was less than 45%. **Figure 4.16** show segments of SS 1 transect.

Figure: 4.16: Mangrove Vegetation – QIT Axis (Ibeno)

SS 6

VEGT-6 transect passes through a secondary riparian forest near Eket Bridge. The forest shows 2-layer stratification, and was co-dominated by *Raphia, Hallea and* Anthocleista *spp*. With a maximum tree height of 24m recorded on an oil palm tree, the forest had the greatest diversity of woody flora throughout the sampled stations. Common among the trees and shrubs were:

Pandanus candelabrum (Screw Pine)	20%
Musanga cecropoides (Umbrella tree)	20%
Anthocleista vogelli.(Cabbage tree)	40%
Cleistopholia patens	10%
Elaeis guineensis (Oil Palm tree)	30%
Raphia sp (Raffia palm)	40%
Hallea ledermanii (Abura)	40%
Dracaenea arborea (Boundary tree)	40%
Alstonia boonei (Stoolwood)	30%

The undergrowth measuring about 2.5m high was highly diversified, with thickets of shade-tolerant and flood-tolerant weeds , namely, *Nephrolepis biserata, Pteridium acquilinum, Selaginella myosurus, Triumfetta cordifolia, Costus afer, Aspilia africana, Ageratium conyzoides, Chromolaena odorata, Panicum repens, Paspalum scrobiculatum, Desmodium scorpiurus, Paliosota hirsuta, Aframomium melegueta, Croton lobatus, Combretum hispidum, Emilia practessima, Asystasia gangetica, Mitracarpus villosus*, and creepers such as *Heterotis rotundifolia, Smilax anceps* and *Luffa cylindrica*. The weeds also included grasses and sedges such as *Cyperus sp, Mariscus sp., Fimbristyllis* sp etc. Thus, the stocking density was boosted to 54 plants /m^2 and the percentage litter cover reached 75%. No serious pathological was detected, except for a mild case of leave variegation on the Christmas tree, *Alchornea cordifolia* due to the grasshopper, *Zonocerus variegatus*. A segment of SS 6 transect is shown in **Figure 4.17**.

Figure: 4.17: Secondary Riparian Forest – Eket Axis

SS 10

This transect was accessible through Ukpana road in Ikot Edor in Onna LGA. It traverses a seasonal freshwater swamp (dominated by *Raphia sp*) and a cassava farmland in the neighborhood. The cassava farm was disclosed to be about 6 months old by the local farmer during field studies. The transect's maximum tree height of 22m was measured on an oil palm tree. No distinct stratification was observed. Among the common trees were:

Harungana madagascariensis	30%
*Calamus deeratus (*Cane *)*	10%
*Anthocleista vogelli.(*Cabbage tree*)*	20%
Dracaena arborea	20%
*Elaeis guineensis (*Oil Palm tree*)*	40%
*Raphia sp (*Raffia palm*)*	50%

The wetter floor of the forest interior had thickets of weeds composed primarily of *Selaginella myosurus, Nephrolepis biserata, Pteridium aquilinum, Cyrtosperma senegalense, Lycopodium sp*., and *Triumfetta cordifolia* while the drier outskirt was more diversified with clusters of *Aspilia africana, Ageratium conyzoides, Costus afer, Chromolaena odorata, Panicum repens, Paspalum scrobiculatum, Synedrella nodiflora, Desmodium scorpiurus, Culcasia scandens, Croton lobatus, Combretum hispidum, Asystasia gangetica, Mitracarpus villosus, Heterotis rotundifolia, Sida acuta, Urena lobata* and *Sertaria barbata*. As a result a high stocking density of 58 plants/m2 and percentage litter cover of 85% was recorded in this transect.

In the farmland segment (which included crops like cassava, *Manihot esculenta*; Cocoyam, *Colocasa sp*; Yam, *Dioscorea sp* and Maize, *Zea mays*; Melon, *Citrullus vulgaris*; Okro, *Abelmoschus sp*, Garden egg, *Solanum sp*, Red Pepper, *Capsicum sp* and *Telfairia occidentalis*) the stocking density and percentage litter cover were much lower (12 plants/m2) as the farm was tendered. Some of the Okra leaves had the powdery mildew, *Oidium abelmoshii* with an incidence of 10% and severity index of 2 (=moderate infection) while others were attacked by the leaf roller, *Sylepta derogata* , with an incidence of 5% and severity index of 1(=mild infection). **Figure 4.18** show segments of SS 10 transect.

Figure: 4.18: Secondary Forest – Onna Axis

SS 13

This transect is situated in Ekim area, opposite Akwa Ibom State University Main Campus, in Mkpat Enin LGA. It passes through a degraded gallopy freshwater swamp at one end, and a bush fallow at the other. There was neither a distinct stratification nor interlocking canopies. The transect's maximum tree height of 23m was recorded from an oil palm tree. Among the common trees and shrubs were:

Harungana madagascariensis	40%
Alstonia boonei	10%
*Anthocleista vogelli.(*Cabbage tree*)*	20%
Bambusa vulgaris	10%
*Elaeis guineensis (*Oil Palm tree*)*	60%
*Raphia sp (*Raffia palm*)*	50%

The undergrowth of this transect was characterized by thick thickets of sedges, grasses, creepers and herbaceous forms among which were - *Cyperus sp, Mariscus sp, Fimbristyllis sp., Sertaria barbata, Emilia practessima, Selaginella myosurus, Heterotis rotundifolia, Ipomea sp, Smilax anceps, Luffa cylindric*a and ferns like *Nephrolepis biserata, Pteridium acquilinum, Pteris sp* and *Lycopodium sp*, Stocking density estimate was about 35 m2 . Because of the flooded condition of the transect, assessment of litter cover was impracticable. However, overall, the flora was lush and free of pathological conditions, with *Aspilia africana*, *Ageratum conyzoides* and *Triumfetta cordifolia* in bright flowers. **Figure 4.19** presents a segment of SS13 transect.

Figure: 4.19: Palm Forest – Mkpat Enin Axis

SS 16

Accessible through Ikwa town (in Ikot Abasi LGA) this transect is situated 187m off the main road on the eastern flank. It passes through a degraded secondary forest and cassava farmland. There was no distinct stratification, as the trees were scattered all over the place. The transect's maximum tree height of 25m was measured on an oil palm tree.

In this transect, the undergrowth about 1.5m high was composed of herbaceous weeds such *Aspilia africana, Ageratium conyzoides, Phyllanthus amarus, Costus afer, Chromolaena odorata, Panicum repens, Urena lobata, Paspalum scrobiculatum, Andropogon, Desmodium scorpiurus, Croton lobatus, Combretum hispidum, Asystasia gangetica, Mitracarpus villosus, Heterotis rotundifolia, Sida acuta, and Sertaria barbata*. Stocking density estimate and percentage litter cover were estimated at 28 plants/m^2 and 90% respectively. No pathological condition was detected.

SS 23

Situated on the eastern flank of ALSCON, this transect is accessible through ALSCON premises. It traverses a secondary forest dominated by oil palm trees and a cultivated farmland dominated by cassava. The transect's maximum tree height of 28m was recorded on a lanky oil palm tree. Interspersed in the Oil-Palm community are the following trees in descending order of abundance.

Musanga cecropoides	40%
Dracaena arborea	40%
Harungana madagascariensis	30%
Anthocleista vogelii	20%
Gmelina arborea	20%
Alstonia boonei	20%

Among the shrubby components were *Cnestis ferruginea, Manniophyllum fulvum* and *Loncocarpus griffifornis*. The undergrowth reached a maximum height of 1.2m and consisted of a wide variety of weeds such as *Aspilia africana, Chromolaena odorata, Triumfetta cordifolia, Urena lobata, Costus afer, Ageratum conyzoides, Nephrolepis biserata, Pteridium acquilinum, Selaginella myosurus, Smilax anceps, Caladium sp., Vernonia sp and Phyllanthus amarus*. Clusters of grasses and sedges were common in the undergrowth, including *Panicum maximum, Cyperus sp., Paspalum sp., Fimbristyllis, Mariscus sp., Kyllinger sp, Bracheria sp., and Commelina sp*. Thus, the stocking density was fairly high, up to 42 plants /m2 and the percentage litter cover was well above 75%. Cases of chlorosis and necrosis were recorded on *Anthocleista vogell*i and *Musanga cecropoides* respectively. The chlorotic conditions had an incidence of 5% and severity index of 1 (= mild infection) were traced to insufficient supply of light to the plant from affected angles, while the necrotic conditions were traced to Fusarium infection with an incidence of 15% and severity index of 3 (= severe).

At the cassava farmland segment of transect SS 23, these weeds were also recorded but at much lower densities, as the farm was tendered. Other crops of the farm were cocoyam, pepper, yam, okra, garden egg and vegetables like fluted pumpkin, *Telfairia occidentalis*; Green, *Amaranthus sp,* and Water leaf, *Talinium triangulare*.

Farmlands across the area irrespective of the sampling transects are first cultivated at the end of the dry season, when the rain begins to fall. Farmers plant their crops after the first or second rain in the month of March, and sometime in April. The periodic rainfall pattern before the peak in June enables farmers to cultivate various crops including maize, cassava, melon, groundnut, yam and others. Specifically oil palms are either of wild groves origin or cultivated in small scales and are left often untended along the area.

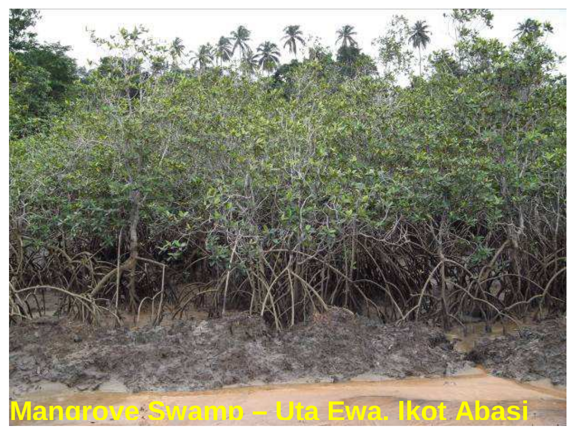


Figure: 4.20: Vegetation Types – Sub-station Axis (Ikot Abasi)

Bordering one end of the farmland is a small tidal creek, which branches off from Uta ewa in the south. Mangroves such as *Rhizophora sp, Avicennia* and the fern *Achrosticeum aureum* and a few stands of *Nypa fructicans* marked the shores in low densities. **Table 4.12a** shows a checklist of specific conservation status for identified flora along the project area. Although the list identifies six of the species as endangered and 43 as vulnerable, the ranking is based on IUCN standards as these species are locally abundant.

Table 4.12a: Flora Conservation Status

Species	Family	IUCN Status
Acanthus montanu	*Acanthaceae*	*LC*
Acrostichum aurenm	*Ceratopteridaceae*	*LC*
Albizia ferruginea	*Fabaceae*	EN
Albizia adianthifolia	*Fabaceae*	*VU*
Alchornea cordifolia	*Euphorbiacea*	*VU*
Alstonia cogensis	*Apocyanaceae*	*LC*
Alstonia boonei	*Apocyanaceae*	VU
Anogeissus leiocarpus	*Euphorbiacea*	*LC*
Anthocliesta voegilii	*Loganiaceae*	*LC*
Anthonotha macrophylla	*Fabaceae*	*VU*
Anthostema aubryanum	*Euphorbiacea*	*VU*
Avicennia africana	*Avicenniaceae*	*LC*
Bligha sapida	*Sapindaceae*	*LC*
Canna indica	*Cannaceae*	*LC*
Celosia argentea	*Amaranthaceae*	*LC*
Ceratophyllum demersum	*Ceratophyllaceae*	*LC*
Clistopholis patens	Cupressaceae	*EN*
Cnestis spp DC.	*Vonnaraceae*	*LC*
Cocos nucifera	*Arecaceae*	*VU*
Codiaeum variegatum	*Euphorbiaceae*	*LC*
Cola millini	*Sterculiaceae*	*DD*
Combretum racemosum	Combracaceae	*LC*
Crescentia cujete	*Bignonanceae*	*DD*
Croton hirtus	*Eupphorbiaceae*	*VU*
Croton lobatus	*Eupphorbiaceae*	*VU*
Cyperus papyrus	*Cyperaceae*	*VU*
Crytosperla senegalense	Araceae	LC
Desmodium salicifolium	*Fabaceae*	*LC*
Dissotis spp	*Melastomataceae*	*VU*
Dracaena arborea	Dracaenaceae	LC
Ecastophyllum brownii	*Fabaceae*	*DD*
Eichhornia crassipes	*Ponterderiaceae*	*LC*
Eleais guineensis	*Arecaceae*	*VU*
Elaeocarpus pyriformis	Elaeocarpaceae	VU
Euphorbia hirta	*Euphorbiaceae*	*VU*
Ficus exasporata	*Moraceae*	*VU*
Funtumia elastica	Apocynaceae	*VU*
Grewia auriculata	*Tiliaceae*	*VU*
Guarea cedrata	Meliacea	*VU*
Hallea ledermannii	Rubiaceae	*EN*
Heterotis rotundifolia	Melastomataceae	LC
Homalium dalzielii	Salicaceae	VU
Hyptis suaveolens	*Lamiaceae*	*NT*
Irvingia wombulu	*Irvingianceae*	LC
Lantana camara	*Verbenaceae*	*LC*
Laportea ovalifolia	*Urticaceae*	*LC*
Lemna minor	Lemnaceae	*VU*
Lophira alata	*Ochnaceae*	*VU*
Lophira procera	*Ochnaceae*	*LC*

Lovoa trichiliodes	Meliaceae	*VU*
Macaranga barteri	Euphorbiaceae	*VU*
Mallotus oppositifolia	*Euphobiacee*	*VU*
Manniophyton fulvum	*Euphobeaceae*	*VU*
Marantochloa purpurea	Marantacea	VU
Merremia aegyptia	*Convolvulaceae*	*LC*
Mimosa invisa	*Fabaceae*	*VU*
Mimosa pudica	*Fabaceae*	*LC*
Momordica charantia	*Cucurbitaceae*	*LC*
Monodora myristica	*Annonaceae*	*DD*
Musanga cercropodes	Urticaceae	VU
Mussaenda polita	Urticaceae	LC
Myrianthus arborea	Urticaceae	VU
Nauclea diderrichi	*Rubiaceae*	EN
Nesogordonia papaverifera	*Malvaceae*	VU
Nymphaea odorata	Nymphaeaceae	LC
Oldfieldia africana	Euphorbiaceae	VU
Ouratea spp	Ochnaceae	VU
Pandanus candelabrum	Pandanaceae	VU
Parkia bibliogosa	Fabaceae	LR
Pentadesma butyracea	Clusiaceae	VU
Peporomia pellucida	Piperaceae	LC
Phyllantus amarus	Euphobiaceae	LC
Physalis micrantha	Solanaceae	LC
Pimenta racemosa	Myrtaceae	VU
Piptadeniastrum africanum	Fabaceae	VU
Pistia stratoites	Araceae	LC
Platostoma africanum	Lamiaceae	VU
Pterocarpus mildbraedii	Fabaceae	EN
Pterygota macrocarpa	Sterculiaceae	VU
Raphia africanum	Arecaceae	DD
Raphia hookeria	Arecaceae	DD
Rhizophora racemosa	Rhizopharaceae	VU
Sacoglottis spp	Celastraceae	VU
salacia pyriformis	Celatraceae	VU
Salvinia molesta	Salvinaceae	LC
Schnwenkia americana	Fabaceae	LC
Serindeia warneckei	Leguminosae	DD
Spathandra blakeoides	*Melastomataceae*	VU
Stachytarpheta jamaicensis	Verbanaceae	LC
Sterculla tragacantha	Sterculiaceae	LC
Symphonia globulifera	Guttiferaceae	VU
Terminalia catappa	Terminaliaceae	EN
Alternanthera maritima	Amaranthaceae	LC
Xylopia rebescens	Annonaceae	VU

* E=endemic; EN= endangered; VU=vulnerable; LR=low risk; LC=least concern; NT=not threatened; DD=data deficient.

4.10.2 Wildlife

A comprehensive checklist as well as their local, national (Act 11 of 1985) and international (IUCN) conservation status of wildlife known along the proposed QIT – Ikot Abasi power transmission line is presented in **Table 4.12b**.

Table 4.12b: Wildlife Diversity and Conservation Status

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
M/01	Mammalia	Cricetidae	*Cricetomys emini*	Oyiot	XXX	Aug-11	S	-	-	-
			Giant Rat							
M/02		Soricidae	*Xerus erythropus*	Adua/Ato-toi	XXX	Aug. 2011	S	-	-	-
			(West African ground Sqirrel) squirrel)							
M/03			*Epixerus ebii*	Ikara	XXX	Aug,2011	S	-	-	-
			(Palm Squirrel)							
M/04			*Helioscuirus rufobrachium*	Ikara	XX	May, 2011	S	-	-	-
			(Red-legged Sun Squirrel)							
M/05		Thryonomidae	Thryonomys swinderianus	Ineh	XXX	Aug. 2011	S	-	-	-
			(Cane Rat or Grasscutter)							
M/06		"	*Atherurus africanus*	Ebiong	XX	Aug. 2011	S	-	I	Sch.1
			(Brush-tailed Porcupine)							
M/07		Bovidae	*Cephalophus maxwelli*	Ukem	XX	Aug. 2011	S	-	K	-
			Maxwell's Duiker							
M/08			*Tragelaphus scriptus*	Ediop	XX	Aug. 2011	V	-	K	-
			(Bushbuck)							
M/09			*Tragelaphus spekei*	Ediop	X	Aug. 2011	V	-	E	Sch 1
			(Sitatunga)							
M/10			*Hymenoschus aquaticus*		X	Jun., 2008	V	-	-	Sch 1
			(Water Chevrotain)							
M/11			*Neotragus batesi*	Esorh	XX	Aug. 2011	V	-	-	Sch 1
			(Bate's Pygmy Antelope)							
M/12		Suidae	*Potamochoerus porcus*	Edi-Ikot	XXX	Apr., 2010	S	-	-	-
			(Bushpig)							
M/13		Viverridae	*Viverra civetta*	Ekiko	XX	Aug-11	S	-	-	Sch 2

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
	Mammalia		(African Civet Cat)							
M/14			*Genetta poensis*	Eyiet	X	May, 2011	V	-	-	Sch 2
			(Forest Genet)							
M/15			*Nandinia binotata*	Atan	X	June, 2011	V	-	-	Sch 2
			(Two-spotted Palm Civet)							
M/16			Herpestes ichneumon	-	X	Jan-11	V	-	-	Sch 2
			(Egyptian mongoose)							
M/17		Mustelidae	*Aonyx capensis*	???	X	Sep-10	V			Sch. 1
			(Cape clawless otter							
M/18		Manidae	*Manis tetradactyla*	????	X	Nov, 2010	V	-	-	Sch 1
			(Long-tailed Pangolin)							
M/19			*Manis tricuspis*		X	Apr.2008	V	-	-	Sch 1
			(Tree Pangolin)							
M/20		Cercopithecidae	*Cercopithecus mona*	Ebuk	XX	Jul-11	V	-	-	Sch 2
			(Mona Monkey)							
M/21			*Cercopithecus nictitans*	Ebuk	X	May, 2011	V	-	-	Sch 2
			(Putty-nose monkey)							
M/22			*Cercopithecus erythrotis*	*Ebuk*	*X*	*Oct.2009*	V	-		Sch 2
			Red-eared guenon							
M/23		Loridae	*Perodicticus potto*	Adue	X	April,2008	I	-	-	Sch 2
			(Bosman Potto)							
M/24		Galagonidae	*Galagos sp*	???	X	Nov.2008	I	-	-	Sch 2
			Bush Baby							

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
AV/25	Aves	Accipitridae	*Milvus migrans*	Mukpo	XXX	Aug. 2011	S	Afm/B, PM	-	Sch 1
			(Black Kite)							
AV/26			*Kaupifalco monogramicus*	Okwukwor	*XXX*	"	S	RB, ?Afm	-	Sch 1
			(Lizard Buzzard)							
AV/27			*Accipiter erythropus*	Okwukwor	XXX	"	S	R(B)	-	Sch 1
			Chicken Hawk)							
AV/28			*Gypohierax angolensis*	Ntrukpom	*X*	"	V	RB	-	Sch. 2
			(Palmnut Vulture)							
AV/29		Bucerotidae	*Tokus fasciatus*	Ekpang	XXX	"	S	RB	-	-
			(African Pied Hornbill)							
AV/30			*Ceratogymna fistulator*	Ekpang	*XX*	"	V	RB	-	-
			(Piping Hornbill)							
AV/31		Ardeidae	*Bulcubis ibis*		XXX	"	S	RB	-	Sch.2
			(Cattle Egret)							
AV/32			*Egretta garzetta*		XX	"	S	RB	-	Sch 2
			(Little Egret)							
AV/33		Covidae	*Corvus albus*	Ekong	XXX	"	S	RB	-	-
			Pied Crow							
AV/34		Alcedinidae	*Halcyon malimbica*		X	"	S	RB		-
			(Blue-crested Kingfisher)							
AV/35			Halcyon senegalense		XX	"	S	RB		-
			(Woodland Kingfisher)							
AV/36			Megaceryle maxima		X	"	V	R(B)		-
			(Giant Kingfisher)							

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
AV/37	Aves	Meropidae	Merops pusillis		X	"	S	RB		-
			(Little Bee-eater)							
AV/38		Apopidae	*Apus affinis*	Enuen-Enyang	XXX	"	S	RB, PM		-
			(Little Swift)							
AV/39			*Cypsiurus parvus*		XXX	"	S	RB		-
			(African Palm Swift)							
AV/40		Picidae	*Dendropicos pyrrhogaster*		*X*	"	S	RB		-
			Fire-bellied Woodpecker)							
AV/41		Ploceidae	*Ploceus cucullatus*	Nsa-sak	XXX	"	S	RB		-
			(Village Weaver)							
AV/42			*Ploceus ocularis*	Nsa-sak	XXX	"	S	RB		-
			(Spectacled Weaver)							
AV/43			*Ploceus melanocephalus*	Nsa-sak	*XX*	"	S	RB		-
			(Black-headed Weaver)							
AV/44		Pycnonotidae	*Pycnonotus barbatus*		XXX	"	S	RB		-
			(Common Bulbul)							
AV/45		Pscittacidae	*Pscittacus erithacus*		XX	Jul-11	V	RB		Sch.1
			(Grey Parrot)							
AV/46		Cuculidae	*Centropus senegalensis*	Odudu	*XXX*	*Aug-11*	V	RB		-
			(Senegal Coucal)							
AV/47		Columbidae	*Streptopelia semitorquata*		XXX	"	S	RB		-
			(Red-eyed Dove)							
AV/48		Phasianidae	*Francolinus bicalcaratus*		XX	Jun-11	S	-		
			(Double -spurred francolin)							

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
RE/49		Agamidae	*Agama agama*	Okpok	XXX	Aug.2011	S	-		-
			(Rainbow Lizard)							
RE/50		Scincidae	*Mabuya affinis*	Ewa-Ngwang	XXX	"	S	-		-
			(Blanding's snake) skink)							
RE/51			*Lygosoma fernandi*		X	Jun.,2008	V	-		-
			(Red/Fire Skink)							
RE/52		Varanidae	*Varanus niloticus*	Utai	X	May, 2009	V	-		-
			(Nile Monitor)							
RE/53			*Osteolaemus tetrapsis*	Ibah	XX	June, 2009	V	VU		Sch.1
			(Short-nosed Crocodile)							
RE/54	Reptilia	Chamaeleonidae	*Chameleo sp*	Akube	XX	July, 2009	V	-		Sch.1
			(Chameleon)							
RE/55		Boidae	*Python sebae*	Asabor	X	Nov.,2008	V	-		Sch. 1
			(African Rock Python)							
RE/56			*Python regius*	Ntene Asabor	X	Jan., 2009	V	-		Sch.1
			(Royal Python)							.
RE/57			*Calabaria reinhardtii*	???	X	May, 2009	V	-		Sch. 1
			(Calabar Python)							
RE/58		Viperidae	*Causus maculatus*		XX	Feb., 2009	V	-		-
		"	(Night Adder)							
RE/59		"	*Bitis gabonica*	Ibom	XX	Nov., 2008	V	-		-
			(Gabon Viper)							

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
RE/60			*Bitis nasicornis*	Ibom	XX	April,2009	V	-		
			(Rhinoceros Viper)							
RE/61			*Naja nigricollis*	Ibere	XX	Aug., 2009	S	-		-
			(Spitting Cobra)							
RE/62		Elapidae	*Naja melanoleuca*		X	June, 2008	S	-		
			(Forest Cobra)							
RE/63			*Dendroaspis jamesoni*	Asak	X	Nov-10	S	-		
			(Green Mamba)							
RE/64	Reptilia		*Gastropyxis smaragdina*	???	X	Apr-11	S	-		
			(Emerald Green Snake)							
RE/65		Colubridae	*Grayia smythii*	????	X	Aug-11	S	-		-
			(Smyth's Water Snake)							
RE/66			*Boiga blandingi*		X	Oct., 2009	S	-		
			(Blanding's snake)							
RE/67		Testudinidae	*Kinixys erosa*	Ikut	X	Aug-11	S	-		
			back-hinged tortoise							
RE/68		Pelomedusae	*Pelusios niger*	Ekit inyang	X	May, 2011	S	DD		-
			(Freshwater terrapin)							
AM/69			*Bufo maculatus*	Ekwat	XXX	Aug-11	S	LC		-
	Amphibia	Bufonidae	(African toad)							
AM/70			*Dicroglossus occipitalis*	Edong	*XX*	"	S	LC		-
			(Bull-frog)							

Table 4.12b: Wildlife Diversity and Conservation Status Cont'd

Ref code	Class	Family	Species	Ibibio name	Abundance Index (AI)	Date last Sighted	Conservation Status			
							Local	IUCN	WCMC	Act 11
AM/71	Amphibia	Ranidae	*Ptychadena mascariensis*	Edong	*XXX*	"	S	LC		-
			(Mascariene Frog)							
AM/72			*Ptychadena aequiplicata*		XX	"	S	LC		-
			(?)							
AM/73		Pipidae	*Silurana* (=Xenopus) tropicalis	???	XXX	"	S	LC		-
			(Claw-toed Frog)							
AM/74		Hyperolidae	*Hyperolius sp*	Mme	X	"	V	LC		-
			(Tree frog)							
AM/75			*Afrixalus dorsalis*	Mme	X	"	V	LC		-
AM/76		Arthrolepidae	Arthrolepis sp	?	X	"	V	LC		-

(Common name in parenthesis)
S = Satisfactory; E= Endangered; V= Vulnerable; K = Suspected to be in E or V categories; I = Indeterminate ;? = Probably present
IUCN : International Ranking in 2006 IUCN Red list
WCMC: National Ranking in WCMC's 1988 Nigeria Biodiversity Report
Act 11: Ranking in Federal Endangered Species Act 11 of 1985 (Schedule 1 & 2)
Abundance Index (AI): X = Few ; XX = Common ; XXX = Abundant

IUCN Red List Category Key
EX = Extinct
EW = Extinct in the Wild
CR = Critically Endangered
EN = Endangered
VU = Vulnerable
LR/cd = Lower Risk; Conservation Dependent
LR/int or NT = Near Threatened
DD = Data Deficient
LR/lc or LC = Least Concern (Not Considered to be red listed)

Avian Migratory and breeding Habit
RB = Resident Breeder
R(B) = Resident, but Breeding unproved
PM = Palaearctic Migrant
Afm = Migrates within Nigeria
AfM/B = Migrates to and from Nigeria to Breed in Nigeria
V = Vigrant
PM = Palaearctic Migrant
Afm = Migrates within Nigeria
AfM/B = Migrates to and from Nigeria to Breed in Nigeria

The table reveals that there are at least 76 vertebrate species (excluding nocturnal species like - mice, bats, owls, etc), presently resident in the freshwater swamp forests, dry secondary forests, bush fallows and farmlands sampled. A breakdown shows that there are approximately 24 mammalian species belonging to 11 families; 24 avian species belonging to 14 families. Reptiles are represented by 20 species from 10 families, while amphibians had the lowest number of species with 8 species from 5 families. Locally, 8 mammalian species are not threathened, while 13 are vulnerable. The status of two species, the Bush baby, *Galagos sp* and Bosman Potto, *Perodicticus potto* is unclear due to insufficient data.

Following the ranking of Act 11 of 1985, about 28 species are nationally endangered with 16 belonging to schedule 1 category and 12 to schedule 2. Among the mammals of schedule 1, are the Brush-tailed porcupine, *Atherurus africanus*, the Sitatunga, *Tragelaphus spekei*, Water Chevrotain, *Hymenoschus aquaticus*, Cape's clawless otter, *Aonyx capensis* and the Pangolins, *Manis tetradactyla* and *Manis tricuspis*, while all the primates belong to schedule 2. However, according to the National Ranking in WCMC's 1998 Nigeria Biodiversity report, Maxwells Duiker (*Cephalopus maxwelli*), Marshbuck (*Tragelapus speki*) and *Neotragus batesi* are locally considered to be under threat. This is also consistent with findings from biodiversity studies around the project area (NIPP 2007, BLNG 2008).

Among the aves, 19 species locally, have satisfactory conservation status while 5 are vulnerable, namely – *Gypohierax angolensis* (Palmnut Vulture), *Ceratogymna fistulator* (Piping hornbill), *Megaceryle maxima* (Giant Kingfisher), *Psittacus erithacus* (Grey Parrot) and *Centropus senegalensis* (Senegal Coucal). By IUCN classification, many of the birds are Resident Breeders (RB) and of which none has been classified as endangered by the international conservation body. A few species like *Milvus migrans* (kite) and *Kaupifalco monogramicus* (Lizzard Buzzard) migrates within Nigeria, while others are Palearctic migrants e.g, *Apus affinis*.

Obviously common and ubiquitous reptiles in the area are the Agama lizard, *Agama agama* and the skinks, *Mabuya affinis*. The conservation status of snakes could not be determined precisely with certainty because of their secretive nature, however biodiversity studies around the project area (NIPP, 2007) reported no endangered reptilian species in line with the IUCN ranking. But the high frequency of killings and encounter by hunters and farmers indicate that such forms like the *Bitis gabonica*, (Gabon Viper), *Naja nigricollis*, and *Psammophis philips*i are common or abundant.

Mammals

Result of Investigations into mammalian diversity reveal that mammals commonly caught in the prospect sites are *Cricetomys emini*, *Thryonomys swinderianus*, *Atherurus africanus*, *Cephalopus maxwelli*, *Tragelaphus scriptus*, *Neotrogus batesi*, *Potamochoerus porcus*, *Viverra civetta* and *Cercopithecus mona*.

Photo Source: BLNG (2008) Brass Biodiversity Study

Figure: 4.21: Mammals Along Project Area

Evidence of wildlife presence, such as footprints, trails, scats, skeleton, sloughed skin, etc were encountered in the farmlands and bush fallows, where they forage, as well as shorelines of freshwater swamps where they drink, the ecology, distribution and conservation status of these mammals have been discussed in earlier works in the Niger Delta (BLNG, 2008).

Aves

The bulk of the birds commonly sighted along the proposed power transmission route during the period were mainly, the diurnal birds of prey, seed-eaters and scavengers such as Ploceidae (Weavers), Covidae (Pied Crow), Accipitridae (Kites, Hawks, Palm nut vulture), Bucerotidae(Hornbills), Ardeidae (Egrets), Alcedinidae (Kingfishers), Apopidae (Swifts), Hirundinidae (swallows), Pycnonotidae (Bulbuls), and Columbidae (Doves).

Figure: 4.22: Little Egret (*Egretta garzetta*) – Douglas Creek Area

These birds appeared to have activity peaks in the morning and evening hours. They often alight from the forest edges, and their nests to feed in farmlands and bush fallows, while kites and hawks hover over burning bushes to hunt for offal. By wet season many birds remain perched most times; taking shelter or tendering their young. The reverse was the case during the dry season studies, as more birds were sighted.

Reptilia

The reptilian fauna of the area are diverse. During the wet as against dry season observationsminimal acitivity was obsereved for most species, thus they could only be sighted when they were basking. Lizards and skinks were abundant in all the transects and none of the identified species are classified as threatened or endangered in the IUCN ranking (see **Table 4.12**); skinks were more frequently encountered in the interior of forests than lizards and areas where timber, oil palm fruits and refuse were dumped. The occurrence of poisonous snakes like the Gabon Viper, *Bitis gabonica*; Spitting Cobra, *Naja nigricollis*, Forest Cobra, *Naja melanoleuca*, and Jameson's Mamba, *Dendroaspis jamesoni*, in the thick forest and bush-fallows was commonly reported by the hunters.

Swamp fishers also reported the take of the non-poisonous water snake, *Grayia smythii* in their basket traps. They also confirmed that ground-racing snakes like *Psammophis phillipsi,* Blanding's snake, Toxidryas (=Boiga) blandingi) and the Emerald Green snake, *Gastropyxis smaragdina* are commonly encountered in farms and bush fallows on drier, warm days. Three boids are known in the area, namely – the Royal Python, *Python regius*, the African Rock Python, *P. sebae*, and the Calabar Python, *Calabaria reinhardtii*. The first two prey on mammals in the forest, while the Calabar python lives in burrows in the swamp and feeds on ants. By wet season when the swamp is inundated, it migrates to the periphery and remains there till dry season. **Figure 4.23** shows a tortoise caught by one hunter in Ekim (Mkpat Enin LGA,) during the survey.

Figure: 4.23: Tortoise –Hunters Bag in Mkpat Enin Axis

Amphibia

Amphibians commonly found during the survey were the African toad *Amietophrynus* (Bufo) maculatus, and the frogs, *Ptychadena mascariensis*, and *P. aequiplicata*, The black clawed frog, *Silurana (Xenopus) tropicalis* and the Bullfrog, *Hoplobatrachus (= Dicroglossus) occipitalis* are restricted to the swamps where they constitute important component of the fishery. Records of tree frogs such *Hyperolius sp* and *Afrixalus dorsalis (***Figuren 4.24***)* were taken on the littoral shrubs and herbs of the swamp, especially, *Cyrtosperma senegalense,* which provide enough shade and substrate.

Photo Source: BLNG (2008) Brass Biodiversity Study

Figure: 4.24: Tree Frog - *Afrixalus dorsalis*

The humid condition in wet season enables them to come out in high numbers, especially at night.

Conservation Issues

Poaching is the primary route to wildlife depletion in the area, as it is an important source of income for the rural people, especially around the villages. The incentives of the business are the diversity of game animals in the area and the high patronage by bushmeat sellers. Bushmeat is a delicacy in the area, and conservation awareness is very low, hence trade on it goes on, inspite of the provisions of Act 11 of 1985. Data from the field as shown in **Table 4.13** indicates that sitatunga, bushbucks, and bush-pigs are the most expensive animals followed by monkeys, grasscutters and porcupines. The project mitigation and management provides clear measures that prohibit poaching, hunting, trapping and killing of wildlife by project personnel.

Table 4.13: Cost of Game Animals Along Study Area

Common name	Ibibio name	Price range (Naira)
Giant rat, (“Rabbit”)	Oyiot	950 - 1300
Cane rat (“Grasscutter”)	Ineh	3,800- 4,500
Porcupine	Ebiong	3,500-4,500
Maxwell’s Duiker	Ukem	5,800-7,000
Bates Antelope	Esorh	4,500-5800
Bushbuck	Ediop	43,000-47000
Sitatunga	Ediop	42,000-46,800
African Civet Cat	Ekiko	8,850-11,500
Genet	Edue	800-1,500
Two spotted Palm civet	Atan	800-1,200
Monkeys	Ebok	4,000-5,000
Bush-pig	Edi-Ikot	34,000-36,200
Tortoise	Ekit	4,800-6,000
Terrapins	Ekit-Inyang	4,800-6,000
Nile Monitor	Utai	6,600- 8,500
Crocodile	Ibha	9,840-10,900

Most of the hunters uphold that the upper limits of the market price ranges are reached in festive seasons, like new yam festivals, masquerading season, Easter, and Christmas. The high prices of duikers and antelopes, according to respondents, are due to the fact their skins are useful for indoor decorations, chieftaincy decorations, and for the construction of tom-tom and base drums, and their parts (skull, teeth, hoofs, etc) are often used in certain traditional medicine.

Information as obtained from field interviews with the chiefs, traditional custodians and local hunters was that pythons (locally called Asabor) are culturally protected in line with historic traditional beliefs. Also at Ikot Ebidang in Onna LGA, the bush pig, *Potamochoerus porcus* and Bosman Potto, *Perodictitus potto*, are treated as totemic animals. However there were no records, as observed during biodiversity consultations, of any sacred grooves around the project area.

Hunters also report that hunting successes are much higher in wet season than in dry season, hence hunting is carried out primarily in wet season. Hunting successes are reduced in dry season, because it is difficult to travel quietly through the bush, without noise of trailing steps on the dry leaves alerting the animals.

Hunting is carried out both by day and night and the hunter will often stay several days in the bush, if there is abundant evidence of wildlife in the area besieged. At night carbide lamps are used, which dazzles the prey with light, providing the hunter with a clearer vision for accurate shot. During the day, specially tamed hunt – dogs may be used to "rake" the bush and challenge the wild animals out of their hide-outs, for the hunter to shoot. The majority of hunters use "dane-guns", locally manufactured single barrel 12 bore shotguns, and cartridges used are British made and sell for a few hundreds of naira.

Trapping is carried out both as a means of vertebrate pest control around cultivated areas and also as an income earning activity in the forest. The traps or snares are constructed from wire and placed on animal tracks and runs. Around farms, short drift fences or barricades are constructed from bamboo or palm fronds (with the round wire traps located at intervals of 4 meters) to compel the animals drift into the traps. The major species trapped are porcupine, grass-cutter, antelope (bushbuck), monkey and duiker. Occasional catches include snakes like the python, Gabon viper, and spitting cobra.

A trapper's drift fence may be 2-5 km long and could have 100 – 200 traps set, usually during wet season. They are inspected every two or three days. In a day as many as 8 animals of two or more species may be trapped. Where the hunter is not disposed to inspect his numerous traps, he delegates a teenage boy. On his return, the boy would have some share from the animal brought home for the hunter. Otherwise the trapped animals would rot and waste in the bush, or devoured by scavengers like vulture and Civet cat.

Hunting activities along the project area cannot be termed widespread. For instance hunting activities as documented from interview sessions are at a lower spread in the more coastal areas of the route like Ibeno, and Esit Eket than when compared to hunting spread in Mkpat Enin and Onna. This information is supported by the fact that in the more coastal areas of the line apart from the Ikot Abasi axis, fishing is a more prominent -activity of the locals. The construction and operation of the line is not expected to have significant impacts on hunting activities as access to hunting grounds will not be prohibited except for prohibitions to poaching and killing of wildlife by site workers.

4.10.3 Fish and Fisheries

Fishing is important in Ibeno LGA, Eket and some creeks in Ikot Abasi LGA, where, tidal waters of the Bight of Bonny bring in a variety of fish, namely sardines, mullets, croakers, tilapia, baraccuda, shine nose (*Parachana africana*)etc

They are commonly caught with basket traps which have non-return valves. A sample of the freshwater fish landing as well as types of fishing gears used within the area is shown in **Figure 4.25**. The clariids constitute the major component of the catch.

Figure: 4.25: Fish Gears and Fish Types

The freshwater swamp fishery at Onna and Mkpat Enin include - *Claria*s, *Heterobranchus* *s*p, *Malapterurus electricus*, *Schilbe sp*, *Mormyrus sp*, *Calamoichtyes calabaricus*, etc.

4.11 Socio-Economics

In line with the corporate policy of PHCN and its commitment to meeting its social corporate responsibilities, it was necessary to undertake socio-economic and health conditions survey of communities in the proposed project area. The study is an integral part of the environmental and social impacts management and overall sustainable development arrangement. Consequently, a detailed socio-economic and health status survey of the communities within the proposed project area has been undertaken.

Various consultation exercises were conducted with the purpose of intimating those from affected areas of the proposed project, its objectives, potential impacts, and management strategies. Meeting dates, times, and agendas were agreed with the leadership of each group to be consulted who in turn notified those who were to be in attendance ahead of the schedules. The meetings would start with introductions of participants, the objectives, and the programs for the meeting. Agendas include the proposed project description, areas likely to be affected, potential impacts, and planned mitigation and compensation strategies. Attendance lists are passed around while the meeting is in progress and photographs of all attendees taken at the end of each meeting. Issues discussed and matters arising are documented by nominated representatives of the group and the consultant.

The continuous consultation exercises include interactions with community members and stakeholders to ensure that the right and sufficient information about the project and its associated activities is provided, their views are considered, ambiguous issues are clarified, while their concerns and expectations are noted for appropriate considerations in the project planning and due provision of feedback. So far, a total of about (65) different meetings have been held with varying categories of persons, groups, and families among whom are leaders and youths members of the community in addition to persons directly affected by the transmission line route. An estimate on the total no of persons that will be affected by the project (Project Affected Persons – PAPs) will be provided upon conclusion by PHCN of its enumeration/valuation and census program along the ROW. The enumeration and valuation process commenced on the 30th of May 2012 and should be completed in the last week of September 2012. The specific number of persons and properties to be affected as well as the anticipated budget for compensation will be determined at the end of enumeration and valuation program. PAPs will be impacted directly or indirectly through loss of properties which will generally include farmlands, temporary farm structures like farm huts, fish ponds, and fallow lands etc. Consultation sections as described in above paragraph have been carried out with identified stakeholders including potential PAPs to enlighten them on the project as well as capture and address their needs and concerns in relation to the development. Copies of attendance sheets are attached in **Appendix 4.5** and pictures provided along with respective consultative discussions. These consultations are anticipated to continue throughout the project life cycle.

4.11.1 Scope of Study

The proposed transmission line will traverse through 6 LGAs of Akwa Ibom State, namely; Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot Abasi. The study however covered fifty communities, nine clans councils and six identified Traditional Ruling Councils (TRC) (**Table 4.14**).

Table 4.14 No of Consulted / Surveyed Groups

S/NO	LGAs	No of Consulted TRC	No of Consulted Clan Council	No of Surveyed Communities	No. of Respondents
1	Ibeno	1	1	2	24
2	Esit Eket	1	1	3	19
3	Eket	1	1	4	53
4	Onna	1	1	6	84
5	Mkpat Enin	1	2	14	88
6	Ikot Abasi	1	3	21	150
Total	**6**	**6**	**9**	**50**	**418**

A total number of 418 respondents (**Table 4.14)** were also consulted. However, it should be noted that prior to detailed socio-economic survey across affected communities, PHCN had carried out in depth sensitization and consultation activities at the three levels of traditional organisation in the area. i.e the traditional ruling council, the clan council and village council levels. Evidences of such consultation activities as well as those carried out during the socio-economic gathering exercise are presented in **Appendix 4.5**.

Table 4.15: Socio-economic Survey Program

Date	LGA	COMMUNITY	CONTACT PERSONS	REMARKS
10/8/11	Mkpat Enin	Ikot Akpa Okop	Eteidung Obot Akpan – Acting Clan Head of Ukpum Minya and 4 others = **5**	Socio Economic team introduced by the PHCN Officials
10/8/11	Ibeno	Mkpanak	Chief Edmund N. Okon – Village Council Chairman; Rt. Hon. Nkpouto Essien – Village Council member and 7 others = **9**	FGD conducted
		Ibeno Clan Council	Owong (Dr.) Effiong Archianga – Paramount Ruler Elect; Chief Okutinyang – Secretary Ibeno Clan council and 7 others = **9**	Clan council consulted
17/10/11	Eket	Ebana	Chief Emmanuel Eshiet III – Village Head and Inspector Nsien S. Nsien (Rtd.) – Village Coucil Sect.& 7 others = **9**	IDIs Conducted
		Esit Urua	Chief Wilson Etop Itok – Village Head and 11 others = **12**	FGD Conducted
		Ede Obuk	Chief Assam M. Assam – Village Council Chairman; Mr. David Willie Etuk – Village council Sect. and 19 others = **21**	FGD Conducted
18/10/11	Eket	Afaha Eket	HRM Edidem N. J. E. Oduenyie – Paramount Ruler; Chief Etinyang J. Udofa (JP) – Afaha Clan Admin. Secretary and 7 Others = **9**	FGD/IDIs Conducted
18/10/11	Onna	Ikot Akpatek	Eteidung Okon Idem Mboso – Village Head; Mr Monday Sampson Idem – Village Council Sect.	FGD Conducted

			And 7 others = **9**	
		Ikot Ebidang	Bishop Rex A. Uko – Vice Chairman Advisory Committee and 22 others = **23**	FGD Conducted
		Ikot Annang	Eteidung Udo Sampson – Village Head and 23 others = **24**	FGD Conducted
		Mkpa Eto	Eteidung Akpaqn A. Inyang – Village Head and 7 others = **8**	FGD Conducted
		Ikot Eko Ibon	Eteidung (Hon.)Emem D. Nwa II and 11 others = **12**	IDI Conducted
31/10/11	Onna	Ikot Edor	His Eminence Akwa Edidem (Dr.) Akpabio Udo Ukpa JP/FCE, Oku Ibom Ibibio III and Par. Ruler & 1 other = **2**	IDI Conducted
12/11/11	Mkpat Enin	Ikot Ekong	Eteidung (WO) Raymond Udia Rtd. – Village Head Ikot Ekong; Chief (Hon.) Bassey I. Ekong – Village Head Elect Ikot Umoh Ekong; Chief Paul D. Ekpoffiong – Village Head Elect Odoroinyang and 22 others = **25**	FGD/ IDIs Conducted
		Ndon	Eteidung Okon Udo Ekpo – Village Head and 6 others = **7**	FGD Conducted
		Ibotio	Eteidung Joseph U. Imoh – Village Head & 3 others = **4**	IDI Conducted
12/11/11	Mkpat Enin	Ikot Enin	Eteidung Akpan Nelson Ekpo - Village Head & 5 others = **6**	IDI Conducted
		Ekim	HRH Obong P. N. John Udoh (JP) – Village Head/Clan Head of Ikpa Ibom & 1 other = **2**	IDI Conducted
		Ikot Oyoro	Eteidung Sylvester A. Inyang – Village Head & 7 others = **8**	FGD Conducted
14/11/11	Mkpat Enin	Ikot Obio Ndoho	Chief Anthony Ukpong – Village Council Chairman And 9 others = **10**	FGD Conducted
		Ikot Aba	Eteidung M. S. Akpan – Village head and 5 others = **6**	FGD Conducted
14/11/11	Ikot Abasi	Ikwa	Eteidung Chief Akpan J. Ekpe – Village Head & 4 others = **5**	IDI Conducted
		Ikot Ataha	Eteidung Akpan N. Ntia – Village Head & 6 others = **7**	IDI Conducted
		Ikot Umiang Okon	Eteidung Ufot S. Ufot – Village Head &14 Others = **15**	FGD Conducted
		Iman Ekabom I & II	Chief Friday Attat – Village Head and 28 others = **29**	FGD Conducted
		Obiokama; Ete; Ubeneke I & II	Eteidung A. O. Ekpe- Village Head and 21 others = **22**	FGD Conducted
15/11/11	Mkpat Enin	Ikot Akpan Okop	Eteidung Obot Akpan – Village Head and 4 others = **5**	FGD Conducted
		Ikot Ekpang and Ikot Aka	Elder Eyop George – Village council Speaker and 15 others = **16**	FGD Conducted
15/11/11	Esit Eket	Akpambiet Edo Community	Chief Akpan A. Ibok; Chief Okon Tom Ekwere; Chief Joshua W. Edemidiong (Village Heads) and 8 others **11**	FGD Conducted
		Edida Edo	Chief Johnson Assam Etidem – Village Head & 3 others = **4**	IDI Conducted
		Oniok Edo	Elder Abia Jonny Abia – Village Council President & 3 others = **4**	IDI Conducted
16/11/11	Ikot Abasi	Abasi Ute (5); Abiaran (7); Odiono Isoutibe (6); Essien Etuk (5); Urua Essien Etuk (4); Okpoto (5); Adaha Ukim (6); Ikot Etenghe (5) and Ekpuk Inang (5)	Chief (Barr.) C. M. Ikotidem, - Acting Clan Head and other Village Heads/ Chairmen of Village Councils = **48**	FGD/ IDIs conducted
		Ikot Etetuk	Mr. Uduak Udo Tom – Village Council Chair & 5 others = **6**	IDI Conducted

		Ikot Essien	Elder Ufot Akpan Nathaniel and 7 others = **8**	FGD Conducted
		Ikot Akpan Ata	Chief Aniefiok Akpan Usoro and 4 others = **5**	FGD Conducted
		Ikot Abasi Village	Chief Akpan Monday Okubre and 4 others = **5**	FGD Conducted

FGD: Focus Group Discussion
IDI: In Depth Interview

4.11.2 Consultations

Consultations is a major feature of the socio-economic component of the Environmental Impact Assessment (EIA) process for any intended project, which in this case incorporates all individuals and communities that may be directly or indirectly affected by the proposed project. Consultations aim to inform relevant stakeholders about the intentions / plans of project proponents. It also attempts to record the concerns and views of all stakeholders and helps to minimise potential conflicts that could arise during project implementation.

The consultation programme for the proposed project consisted of a two-tier process.

- Reconnaissance visits to key LGA and Clan level stakeholders (political leaders / traditional rulers / civic leaders). This was done for legitimation purposes, as to secure permission and cooperation for the study. Specifically, notification visits were carried out to the LGA council authorities of Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot Abasi. Visits at the TRC level of the local governments as well as identified clans within the LGAs were also carried out. This phase of consultation was initiated between February to August 2011, giving way to the next level of consultations.
- Direct consultation with identified stakeholders. This phase was conducted by the SIA / H team from the 10th of August till the 16th of November, 2011 (10/08/2011 – 16/11/2011). It consisted of visits (3 phased visits, TRC level, clan level and village levels) to the various communities/settlements which had been earlier identified by PHCN, as areas over which the proposed power transmission line will traverse. Participatory tools were thereafter utilised to elicit information from stakeholders on community baseline data, expected impacts (direct/indirect, adverse/beneficial, short/long term etc). Attempts were also made to ascertain stakeholders' concerns as well as identify the benefits of the proposed projects can be enhanced for the affected communities. A total of about 115 visits covering both phases of consultations have been carried out so far.

Public Forum

Public participation plays an important role in the EIA process and the planning, design and implementation of any development. PHCN organised a public forum on the 28th of March, 2012 involving as many potentially interested and affected parties (including, federal, state and local government stakeholders, traditional ruling councils, clan councils, village councils, youths, women, middle age, NGO, press etc) as possible. The comments received and the issues arising from the public forum have been used extensively in this EIA. Attendance list from the public forum as well as a panaroma of photos are presented in **Appendix 4.5**.

4.11.3 Socio-economic Survey Methodology

Socio-economic data gathering/survey involved a multidisciplinary approach. Experts in various aspects including health and agricultural economics were inclusive in the overall socio-economic / health baseline profile of the study area.

Socio-economic baseline data gathering was carried out as an independent aspect of the consultation / sensitization programme of this project. The socio-economic / health team were however present during majority of the consultation program to give clarity and document information arising as a result of the public disclosure activities. This was the situation in Mkpanak area of Ibeno where the socio-economic team carried out data gathering exercise side by side with consultation, sensitization and notification exercise by PHCN to the chiefs, youths, women group, middle age, community development group and other age groups within Mkpanak community.

Detailed socio-economic data gathering exercise for the project affected area commenced August 2011 and lasted till November 2012, while PHCN detailed consultation, notification and sensitization programmes across the project area was initiated in June 2011 and is still ongoing and expected to last throughout the project life span.

For the Socio-economic/health data gathering a non-probability purposeful sampling procedure based on convenience sampling (Akpabio-2008, AKSG-2005**)** was utilized to pick respondents (groups/individuals) for the data gathering activities. Convenience sampling is a typical socio-economic data gathering method where the community leadership and/or key stakeholders (most especially of prone areas) assign to the SIA team members of the community knowledgeable in relevant areas of expertise (e.g, traditional custodians, the aged, hunters, celebrated farmers, women leader, etc) to ease the socio-economic investigations. This dealt with participatory choice of survey communities/areas by representatives of project proponents, in conjunction with community/local government stakeholders. It also involved visits to identified communities and eventual interviews and correspondence with community indigenes gathered at either the community hall or the residence of the village head or village council chairman. The survey team was thereafter taken on guided tours to specific locations of interest to community stakeholders. These tours were guided by delegated members of the community or group, appointed by the traditional leadership to assist the team.

Data Collection Techniques

The study utilised both primary and secondary data. Primary data collection was through Focus Group Discussion (FGD), General Group Discussion (GGD) and In Depth Interview (IDI) sessions (see **Appendix 4.6**) of community representatives and stakeholders (stakeholders as much as possible covered all groups within any such identified community, including the chiefs, age groups, the youths, the aged, women wings, middle aged as well as community development committees) **Figure 4.26**.

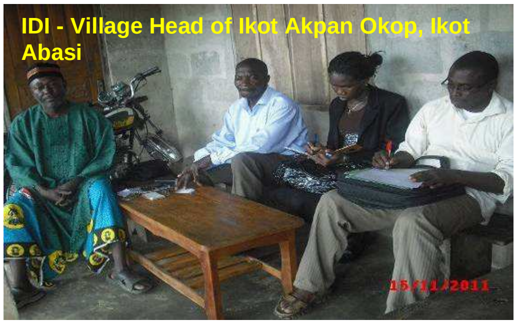


Figure: 4.26: Examples of meetings with local representatives

This was facilitated with the aid of participatory tools like FGD/ GGD guides and IDI schedules including the use of map guides. Non-participatory observation techniques and visual photography sessions were utilised as complementary data collection tools. . There is a rich collection of literature and official records about the study area (AKSG-2005, Ekpenyong, R. E 2007, NBS-2006, NBS-2009, NBS-2011, NPC-1991, NPC-2006). Such secondary data was mainly utilized to complement (clarify and enrich) submissions from the interactive phase of the field study. Descriptive statistics were utilised to analyse collated data. These included basic statistic tools like means, percentages, frequency tables and charts.

4.12 General Description of Akwa Ibom State

The proposed project will take place in Akwa Ibom State. The state occupies the South-South fringe of Nigeria.

The state is bounded on the North by Abia and Cross River States and on the South, by the Atlantic Ocean. On the East, the State shares its boundary with Cross River State along Okpokong River and on the West, by Rivers and Abia States. The State is divided into 31 Local Government Areas, covers a total land area of 7,245,935sq.km, representing about 0.87 percent of the country's total land area (NBS, 2009). It is the 15th most populous state in Nigeria with a high population density, ranging between 285-400 persons per square kilometre.

More than 80% of the peoples from the six LGAs identified to be affected by the project are Christians with very few traditional worshippers. The culture including faith and beliefs of the people are to a very great extent homogenous (they are basically Ibibios with a common culture and traditional way of life). This uniform ethnicity and cultural background defines their lifestyles and is important in describing anticipated impacts in relation to the work and ethic ways of the locals. This Ibibio group on the coastal axis of Akwa Ibom state have been exposed to several developmental projects over the years including oil and gas activities. The people are used to modern infrastructures as well as basic stages in developmental projects. They have worked amicably well overtime with foreigners as well as neighbours in various projects such as the QIT development by Exxonmobil, Alscon Smelter, Ibom Power Project, etc. It is expected that there would be no much impact to the project and its host peoples resulting from the cultures and ethics of the people.

4.12.1 Ibeno LGA

Ibeno LGA has its headquarters at Upenekang. It is located at the Southern end of Akwa Ibom State, occupying a vast coastal area of over 1,200sq. km. It stretches from Okposo 1 at the Eastern flank, bordering Mbo Local Government Area and Bakassi Pennisula to Atabrikang village on its Western flank. It is bounded in the South by the Atlantic Ocean and shares border with Eket, Esit Eket, Onna and Eastern Obolo local government areas.

Ibeno LGA is made up over 25 gazetted villages and 43 un-gazetted ones. The Qua-Iboe river estuary forms the major body of water in addition to the Atlantic Ocean. The Local Government Area is located in the mangrove forest belt of the Niger-Delta region of Nigeria, often referred to as “strand coast”. Ibeno is the host community of Exxon-Mobil Producing Nigeria.

Ibeno people are basically of the Obolo/Andoni origin. The common dialect of Ibeno people is Ibeno/Obolo language prominently spoken by Ibeno and Eastern Obolo people in Akwa Ibom State. By ethnic composition, Ibeno indigenes constitute between ½ to ¾ of the total population. The Ibibios, Andonis, Annangs, Orons make up slightly less than half the remaining population, while the Ghanaians and Ilaje’s – make up the total number of residents. Ibeno people are rich in cultural heritage

With reference to religion, inhabitants of the study area are Christians – (about 90 percent). Traditional religion however persists and many people still practice both Christianity and traditional religion, through pouring of libation and appeasement of natural deities, especially among fishermen, water transport operators and traditional rulers. Major traditional gods in the study area include: “Asuakasi”, “Ogbomo” and “Iso-abasi Ibeno” – all of whom are reputed to serve purposes of community and individual protection and survival, especially for those who ply their trade on the high seas. December is the period of festivities and apart from the modern Christian oriented festivals of Easter, Christmas and New Year; during which even traditional cultural displays like Ekpe and Akata; may also feature, each community also celebrates a special home-coming day (eg Upenekang day, Iwuoachang day, etc) which occur at the latter days of December and during which sacrifices are made to traditional gods for individual and communal protection. The people have many age-long traditional institutions like Ekpe, Obon, Uke, Ekong, Akata, Eka-Ebitu, Ubom Isong, Oluo, Ikini and the age-grade system is highly recognized and practiced in Ibeno. Major market in the area is the Iwuoachang market which holds once in every week. i.e every six days interval. Traders and buyers from Esit Eket and minority from Onna patronise the Ibeno market as there are no comparable major markets as such in these areas. Major market days along the affected local governments vary and for close to 50years have been planned not to coincide with each other. For example if Ibeno holds its major market on a Tuesday, on a Wednesday or Thursday that of Eket and Ete (Ikot Abasi) may hold. Also it should be noted that there are no specific days of the week for these major markets, it is sequential. If it holds on a Thursday the next market is automatically scheduled for a Wednesday thus complying with the six days interval put in place for each.

Cultural sites of importance in the L.G.A. include the Stubbs Creek and the Ibeno beach which has witnessed an appreciable level of modernization. Two communities in Mkpanak and Upenekang were surveyed in Ibeno LGA.

4.12.2 Esit Eket LGA

Esit Eket LGA was created from the former Uquo Ibeno by the Local Government and the people are of Ekid stock. It is situated by the Western Atlantic coast line with boundaries with Ibeno, Eket and Nsit Atai Local Government Areas. The LGA has 10 wards and 2 clans. It has a land area of 411,700 sq km. Apart from the majority Ekid stock there are many migrant fishermen of Ghananian and Ilaje (Yoruba) stock. Esit Eket Local Government Area is presently made up to two clans namely: Eket Offiong and Eket Afaha, which are held together by common tradition, customs and ancestry relationship. The Local Government Headquarters is at Uquo. There are 23 recognized villages in the local government area, although some omitted villages are yet to be gazetted. These villages are spread across the three geo-political zones making up of Uquo and the development zones A, B and C.

Christianity is the dominant religion in all the communities. Despite the large influence of Christianity in the areas, some nominal Christians are involved in one form of traditional belief as dictated by the culture of the people.

The socio-cultural and traditional life of the people of Esit Eket local government is well displayed in dances, songs, plays and mythology, oracles, cults and festivals. The picturesque representations of these are manifested in Ekpe masquerade and in traditional dances, story- telling and plays. Traditional plays include Ekpe, Ekong, Obon, Ekong Isong, Nyoho, Akata, Ntok Odio Odio, Atia Ata, Ebre and Ikara. There are also taboos and totems, some of which are no longer observed because of the influence of Christianity. The principal deities in Esit Eket include the Atara, Akuki, Yokho, Nsoabasi, Idim Itiet, and Isemin Odiong. Each of these presides over a number of pantheons and has a messenger popularly called Nsong Edoho.

The deities are still regarded as protectors and keepers of peace and order in the society. Even though deity worship is minimal, some people still regard these deities as the pervading and guiding spirit in the communities. Three communities were surveyed in Esit Eket LGA viz; Akpambiet Edo, Edida Edo and Oniok Edo.

4.12.3 Eket LGA

Eket LGA is one of the oldest administrative headquarters in the southern part of the country as it has served as an administrative headquarters since the early 1950's even before the creation of the defunct South-eastern state. It is located about 5km off the Northern coast of the Atlantic Ocean and is flanked by Onna and Nsit Ubium LGAs on the Western and Northern borders respectively and Ibeno and Esit Eket LGAs on its eastern and southern boundaries.

Eket consists of 11 clans, 71 recognised villages and many omitted ones. By virtue of their natural habitat, the people of Eket were traditionally hunters and fishermen and were also engaged in subsistence farming, pottery and foundry works. However by the end of the third quarter of the 20th century, oil exploration and exploitation made a tremendous impact on the lives and culture of the people more so with the commencement of operations by Mobil (precursor of Exxon-Mobil) the lives and fortunes of the inhabitants of this ecological zone experienced mixed fortunes. Eket people are however generally meticulous, intensely religious to high standards, and exhibit an urbanised demeanour. They are therefore an invaluable asset for sustainable community development.

Although Eket is one of those communities that embraced Christianity early, traditional religious practices are still prevalent such as the Supreme God (Abasi Ibom/ Abasi Anyong) other deities like Edoho – "Abasi Isong". Some of these deities were said to have sacred shrines but none of which located along the proposed ROW from Ibeno to Ikot Abasi. This information was as obtained from discussions with locals during the socio-economic / health baseline data gathering. In the communities, affiliates of Christian faith are in the majority. This is reflected by the number of churches that are prevalent in each of the communities. In these communities, there are in existence different deities or shrines which the people believe to have some protective duties/power over their communities. This belief and perhaps relevance of these known deities is fast becoming a myth among the people. Therefore, emphases on these deities and shrines have greatly reduced as well as performance of appeasement rites.

Eket is blessed with a rich and enviable cultural heritage. "Ekid," is the ethnic language and it conveys a unique culture and identity to the people. Eket has a plethora of cultural displays such as Ekong, Eka-Ekong, Mbok, Obon, Ekang, Ibang-Isong, Akata, Nnabo, Ibem, Ekpe-Obon, Nkuho, Ekpe, Ntok Unaidi. There are also many cultural practices and ceremonial prevalent in Eket and which have a defined pattern. These include burial ceremony, coronation, marriage, status initiation, land-holding, extended family system, harvesting of palm fruits, births and child-naming ceremony. In Eket the major market is the Orafionto market holding every six days interval. It is located in Afaha Ukwa area of the town. Peoples from Onna, Esit Eket and some times Ibeno patronise this market.

Four communities in Esit Urua, Ebana, Ede-Obuk and Afaha Eket were consulted. Esit Urua is made up of three gazetted villages (Esit Urua, Idung Imose and Idung Adiakot), while Afaha Eket is also constituted by three villages of Atibe, Atai Ndon and Ekpene Nditia

4.12.4 Onna LGA

Onna LGA has its headquarters at Abat. It shares common boundaries with Mkpat Enin and Etinan LGAs in the West; Ibeno and Eket LGAs in the North; and the Atlantic Ocean and Qua Iboe rivers in the South. Onna`s name derives from an acronym of the three clans that make up the LGA: Oniong, Nnung Ndem, and Awa. The LGA consists of 3 clans, 41 villages and 12 political units.

The people are very enterprising and are involved in various economic endeavours. The people are however predominantly fishermen and farmers. Some are also engaged in trading, craft making and artisanship. Onna LGA is endowed with enormous quantity of rich mineral and other natural resources, including clay deposits, gravel and sand. Oil deposits are also found in commercial quantities in the rock base of the Atlantic ocean and the Qua Iboe marshes.

For ethnic background, the findings reveal that 3/4 of the respondents are Ibibios, while Annang and Oron make up the remaining 1/4. A lot of stranger elements inhabit these areas, however, indigenes and strangers live together in the community. As regards religion, most of them are Christians. Only very few practice traditional religion, that is why they have the following gods; “Ubo”, which they claim is god of war located at Ikot Ubo. “Akpan Abasi” – god of the sea located at Atlantic Coast. “Iso Ekpenyong” god of the farm, located at the forest farmland and “Akankan” god of the fish located at the river (forest).
A total of six (6) communities of Ikot Ebidang, Ikot Akpatek, Ikot Annang, Mkpa Eto and Ikot Eko Ibon were surveyed in Onna LGA.

4.12.5 Mkpat Enin LGA

Mkpat Enin LGA was excised from Ikot Abasi LGA. It has a land mass of about 488.9sq km. The LGA is bordered by Ikot Abasi, Eastern Obolo, Oruk Anam, Etinan and Onna LGAs. The LGA has 4 clans, 14 political wards and 87 gazetted villages. It is located on a level – gently undulating sandy plain with shallow depressions, some of which form seasonal lakes. Major occupations of the people include: farming, fishing and trading.

Ibibios make up more than 98% of the population while the remaining 2% are either itinerant Ibo traders or Annang indigenes. Christianity is the dominant faith although the people still uphold some traditional religious tenets like pouring of libation. There are also a myriad of deities, with particular peculiar reference to different communities while traditional festivals include “Ekpo and Ekong” which take place around September and October; “Udia eduek” which takes place around the second week of February, to mark the beginning of bush clearing; and “usuk udia” festival which marks the beginning of the harvest period and is marked around October.

The level of observance of these traditional festivals is however very low. Lots of cultural sites of importance dot the natural landscape of each community but none has been destroyed nor damaged over time.

Fifteen (15) villages were surveyed in Mkpat Enin LGA. These are; Ibotio, Ndon, Ikot Ekong (a community of three gazetted villages: Ikot Ekong, Ikot Umoh Ekong and Odoro Inyang), Ikot Enin, Ikot Akpaden, Ikot Oyoro, Ikot Obio Ndoho, Ekim, Ikot Aba, Ikot Ekpang, Ikot Akan, Ikot Akpan Imo and Ikot Akpa Okop. Majority of the Makpat Enin people patronise the Ete market in Ikot Abasi which holds once in every week.

4.12.6 Ikot Abasi LGA

Ikot Abasi LGA is one of the oldest of such in the country, having started as a Native Administration /county council and was formerly called Opobo. In 1976 however the name Ikot-Abasi was adopted following the excision of former Obolo county council from the Opobo division of the former Cross River State. Ikot-Abasi LGA consists of five clans, namely; Ikpa-Ibekwe, Ukpum Ete, Ukpum Okon, Edemaya and Ikpa Nung Asang. Ikot-Abasi is bounded on the South and West by the Imo River, Atlantic Ocean and Eastern Obolo LGA, on the North by Oruk Anam LGA and on the East by Mkpat-Enin LGA. The LGA lies within the Mangrove swamp and the high rain forest belt and therefore experiences heavy rainfall. The main occupation of the people are fishing and farming. The recently revived Aluminum Smelting Company of Nigeria (ALSCON) is also located there and employs people from the host communities and from the region.

Ibibios make up more than 90% population of the study area. There is also a sprinkling of Annangs and Ibos in the study area, while in the fishing settlements, there are a lot of Ghanaians and Ilaje’s (Ondo State). A lot of people of Obolo indigenous stock also inhabit Ikpa-Ibekwe, especially, Ikot-Abasi town, which hosts the LGA headquarters.

With respect to religion the Christian faith has taken tremendous roots in the study area, with more than 98% indigenes involved in the faith. This does not however exclude the pouring of libation to small deities and the knowledge of these small gods. The practice of traditional religion is however limited to less than 2% inhabitants of the study area. Common community gods however include – “Ntita Abeka” and “Okwok Oduk” and they function mainly for protection purposes. However many cultural sites of importance have been destroyed especially in Ikpa-Ibekwe, where most of their land have been appropriated for industrial purposes.

Twenty one (21) villages were surveyed in Ikot Abasi LGA. These are Iman Ekabom I, Iman Ekabom II and Ikot Umiang (Ukpum Okon clan). Ikot Essien, Ikot Abasi, Ikot Etetuk, Ikot Akpan Ata and the omitted Ikpetim are in Ikpa Ibekwe clan. The remaining are in Ukpum Ete clan. These are; Ikwa, Ikot Ataha, Ete village, Ikot Etenge Ete, Okpoto Ete, Abasute, Essien Etuk & Urua essien Etuk, Abiaran Ubeneke I, Ubeneke 11, Obiokama, Odiono Isoutibe, Adaha Ukim and Ekpuk Inang. Major market in the area is the Ete market which holds once in every week. i.e every six days interval.

4.13 Traditional / Political Governance & Community Organisation

There are two levels of political organisation in the study area; (i) the formal government and (ii) the local / traditional administration. At the formal governmental level, study area communities / settlements fall under the administrative authority of the Local Government Areas (LGAs) presently constituted by elected representatives of all constituent parts of each LGA.

4.13.1 Traditional Organisation

The local traditional political organisation consists of five tiers of authority, consisting of the Nuclear Family Heads; extended (lineage) Family Heads (Obong Ekpuk) and Village Heads (Ete Idung) who superintend over various families **Figure 4.27**.

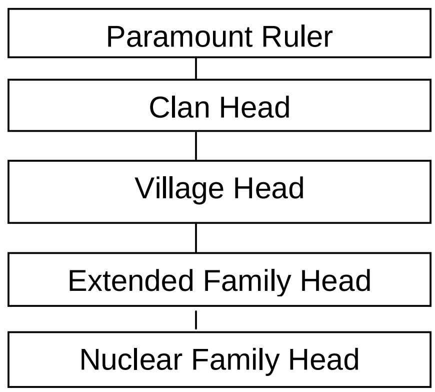


Figure 4.27: Traditional Tiers of Authority

They are aided by the Village Council, constituted by representatives of various families in the village and may include the youth and women representatives. A collection of villages (Oduk or Ikpa Isong) sharing some traditional bonds (deity, food prohibition etc) come under the leadership of a Clan Head – who is chosen from the rank of Village Heads. The highest office in the traditional LGA setting is that of the Paramount Ruler, who is chosen from the rank of Clan Heads. There are also Traditional Rulers Councils at both the LGA and State level.

Figure 4.28: Typical Traditional Organisation

4.13.2 Traditional Governance

In terms of traditional administrative duties and with reference to the family or lineage level, the family head presides over family meetings, which are held on a particular market day. During such meetings, land boundary disputes and other minor disputes between family members are resolved. At the village level, the Village Head presides over Village Council meetings. The Village Council is composed of mainly the different family heads and other co-opted members, representing the different families, youth and (a times) women groups. Above the Village level, the Clan Head exercises administrative and judicial authority over his clan through the Clan Council (Esop Ikpa Isong). This council has authority to settle all forms of conflict. The family council (esop ekpuk) and village council (esop isong) are linked to the clan council by representatives of each village.

The economic base of the chieftaincy in the study area consists of tributes, gifts, fees, fines, compensations and money accruing from settlement of cases. The Clan Council is summoned occasionally to hear inter village cases, which contravene clan laws like murder through alleged witchcraft, physical assault, arson and armed robbery. Other intra-village and minor cases like petty theft, land dispute, matrimonial and debts settlements are adjudicated at the family or village councils. However cases that cannot be amicably settled at the lower tiers of authority are referred to the progressively higher authorities, for possible solutions.

4.13.3 Community / Social Organisation

With regard to community organization, communities in the study area exhibit a high level of cooperative tendency. The people also speak with one voice and bear allegiance to their groupings of affiliation. At the local intra-communal level exists the village council, youth and women councils. The youth are usually incorporated into the executive arm of each village council. The village councils handle traditional and non-criminal issues. Also important are the age-grades, church based societies and ubiquitous credit and thrift groups (commonly known as etibe). The pre-cooperatives and etibe groups provide a lot of financial assistance to needy members, at little or no interest, and group members generally offer material, social and financial assistance to needy members and also render moral support during the celebration of members' joyous occasions. Leadership of various traditional, civic and political settings may be through inheritance, nomination/consensus and/or elective means.

With reference to social organizations, the people have realised the need to develop their social and human capital through group formation and affiliation. In this wise, a lot of social groups have arisen in the study area, including: rotatory savings schemes (etibe), cooperatives, church societies, village, youth and women councils/associations. These are the prevalent social groupings which attract maximum affiliation, obeisance and prestige. These groups involve both male and female - sometimes in mixed groups and sometimes in gender specific groups.

At the clan / LGA level, prominent groups include Ibeno Clan Council and Mboho Ndito Ikot Abasi. The Afigh Iwaad Ekid is a powerful inter local government youth group. These all serve functions of resources mobilisation, community administration and financial assistance to members. These local groupings have been involved in a lot of projects over time. These include: initiation and completion of council halls, electricity projects and bus-stops. They are also involved in community sanitation activities and access road maintenance, while larger and richer ones have awarded educational scholarship to deserving sons and daughters.

4.14 Demography

4.14.1 Population Size

Akwa Ibom State has landmass of 8,412 sq. Kilometres. (AKSG, 2007).This area is inhabited by a total population of 3,920,208 people made of up of 2,044,510 males and 1,875,698 females (**Table 4.16)**.

Table 4.16: Population Characteristics of Surveyed LGAs

S/N	LGA	Total	Male	Female	Dependency Rate	Sex Ratio (M:F)
1	**Ibeno**	75,380	41,311	34069	66.47%	1.2:1
2	**Ikot Abasi**	132,023	70,192	61,831	49.29%	1.1:1
3	**Mkpat Enin**	178,036	93,927	84,109	53.82%	1.1:1
4	**Esit Eket**	63,701	33,942	29,759	60.51%	1.1:1
5	**Eket**	172,557	88,635	83,922	51.23%	1.05:1
6	**Onna**	123,373	59,598	63,775	40.02%	0.9:1
7	**Akwa Ibom**	3,920,208	2,044,510	1,875,698	53.80%	1.09:1

Sources: (i) Federal Republic of Nigeria Official gazette 15th May 2007, (AK-BASES) 2005.

This gives the state a population density of 466 persons/sq. kilometres. **Table 4.17** show projected population figures for the surveyed communities in the study area. (Please note that the NPC is yet to release 2006 population figures for various communities in Nigeria. Population projections as derived from the NPC within the area are relatively aligned with the population perspectives of the people.

Table 4.17: Projected Population Figures for Surveyed Communities

S/N	LGA	COMMUNITIES	2011 PROJECTIONS			1991 FIGURES		
			TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE
1	**Ibeno**	Mkpanak	13166	6846	6320	6746	3508	3238
2	**Eket**	Ebana	925	486	439	474	249	225
		Esit Urua (Now 3 villages: Esit Urua; Idung Imose and Idung Adiakot)	5678	2885	2793	2909	1478	1431
		Ede Obuk	1889	997	892	968	511	457
		Nditia	427	236	191	219	121	98
		Atibe	16263	8216	8047	8333	4210	4123
		Atai Ndon	3084	1544	1540	1580	791	789
		Afaha Ekpene	1922	927	995	985	475	510
3	**Onna**	Ikot Akpatek	15032	6919	8113	7702	3545	4157
		Ikot Ebidang	5348	2518	2830	2740	1290	1450
		Ikot Ebekpo	3632	1780	1852	1861	912	949
		Ikot Annang	4321	2090	2231	2214	1071	1143
		Mkpa Eto	1798	898	900	921	460	461
		Ikot Eko Ibon	13076	6407	6669	6700	3283	3417
		Ikot Edor	20299	10248	10051	10401	5251	5150
4	**Mkpat Enin**	Ikot Ekong (now a community of three gazetted villages of Ikot Ekong; Ikot Umoh Ekong; and Odoro Inyang)	6314	3318	2996	3235	1700	1535
		Ndon Ibotio	3767	1897	1870	1930	972	958
		Ibotio	5771	2818	2953	2957	1444	1513
		Ikot Enin	1009	507	502	517	260	257
		Ekim	29645	1429	1536	1519	732	787
		Ikot Oyoro & Enen Eyep	1626	798	828	895	409	424
		Ikot Akpaden	4370	2157	2213	2239	1105	1134
		Ikot Obio Ndoho	3146	1532	1614	1612	785	827
		Ikot Aba	2496	1216	1280	1279	623	656
		Ikot Akpan Okop	724	347	377	371	178	193
		Ikot Ekpang and Ikot Aka	1454	703	751	745	360	385
5	**Esit Eket**	Akpambiet Edo Community	1727	792	935	885	406	479
		Edida Edo	1333	566	767	683	290	393
		Oniok Edo	3314	1602	1712	1698	821	877
6	**Ikot Abasi**	Ikwa	3035	1649	1386	1555	845	710
		Ikot Ataha	722	357	365	370	183	187
		Ikot Umiang Okon	1653	747	906	850	383	464
		Iman Ekabom I & II	1596	751	845	818	385	433
		Ete village	NA	NA	NA	NA	NA	NA
		Ikot Etenge Ete	1483	751	732	760	385	375
		Okpoto Ete	986	439	547	505	225	280
		Abasiute	3479	1639	1840	1783	840	943

Table 4.17: Projected Population Figures for Surveyed Communities Cont'd

S/N	LGA	COMMUNITIES	2011 PROJECTIONS TOTAL	2011 PROJECTIONS MALE	2011 PROJECTIONS FEMALE	1991 FIGURES TOTAL	1991 FIGURES MALE	1991 FIGURES FEMALE
6	Ikot Abasi	Essien Etuk & Urua essien Etuk	1438	675	763	737	346	391
		Abiaran	798	396	402	409	203	206
		Ubeneke I	NA	NA	NA	NA	NA	NA
		Ubeneke 11	NA	NA	NA	NA	NA	NA
		Obiokama	5937	1922	4015	1072	985	2057
		Odiono Isoutibe	NA	NA	NA	NA	NA	NA
		Adaha Ukim	NA	NA	NA	NA	NA	NA
		Ekpuk Inang	2746	876	1870	509	449	958
		Ikot Etetuk	1280	767	513	656	393	263
		Ikot Essien	426	252	174	218	129	89
		Ikot Akpan Ata	1794	894	900	919	458	461
		Ikot Abasi Village	11093	5958	5135	5684	3053	2631

Sources; NPC, 1991; NPC 1996

Table 4.18: Respondents' Consensual Perceptions on Demographic Characteristics

Parameter: Demographic Structure	Local Government Areas: IBENO	Ikot Abas	Eket	Esit Eket	Mkpat Enin	Onna
(a) Major Ethnic Group	Ibeno	Ibibio	Ekid	Ekid	Ibibio	Ibibio
(b) Population Structure						
(i) Children	50%–75%	75%	75%	75%	75%	75%
(ii) Youth						
(iii) Middle-aged	≈ 25%	≈ 25%	≈ 25%	≈ 25%	≈ 25%	≈ 25%
(iv) Elderly						
(c) Male/Female Ratio	50:50	43:57	47:53	46:54	49:51	50:50
(d) Marriage Mode: Poly/Mono	56:44	40:60	50:50	55:45	35:65	60:40
(e) Mean Household Size	11	8	9	9	7	8
(f) Mean No. of Children/Household	9	6	7	7	6	6
(g) Literacy Level						
(i) Functionally literate	≈ 25%	≈ 25%	≈ 25%	≈ 25%	≈ 25%	≈ 25%
(ii) Academically literate	≈ 25%	>50%	>50%	>50%	>50%	>50%
(iii) Non-literate	>50%	<75%	<25%	<25%	> 25%	> 50%

Source: Field Survey, 2011

Information obtained during baseline data gathering suggests that in recent times there has been outward migration of locals from the rural areas (more interior villages) to the hub of industrialisation activities. Of note are movements of youths from the interiors to Eket and Ibeno due to oil and gas activities and to Ikot Abasi as a result of Aluminium smelting activities by ALSCON as well as oil and gas activities.

4.14.2 Population Characteristics

Household Size

The mean household size was revealed to range from 7–11 people for all surveyed communities, while the mean number of children per household was between a range of 6 to 9 for identified LGAs. Household size along the project area does not vary much from village to village. The National Bureau of Statistics (NBS) Annual Abstract of Statistics (AAS – 2009) however reports an average household size of 5-6 (5.1) for the study area.

Table 4.18 above also shows the general belief of respondents that the female folks are of a higher proportion than the male folks in Ikot Abasi, Eket, Esit Eket and Mkpat Enin LGAs; while the male: female proportion is adjudged to be equal in both Onna and Ibeno LGAs. This does not corroborate with official statistics. **Table 4.16** indicates a sex (male: female) ratio of 109.0 (NPC, 2006) for Akwa Ibom State. This figure is quite close to the national ratio of 105.0, meaning that generally, the male population is slightly higher than the female population. This trend is similar for a majority of the LGAs under focus, except for Onna LGA, where the female population predominate over the male.

Population Structure

With regard to population structure, **Table 4.19** shows community perceptions to the effect that the children and the youth constitute about three-quarters of the population of surveyed communities, while the middle aged (41 – 60 years) and the elderly (more than 60 years) constitute the remaining one-quarter of the total population.

Table 4.19: Age and Sex Structure of Akwa Ibom State

Age Categories (yrs)	Male (%)	Female (%)	Total
less than 15	32.22	33.34	32.77
15 – 24	26.12	25.42	25.78
1 – 24	**58.34**	**58.76**	**58.55**
25 – 34	14.52	15.80	15.15
35 – 44	9.88	13.21	11.52
25 – 44	**24.40**	**29.01**	**26.67**
45 – 54	9.71	9.02	9.37
55 – 64	5.22	2.27	3.77
45 – 64	14.93	11.29	13.14
65 years and above	2.32	0.94	1.64

Source: AK-BASES (2005) NBS (2009)

Official population structure information is shown on **Table 4.19**. The table shows that the general study area exhibits the typical pyramidal structure characteristic of Akwa Ibom and Nigeria, in general. Population is rather loaded for the lower range cohorts. With reference to the table, the bulk of the population (58.6%) is made up of persons below 25years old. Those of the 25–44 years age group make up 26.67% of the population, while the 44 – 64 years bracket constitutes 13.14% of the population. The implication of the loaded lower range cohorts is a young and growing population with heavy burden on the adult population, and a high dependency ratio.

Dependency Rate

This is the proportion of the working population (those between 15 and 64 years) to the dependent (those under 15 years and those 65 years and above) population. **Table 4.18** gives the dependency rate for the LGAs under consideration. The NPC (2006) however reported a Dependency Ratio of 0.6%, which indicates that less than one person is dependent on one economically active person; while the NBS-AAS (2009) reported an increase to 2.3%, indicating that about 2 persons are dependent on each active worker. This is still relatively lower than the national dependency rate of above 55%.

4.15 Marriage

Marriage is an important social institution in the study area. It is a basic social phenomenon which exists in all the surveyed societies in many forms, guarded by sets of regulations as to who may or may not marry each other. It is a legitimate union of man and woman for begetting and bringing up children and for mutual aid and solace.

Monogamous and polygamous marriages exist in the study area. Although a monogamous marriage involves marrying of one wife, which has to do with the Christian concept of "one wife one husband" it was traditionally largely identified with poverty, implying that the man could not afford to maintain a chain of wives. Any case of monogamy generally existed either as a self denying ordinance in the sense that a man voluntarily renounced or abstained from polygamy or it was dictated by the inability to afford more than one wife.

Polygamous marriage fits well into African structure and the traditional life of the people and has been traditionally identified with wealth and prestige. The number of wives and children one had, counted as a status symbol especially to the chiefs and elders. Also in agrarian and fishing communities, there was need for many hands to ease farming and fish harvest. Many wives therefore provided cheap labour and also served as potters in transporting goods to distant markets.

Importance of Marriage

Marriage has been seen as a means of self preservation, in order to ensure the perpetuation of peoples' names and lineage in the world. Marriage provides family settings in which grown up children properly assume the obligation of caring for their aged and feeble parents. Marriage also provides emotional and financial security for the children born to the family. The family is the structural unit of the community and nation.

Focus group discussions with regard to prevalent mode of marriage reveal that polygamy (at least two wives / husband) and monogamy were almost equally practiced in the study area. Polygamy is very common with mainly elderly / illiterate farmers and fisher folks, while monogamy is becoming very popular among various segments of the educated populace.

4.16 Education and Literacy

4.16.1 Education

Education is a major socio-economic variable which influences nearly every aspect of human life. Education is generally a thriving industry in the study area, alike other parts of the state, where parents / guardians (and children alike) are constantly in a struggle to ensure that their wards attain, at least, the minimal level of educational requirement. According to the National Bureau of Statistics (NBS-2004), primary and secondary schools enrolment figures for the State peaked at 96.31% and 99.07% respectively in 2004. The NBS (2006) Core Welfare Indicator Questionnaire (CWIQ) Survey for Akwa Ibom State, however reported a reduction in net primary and secondary schools enrolment figures as 78.5% and 59.0% respectively. **Table 4.20** shows some basic educational statistics of the study area, including students and pupils enrolment figures.

Table 4.20: Primary and Secondary School Statistics

	Primary Schools						Secondary Schools					
	No. of Schools		No. of Teachers		Pupils Enrolment		No. of Schools		No. of Teachers		Students Enrolment	
LGAs	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Eket	29	31	486	464	30,496	30,952	9	9	327	318	9,685	10,186
Esit Eket	16	21	233	205	12,370	13,370	3	3	44	62	1,257	3,179
Ibeno	12	12	107	102	11,803	12,303	1	1	35	35	1,485	1,716
Ikot Abasi	35	34	246	310	27,341	28,849	6	6	67	83	3,213	5,205
Mkpat Enin	49	49	446	457	29,950	30,950	15	15	190	176	5,647	7,852
Onna	26	26	317	287	20,380	21,380	9	9	141	140	4,263	6,614

Source: Akwa Ibom State Universal Basic Education Board (2010)

The education and literacy level of those within the local governments in the project area informed the methodology of communication adopted during consultation and public disclosure activities. The peoples from the area can be said to be moderately literate. More than 80% in all LGAs have at least attained basic primary education. The use of English as standard communication language was employed throughout the project area. However, where communication gaps were identified, a language that was easily understood by the group under consideration such as Pidgin English language and the local dialects. were engaged with the help of community nominated spokespersons.

Mkpat Enin has the highest number of primary schools (49) while Ibeno (10) has the lowest number. Eket however has the highest number of primary school teachers for 2009 and it also shares the record of harbouring the highest number of pupils (30,952) with Mkpat Enin (30,950).

With regard to secondary schools, Mkpat Enin has 15 while Ibeno has only one public secondary school. Eket however records the highest number of students (10,186). More recent figures (**Table 4.21**) show a trend of general increase in secondary schools' students' enrolment rates in the study area. Eket however, still retains its record for highest number of teachers (290) and students' population (1561).

Table 4.21: Secondary School Statistics - August 2011

S/N	LG A	No. of students		Total	No. of teachers		Total	No. of Public Sec. Schs.
		M	F		M	F		
1.	Eket	6316	8845	15161	97	193	290	9
2	Esit Eket	1602	1774	3376	28	18	46	3
3.	Ikot Abasi	3686	3532	6626	37	35	72	4
4.	Ibeno	1342	1388	2730	12	14	26	1
5.	Mkpat Enin	4816	5133	9949	133	34	167	15
6.	Onna	3997	3664	7661	83	36	119	9

Source: Akwa Ibom State Secondary Schools Management Board (2011)

It is pertinent to observe that high enrolment figures as depicted in **Tables 4.20** and **4.21** do not automatically translate into, even minimal school attendance.

Table 4.22 shows a report by the NBS- Multiple Indicator Cluster Survey Report (2012) to the effect that in 2010, Akwa Ibom State recorded the lowest Primary school completion rate in the country.

Table 4.22: Completion Rate in Primary Schools

Pry. Sch. Completion Rate (Lowest Proportion)	Akwa Ibom State (27.1%)
Pry. Sch. Completion Rate (Highest Proportion)	Lagos State (98.7%)
Pry. Sch. Completion Rate (National)	67.5%

Source: Multiple Indicator Cluster Survey (MICS-2012)

The same report also revealed primary and secondary schools net attendance figures at 63.9% and 48% respectively, for the year 2010. In essence, according to the report, 36.1% Primary schools students and 31.4% Secondary School students were out of school in 2010. The record however shows an improvement over the 18.1% and 19.3% respective net primary and secondary schools completion rates reported by NBS (2006). A recent study (Akpabio, 2008) revealed that secondary schools recorded higher dropout rates than primary schools. Major reasons for this trend was found to include: long distance to school, inability to pay fees and lack of facilities - for secondary schools; and lack/absence of teachers and lack of class rooms - for primary schools.

4.16.2 Literacy Level

Literacy level (ability to read and write with understanding in English or any language) is generally regarded as one of the indicators of level of socio-economic development of any society. **Table 4.23** shows the literacy rate in Akwa Ibom State as 75.1%, which is higher than the estimated national rate of 68%.

Table 4.23: Literacy Rate

S/N	LGA	Literacy Rate (%)		
		Total	Male	Female
1	Eket	76.2	82.4	69.8
2	Esit Eket	58.7	67.3	50.1
3	Ibeno	88.8	93.3	83.6
4.	Ikot Abasi	71.9	75.2	68.6
5.	Mkpat Enin	56.6	63.9	49.3
6.	Onna	70.2	75.1	65.2
7	Akwa Ibom State	75.1	79.7	70.2
8	Akwa Ibom (Youths)	92.3		
9	Akwa Ibom (Adults)	75.1		
10	Nigeria (Adults)	57.9	57.9	50.6
11	Nigeria (Youths)	76.3	81.0	71.4

Source: NBS National Literacy Survey (2010).

WIth regard to the specific study area, **Table 4.23** shows that no LGA has a literacy level of less than 56.6%. The highest literacy level of 88.8% is recorded for Ibeno LGA. This finding contradicts information depicted on **Table 4.21** to the effect that Ibeno has the lowest number of primary and secondary schools in the study area

4.17 Contentious Issues and Conflict Management

Information on conflict management was obtained from interviews with traditional authorities and FGD with members of host communities together with records of previous studies around the area. Traditionally, conflicts arise at individual, family and community levels. All social organizations and those directly involved in community governance play various roles in conflict management depending on the nature of conflict.

Contentions from survey conducted are said to arise out of perceived uneven sharing of political patronage (positions, money, scholarship awards, development activities etc), ceding or usurpation of communal rights (in terms of job placements and contracts awards) to (by) strangers such as visitors/investors, traders, etc or as the case may be; usurpation of authority /infringement of rights/perpetuation of injustice (insults, thuggery / battery / or political opponent / bodily violation / forced abduction, and the likes. In essence, any intentional or unintentional perceived misdemeanour may become contentious if not properly handled .

Intra communal tension may arise between the youth and community elders, when the youth perceive the elders as trying to infringe on their rights, while the elders may feel that the youth are attempting to undermine their constituted authority. When instances of this occur, the youth would mobilize themselves and move to the central meeting point in the community. From there, they either send representatives or move as a group to the house ofa respected community elite or to the house of the offending party, to air their complaints. As a last resort and after exhausting these pseudo peaceful moves they may traverse the whole community, while chanting songs of protest.

When the youth are done, a higher authority – Clan council or Paramount Ruler-in-Council, as the case may be – would embark on fence-mending measure, in order to douse raised tensions. This is accomplished by inviting the leadership of the two antagonising parties to the negotiating table. Valiant attempts are made to ensure amicable resolutions-. If the restored rights bordered on income generating activities, the relevant group (invariably the youth group) are expected to mobilize available resources within a 2-3 weeks span and procure yams, goat and spirit drinks, for onward presentation to the elders, who in the prevailing spirit of forgiveness also accept such gifts and go further to pour libation and / or offer prayers to ward off or revert whatever curses that may have been uttered against the youth, when the imbroglio persisted. Only in very few cases do the youth embark on violent or destructive action and these arise when the elders remain recalcitrant, even after third party involvement, or as reprisal attacks for earlier unpremeditated attacks.

It is also pertinent to note that formal law enforcement agencies are rarely contacted to adjudicate on contentious communal issues. They are only called in when traditional conflict resolution mechanisms do not achieve desired effects. It may also be mentioned that law enforcement officials would rarely enter a community to arrest alleged offence perpetrators, without at least, informing the Community Head, either before or after the arrest.

4.18 Economics

4.18.1 Income Generation Activities

The study area is located in the humid tropical zone with abundant vegetation and rich soils, complemented with heavy rainfall. In essence, there is a very high level of dependence on natural resources, especially on water, land and forest resources for livelihood sustenance. The people of the study area are very industrious, enterprising and resourceful and hence they identify themselves with many aspects of economic endeavour. Crop farming, oil palm harvesting and processing, and fishing with locally made canoes and nets; are major economic activities in the study area (**Table 4.24**). Other traditional occupations include trading, hunting, wood carving, arts and craft, raffia works, etc.

Table 4.24: Perceptions on Economic Scenario of Study Area

Parameter	Local Government Areas					
	Eket	Ikot Abasi	Mkpat Enin	Esit Eket	Ibeno	Onna
Economic Scenario (a) Major Occupation	Fishing/ trading / farming	Farming, fishing trading artisanship Collection of forest/water produce	Palm fruit harvesting/ processing, farming, Trading/ Artisanship	Fishing/ farming/ agro processin g Artisanshi p/forest produce collection	Fishing/ trading/ collection of forest/water products / Artisanship	Farming, fishing trading artisanship Collection of forest/water produce
(b) Estimated Monthly Income						
(i) < 1,000	10%	20%	25%	5%	10%	10%
(ii) 1,000 – 10,000	50%	75%	70%	75%	70%	60%
(ii) 10,000 – 50,000	30%	3%	3%	10%	10%	20%
(iii) > 50,000	10%	2%	2%	5%	10%	10%
(c) Savings						
(i) Nil	35%	50%	40%	40%	40%	50%
(ii) Etibe	45%	25%	20%	40%	40%	25%
(iii) House	10%	20%	10%	15%	10%	20%
(vi) Bank	10%	5%	10%	5%	10%	5%

Source: Field Survey, 2011

The women are involved in farming, the marketing and sale of raw and processed farm and water produce and in the gathering of non-timber forest produce. The male are also involved in artisanal occupations (masonry, carpentry, welding and mechanical and electrical repairs) and in palm wine tapping and local gin distillation. In addition to the above, the male youth undertake motorcycle transportation and sand dredging. They are also offered essential services as hired labour on farms and at construction sites.

Agricultural Production

This is a very important activity in the study area as the state falls within the tropical zone with a dominant vegetation of green foliage of trees, shrubs and oil palm tree belt. Cassava is the main food crop planted although it is fast becoming a commercial endeavour. Other commonly grown crops include: yam, cocoyam, plantain / banana, vegetable crops (especially fluted pumpkin) and some perennial tree crops like oil palm, bush mango (uyo) star-apple (udara) pear (eben), raffia palm tree, etc. Apart from other artisanal trades and public employment, agriculture plays an important role in the economies of the communities along the line. Farming of food and cash crops constitute the bases of economic activities in the more hinterland communities of the project area, e.h the Mkpat Enin and Ikot Abasi axis.

Figure 4.29: Farmlands

Fish Production

Fishing activities occurs in the lakes, swamps and brackish waters which occur at the banks of the main rivers and those of big streams. These kind of fisheries occur in all the water bodies of the surveyed LGAs. Catfish (particularly Mud Catfish) tilapia, mullet, feather back and electric fish are regularly harvested from these fisheries with the aid of hooks, long-lines, traps, poisons, nets and drain. The coast of Akwa Ibom State is characterised by extensive stretches of swamps and shallow waters, which are not utilised for any profitable form of agriculture. Bonga, shad, catfish and mullet are regularly harvested from these areas.

Private fish ponds exist in some parts of the study area. The pond sizes, stock and yields do vary, but generally cultivated species include carp, tilapia, catfish, and Niger perch. The pond generally consists of nursery, transition and production ponds. Only very few have hatcheries. Constraints affecting fishery development in Akwa Ibom State, include: mangrove ecosystem destruction by oil production, mangrove colonisation by nypa palm and lack of motorized equipment for deep sea fishing (capture fisheries). Others are, lack of finance, shortage of frys, fingerlings and feed supplements, etc.

4.19 Land Ownership / Land Use / Changes in Land Cover

Land in study area is joint property of the extended family system, leading to fragmentation and small sizes of non-contiguous farm holdings. Land acquisition in Akwa Ibom State, is by either of four means: outright purchase; leasing (oto-owo); inheritance (Ikot ufok / ekpuk); and pledging (Ubiong ikot) in lieu of loan acquisition, and which is returned to original owners after loan payment to creditors. Some conditions may be attached to land acquisition (especially leased or pledged land). For example, length of time of acquisition may be for a single or more planting seasons on leased land; and in cases where oil palm trees are planted on pledged or leased land, the temporary owner may be forbidden from harvesting produce thereof. In terms of family land, family members may be barred from outright sale of their portion to non-family members.

In essence, Individuals, families and the community could own Land in the study area. Individual and family land holding are inherited from the forefathers and / or bought out rightly from the original landowners. Communal land holdings (Ikot Isong) are a general phenomenon in the study area. These form of holdings, which may have been former sacred forests, contentious land holdings or just set apart and left fallow for future community development purposes, are held in trust by the leaders / elders of particular communities.

It is important to note that women retain limited rights of land tenure in the study area, except through outright purchases. Family land may not be shared with daughters because of the belief that they would be married out. On marriage, a woman controls "Ikot ubok" plots, which are permanently allocated to her by the husband and remains her bonafide property till death, after which the holding is apportioned to her children. A woman has only temporary rights on "nno nkama" land, which is loaned to a wife by the husband, for her management and is reclaimed after her demise. A landowner is however free to sell-off his holdings or give such out on pledge (ubiong or nno nkama).

Soil in the study area is replenished through rudimentary bush fallows which may last between 5 and 7 years. Population pressure may however lead to reduction of fallow period. Average family farm size may range between 0.2 – 2 hectares. On farm tasks performed by different gender and generation, it is a known fact that the female gender is more involved in most aspects of farm work than the male gender. The children perform assigned tasks especially in planting and weeding, but their active participation may be constrained by school activities.

Changes in Land Cover

Lots of changes have been recorded in land cover pattern in the study area. Available official records, as shown on **Table 4.25** shows some changes in the available sizes of various land formations and which has invariably affected the use to which land is put. In particular is the area of land for mangrove forest and urban industrial built up. Reductions in the described categories are very noticeable in the urban areas, especially in Eket, Mkpanak, Ikot Abasi and Onna.

Table 4.25: Changes in Land Cover

Land Cover Type	Area (1984)	Area (2003)
Bare soil	2,551.13	38,817
Beach sand	135,946	127,539
Fallow land/ grassland	26,939.05	29,074.48
Mosaic farmland/ oil palm forest	8,464.60	10,662.29
Fresh water swamp forest	9,922.95	7,545.29
Mangrove forest	3,739.45	1,644.91
Rivers/ natural water bodies	10,192.99	10,721.20
Urban industrial built up	895,995	3,028. 115

Source: Ekpenyong (2007)

4.20 Quality of Life

This attribute encompasses many indices, all aimed at ascertaining the level of well being of the people inhabiting a particular community / area. These are as detailed below.

4.20.1 Settlement Pattern / Housing Structure / Tenure

Settlement Pattern

Participatory observation reveals that the study environment exhibits both the linear (along road arteries and the banks of waterways) and nucleated (clustered) settlement patterns. A relatively higher proportion of the houses in the towns are multi-tenement with shared facilities, while owner occupied family houses are more prevalent in the more rural settings.

Figure 4.30 Housing Structures

Housing Structure

With regard to housing structure the Nigeria Bureau of Statistics (NBS, 2005) has given statistical data (**Figure 4.31**) showing that 49.44% of dwelling houses in Akwa Ibom state are made of cement / concrete mixture while 32.96% are made up of mud materials.

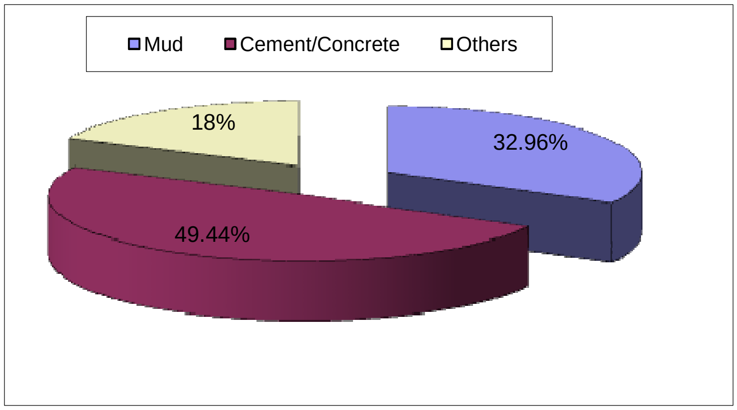


Figure 4.31: Housing Structure - Percentage Distribution

These figures may also hold true for the urban / upland areas of the LGAs under focus as depicted by **Table 4.25**.

Table 4.26: Description of Some Quality of Life Indicators

Parameter	Local Government Areas					
	Eket	Ikot Abasi	Mkpat Enin	Esit Eket	Ibeno	Onna
Quality of Life/Std of Living						
(i) Household Pattern						
Mud wattle/zinc	10%	10%	10%	20%	10%	10%
Earth block/zinc	10%	20%	20%	25%	20%	20%
Cement block/zinc	60%	50%	50%	30%	30%	50%
Cement block/Asbestos	10%	10%	10%	5%	20%	10%
Mud/wattle thatch	10%	10%	5%	20%	20%	10%
(ii) Modern conveniences	More than half	50%	25%	25%	25%	25%
(iii) Proportion of poor	75%	75%	75%	75%	75%	75%
(iv) Proportion of jobless	75%	75% (disguised unemployment)	75%	75%	75%	75%
(v) Most affected sub group	partially educated	partially educated	partially educated	partially educated & graduates	partially educated	partially educated
(vi) Expenditure pattern	food/education (75%)	food/health/ education (75%)	education/ food75%)	food & education (75%)	food / health (75%)	food/ education 75%

Source: Field Survey, 2011

With regard to tenure of dwelling houses, a related finding revealed that houses made of cement blocks were permanent and may only have its parts renovated over time arising from wear and tear, while houses made of natural materials were perishable and are always replaced over time when individual economies improve.

4.20.2 Monthly Family Expenditure Pattern

Tables 4.25 and **4.27** reveal respective primary and secondary data results to the effect that food, education and health take the lion share in the expenditure on various necessities in Akwa Ibom State. The three items account for over 50% of the mean monthly household expenditure. The Nigeria MDG Report (2010) reported that food accounts for 63.3% household consumption expenditure.

Table 4.27: Monthly Expenditure Pattern Per Family (%)

S/N	LGA	Necessities								
		Food	Water	Health care	Transportation-	Education	Rent	Electricity	Clothing	Mean salary/income(N)
1.	Eket	31.4	2.9	11.5	8.5	21.9	8.9	3	12	18,743
2.	Esit Eket	27.4	3.4	11.7	7	24.6	12.5	3.6	9.9	22,196
3.	Ibeno	25.2	5	8.2	12.4	18.9	10.9	4.1	15.3	13,507
4.	Ikot Abasi	31.8	3.1	10.7	10.2	18.9	7.6	3.9	13.8	16,999
5.	Mkpat Enin	35.2	2.1	8.6	8.7	20	7.6	5.4	12.4	13,202
6.	Onna	27.6	4	11.2	8.6	19.1	13.2	14.1	12.1	14,198
Akwa Ibom State		29.6	3.5	10.2	8.9	21.1	10.7	3.9	12.7	15,067

Source: AKBASES (2005)

4.20.3 Availability and Access to Household Conveniences

With regard to availability and general access to household conveniences AKBASES (2005) reveals that clocks/watches (90% households) and radio sets (87% households) as the most common and generally easily accessible household conveniences.

4.20.4 Availability and Access to Household Conveniences

Figures 4.32 and **4.33** also reveal that fuel wood and kerosene respectively, remain the most popular materials utilized as fuel and light sources in Akwa Ibom households.

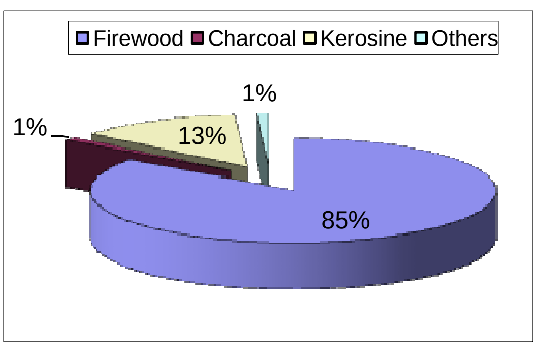


Figure 4.32: Types of Fuel Used

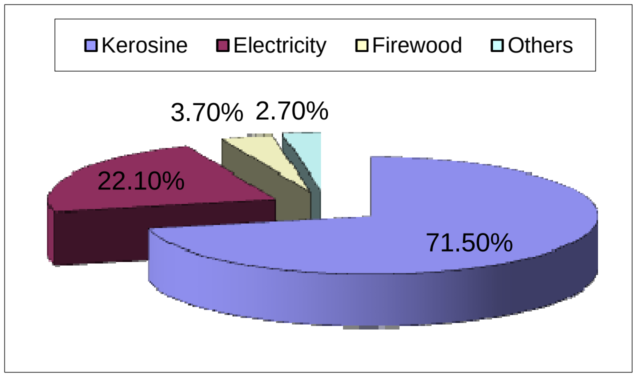


Figure 4.33: Light Sources

4.21 Poverty and Inequality

Absolute poverty refers to deprivation in well being, reflected in the inability to attain a minimum standard of living; while Inequality (relative poverty) is defined as unequal distribution of income/expenditure across the entire population. The African Peer Review Mechanism (APRM) Nigeria Country Report (2009) estimated that about 54.4% Nigerians (76 million population) lived below the poverty line of 1.25 US dollars per day in 2008. This figure has however increased to 70% (105 million Nigerians) in 2010, according to the Governor of Nigeria's Central Bank (Daily Trust, 2011). The MDG Report (2010) traces poverty incidence in Nigeria, for the years 2000, 2004, 2006 and 2009; as 60%, 54.4%, 51.6% and 54.0% respectively. Estimates were based on people living below the poverty line of 1 Dollar / day. For Akwa Ibom State, the NBS (2006) reported a 70.8% self classified poverty status in 2005.

With regard to inequality, the UNDP (2009) declared that 20% of the Nigerian population own 65% national assets, while 70% of the population are peasant rural workers and artisans. AK-BASES (2005) also revealed the disparity in household expenditure between the poorest and richest deciles in Akwa Ibom State. Total expenditure per capita for the lowest 10% was revealed as N726.00, as against N6, 000 for the highest 10%.

It was generally observed that the poorest population segment spent more on food than on non-food items, while the reverse held for the highest segment of households. A wide disparity in food poverty level (measured by 2100 calories food intake) was also reported for Akwa Ibom State, where 68.40% of the population exists below the minimal food security level. **Table 4.28** shows that in the study area, income poverty varies between 58.61% (for Eket) and 78.95% (for Ibeno).

Table 4.28: Income and Food Poverty Indices

S/No.	LGA	Income (%)	Food (%)
1	Eket	58.61	19.44
2.	Esit Eket	63.42	21.97
3.	Ibeno	78.95	44.74
4.	Ikot Abasi	65.74	29.63
5.	Mkpat Enin	72.51	33.58
6.	Onna	73.41	40.24
17	Akwa Ibom State	73.73	37.02

Source: AKBASES (2005)

In essence, 59% of Eket people and more than 78% of Ibeno people cannot be sustained by their monthly incomes. With regard to food poverty indices, the range is between 19.44% (Eket) to 44.74 (Ibeno). In essence, about 45% of Ibeno residents cannot access adequate food for a functional life.

Table 4.29: Poverty / Inequality Highlights - Akwa Ibom State

S/N	Indices	Rate	
1	Income poverty level	74%	
2	Food poverty level	63%	
3	Inequalities Indicators	**Richest decile**	**Lowest decile**
a	Income	31.4%	1.3%
b	Expenditure/capita	N6,000	N726.00
c	Expenditure on food	N2,500	N313.00
d	Expenditure on non – food items	N3,677	N250.00

Sources: (AKBASES 2005; FOS 2004; USAID 2005; UNDP 2006; NBS, 2006)

4.22 Employment / Unemployment

4.22.1 Employment

AK-BASES (2005) reported that over one third (36.267%) of the employed people in Akwa Ibom State are involved in extractive occupations (fishing/farming/logging/sand excavation/collection of timber/non timber forest products etc) while 20.25% of employed are traders. The Annual Abstract of Statistics (2009) stated that 28.53% of the employed in Akwa Ibom State are involved in agricultural production. Both the Nigerian Bureau of Statistics (NBS, 2005) and the Akwa Ibom Baseline Socio-Economic Survey (AK-BASES, 2005) have depicted the 25 – 54 years age category as making up more than 80.99% of the working population in the study area.

4.22.2 Unemployment Rate

Unemployment (non-utilization of human resources, especially among the 15 – 64 years age group or proportion of those who worked for at least 40 hours during reference period, to the total currently inactive labour force population) in the study area is in tandem with international human capital profile. **Figure 4.34** shows a high unemployment situation (53%) among persons aged 15 – 24 years.

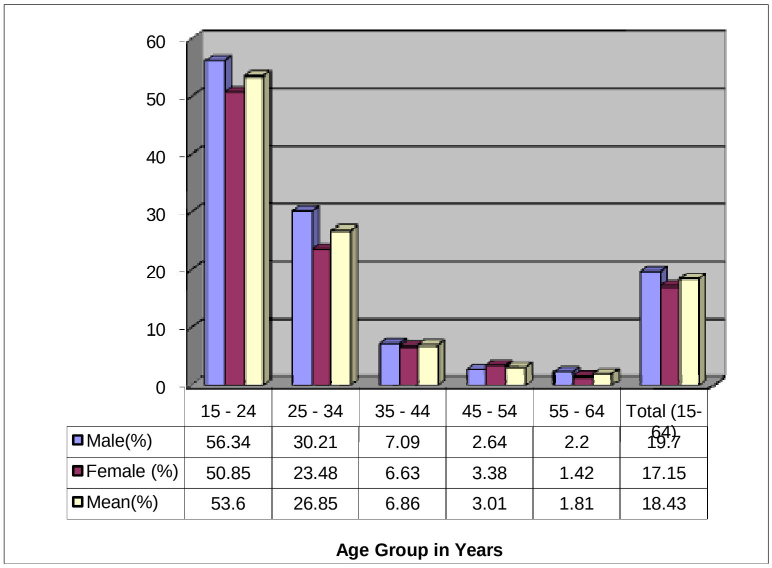


Figure 4.34: Unemployment Rate

Unemployment is also relatively high (26.86%) in the 25 - 34 years age group. It is important to note that the most economically active productive age group (15 – 34 years) has the highest unemployment burden of about 80%. This is indicative of the wastes in man power through unemployment that is facing the state. Also note that the unemployment rate of the males exceeds the corresponding rate for the female counterparts at every age group except the 45 - 54 years group. Related data reveals that unemployment rate is highest among the unmarried females and young school leavers/ graduates (87.94%).In the same vein, The Sunday Punch newspaper of July 20, 2008 reported a statement credited to the Minister of youth affairs, to the effect that 80% of the estimated 80 million Nigerian youths are unemployed, while 1.6 million of the estimated 16 million employed Nigerian youths are underemployed.

Field survey shows that the partially educated and post secondary graduates make up the highest proportion of the unemployed in the surveyed communities, while **Table 4.30** shows that national unemployment rate increased from 19.7% (209) to 21.1% in 2010. An NBS (2010) survey put the unemployment rate for Akwa Ibom State at 25.8%

Table 4.30: National/ Akwa Ibom Unemployment Rates (%)

Year	Unemployment Rate
2001	13.1%
2005	11.9%
2008	14.9%
2009	19.7%
2010	21.1%
Akwa Ibom (2010)	25.8%
Male	25.8%
Female	26.0%
Most Affected Age Group	
15-24 years	35.9%
25-34 years	23.3%

Source: NBS Nat. Manpower Stock & Employment Generation Survey (2010)

4.23 Infrastructural Base

A broad picture of the infrastructural base of the affected communities along the proposed transmission line is presented in **Table 4.31**.

Table 4.31: Community Infrastructure Base

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Mkpanak *Urban/Accessible*	Eket - QIT road (dilapidated asphalt but reconstruction contract awarded)	Major ones asphalted but with poor drainage	None, closest at Iwuochang	Rain ; Sachet water and Private Bore-holes	MTN; Glo; Airtel; Etisalat; Starcom; and Visafone	One Primary Health Care centre	One with functional classroom blocks	One private technical School. Closest public school at Upenekang	Available and supplied from MPNU QIT	Beach Resort; Hotels; Commercial banks
Ebana *Rural/Accessible*	Eket - QIT road (dilapidated asphalt but reconstruction contract awarded)	Mainly Earthen and maintained by community effort	None, land allocated for the proposed Evening Market	Streams; bore-hole by MPNU; Hand Pumps. Treated water scheme ongoing by Pro-Natural Int'l and Frontier Oil Ltd.	MTN; Glo; Airtel; and Etisalat	Health Post present on rented space but Permanent Health Centre building under construction	One with good five blocks of classes but jointly owned with Ede Obok	None. Closest at Esit Urua (about 3km) and Afaha Eket (bout 4km)	Available but Erratic supply. Provided by MPNU in 2002	-
Esit Urua (3 villages: Esit Urua; Idung Imose & Idung Adiakot) *Semi-urban/Accessible*	Eket - QIT road; asphalted but, dilapidated - reconstruction contract awarded and on-going.	Mainly Earthen and maintained by community effort	None	Streams. Bore-hole by State Govt. now non-functional	MTN; Glo; Airtel; Etisalat	None	One with average structures	One built by community effort now managed by The Apostolic Church	Available in some parts of the community. Supply is erratic.	One Police Post which is non-functional
Ede Obuk *Semi urban/Accessible*	Eket - QIT road; asphalted but, dilapidated - reconstruction contract awarded and on-going.	Mainly Earthen and maintained by community effort	None, land allocated for the proposed Evening Market	Streams which are silting, two boreholes by the State govt. and MPNU	MTN; Glo; Airtel; Etisalat	None, closest being Poly-Clinic, Upenekang and General Hospitals at Upenekang and Eket	One, with average structures	None	Available with erratic supply	
Afaha Eket (comprises 3 villages of Atibe; Atai Ndon; and Ekpene *Urban/Accessible*	Afaha Eket road; Marina road; Grace Bill road and Afaha Ukwa road, all Asphalted.	Major ones are asphalted since these are roads within Eket Urban. Some are in a deplorable state.	One Daily Market with lock-up stalls (Urua Nka); one fruit and yam market; one timber market.	Private bore-holes and sachet water. Public potable water no more functional	MTN; Glo; Airtel; Etisalat; Starcom; and Visafone	One General Hospital and one Psychiatric hospital	Two public primary schools with functional classroom blocks	Two, with inadequate and dilapidated structures	Available with erratic supply	One School of Nursing; MPNU Staff Estate; over five commercial banks; Major Hotels in Eket

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ikot Akpatek *Urban/Accessible*	Ndon Eyo – Ikot Akpatek – Odio road (asphalted but abandoned after the community - rendering it deplorable)	All earthen, maintain by community effort. Some are deplorable.	One evening and One weekly market with good open and lock-up stalls (Urua Edere Obo managed by Onna LGA.	Streams and one bore-hole by LGA. Bore-hole by the Federal govt. non functional	MTN; Globacom; Airtel and Etisalat.	None. Nearest at Abat (PHC)	One with three functional classroom blocks renovated by MPP6 and LGA	One with functional classroom blocks	Available but needs extension to all part of the community	One civic centre (ongoing since 2002 by NDDC)
Ikot Ebidang *Semi-urban/Accessible*	Earthen and deplorable Abat – Ikot Ebekpo – Ikot Ebidang - Rice Farm road	Earthen maintained by community effort	One daily market with open stalls constructed by the LGA	Streams. Hand pumps are non-functional.	MTN, Globacom and Airtel	One Health Centre abandoned with dilapidated structure.	One with good classroom block	None. Nearest at Abat (about 45minutes walk)	Available sponsored by the LGA	Abandoned Ibom Rice Farm (a joint venture project of AKSG and MPNU)
Ikot Annang *Rural/Accessible*	Abat – Ikot Edor road	Earthen maintained by community effort.	None. Nearest is Edere Obo about 30minutes walking distance	Stream and private bore-holes. Public bore hole not functional	MTN, Globacom and Airtel	One Primary Health Centre (PHC)	One with three blocks of classroom	None	Available	
Mkpa Eto *Rural/Accessible*	Ikot Ebiere – Ikot Edor - Mkpa Eto – Ndon Ibotio – Ikot Ekong road (Asphalt up Ikot Eko Ibon)	Earthen	One daily market jointly owned with Ikot Edor. Stalls need renovation	Streams and Bore-holes	MTN, Globacom and Airtel	None. Closest located at Ikot Eko Ibon	One jointly owned with Ikot Eko Ibon	None. Nearest one at Ekot Edor	Available. Transformer jointly shared with Ikot Eko Ibon	One Town Hall built by community effort. Structure needs renovation.

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ikot Eko Ibon *Semi-urban/Accessible*	Ikot Ebiere – Ikot Edor - Mkpa Eto – Ndon Ibotio – Ikot Ekong road (Asphalt up Ikot Eko Ibon)	Earthen and maintained by community effort	One daily market with open stalls	Streams and two bore-holes by LGA and MPNU	MTN; Globacom; Airtel; and Etisalat	One Cottage Hospital. Functional with Medical Doctor	One jointly owned with Mkpa Eto	None. Nearest ones at Ikot Edor and Ibotio/Ndon (Mkpat Enin LGA)	Available	Town Hall by community effort Ongoing
Ikot Edor *Semi-urban/Accessible*	Ikot Ebiere – Ikot Edor - Mkpa Eto – Ndon Ibotio – Ikot Ekong road (Asphalted up Ikot Eko Ibon)	Earthen and maintained by community effort	One daily market jointly owned with Ikot Edor. Stalls need renovation	Streams and Bore- hole	MTN; Globacom; Airtel; and Etisalat	One Health Centre under construction	One with good classroom blocks	One with good classroom blocks	Available. Services much improved	
Ikot Ekong (3 gazetted villages of Ikot Ekong; Ikot Umoh Ekong; & Odoro Ikot) *Semi urban/rural. OdoroIkot- No easy access*	Eket – Ikot Abasi (East – West) road. Contract awarded for dualization and on-going	Earthen maintained by community effort	One daily with two open sheds by community effort and one weekly with two sheds by Fadama III project	Streams and two bore- holes by LGA and Fadama III. Hand pumps non functional	MTN; Globacom; Airtel; and Etisalat	None. Nearest one at Ikot Akpaden	Jointly owned with Ikot Enin. It has three dilapidated classroom blocks, laboratory and Technical workshop	One with three classroom blocks. All structures in deplorable state.	Available with improved services	
Ndon Ibotio *Rural/Accessible*	Ikot Ekong – Ndon – Ikot Eko Ibon – Ikot Edor – Ikot Ebiere road. Only asphalted at Ikot Edor axis	Earthen maintained by community effort	One daily with two open sheds by community effort.	Streams. Bore hole by Shell BP non- functional	MTN; Globacom; Airtel; and Etisalat	None. Closet ones at Ikot Ebiere and Ikot Akpaden	One jointly owned with Ibotio. Has Good classroom blocks	One jointly owned with Ibotio. Structures dilapidated	Available but transformer shared with Ibotio	
Ibotio *Semi-urban/Accessible*	Ikot Ekong Ibotio- Ndon road with broken bridge	Earthen maintained by community effort	One shared with Ndon	Stream	MTN; Globacom; Airtel; and Etisalat	None. Closet ones at Ikot Ebiere and Ikot Akpaden	One jointly owned with Ndon. Has Good classroom blocks	One jointly owned with Ndon. Structures dilapidated.	Available but transformer shared with Ndon Ibotio	

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ikot Enin *Rural/Accessible*	Eket – Ikot Abasi(East – West) road. Contract awarded for dualization and on-going	Earthen maintained by community effort	None	Two bore – holes by Indigenes	MTN; Globacom; Airtel; and Etisalat	None. Closet one at Ikot Akpaden	None	Jointly owned with Ikot Enin. It has three dilapidated classroom blocks, laboratory and Technical workshop	Available. Provided by NDDC	
Ekim *Rural/Accessible*	Ikot Akpaden – Ndon Obodom – road Abandoned from the village	Earthen - maintained by community effort	One daily/ Weekly market	Stream and Bore- hole	MTN; Globacom; Airtel; and Etisalat	None. Closet one at Ikot Akpaden	One with good classroom blocks	One with dilapidated blocks	Available	
Ikot Oyoro *Rural/ Not easily accessible*	Ikot Akpaden – Okoroete road (asphalted) and Ikot Oyoro – Ikot Ekong road (Earthen and Deplorable)	Earthen - maintained by community effort	None.	Stream and One Bore- hole	MTN; Globacom; Airtel; and Etisalat	None. Closet one at Ikot Akpaden	None	None	None	
Ikot Obio Ndoho *Rural/Accessible*	Eket – Ikot Abasi (East – West) road. Contract awarded for dualization and on-going.	Earthen and maintained by communal effort	One weekly/ evening market with dilapidated structures	One bore – hole and stream now polluted due to Gas pipe laying by Septa Energy	MTN; Globacom; Airtel; and Etisalat	Health Post operational. temporarily located at Community Civic Centre	One with good classroom blocks	None. Nearest located at Ekim	Available	A community built Civic Centre renovated and equipped by an illustrious son.
Ikot Aba *Rural/Accessible*	Ikot Akpaden – Ekim – Ikot Aba – Ikot Eti – Eket / Ikot Abasi road (Earthen and deplorable)	Earthen and maintained by communal effort	One daily/ weekly market with dilapidated trading sheds.	Streams; two bore-holes; two hand pumps. One abandoned bore-hole by Cross River Basin Authority	MTN; Globacom; Airtel; and Etisalat	None	One with two blocks of classrooms	None. Nearest located at Ekim	Available. provided by NDDC since 2004	A standard civic centre under construction by the LGA

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ikwa *Semi Urban/ Accessible*	Eket – Ikot Abasi(East – West) road. Contract awarded for dualization and on-going.	One major (asphalted) while others are earthen and maintained by communal effort	One daily market	Streams; two hand pumps and one bore-hole.	MTN; Globacom; Airtel; and Etisalat	One Missionary Hospital	One Primary jointly owned with Ikot Ataha	One jointly ownewith Ikot Umiang Okon	Available	A religious group (Christian Witness Team) has operational base/ community and real estate properties within the village
Ikot Ataha *Rural/Accessible*	Eket – Ikot Abasi(East – West) road. Contract awarded for dualization and on-going..	Earthen and maintained by communal effort	None	Streams and Hand pumps	MTN; Globacom; Airtel; and Etisalat	None	One Primary jointly owned with Ikwa	None	Available with erratic services	
Ikot Umiang Okon *Rural/Accessible*	Odoro Atan – Ikot Umiang – Okon road. Asphalted, dilapidated with one abandoned major bridge (now crossed with a canoe) & two smaller bridges	Earthen and maintained by communal effort	None	Stream; One bore-hole	MTN; Globacom; Airtel; and Etisalat	One Health Post yet to be completed but operational	None	One which the compound is usually flooded during heavy rains and structures dilapidated	Available but erratic supply	
Iman Ekabom I & II *Rural/Accessible*	Eket – Ikot Abasi(East – West) road. Contract awarded for dualization and on-going.	Earthen and maintained by communal effort	One evening market	Streams	MTN; Globacom; Airtel; and Etisalat	none	One primary	One with inadequate structures	Not electrified	

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ikot Akpan Okop *Rural/Isolated Very hard to access- Impassable during rains*	Eket – Ikot Abasi (East – West) road. Contract awarded for dualization and on-going..	Earthen and maintained by communal effort	One weekly market with open stalls	Streams; one bore-hole by LGA; one hand pump by Septa Energy. One abandoned bore-hole by Cross River Basin Authority	MTN; Globacom; Airtel; and Etisalat	None	One, with two classroom blocks built by community and British Council.	None	Not connected to National grid	
Ikot Ekpang and Ikot Aka *Rural/Isolated Very hard to access- Impassable during rains*	Odoro Atan – Ikot Ekpang – Ikot Iyang Okop – Elele road (Earthen totally deplorable)	Earthen and maintained by communal effort	One evening/ weekly market with open stalls constructed by community in conjunction with EU MPP6	Streams which are polluted	Airtel and MTN provide erratic services	None. Closest located at Ikot Inyang Okop (just completed) and Ikot Akpaden (a 1hour ride on motorcycle)	One whose structures are dilapidated	None. Closest located at Odoro Atan which is a 1hour 30min. trekking distance	Not connected to national grid.	
Akapmbiet Edo Community *Rural/Accessible*	QIT – Edo – Uquo road (Asphalt)	Earthen and maintained by communal effort	One weekly/ evening market with open stalls	Hand Pumps	MTN and Airtel	None	None	One for the entire Edo group of villages	Available but erratic services	
Edida Edo *Rural/Accessible*	Edo -Akpambiet -Edida road (Earthen and deplorable)	Earthen and maintained by communal effort	None	Streams; Private bore-holes.	Airtel	None	One established by Lutheran Mission	One for the entire Edo group of villages	Available but erratic services	
Oniok Edo Rural/Accessible	QIT – Edo – Uquo road (Asphalt)	Earthen and maintained by communal effort	One daily	Streams and Two functional bore-holes by NDDC and LGA	MTN; Globacom; and Airtel	One Primary Health Centre	One with good structure	One for the entire Edo group of villages	Available in some part. Services erratic	
Ikot Etetuk *Semi urban setting/accessible*	Eket – Ikot Abasi Road.	Mostly earthen and some abandoned by contractor	Small Evening market jointly owned with Ikot Akpan Ata	Public pump. Water supplied from ALSCON mains. Not sufficient for the community	MTN; Globacom; Airtel; and Etisalat	One Primary Health Centre. Not equipped.	One jointly owned with Ikot Akpan Ata	None. Closest located at Ikot Abasi Village	Regular supply from ALSCON but controlled by PHCN	

Table 4.31: Community Infrastructure Base Cont'd

Community	Accessibility / Access Road	Intra Road Network	Market	Water source	Telecommunication	Health Facility	Primary School	Secondary School	Electricity	Others
Ete village; Obiokama; Ubeneke I; Ubeneke II; Abasi Ute; Abiaran; Odiono Isoutibe; Essien Etuk; Urua Essien Etuk; Okpoto; Adaha Ukim; Ikot Etenghe and Ekpuk Inang *Combined urban/semi urban/rural attributes/easily accessed*	Eket – Ikot Abasi (East – West) road. Contract awarded for dualization and on-going..	Majority are asphalted	Two major markets: one weekly and one daily	Streams which have been destroyed by gas pipes and Electricity transmission lines. Only one public bore-hole and two hand pumps by Septa Energy are functional. Bore-holes by DFRRI; V-Mobile not functional.	MTN; Globacom; Airtel; and Etisalat	None. Closest is located at Ikot Akan	Two primary schools owned by the group of villages	One owned by the Methodist Church	Available but service is epileptic	One major Motor Park; one Civic Centre (ongoing) by NDDC; one commercial bank
Ikot Essien *Semi urban setting/accessible*	Eket – Ikot Abasi Road	Mostly earthen and some abandoned by contractor	None. Nearest is the one at Ikot Abasi Urban	Dug wells and Private bore - holes	MTN; Globacom; Airtel; and Etisalat	None. Closest is the General Hospital in Ikot Abasi Urban	One jointly owned with Ikot Obong	None. Closest located at Ikot Abasi Village	Regular supply from ALSCON but controlled by PHCN	
Ikot Akpan Ata *Semi urban/urban setting/accessible*	Eket – Ikot Abasi Road	Earthen and deplorable	Small evening market	Streams	MTN; Globacom; Airtel; and Etisalat	None. Closest is the General Hospital in Ikot Abasi Urban	One jointly owned with Ikot Etetuk	None. Closest located at Ikot Abasi Village	Uninterrupted supply directly from ALSCON	
Ikot Abasi Village *Semi urban/urban setting/accessible*	Eket – Ikot Abasi Road	Some are asphalted while some are either abandoned or undergoing construction. (They form part of the Ikot Abasi Urban roads	One morning market and one Evening Market	Private Bore-holes	MTN; Globacom; Airtel; and Etisalat	One General Hospital and One Primary Health Centre	Two Primary schools with average structures	One Secondary Commercial established by Late Justice Udo Udoma	Regular supply from ALSCON but controlled by PHCN	Major Hotels in Ikot Abasi; Ibom Dock Yard company; Marine Police base; Local Govt. Council Secretariat;

In termsof road infrastructure most of the communities are accesed by the Fedral East-West road. The transmission line is to run south of this road (see **4.23.**2). As discussed earlier majority of the communities are currently connected to the national grid system for power supply. Major public health care facilities are located in Uyo, Eket and Ikot Abasi; however as earlier presented smaller rural communities like Oniok Edo have primary health care centres set up by the government. See sections below for interrelationship of communities in terms of basic infrastructure.

4.23.1 Market Facilities

Major markets in the study area include Iwuoachang (Ibeno) Urua Nka (Eket), Urua Edere Obo (Onna) Ukam (Mkpat Enin), Ete (Ikot Abasi). Some of these markets are held daily or once every week. Other smaller communities depending on their proximity and teis to where the major markets are sitauated patronise these markets as well as partake in bringing their products for sale.

It is important to note that smaller evening markets exist in almost all communities of the study area. It is also important to note the poor state of infrastructure in some of the major markets like Ukam and Ete, where the few lock-up stores (whenever they exist) are in dilapidated conditions. Electricity and potable water sources are either absent or non-functional, while intra-market passages are soggy, marshy and sandy terrains that are hard to traverse during the rains.


Edereobo Market - Ikot Akpatek, Onna LGA

Market - Edor, Esit Eket LGA

Figure 4.35: Market Structures

4.23.2 Access Road / Public Transportation

Accessibility into all the surveyed LGAs / communities is through three major roads: (i) the Eket – Ibeno Road, which is in a dilapidated condition, but currently undergoing reconstruction; (ii) the Eket - Ikot Abasi Road (part of the East – West road chain) which is fairly good but presently undergoing dualisation ; and (iii) the Ete - Ikot Abasi Road, which is asphalted and in good condition. Some of the intra- LGA routes may be described with adjectives like: good, good with failed portions, bad and abandoned, bad and undergoing reconstruction activity, constructed but abandoned at a portion and bad

It is important to note essentially that land access also exists to these riverine settlements. Inter LGA roads linking Uyo- the state capital- with the headquarters of the LGAs under survey are in fairly good conditions. The same can be said about the roads leading to the headquarter communities of these LGAs.

Cars and trucks in various passable states are utilized for the movement of goods and commuters. Motorcycle machines, especially, large engine CG 115, 150 and 175 double silencer types predominate. Popular brands include Nanfang, Frajend, Suzuki and Q-link; which are all reported to be strong and hardy enough to traverse the rough, erosion ravaged and poorly maintained road networks. Bicycles may serve for intra settlements / communities movement. Human porterage on heads / shoulders is also a common activity, especially by the female gender.

Access Road – Ede Obuk

Rice Farm Road – Ikot Ebidang

Ikot Akpatek – Ikot Edor –Ikot Ekong Road

Abat – Ikot Ebekpo – Ikot Ebidang Road

Intra Community Road - Mkpanak

Abandoned NDDC Bridge – Ikot Umiang Okon

Figure 4.36: Road Infrastructures

4.23.3 Electricity Supply

Almost all the surveyed communities (apart from Ikot Ekpang, Ikot Aka, Ikot Akpan Imo and Ikot Akpan Okop) are supplied with electricity. All are linked to the national PHCN grid, where they have to contend with limited supply characteristics. Mkpanak is in Ibeno LGA and is supplied electricity directly from the -MPN electricity mains in QIT. All the communities in Ikpa Ibekwe clan of Ikot Abasi LGA are supplied electricity from the RUSAL- ALSCON although controlled by the PHCN, the supply is dependable. Only Ikot Akpan Ata has access to constant power - supply directly from the ALSCON.

The major towns in each LGA of the survey area are linked to the national grid. Communities situated in difficult terrain (Ikot Ekpang and Ikot Akpan Okop) may not have access to power supply from the national grid. Electricity generating plants are utilized by very few relatively well off individuals and by bars and eateries. Bush lamps and candles (rarely) provide illumination in the night. the issue.

4.23.4 Educational Facilities

Primary schools are easily accessed within a 1–5 km radius in the incident zone. Secondary schools may not be so easily accessed. The introduction of free and compulsory education in the study area, which has led to an influx of pupils and students, has facilitated the provision and/or upgrading of educational facilities.

Figure 4.37: Educational Structures

4.23.5 Postal / Telecommunication Facilities

The major GSM telecommunication providers (MTN, Airtel, Glo and Visafone) are generally making in-roads into the area. The capital cities and other major towns in the study area are fully covered by one or the other of these networks. It is therefore quite easy to communicate socially and also carry out business transaction within any part of the State. The settlements may not be as effectively covered by the GSM It is however important to note the near absence of postal services – even in the major communities of the survey area.

4.23.6 Water Supply

Boreholes, sachet water and streams, remain the major sources of water for household utilization. More details are provided in the health section.

4.24 Health Facilities

There are 106 facilities that are accredited by the state Ministry of Health to provide health care services to the people of the survey area. **Table 4.32** shows that these include 70 public primary health care (PHC) facilities, 10 public secondary health (SHC) facilities and 26 privately owned clinics.

Table 4.32: Distribution of Accredited Health Facilities in the Study Area

S/N	LGA	PHC Institutions			SHC Facilities				Registered Private Clinics	Grand Total
		CHC	Others (HCs, HPs)	Total	Govt. owned Hosps.	Voluntary Agency owned	State Govt. Clinics/ Dental Centres	Total		
1	Eket	1	11	12	2	0	1	3	16	31
2	Esit Eket	0	9	9	1	0	0	1	1	11
3	Ibeno	0	13	13	1	0	0	1	2	16
4	Ikot Abasi	1	12	13	1	0	0	1	4	18
5	Mkpat Enin	1	11	12	3	0	0	3	2	17
6	Onna	1	10	11	1	0	0	1	1	13
Total		**4**	**66**	**70**	**9**	**0**	**1**	**10**	**26**	**106**

Source: Akwa Ibom State Ministry of Health, Uyo (2009)
N/B: CHC = Comprehensive Health Centre; HC = Health Centre; and HP = Health Post;

Figure 4.38: Health Facilities

4.25 Disease Prevalence

Interactions during FGDs, IDIs with various respondents reveal common diseases in the study area to include malaria, typhoid, cholera, pneumonia, tetanus and whooping cough (pertussis) etc. Various eye ailments have also been reported, mainly at riverine areas like Mkpanak, Ikot Akpan Okop and Akpambiet Edo; arising from the exposure of unprotected eyes to fish processing (especially smoking) activities.

IHealth survey also reveal that sources of treatment of the various ailments could be traditional, with the aid of herbs or modern – predicated on visits to health centres and hospitals; or spiritual – resort to churches / prayer houses. Essentially, visits to health centres and hospitals for treatment is always the last resort of majority of persons who claim to be discouraged by the cost of treatment and long queues in general hospitals, and by the official documentation procedures and processes that have to be observed in health centres, in order to access Medicare. Patent medicine stores/itinerant drug vendors are therefore very popular Medicare avenues and thus enjoy a lot of support, even though the quality of dispensed drugs cannot be ascertained.

Attached overleaf (integrated disease data sheet) presents records of disease trend and patients' attendance at public health facilities to seek curative action for the prevalent ailments in the survey area. The table depicts that for the periods of January - December 2010 and January - May 2011, the malaria group of diseases were the most endemic in the state. The table reveals that for 2010, common malaria (61,230 cases), malaria in pregnancy (14,298 cases) and diarrhoea (with and without blood- 7881 cases) were reported and treated as the most prevalent diseases in the various health care facilities in the state. With regard to the specific study area, Mkpat Enin had the highest cases of reported malaria ailments (4844).

The scenario for 2011 (January – May) involved common malaria (24,840 cases), malaria in pregnancy (8,146 cases) and diarrhea (with and without blood- 1,952 cases) as the most serious ailments. A detailed look at the record shows that diseases like new HIV / AIDS, pneumonia, and tuberculosis, along with high blood pressure and typhoid fever are emerging ailments with relatively high trend which are captured in the 2011 survey. Eket, with 1459 reported malaria cases was highest for the study area.

4.26 Water Supply

Interactive sessions (FGDs and IDIs) revealed that level of potable water supply is low in the general survey area. Major sources of water supply for consumption and domestic uses are from rain water run-off – collected from thatched / woody / rusty iron sheet roofs. These are invariably unhygienic and particles/germs infested. In the dry season, domestic water supply is from shallow hand-dug wells, the liquid contents of which are separated from the earth surface by rusty iron –wrought containers.

Water may also be collected from shallow unhygienic streams which become water logged during the rains and from private and public bore holes. With regard to towns and villages, only a small segment of the population of Eket and Ikot Abasi may lay claims to government supplied, potable water sources. A majority of the residents may however access privately provided boreholes which supply untreated water sources. Relatively well-off individuals from the Island settlements who can withstand high cost of transportation may access such water sources at a rate of about N50.00/20 litre jerry can. In an attempt to improve on the water supply situation in the study area, the various LGAs, state government, corporate establishments and illustrious citizens are making efforts to drill bore- holes in some communities. This informs why abandoned or uncompleted bore hole projects are visible in some of the surveyed communities

Majority of the people in the study area source their drinking water from untreated water sources like river, streams, and ponds. This is shown on **Table 4.33**. Water quality from these streams and bore- holes will undoubtedly be poor as interactions revealed that solid waste disposal is into running streams/ stagnant water, while human waste is disposed off into water channels in the coastal communities and in bushes surrounding streams in the upland communities.

Figure 4.39: Water Supply Facilities

Table 4.33: Drinking Water Sources in the Study Area

S/N	LGA	Sources of Drinking Water						
		Piped in Dwelling	Public Tap	Hand Pump & Borehole	Dug Well	Spring/River/ Stream/Pond	Others	Total
1.	Eket	10	10.8	44.6	0.5	33.8	0.3	100
2.	Esit Eket	11.5	1.4	2.2	0.7	84.2	0	100
3.	Ibeno	0	4.7	32.5	44.2	18.6	0	100
4.	Ikot Abasi	0	6.3	8.8	5.3	78.8	0.8	100
5.	Mkpat Enin	0	2.9	10.2	8.4	78.5	0	100
6.	Onna	0.5	7.8	15.6	2.8	71.6	1.7	100
Akwa Ibom State		1.6	4.4	32.5	3	56.3	2.2	100

Source: AKBASES (2005)

In essence the people may be prone to water borne diseases like cholera, typhoid fever etc. About 33% households source their drinking water from mainly untreated boreholes. Only 4% households obtain drinking water from public tap system. A related finding reveals that more than 70% respondents access drinking water from a distance of less than 1km. The NBS-MICS report (2012) corroborates the finding that boreholes remain the major water supply sources in the general study area (**Table 4.34**).

Table 4.34: Improved Water Supply Statistics in Akwa Ibom State

% Using Improved Water Source	74.6% (2011) 58.9% (2009)
% Using Improved Drinking Water Source	33.6% (2011)
% Without Sustained Access to Improved Water Source	67.7% (2011)
Main Water Source	Borehole - 55.5% (2011) Well – 31.5% (2009) Borehole -28.4 (2009)

Adapted from NBS- MICC (2012); NBS- Annual Abstract of Statistics (2009)

4.27 Refuse Disposal System

The most common refuse disposal system in the general study area (**Table 4.35**) is through disposal pits dug within the compound of each house hold, followed by unauthorized refuse dumps.

Table 4.35: Common Waste Disposal Systems

S/N	LGA	Disposal Systems			
		Refuse Bin (Govt. / Private)	Disposal Pit within Compound	Unauthorized Refuse Dump	Outright Burning
1.	Eket	9.2	40.7	26.6	23.5
2.	Esit Eket	0.7	53.2	10.8	35.3
3.	Ibeno	0	33.3	64.3	0
4.	Ikot Abasi	5.4	64.9	9.6	20.1
5.	Mkpat Enin	2.6	64.9	25.1	7.4
6.	Onna	2.3	49.5	39.4	9

Source: AKBASES (2005)

There are however variations within specific LGAs. For example in Ibeno (64.29%), the norm is to dispose refuse into unauthorized places while outright burning of refuse is also common in Esit Eket (35.3%). The ABS-AAS (2009) gives a more recent figure of 38% national statistic of households that dump solid waste in unauthorized locations.

4.27.1 Toilet Facilities

The most common type of toilet facility in about 89.0% households in the study area (**Table 4.36**) is the traditional pit latrine (covered or uncovered). It must be noted however that this situation is peculiar to urban communities.

Toilet facilities may not be available in riverine rural terrains as residents may defecate into stagnant or running water sources. On a nationwide basis, the ABS-AAS (2009) reports that only 54.6% households utilize pit toilets for human waste disposal.

Table 4.36: Common Types of Toilet Facilities

S/N	LGA	Toilet Systems						
		Sewage System	Septic Tank	VIP Latrine	Latrine with Sanplat	Pit Latrine (Covered)	Pit Latrine (Uncovered)	No Facility
1.	Eket	9.2	10.5	1.8	3.1	55.5	18.4	1.5
2.	Esit Eket	1.4	0	0	0	84.2	13	1.4
3.	Ibeno	7	0	0	0	25.6	7	60.5
4.	Ikot Abasi	3.8	3.8	2.5	2.9	74.5	6.3	6.3
5.	Mkpat Enin	0	2	0.2	2.7	74.6	20.1	0.4
6.	Onna	2.3	2.5	0.5	3.4	73.6	17.2	0.5

Source: AKBASES (2005)

4.28 Community Concerns

Notification of the host communities and other key stakeholders as regards the project by PHCN was positively received. 80% of all stakeholders however expressed dismay at the irregular power supply that attracts high bills which are decided by estimates instead of with metered aids, and intermittent power surges that destroy their electrical appliances both of which make life more difficult. The people complained that power generators have become the main source of power for the rich citizens who can afford them while the majority of people have resorted to the use of candles and lamps. The table below summarises key concerns and expectations that arose as at the time of this report during the project notification, sensitization and public disclosure (including consultations). Also included side by side in the other column are responses provided by PHCN during such meetings.

Stakeholders Concerns/Expectations	PHCN Reposnses
Non availability of power to aid artisanship, thereby affecting basic life needs and catering for family.	PHCN informed group of artisans raising this concern that it is the goal of the FGN to increase electricity availability to the nation (reason for this and other power projects). The transmission line would evacuate power to a substation which will in turn step it down before it is distributed through the national grid where it would get to the populace.
The issue of fair and adequate compensation was raised in virtually all communities for economic trees, land, structures, etc that may be affected by ROW	PHCN assured stakeholders that it has in place a ROW acquisition process which includes enumeration, valuation and compensation. ROW and settlement strategies will be in line with OP 4.12 to be detailed in the RAP for The World Bank's approval. PHCN shall be responsible for the implementation of the approved RAP. ROW acquisition and works shall not commence until the approval of the RAP and implementation shall be in line with The

	World Bank's approved process.
Employment opportunities to members of host community.	PHCN informed that a Community Relations and Engagement Plan will be developed prior to project commencement to cover all terms and modalities of engagement and ensure that affected communities are equitably represented. PHCN Also informed stakeholders and other community members that there would be opportunities for contracting and subcontracting activities which will benefit stakeholders.
Some communities required upgrading of electrical facilities / extension of electricity supply to other parts of their communities, while Iman Ekabom 1 and 11, Ikot Ekpang, and Ikot Aka communities asked for provision of electricity and subsequent linkage to the national grid.	With regards to the upgrade on electrical facilities and provision supply to the communities mentioned, PHCN spokesman during the consultation/sensitization programmes informed that the department responsible for connection to the national grid and distribution is different. However it was agreed with stakeholders that this complaint and expectations will be communicated to PHCN appropriate authorities in the Federal Capital Territory (FCT) Abuja for further actions.

It is anticipated that the drive of the Federal Government to enhance the power situation in the country will have significant influence in addressing the concerns of the communities.

CHAPTER FIVE

POTENTIAL AND ASSOCIATED IMPACTS

CHAPTER FIVE

POTENTIAL AND ASSOCIATED IMPACTS ASSESSMENT

5.1 General

This chapter outlines the methodology for predicting impacts of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line project. It also identifies and discusses subsequent mitigation measures recommended for each impact identified.

This assessment process involved the identification of the environmental aspects (i.e. elements/activities of the proposed project that will interact with the air, water, sediment, plankton, benthos and human population) as per project description (**chapter three**). These aspects were then superimposed / interacted with the environmental components (described in **chapter four**). The effects, nature, and extend of the impacts were then evaluated and ranked.

Internationally and locally proven acceptable methods of impact prediction and evaluation were used as basis for developing the assessment process for the proposed project associated and potential impacts.

5.2 Impact Assessment Methodology

The methodology adopted in the assessment of impacts entailed identification of aspects and impacts using source reference materials; defining impacts criteria and determination of mitigation measures followed by the formulation of impact management plan.

Source Reference Materials
- Project Environment Description (Baseline data)
- FMENV EIA Sectoral Guidelines for Power Transmission Line Projects
- ISO 14000 Guidelines
- World Bank /IFC Environmental Assessment Sourcebook/Guidelines, etc

Aspects and Impact Identification
- Direct
- Indirect
- Cumulative
- Residual
- Adverse
- Beneficial
- Long term
- Short term

Impact Criteria
- legal/ regulatory requirements
- risk
- frequency
- importance
- public concern

Impact Assessment Evaluation

Is the impact significant?
In terms of:
- people and their health and safety
- environmental pollution/ deterioration
- asset/property damage
- statutory/ regulatory compliance
- imaqe and reputation

- Barriers to prevent adverse effect
- Control/reduction of escalation factors
- Recovery preparedness measures

Impact Control
- prevention strategy
- reduction strategy
- control strategy

Impact Management Plan
- management responsibilities
- monitoring plan
- auditing and review

Figure 5.1: Impact Management Procedure

The impacts are analysed and discussed in detail in line with the EIA scope. All impacts were first assessed without the necessary mitigation and the results presented in a summarised impact table (**Table 5.5**), which form the core of the impact assessment. Mitigation measures were thereafter recommended and discussed, with the aim of enhancing positive impacts and minimising negative impacts.

5.3 Project Environmental Overview

The process adopted in the identification and assessment of the potential and associated impacts of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line project considered various phases of the project, namely:

- **Pre-construction**:- this will include mobilisation of materials and personnel, community engagement, permit to work, site preparation activities etc;
- **Construction / Installation**:- foundations, tower construction, transmission line erection and stringing and other associated earthen works;
- **Commissioning and Operation / Maintenance**:- project inspection, turnover, commissioning as well as operations and subsequent maintenance activities;
- **Decommissioning** : - disusing/abandoning of project facilities

5.4 Impact Identification and Characterisation

Impacts can be induced during the construction of the facility, and later during its operation. In the case of transmission line facilities, the main potential receptors are soil, surface water bodies, flora and fauna, occupational health, in addition to socio-economic amenities.

Impact assessment defines the criteria and processes against which potential project impacts can be measured and mitigated. A multidisciplinary team comprising engineers, scientist, environmentalists etc were involved in the identification and characterisation of impacts of the approximately 58km 330kv QIT – Ikot Abasi Transmission Line project.

5.4.1 Impact Identification

An interaction matrix (**Table 5.1**) have been developed and populated to identify the proposed project activities and components of the physical, biological and social environment that may be affected as a result of planned and unplanned project activities.

Table 5.1: QIT – Ikot Abasi Transmission Line Project Activities – Environmental Indicators Interaction Matrix

Project Activities	Pre-construction			Construction & Installation									Operation / Maintenance										Decommissioning	
				Planned Activities							Unplanned		Planned Activities						Unplanned					
Environmental Indicators	Mobilisation of construction elements	Recruitment / Community Engagement	Site Preparation (access & camping)	Onsite fabrication (Metal works)	Tower foundation (piling, trenching, etc)	Tower erection / stringing activities	Waste Management	Fuel / hazardous materials handling	Painting and coating	Logistics (support, supply & servicing)	Fires / explosions	Incidents / |Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Line element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Transmission Line Decommissioning	Abandonment / Restoration
Air Quality																								
Particulates	X		X	X	X					X	X				X			X		X		X	X	X
NO_X, SO_X, CO_X, etc	X		X	X	X					X								X				X	X	X
Gaseous Hydrocarbons	X									X								X					X	
Water Quality																								
Turbidity			X		X		X								X		X						X	X
Water Physico-chemistry	X		X		X		X	X	X						X		X						X	
River-bed Physico-chemistry			X		X		X	X									X						X	
Aquatic Ecology																								
Plankton					X		X	X									X						X	
Fishes							X	X									X					X	X	
Macro-benthos					X		X	X									X					X		
Terrestrial Ecology																								
Fresh Water Swamps			X		X		X	X							X		X						X	
Mangrove Swamps			X		X		X	X							X		X					X		
Rainforests			X		X		X	X			X				X		X			X		X	X	
Avifauna	X		X		X	X				X	X			X	X			X					X	
Rodents and Mammals	X		X		X	X	X	X		X	X			X	X		X	X				X	X	X

Table 5.1: QIT – Ikot Abasi Transmission Line Project Activities – Environmental Indicators Interaction Matrix Cont-d

Project Activities	Pre-construction			Construction & Installation									Operation / Maintenance										Decommissioning	
				Planned Activities							Unplanned		Planned Activities						Unplanned					
Environmental Indicators	Mobilisation of construction elements	Recruitment / Community Engagement	Site Preparation (access & camping)	Onsite fabrication (Metal works)	Tower foundation (piling, trenching, etc)	Tower erection / stringing activities	Waste Management	Fuel / hazardous materials handling	Painting and coating	Logistics (support, supply & servicing)	Fires / explosions	Incidents / |Accidents	Commissioning / Testing	Power Transmission	ROW maintenance	Line element replacement	Waste Management	Logistics (support, supply & servicing)	Tower falling incidents	Fires	Incidents and Accidents	Geo-hazards	Transmission Line Decommissioning	Abandonment / Restoration
Soil Quality																								
Physico-chemistry			X		X	X	X	X	X							X	X						X	
Topography / Natural Drainage	X		X		X	X				X					X			X				X	X	X
Sensory Perceptions																								
Noise Disturbance	X		X	X	X	X				X	X			X	X			X					X	
Visual Intrusions			X		X	X							X						X				X	X
Socio-Economics / Human Health																								
Existing / Planned Infrastructures	X		X		X	X	X			X	X	X		X	X		X	X	X	X			X	
Employment Opportunities		X	X	X	X	X	X		X	X					X		X	X					X	X
Worker Safety / Occupational Health	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X
Public Health			X				X							X	X		X		X			X		
Landuse			X		X			X			X		X										X	
Fishing			X				X	X																
Traffic on Local Roads	X		X		X	X				X								X					X	
Macro & Micro Economics	X	X	X	X	X	X	X						X	X	X	X		X					X	X

5.4.2 Impact Characterisation

The checklist approach was adopted; this involved categorising the project into activities/phases and then the project environment into various components.

The interaction between these two elements (the project and environment) may lead to changes in the environment and is illustrated below:

[Environment] + [Project] ⟶ {Changed Environment}

This change may be direct or indirect, adverse or beneficial, cumulative or residual, long term or short term as described below.

Direct Impacts	These are impacts resulting directly (direct cause-effect consequence) from a project activity
Indirect Impacts	These are impacts that are at least one step removed from a project activity. They do not follow directly from a project activity
Adverse Impacts	Adverse impacts are those that would produce negative effects on the biophysical or socio-economic environment
Beneficial Impacts	These are impacts that would produce positive effects on the biophysical or socio-economic environment.
Cumulative Impacts	These are impacts resulting from interaction between project activities with other activities, taking place simultaneously.
Residual Impacts	These are impacts that would still remain after mitigation measures have been applied.
Long term	These are impacts whose effects remain even after a specific project activity (e.g. permanent vegetation loss due to forest clearing)
Short term	These are defined as impacts that will last only within the period of a specific project activity (e.g. noise due to construction activities).

Table 5.2 presents a summary characterisation of some potential and associated adverse and beneficial impacts of the proposed project.

Table 5.2: QIT – Ikot Abasi Transmission Line Impacts Categorisation

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Residual	Long term	Short term
Pre-construction • Permitting • ROW Acquisition • Mobilisation • Recruitment • Site Preparation	Employment opportunities arising from recruitment of technical and non technical transmission line workers										
	Business opportunities for local contractors through sub contracting activities										
	Local support services from road side supply markets and shops etc										
	Skill acquisition and enhancements to local indigenes and workforce.										
	Improvement in quality of life for adequately compensated individuals										
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure										
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites										
	Increase in social vices (like theft, prostitution) resulting from increased number of people										
	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc										
	Uncertainty and increased perturbation due to a lack of information and communication.										
	Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset.										
	Risks of armed robbery attack and hostage taking leading to injury/ death of personnel.										
	Exclusion of vulnerable groups from consultations which may lead to strife										
	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting site workers and wildlife.										
	Increase of dust particles and vehicular emissions.										
	Conflicts/community agitations over employment issues (quotas and methods)										
	Disturbance of the vegetation cover / loss of forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation.										
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • Waste from laydown area and tower sites from grubbing of ROW (Material and wood)										
	Contamination of surface water as a result of siltation caused by increased erosion, during site preparation.										

Table 5.2: QIT – Ikot Abasi Transmission Line Impacts Categorisation Cont'd

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Direct	Indirect	Adverse	Beneficial	Reversibl	Irreversibl	Cumulativ	Residual	Long	Short
Construction / Installation: • Tower Foundation • Piling, trenching, etc • Tower erection • Conductor wire stringing • Painting and coating • Transportation and logistics, etc • Commissioning / Testing • Turnover • Waste management • Logistics	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.										
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities										
	increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting										
	increase in revenue opportunities for local population due to presence of non-resident workers and travellers										
	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.										
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access roads and at tower sites										
	Fauna disturbance and displacement as a result of migration away from construction activity area (this includes impact on birds)										
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)										
	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro construction sites.										
	Traffic diversion and congestion along local roads during installation at road crossings.										
	Interruption of surface water flows and potentials for salt-water intrusion in identified tidal zones of Eket and Ikot Abasi areas during construction.										
	Potential collapse of transmission towers as a result of unsuitable geotechnical conditions										
	Reduction in wildlife population as a result of poaching due to easier access created by ROW clearing										
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of tower components										
	Noise nuisance (including impulsive noise) from construction activities (e.g. piling) resulting to temporary migration of sensitive mammals and rodents.										
	Visual intrusion as a result of alterations to normal landforms and aesthetic beauty of construction sites										
	Risks of fire/explosions resulting from accidental ignition of onsite diesel storage tanks										
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • used oil and replaced/obsolete equipment pars that may contaminate soil/groundwater • Waste from laydown area and tower sites from grubbing of ROW										

Table 5.2: QIT – Ikot Abasi Transmission Line Impacts Categorisation Cont'd

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Residual	Long term	Short term
Demobilisation • Demobilisation after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.										
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)										
	Traffic congestion during transportation of demobilised equipments and personnel										
	Generation of dust and automobile / heavy duty equipment emissions.										
	Reclamation of marshalling yards and laydown areas										
	Waste disposal (scrap metal, wood, sand, concrete, paper, domestic waste)										
	Reclamation and restoration of tower construction areas										
	Reclamation and restriction of access roads to prevent unauthorised uses										
	Loss of employment and business opportunities due to completion of construction phase										
	Illegal access to transmission line towers leading to accident, sabotage, asset damage, and loss										
	Soil runoff and erosion resulting in sedimentation problems										
Operations • Tower inspection & Checks • Line element replacement • ROW Maintenance	Increased electricity transmission and distribution capacities within the national grid										
	Increased business opportunities and quality of life (small, medium, large scale) due to enhanced power delivery										
	Improvement in environmental standards due to reduced emission from standby diesel or fuel generators, use of fuelwood.										
	Reduced demand on petrol and diesel used for power generation and further reduction in greenhouse gases and noise emissions.										
	Effects of electromagnetic radiation to residents near the transmission line										
	Injuries/fatalities of personnel due to air and road accidents during tower inspection and checks.										
	Risk of collision of air planes with transmission towers and lines										
	Poor aesthetic appeal due to presence and eventual operation of the transmission line										
	Risk of contact of waterway vessels with transmission line conductors										

Table 5.2: QIT – Ikot Abasi Transmission Line Impacts Categorisation Cont'd

Project Activity/ Environmental Aspect	Associated and Potential Impacts	Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Residual	Long term	Short term
Operations • Tower inspection & Checks • Line element replacement • ROW Maintenance	Electric shock and burns to members of the public in the event of tower collapse or damage to transmission wires	✓		✓		✓	✓		✓	✓	
	Explosion and fire hazards at the substation in Ikot Abasi	✓		✓		✓	✓		✓		✓
	Injury / mortality of birds due to collision with earth wires on towers.	✓		✓			✓		✓	✓	
	Noise along the transmission line due to corona effects (humming sound)	✓		✓			✓	✓		✓	
	Fatal electric shock and severe burns to workers during maintenance work	✓		✓			✓		✓	✓	
	Unchecked encroachment on the ROW, leading to land-use conflicts and accident.	✓		✓		✓	✓		✓	✓	✓
	Use of track corridors for other facilities (TLine, communication cables as well as water pipes etc)	✓	✓		✓					✓	
Decommissioning / Abandonment • Unstringing of conductor wires • Tower / facilities removal • Waste generation	Increased sedimentation process close river banks and floodplains along the tower sites.	✓		✓			✓			✓	✓
	Risk of accident and injury to worker during demolition of structures	✓		✓			✓		✓	✓	
	Increased dust and vehicular emissions.	✓		✓		✓					✓
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages.	✓		✓		✓					✓
	Traffic obstruction from transportation of decommissioned structures and equipments to receiving hub.	✓		✓		✓		✓			✓
	Availability of land for alternative uses	✓			✓		✓			✓	

5.5 Impact Evaluation

The potential and associated impacts identified and characterized were evaluated. The evaluation which was based on clearly defined criteria (legal/regulatory requirement, risk, frequency of occurrence, importance and public interest/ concern) was used to determine the significance of the impacts. The criteria and weighing scale adopted for the evaluation are described below.

Legal/Regulatory Requirements

Here, the proposed project activities that resulted in impacts were weighed against existing legal/regulatory provisions to determine the requirement or otherwise for permits prior to the execution of such activities. Such legal/regulatory requirements were identified from the laws/guidelines, which have been reviewed in **chapter one** of this report as well as those guidelines in the source references relating to the proposed project activity as presented in **section 5.2**. The weighting scale used is as follows:

Legal/Regulatory Requirements Criterion

Condition	Rating
No legal/regulatory requirement for carrying out project activity	**Low (0)**
Legal/regulatory requirement exist for carrying out activity	**Medium (3)**

A permit is required prior to carrying out project activity which may result in impact on the environment	**High (5)**

Risk Posed by Impact

The health, safety and environmental risks associated with each impact were assessed and ranked as "low", "medium" or "high", using the Risk Assessment Matrix (**Figure 5.2**). Reference was also made to the source references listed in the previous sections. Three criteria (consequence, probability of occurrence and severity) were used as basis for ranking the risks of the impacts. Risk:-was measured based on risk assessment matrix (RAM).

Increasing Severity

Consequence					**Increasing Probability**				
					A	**B**	**C**	**D**	**E**
Severity	**People**	**Asset Damage**	**Environmental Effect**	**Reputation**	**Practically Impossible**	**Not Likely to Occur**	**Possibility of Occurring Sometime**	**Possibility of Isolated Incidents**	**Possibility of Repeated Incidents**
1	Slight injury	Slight	Slight	Slight	**Low Risk**				
2	Minor injury	Minor	Minor	Limited					
3	Major injury	Localised	Localised	Considerable			**Medium Risk**		
4	Serious injury	Major	Major	National					
5	Multiple fatalities	Extensive	Massive	International					**High Risk**

Figure 5.2: Risk Assessment Matrix

The risks (measure of the likelihood and magnitude of an adverse effect) associated with power transmission line projects were evaluated in terms of:

- risk to human health;
- risk to the biophysico-chemical environment

Based on the matrix above, the weighting used was as follows:

Risk	**Attribute – Environmental, Human Health, Safety and Reputation**
Low (1)	✓ This means that no further mitigation may be required
Medium (3)	✓ This means that the impact can be mitigated with additional controls and modifications
High (5)	✓ This means that the impact require avoidance or major control/mitigation

Frequency of Impacts Occurrence

Evaluation of the frequency of occurrence was rated as "high", "medium" or "low" based on the historical records of accidents/incidents, consultation with experts and professional judgment. The frequency criterion is summarised below.

Frequency *Criterion*

Frequency	Attribute – Environmental, Human Health and Safety
High (5)	✓ Major degradation in quality in terms of scale (>1% of study area or habitat within the study area), appearance, duration (beyond duration of project) ✓ Irreversible or only slowly recoverable (change lasting more than 1 year) degradation of environmental ecosystem level (population, abundance, diversity, productivity) ✓ High frequency of impact (occur continuously and almost throughout the project execution period) ✓ Geographic extent of impact (e.g. encompassing areas beyond the project area)
Medium (3)	✓ Degradation in quality in terms of scale (>0.1% of study area, habitat), appearance, duration (a few months) ✓ Effect beyond naturally occurring impacts variability ✓ Slow reversibility (change lasting a few months before recovery), lasting residual impact ✓ Potential for cumulative impact ✓ Intermittent frequency of impact (occur in only a few occasions during the project execution period) ✓ Limited geographic extent of impact (large area within project area)
Low (1)	✓ Minor degradation in quality in terms of scale (<0.1% of study area, habitat, very localized), appearance, duration (a few days to a month) ✓ Effect within range of naturally occurring impacts, changes, dynamics ✓ Rapid reversibility (change lasting only a few weeks before recovery), no lasting residual impact of significance ✓ No potential for significant cumulative impact ✓ Low frequency of impact (occur in just about one occasion during the project execution period) ✓ Only very localised geographic extent of impact (e.g. not more than a few meters from impact source point)

Importance of Impact

The importance of environmental component in respect of identified potential impact was also determined and rated as “high”, “medium” or “low”. The ratings were based on consensus of opinions among consulted experts including project engineers and other stakeholders in the proposed project. The importance criterion is summarised thus:

Importance Criterion

Importance	Attribute – Environmental, Human Health and Safety
High (5)	✓ Highly undesirable outcome (e.g., impairment of endangered, protected habitat, species) ✓ Detrimental, extended flora and fauna behavioral change (breeding, spawning, molting) ✓ Major reduction or disruption in value, function or service of impacted resource ✓ Impact during environmentally sensitive period ✓ Continuous non-compliance with international best practices
Medium (3)	✓ Negative outcome (e.g., loss time injury from minor burns) ✓ Measurable reduction or disruption in value, function or service of impacted resource ✓ Potential for non compliance with international best practices
Low (1)	✓ non-detectable impact (e.g., emissions from automobile equipments) ✓ alteration in value, function or service of impacted resource that are not obvious ✓ Within compliance, no controls required

Public Interest/Perception

Here, the interest/perception of the public on the proposed project and the identified potential/ associated impacts were determined through consultation with proposed project stakeholders. The ratings of “high”, “medium” or “low” were assigned based on consensus of opinions among consulted known stakeholders. The public perception/interest criterion is summarised below.

Public perception /interest criterion

Public Perception	Attribute – Environmental and Human Health
High (5)	✓ Elevated incremental risk to human health, acute and/or chronic ✓ Possibility of life endangerment for community inhabitants and site personnel ✓ Major reduction in social, cultural, economic value ✓ Continuous non-compliance with international best practices ✓ Any major public concern among population in the project region
Medium (3)	✓ Limited incremental risk to human health, acute and/or chronic ✓ Unlikely life endangerment for community inhabitants and site personnel ✓ Some reduction in social, cultural, economic value ✓ Possibility of adverse perception among population ✓ Potential for non-compliance
Low (1)	✓ No known risk to human health, acute and/or chronic ✓ No known risk of life endangered for community inhabitants and site personnel ✓ Minor reduction in social, cultural, economic value ✓ Unlikely adverse perception among population

5.5.1 Consequence / Likelihood Evaluation

This impact assessment evaluates potentially significant impacts and prioritizes those potential impacts that require mitigation. Each potential impact is assigned a level of significance that reflects the significance of the consequence that could occur without consideration of control and/or mitigation measures, although reasonable best practices and planned control measures are assumed to be in place.

Tables 5.3 and **5.4** provide definitions for the impact significance designations for environmental and worker/public consequences as well as environmental and worker/public likelihood of occurrence respectively. Potential impacts may stem directly from the proposed project or from secondary and cumulative effects.

Table 5.3: Consequence Criterion

Consequence	Severity Rating	Example – Environmental	Example – Workers / Public
Negligible	1	✓ Dropped objects ✓ Small quantities of chemical or fuel spilled (<100litres)	✓ Slight injury (no medical / first aid treatment required)
Minor	2	✓ Small chemical, fuel spill (about 1 tonnes)	✓ Minor injury (lost time) ✓ Minor exposure to toxic environment
Moderate	3	✓ Vehicle damaged, fuel spilled (<100 tonnes) ✓ Moderate oil, fuel, chemical spill (50 tonnes) ✓ Shoreline erosion	✓ Major injury (lost time) ✓ Major exposure to toxic environment
Major	4	✓ Fuel and hazardous chemical leaks , significant volume or ignited, less than 15-day duration ✓ Tanker lost,1500 tonnes of diesel spilled	✓ Single fatality ✓ Multiple major injuries ✓ Pirate attack, multiple injuries, kidnapping
Severe	5	✓ Major explosion, ✓ Major fuel liquid release, 15-90 days duration	✓ Multiple fatalities

Table 5.4: Likelihood Criterion

Likelihood / Probability Rating	Attribute – Environmental / Socioeconomic (workers/public)
A	✓ No known occurrence in power industry (>1,000 equipment years)
B	✓ Has occurred in power industry (1,000 – 100 equipment years)
C	✓ Incident has occurred at PHCN (100 – 10 equipment years)
D	✓ Happens several times/year at PHCN (10 - 1 (equipment years)
E	✓ Happens several times/year in site location (10 - 1 (equipment years)

This consequence criterion (**Table 5.3**) is combined with a probability of occurrence (**Table 5.4**) to assess the potential significance of the routine or accidental impacts. Specifically the process followed in this assessment resulted in categorising the identified potential impacts into High, Medium and Low risk categories as shown in **Figure 5.3** below.

			Likelihood of Occurrence				
			A	B	C	D	E
			No known occurrence in power industry (>1,000 equipment years)	Has occurred in power industry (1,000 – 100 equipment years)	Incident has occurred at PHCN (100 – 10 equipment years)	Happens several times/year at PHCN (10 - 1 (equipment years)	Happens several times/year in site location (10 - 1 (equipment years)
Severity	1	Negligible	1A	1B	1C	1D	1E
	2	Minor	2A	2B	2C	2D	2E
	3	Moderate	3A	3B	3C	3D	3E
	4	Major	4A	4B	4C	4D	4E
	5	Severe	5A	5B	5C	5D	5E

Low Risk | Medium Risk | High Risk

Figure 5.3: Consequence / Probability Risk Assessment Matrix

5.6 Results of the Impact Assessment

For each of the three main project phases (pre-construction, construction and operation), the potential impacts and benefits were described using characterisation and criteria listed above – for example: extent, duration, intensity, nature etc (**Table 5.2**) and Legal, risk, frequency, importance, etc (**section 5.5**). The impacts were then assessed in terms of their significance (major, medium, or minor).

The levels of significance for potential impacts of the proposed project were assigned as those impacts to which the following conditions apply.

- **Major significance** =Impacts for which (L+R+F+I+P) is ≥15 with a consequence / likelihood rating of: 3E, 4D, 4E, 5C, 5D and 5E.

- **Medium significance** = Impacts for which (L+R+F+I+P) is between 10 - 14 with a consequence / likelihood rating of: 2D, 2E, 3C, 3D, 4B, 4C, 5A, 5B.

- **Minor significance** = Impacts for which (L+R+F+I+P) is ≤9 with a consequence / likelihood rating of: 1A, 1B, 1C, 1D, 1E, 2A, 2B, 2C, 3A, 3B, 4A.

Table 5.5 summarizes the potential impacts on the physical, biological and socioeconomic environments caused by the proposed QIT – Ikot Abasi transmission line project.

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria: Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	Impact Significance Category
Pre-Construction								
Permitting & ROW Acquisition • Consultations • Acquisition of license to operate • Stakeholder identification • ROW Acquisition	Acceptance and co-operation/ participation from stakeholders (communities and government) leading to peaceful and timely execution of the project	-	-	-	-	-	-	Beneficial
	Uncertainty and increased perturbation due to a lack of information and communication.	Low (0)	Low (1)	Med (3)	Med (3)	High (5)	3D	Medium (12 / 3D)
	Integration of men and women concerns into the project design	-	-	-	-	-	-	Beneficial
	Exclusion of vulnerable groups from consultations which may lead to strife	Low (1)	Low (1)	Med (3)	Med (3)	Med (3)	3D	Medium (11 / 3D)
	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	Low (0)	High(5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Improvement in quality of life for adequately compensated individuals	-	-	-	-	-	-	Beneficial
Transport of Personnel and Construction Elements • Ikot Abasi – Eket Federal Highway • Eket – Ibeno road • Inland water ways (River crossing sites e.g. Qua Iboe River).	Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset.	Low (0)	High (5)	Low (1)	High (5)	High (5)	4C	Major (16 / 4C)
	Risks of armed robbery attack and hostage taking leading to injury/ death of personnel	Low (0)	High (5)	Low (1)	High (5)	High (5)	4C	Major (16 / 4C)
	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting public and wildlife.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3C	Medium (10 / 3C)
	Increase of dust particles and vehicular emissions.	Low (0)	Med (3)	Low (1)	Low (1)	Low (1)	2C	Minor (6 / 2C)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria: Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	Impact Significance Category
Pre-Construction								
Transport of Personnel and Construction Elements • Ikot Abasi – Eket Federal Highway • Eket – Ibeno road • Inland water ways (River crossing sites e.g. Qua Iboe River).	Work place accidents/incidents from the use of cranes, forklifts, etc. during loading and offloading of materials/equipment.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3C	Medium (10 / 3C)
	Obstruction of/damage to existing roads due to increased usage during mobilisation.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3C	Medium (10 / 3C)
	Interference with other road users along mobilisation route.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
	Leakage of fuel or lube oil onto land or into water bodies during transportation and storage may lead to increased chemical toxicity.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
Recruitment of Labour	Employment opportunities arising from recruitment of technical and non technical transmission line workers	-	-	-	-	-	-	Beneficial
	Skill acquisition and enhancements to local indigenes and workforce.	-	-	-	-	-	-	Beneficial
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites	Low (0)	High (5)	Med (3)	Med (3)	Med (3)	3D	Medium (14 / 3D)
	Increase in social vices (like theft, prostitution) resulting from increased number of people	Low (0)	High (5)	Med (3)	Med (3)	Med (3)	3D	Medium (14 / 3D)
	Conflicts/community agitations over employment issues (quotas and methods)	Low (0)	High(5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria: Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	Impact Significance Category
Pre-Construction								
Site Preparation • Access to ROW creation • Service roads • Camping and campsites	Business opportunities for local contractors through sub contracting activities	-	-	-	-	-	-	Beneficial
	Local support services from road side supply markets and shops etc	-	-	-	-	-	-	Beneficial
	Employment opportunities for local labourers used for land clearing purposes during site preparation	-	-	-	-	-	-	Beneficial
	Contamination of surface water as a result of siltation caused by increased erosion, during site preparation.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Disturbance of the vegetation cover / loss of forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation.	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Loss/disturbance of wildlife due to habitat loss/fragmentation from vegetation clearing along ROW and access roads	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Soil compaction, destabilisation from excavation and runoff erosion resulting in sedimentation problems.	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Derangement of fragmentation of wildlife habitats / increase in poaching due to an easier access for the local population and non-resident workers.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • Waste from laydown area from grubbing of ROW (Material and wood)	Med (3)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (13 / 3D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Construction								
Fabrication and Metal works • Cutting, bending and welding tower steel components • Painting • Handling of conductor wires, strings, insulators and fittings	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	Low (0)	High(5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities	-	-	-	-	-	-	Beneficial
	Risk of electrocution and burns (to onsite workers) from welding flashes and high currents during welding	Low (0)	High(5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Noise and attendant vibration effects from fabrication and associated welding equipments	Low (0)	Low (1)	Med (3)	Low (1)	Med (3)	2D	Minor (8 / 2D)
	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of tower components	Low (0)	High(5)	Low (1)	High (5)	Med (3)	3D	Medium (14 / 3D)
	Generation of metal scraps from conductor wires, strings and steel elements associated with fabrication of tower components.	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	-	-	-	-	-	-	Beneficial
	increase in revenue opportunities for local population due to presence of non-resident workers and travellers	-	-	-	-	-	-	Beneficial
	Interruption of surface water flows and potentials for salt-water intrusion in identified tidal zones of Eket and Ikot Abasi areas during construction.	Low (0)	High (5)	Low (1)	High (5)	High (5)	4B	Major (16 / 4B)

5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Construction								
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Increased jobs and job opportunities from local labour hire and sub-contracting to indigenous suppliers.	-	-	-	-	-	-	Beneficial
	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.	Low (0)	Low (1)	Med (3)	Med (3)	Low (1)	2D	Minor (8 / 2D)
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access roads and at tower sites	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Fauna disturbance and displacement as a result of migration away from construction activity area (this include impact on bird life)	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Potential collapse of transmission towers as a result of unsuitable geotechnical conditions	Low (0)	Med (3)	Low (1)	High (5)	Low (1)	3D	Medium (10 / 3D)
	Reduction in wildlife population as a result of poaching due to easier access created by ROW clearing	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Noise nuisance (including impulsive noise) from construction activities (e.g. piling) resulting to temporary migration of sensitive mammals and rodents.	Low (0)	Low (1)	Med (3)	Low (1)	Med (3)	2D	Minor (8 / 2D)
	Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding in swamp areas as well as water borne diseases e.g. diarrhoea associated with poor sanitary conditions	Low (0)	High (5)	Med (3)	High (5)	Med (3)	4D	Major (16 / 4D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Construction / Installation								
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Anti climbing guards and step bolts • Insulators and fittings • Conductor wire stringing • Connectors fixing, etc	Pollution of soil/water as a result spilled fuel and other waste oil discharge during tower construction and installation processes	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Traffic diversion and congestion along local roads during installation at road crossings.	Low (0)	Low (1)	Low (1)	Med (3)	Med (3)	1E	Minor (8 / 1E)
	Workplace accidents / incidents (trip/falls etc) from heights during conductor wire stringing and bolt/nuts tightening project activities.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro construction sites	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Risks of fire/explosions resulting from accidental ignition of onsite diesel storage tanks	Low (0)	High (5)	Low (1)	High (5)	High (5)	4C	Major (16 / 4C)
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • used oil and replaced/obsolete equipment pars that may contaminate soil/groundwater • Waste from laydown area and tower sites from grubbing of ROW	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
	Localised economic benefits from materials supplies by local contractors	-	-	-	-	-	-	Beneficial
	Induced secondary development within the neighbouring host communities from increased economic activities.	-	-	-	-	-	-	Beneficial

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Construction / Installation								
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Anti climbing guards and step bolts • Insulators and fittings • Conductor wire stringing Connectors fixing, etc	Socio-cultural conflicts between the construction team and indigenous populace due to contrasts in believes and traditions	Low (0)	Med (3)	Low (1)	Med (3)	High (5)	3D	Medium (12 / 3D)
	Visual intrusion as a result of alterations to normal landforms and aesthetic beauty of construction sites	Low (0)	low (1)	Med (3)	low (1)	Med (3)	1E	Minor (8 / 1E)
	Increased demand on existing infrastructure (roads, housing, medical facilities, etc) due to influx of workers / induced secondary development in the area during construction activities resulting in squatter settlements.	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Permanent loss of land (some with arable potentials) potentials along the transmission line ROW	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3C	Medium (12 / 3C)
	Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding in swamp areas as well as water borne diseases e.g. diarrhoea and cholera associated with poor sanitary conditions	Low (0)	High (5)	Med (3)	High (5)	Med (3)	4D	Major (16 / 4D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria: Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	Impact Significance Category
Construction / Installation								
Demobilisation • Demobilisation after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Traffic congestion during transportation of demobilised equipments and personnel	Low (0)	Low (1)	Low (1)	Med (3)	Med (3)	1E	Minor (8 / 1E)
	Generation of dust and automobile / heavy duty equipment emissions.	Low (0)	Low (1)	Med (3)	Med (3)	Low (1)	2D	Minor (8 / 2D)
	Reclamation and restoration of marshalling yards, tower sites, access roads (to prevent unauthorised access) and laydown areas	-	-	-	-	-	-	Beneficial
	Waste disposal (scrap metal, wood, sand, concrete, paper, domestic waste)	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
	Loss of employment and business opportunities due to completion of construction phase	Low (0)	Med (3)	Low (1)	Med (3)	High (5)	3D	Medium (12 / 3D)
	Illegal access to transmission line towers leading to accident, sabotage, asset damage, and loss	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Soil runoff and erosion resulting in sedimentation problems	Low (0)	Med (3)	Low (1)	Med (3)	Med (3)	3D	Medium (10 / 3D)
	Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding in swamp areas as well as water borne diseases e.g. diarrhoea associated with poor sanitary conditions	Low (0)	High (5)	Med (3)	High (5)	Med (3)	4D	Major (16 / 4D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Operations / Maintenance								
Operations • Commissioning and testing • Testing and Turnover	Community dissatisfaction regarding the conduct of PHCN on compensation issues may lead to strife before full operations of transmission line	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Development of agricultural land due to easier access and consequent discovery of new arable lands for farming	-	-	-	-	-	-	Beneficial
Operations • Electric power transmission using the installed lines after commissioning.	Increased electricity transmission and distribution capacities within the national grid	-	-	-	-	-	-	Beneficial
	Increased business opportunities and quality of life (small, medium, large scale) due to enhanced power delivery	-	-	-	-	-	-	Beneficial
	Improvement in environmental standards due to reduced emission from standby diesel or fuel generators, use of fuelwood.	-	-	-	-	-	-	Beneficial
	Reduced demand on petrol and diesel used for power generation and further reduction in greenhouse gases and noise emissions.	-	-	-	-	-	-	Beneficial
	Uncertain effects of electromagnetic radiation on ROW users exposed to (and residents near to) transmission line generating electromagnetic field	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Risk of collision of low flying air planes with transmission towers and lines	Low (0)	High (5)	Low (1)	High (5)	High (5)	5C	Major (16 / 5C)
	Electric shock and burns to members of the public in the event of tower collapse or damage to transmission wires	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Operations / Maintenance								
Operations • Electric power transmission using the installed lines after commissioning.	Unchecked encroachment on the ROW, leading to land-use conflicts and accident.	Low (0)	Med (3)	Low (1)	High (5)	High (5)	3D	Medium (14 / 3D)
	Noise along the transmission line due to corona effects (humming sound)	Low (0)	Low (1)	High (5)	Low (1)	Med (3)	2D	Minor (9 / 2E)
	Distortion of transmission signals and electrostatic circuit due to electromagnetic induction.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Use of track corridors for other facilities (TLine, communication cables as well as water pipes etc)	-	-	-	-	-	-	Beneficial
	Local fauna disturbances from electromagnetic field along the TL ROW	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Mortality of birds, due to collision with earth wires on towers.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Effectively evacuate power to be generated by QIPP in Ibeno for further distribution within the national grid.	-	-	-	-	-	-	Beneficial
	Add to FGN plan to meet 20,000MW electric power capacity by year 2020.	-	-	-	-	-	-	Beneficial
	Development of new infrastructures or improvement to existing ones.	-	-	-	-	-	-	Beneficial

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria						Impact Significance Category
		Legal	Risk	Frequency	Importance	Public	Likelihood / Consequence	
Operations / Maintenance								
Maintenance • Tower inspection and checks • Line element replacements • ROW maintenance • Substation maintenance	Proliferation of weeds around towers.	Low (0)	Low (1)	Med (3)	Low (1)	Low (1)	2D	Minor (6 / 2D)
	Disturbance of bird habitats and avifauna sensitive species from activities of maintenance crew.	Low (0)	Med (3)	Low (1)	High (5)	Low (1)	3C	Medium (10 / 3C)
	Development of local maintenance organizations to encourage employment and empowerment within the communities.	-	-	-	-	-	-	Beneficial
	Interference with local traditional festivals or activities by unscheduled maintenance work and failure to keep to management plans may lead to community strife.	Low (0)	High (5)	Low (1)	High (5)	High (5)	4D	Major (16 / 4D)
	Maintenance of towers within sensitive environments e.g. mangrove swamps, river banks may lead to disturbance of hydrological regime (micro scale) in river banks	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	2D	Medium (12 / 2D)
	Lack of maintenance along TL ROW may lead to collision of wildlife with the stays that are not visible in the dense vegetation	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Limited knowledge on safety measures and behaviours associated with line operation that can lead to accidents	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)

Table 5.5: Identified Potential and Associated Impacts of the Proposed QIT – Ikot Abasi Transmission Line Project – Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Assessment Criteria: Legal (L)	Risk (R)	Frequency (F)	Importance (I)	Public (P)	Likelihood / Consequence	Impact Significance Category
Decommissioning and Abandonment								
Decommissioning / Abandonment • Unstringing of conductor wires • Tower / facilities removal • Waste generation •	Increased sedimentation process close to river banks and floodplains along the tower sites.	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages and wastes from decommissioning.	Low (0)	High (5)	Low (1)	High (5)	High (5)	4C	Major (16 / 4C)
	Increased dust and vehicular emissions during transmport.	Low (0)	Low (1)	Med (3)	Med (3)	Low (1)	2D	Minor (8 / 2D)
	Increase in ambient noise levels above baseline conditions from movement and activities of decommissioning equipments and automobiles.	Low (0)	Low (1)	Med (3)	Med (3)	Low (1)	2D	Minor (8 / 2D)
	Traffic obstruction from transportation of decommissioned structures and equipments to receiving hub.	Low (0)	Med (3)	Med (3)	Med (3)	Med (3)	3D	Medium (12 / 3D)
	Risk of accident and injury to worker during demolition of structures	Low (0)	Med (3)	Low (1)	High (5)	Med (3)	3D	Medium (12 / 3D)
	Risks of pirate attacks and possible hostage taking which may lead to injury or fatality of personnel.	Low (0)	High (5)	Low (1)	High (5)	High (5)	4C	Major (16 / 4C)
	Availability of land for alternative uses	-	-	-	-	-	-	Beneficial

5.7 Impact Discussion

In this section, for the sake of consistency all potential impacts to the environment were summarised in tables. These impacts were then discussed in line with the two major project phases (pre-construction has been merged with the construction phase). Mitigation was typically considered in all the project phases of the transmission line. **Table 6.1** in **chapter 6** however, summarises all mitigation and enhancement measures proffered for the identified impacts of the proposed project as per **Table 5.5** in this chapter. Also included is residual impact ranking after mitigation.

The discussions presented in this section are intended to provide a summary insight into the nature and level of significance of the identified impacts as well as a description of mitigation measures outlined in the various phases of the development.

Construction Phase

This refers to all construction and construction-related activities that will occur within the study area until the EPC contractor leaves the area. The construction activities will take approximately eighteen months to complete and will occur in two distinct phases. The first phase will involve the pre-construction activities. The construction phase will be treated as an integrated whole, as dictated by the nature of the activities and impacts under discussion.

Operational and Maintenance Phase

All post-construction activities, including the operation and maintenance of the transmission line are included in this phase.

Decommissioning Phase

Being permanent electricity infrastructure, it is not envisaged that the transmission power line will be decommissioned in the foreseeable future. However, after operational design lifespan of 25 years, a reassessment of the current status of the transmission line shall be carried out.

5.7.1 Socio-economic Impacts

Activity	Construction and operation of the ~58km QIT-Ikot Abasi transmission line
Impact	• Effectively evacuate power to be generated by the QIPP-PP for further distribution within the national grid; • Improvement in quality of life for adequately compensated locals; • Employment and skill acquisition opportunities arising from local, regional and national recruitment of technical and non-technical line workers; • Improved business opportunities and economies (small scale and large scale) through sub-contracting and supply activities; • Induced secondary development within host and neighbouring communities from increased economic activities along the area; • Development of agricultural land due to easier access and consequent discovery of new arable farm lands along ROW accesses; • Addition to the government of Nigeria's plan to meet 20,000MW electric power supply by year 2020 and subsequent development of new infrastructures and improvement of existing ones. • Uncertainty and increased perturbation due to improper consultation and sensitization; • Agitations resulting to strife from grievances over compensation issues, employment quota, land disputes, wrong stakeholder identification, leadership tussles, etc.; • Pressure on basic infrastructural amenities resulting from influx of resident and non-resident workers into project area which may indirectly lead to increased social vices; • Socio-cultural conflicts between construction workers and indigenous peoples due to contrasts in believes and traditions.

Status Quo

The socio-economic and health survey provided the baseline social profile of the study area. The proposed route for the transmission power line will cut across six local government areas (Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot Abasi) in Akwa Ibom state. The baseline social profile of each LGA and affected communities are discussed in **chapter four** of this report.

Construction Phase

Demography

The inflow of workers who choose to reside along communities during the construction phase of the development may not have any impact on the demography of the area. The numbers of workers anticipated to be employed during the construction phase is estimated at 200 workers who will be directly or indirectly employed in this phase. This number of workers will not necessarily have an impact on demography on the communities which currently show no evidence of overcrowding. There is no impact on the demography of the area hence no mitigation is proposed.

Employment Opportunities

Based on the results of the socio-economic assessment, the un-employment rates in the area are low to average. The locals are however optimistic about the increase in job availability that the development of the transmission line will bring. Any available jobs will provide an immediate positive impact on the employment and income situation at the level of the study area as well as at the regional and national levels. The impact is beneficial.

Employment of casual un-skilled labour would occur, for short-term contracts or for the entire construction phase. This could result in a positive spin-off during the construction phase as any level of employment in this region of moderate unemployment and low wage levels will have a beneficial social spinoff. The impact is beneficial.

Contracting

During the construction phase, there will be provision for sub-contracting to local supplies. Supplies will include raw materials that meet standards as required for the construction of the transmission line facilities. Equal opportunities will be given to sub-contractors from the hot communities. This is a positive impact and as such does not require mitigation.

Information Management

Improper dissemination of information about the project and its activities may pose a risk. This is because lack of information and improper sensitization of stakeholders such as men and women groups, religious groups, vulnerable groups (e.g. aged and widowed) youths, etc about the project may result in local disturbances. This impact is assessed as medium.

Mitigation measures for this impact will include:

- Early engagement of stakeholders
- Provide the opportunities for all affected groups (women, youths, religious, etc) to participate in consultations and ensure that all concerns are duly addressed
- Project will establish and publicize a grievance procedure.
- Plan and execute consultations to educate community members and stakeholders on project activities, schedules and potential impacts.
- Ensure consultation throughout project life span.

Implementation of the above measures reduces the impact to negligible.

Community Agitations

After ROW acquisition by the proponent, there is tendency for agitations by some groups of people or individuals over non-satisfactory engagement and compensations over land and other associated properties. This could lead to strife within communities or groups. This impact has been assessed and ranked with a major significance.

During labour recruitment and prior to full construction activities, there is also potential for conflicts between neighbouring communities or individuals over employment quota systems, sub-contracting procedures or recruitment methodology. This will pose major significant impact on the project construction phase.

Mitigation measures for this impact will include:

- The EPC will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities. Contents of the Community Relations and Engagement Plan are included in Appendix 5.2
- Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons
- Project will develop, establish and publicise grievance procedures;
- Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed.
- All affected stakeholders and legacy issues are identified early, clearly defined , and agreed on.
- Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed
- Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards.
- As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.

Implementation of the above measures reduces the impact to negligible.

Socio-cultural Conflicts

Other potential socio-economic impacts are expected to arise from socio-cultural conflicts between the construction workforce and natives due to contrast in believes and religion. Another challenge in this direction is increased demand on existing infrastructures due to influx of people to project area. These impacts have been ranked with a medium significance level.

Mitigation measures include:

- Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles
- Continuous consultation
- Establish and publicise grievance procedure
- Implementation of community relations and engagement plan by the EPC (see Appendix 5.2)
- Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project to discourage preventable influx of persons
- Work with contractors to ensure that specialised skill workers from outside the areas have access to proper accommodations and other basic infrastructure

- Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job
- Maintain medical emergency response plan so that all injured or ill persons can promptly access appropriate care

Implementation of the above measures reduces the impact to negligible.

Visual Effects

Setting up of tower may create visual intrusion by altering the normal land form pattern along the ROW. This impact has been ranked with a minor significance level.

Mitigation measures include:

- Where practically possible, provide a minimum of 1 km buffer area between the transmission line camp sites and sensitive visual receptors; and
- Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.
- Existing facilities might be used for lay-down and camp site areas to reduce environmental and aesthetic effects

Implementation of the above measures reduces the impact to negligible.

Loss of Land

Acquisition and utilization of land for the transmission line and associated facilities may result in temporary and permanent loss of land, some of which are regarded as arable. The impact was ranked with a medium significance.

Mitigation measures will include:

- Project will develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons
- The final ROW shall traverse in an existing disturbance corridor like other transmission lines or pipelines, where farming activities have already been impacted. In this way negative agricultural and economic impacts would be minimised.
- Land owners shall be compensated for potential loss in revenue and reduction in future development potential. Compensation should be agreed between PHCN and the landowner.

Implementation of the above measures reduces the impact to negligible.

Loss of Income

Completion of the construction phase of the project will lead to loss of employment and business opportunities. This impact has been assessed with a medium significance level.

Mitigation measures will include:

- Organise career development workshops, skills acquisition and enhancement programs to further empower the workforce
- Project will develop, establish and publicise grievance procedures;
- Adequately pay due wages for worked period and settle all financial commitments to workforce before demobilisation

Implementation of the above measures reduces the impact to negligible.

Operational and Maintenance Phase

Community Agitations

After the construction phase of the project there exist the possibility of community or groups of individuals or individual dissatisfaction with the conduct of the proponent regarding compensation issues, recruitment of labour as well as general conduct during the construction and prior to operation. This impact could arise some few months to years after construction activities and could result in strife thereby affecting the operations of the transmission line. This impact has been assessed to have a major significant level.

Mitigation Measures include:

- The EPC will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities (see Appendix 5.2)
- Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons
- Project will develop, establish and publicise grievance procedures;
- Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed.
- All affected stakeholders and legacy issues are identified early, clearly defined, and agreed on.
- Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed
- Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards.
- As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development

Implementation of the above measures reduces the impact to negligible.

Unauthorised Access

Prior to the operation of the transmission line, unchecked and unauthorised encroachment by locals or individuals into the transmission line ROW may lead to land use conflict and possible accidents. This impact significant is ranked as medium.

Mitigation measures will include:

- Provide warning signs at access roads to warn against unauthorised entry
- Through consultations, sensitize stakeholders and members of the communities on government policies along established ROW

Implementation of the above measures reduces the impact to negligible.

Socio-cultural Conflicts

Also the interference with traditional festivals and other socio-cultural programs of the natives as a result of unscheduled maintenance visits may lead to strife on the maintenance operations of the transmission line. This impact has been adjudged with a major significant level.

Maintenance procedures could also interfere with hunting, farming operations and other activities in the area. For instance, large scale maintenance operations could be considered a noisy and intrusive event for which locals within the area should normally receive advance warning.

Mitigation measures include:

- Plan activities to minimize work activities during local events
- Operators will obtain information about planned local activities and avoid disturbing them by shifting maintenance activities to other days whenever possible
- Formal notice of any maintenance work should be given in advance to the communities along the area. Access to the line must be via the approved access roads and corridors (agreed with the host communities)
- Project will develop, establish and publicise grievance procedures;
- The notice shall give details of the purpose of the access, the contact person and number of people to be involved, time frames and machinery that will be used.
- Schedule and implement recommendations of the Community Relations and Engagement Plan and approved work procedures

Implementation of the above measures reduces the impact to low.

5.7.2 Biodiversity

Activity	Clearing of vegetation, site preparation and other construction activities along the ~58km QIT-Ikot Abasi transmission line
Impact	• Destruction of vegetation due to clearance of vegetation at ROW, access roads, lay down areas, marshalling sites, tower sites etc; • Disturbance to freshwater swamps, palm forest, farmlands and pockets of mangrove flora; • Loss of forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation. • Ecosystem fragmentation and habitat loss • Faunal disturbance from construction noise, light, and presence of equipments • Uncertain electromagnetic field impacts to fauna. • Disturbance of avifauna due to collisions with the earth wire of the transmission line, habitat destruction and disturbance and impact of birds on quality of supply. • Increase in poaching due to an easier access for the local population and non-resident workers.

Status Quo

The construction of the ~58km QIT-Ikot Abasi transmission line will result in the removal of approximately two hundred and ninety (290) hectares of natural vegetation in the area. The development may have a major, long-term, irreversible negative impact on the floral composition along the ROW.

Results from biodiversity studies conducted in the area shows that five different ecological zones were identified. These were: lowland forests, seasonal freshwater swamps, cultivated farmlands, bush fallows, and mangrove forests (at Ibeno, Eket, and Ikot Abasi areas) along the transmission line.

Based on the vegetation and faunal investigations, the most sensitive ecological zones are considered to be the freshwater and mangrove river crossings. This finding has also been affirmed during past studies in the area (NIPP 2007, IPC 2005). In addition, the vegetation zones that were identified along the transmission line, are well represented outside of the study area, and are thus not considered threatened ecosystems.

Data on the floristic composition and fauna assemblage along the transmission line and in the immediate vicinity of the proposed transmission line ROW indicate presence of a varied assemblage of forest resources and plant species, some of which are economic and of ethno botanical importance (see **section 4.10.1**, chapter 4) to the people of the communities. Six endangered species were observed as per the IUCN 2006 conservation ranking in the vicinity of the project area. Although IUCN recognises these as endangered, these species are locally abundant. This shows that from an ecological stand-point the area is not one of very high ecological importance.

The main impacts of clearing the vegetation may however be secondary and will affect the species that depend on the area for survival through habitat loss, fragmentation and the impacts of edge effects. This will be further discussed in the sections below.

Construction Phase

The construction phase is the most destructive part of the planned development. During the construction phase various impacts could cause loss and disturbance of vegetation and animal habitats.

Vegetation Clearing

The ROW is approximately 58km long and 50m wide, giving a total area of 2,900,000m^2. Selective clearing within the confines of the ROW is expected to be carried out to the minimum foot print required during the construction phase to allow for foundations, erection of towers and placement of conductors on the towers. However total area permanently lost due to vegetation clearing (including lay-down areas, marshalling yards as well as access roads) is anticipated to be approximately 6ha. In general, because of the linear nature of the ROW, the effects are distributed across a substantial length and losses in any given area (including the sensitive mangrove patches around, Ibeno, and Ete area in Ikot Abasi axis) are not expected to represent a substantial portion of the available resources.

Localised impact on mangrove forest ecology is expected on the ROW segment. Impacts are expected during construction activities (access roads along mangrove paths, as well as movement of construction materials and workers through the creeks to tower sites). This activity, if not managed, may result in significant local damage to the mangrove ecosystem as well as constituent fauna. Given the total 290ha of vegetation along the ROW, the mangrove area envisaged to be affected is less than 5% of this mass. Patches of mangrove existing along the QIPP Power plant area as well as the Ete area where the existing Ibom Power transmission line has its road crossing are the only mangrove areas the construction phase is expected to impact.

There is no plan to construct lay-down areas or marshalling yards along mangrove areas. Overall, the impacts on vegetation and habitat loss due to vegetation clearing and other site preparation activities are put at a medium significant level.

Mitigation measures will include:

- Inclusion of threatened and endangered species strategies in the site specific Environmental Management Plan to be developed by EPC Contractors for the project. This plan shall indicate lists of animals and plant species of concern, development and implementation of a training program that would include photos and other information to identify the various species, procedures for responding if one of the species is found (such as contacts, stopping work until relocation or protection is effected, reporting the incident in routine progress reports, etc.), where appropriate to ensure the designation of certain areas as sanctuaries for species that may be displaced by the project and requirement for a survey by qualified biologist(s) ahead of ROW clearing, as well as strict prohibition for the workforce on killing or capturing any of the species.

- Clearance of mangrove will be kept to a minimum, and material storage areas will not be located in mangrove;
- provision of adequate culverts to maintain natural drainage channels and tidal flushing along the mangrove paths as much as practicable;
- Clear briefings and instructions to EPC regarding the clearance procedures will be undertaken to minimise any mangrove area that may be disturbed;
- Vegetation clearing will be limited to minimum required for work
- Felling of trees of >30cm girth is to be minimized during
- Vegetation clearing will be limited to the minimum required for work. This would be done with considerations to environmental protection.
- Utilisation of existing accessible tracks as much as possible
- Establish a perimeter of protection around sensitive ecosystems such as mangroves along Ibeno and Ikot Abasi and their unique habitats.
- Plan work activities to minimise presence and duration of work in ecologically sensitive areas (mangrove paths, river banks, fresh water swamps).
- Limit vegetation clearing to footprint required for construction purposes to minimize disturbances along proposed transmission line ROW.
- Allow re-growth, within height restrictions, of native ground cover beneath lines (along ROW, lay-down areas and access roads)
- The final ROW shall traverse in an existing disturbance corridor like other transmission lines or pipelines, where farming activities have already been impacted. In this way negative agricultural economic impacts would be minimised.
- Land owners shall be compensated for potential loss in revenue
- Compensation shall be agreed between PHCN and the landowner and implemented accordingly

Implementation of the above measures reduces the impact to negligible.

Erosion

Erosion may take place when vegetation is removed, by the continual movement of vehicles and people, and where vegetation is cleared for construction. Areas of particular concern would be along the access roads, areas in which the lay-down areas are placed, disturbed areas around the towers, and the marshalling yards. Impacts resulting from erosion around lay-down areas, access roads, etc have been ranked with a medium significance.

Mitigation measures will include:

- Implement where appropriate sediment run-off controls and visually inspect after rainfall
- Laydown areas/Marshalling yards are designed to include erosion control
- Reclaim as practicable topography of excavated or compacted upland areas upon completion of activities

- Limit vegetation clearing to footprint required for construction purposes o minimize disturbances along proposed transmission line ROW.
- Allow re-growth, within height restrictions, of native ground cover beneath lines (along ROW, lay-down areas and access roads)Where possible contractor shall reclaim de-vegetated areas with topsoil, reclaim compacted floors with native plant species, etc.
- Auditing EPC contractor to verify reclamation of work sites, marshalling yards, lay-down areas etc

Implementation of the above measures reduces the impact to negligible.

River Bank Disturbances

Damage to river systems could occur where towers are erected close or within the rivers, and/or when maintenance tracks or construction camps are placed within river banks. Rivers are sensitive to disturbance and therefore should the afore-mentioned impacts occur, they would be on medium significance. Fortunately rivers are relatively small in area except for the Qua Iboe crossing. It is not anticipated that the towers will be erected within the river beds at all. The transmission line is designed to ensure that it spans over the rivers. Similarly, if the maintenance tracks do not cross the rivers and construction camps are not built directly next to rivers, there will be no impact. However, specific mitigation measures have been included to ameliorate any possible impacts.

Mitigation measures proffered include

- The transmission line has been designed to have a minimum clearance of about 50m to river banks;
- Marshalling yards, storage areas and/or construction camps shall not be located along river bank areas.

Wildlife Disturbance

During construction there is expected faunal disturbance along the entire length of the transmission line, in which sensitive ground dwelling animals like the squirrels, grass cutters, civet cats etc (see **Table 4.12**) will move out of the area during construction. This is likely short termed, and once construction is finished, fauna will recolonise the area. The impact is anticipated to be medium.

Mitigation measures proffered include

- Vegetation clearing to only unavoidably necessary ones. This should be done with considerations to environmental protection.
- Utilisation of existing accessible tracks as much as possible
- Plan work activities to minimise presence and duration of work in ecologically sensitive areas (mangrove paths, river banks, fresh water swamps).
- Plan and execute construction works to minimize interference on wildlife
- Maintain construction equipments to optimal function conditions
- Monitor presence of wildlife species during construction activities

Implementation of the above measures reduces the impact to negligible.

Avifauna

Although the most severe impacts are the likelihood of electrocutions, collisions, as well as habitat loss and disturbance, the particular design of the transmission line also has a bearing on the inherent risks for birds. There is no peculiar bird breeding areas/migration routes identified along the line. The impact is low and therefore no mitigation is provided.

Operational and Maintenance Phase

During this phase the impacts on the vegetation and habitat of the fauna would be relatively low.

Faunal Disturbance from Electromagnetic Fields

The electromagnetic fields emitted from the transmission lines may result in some form of faunal disturbance, i.e. faunal species (invertebrates and small mammals) may choose not to spend prolonged periods under the transmission lines due to the electric magnet fields. In the majority of situations, the faunal species will simple move into the large expanses of nearby similar vegetation. Impact significance is medium.

Mitigation measures include:

- The design of the transmission line shall be in line with standards observed by International bodies as well as PHCN.
- PHCN shall assure during transmission line component testing that national and international standards and limits are met.

Impacts on Birds

The earth wire is the biggest risk, since it is much thinner and could be unseen by a bird in flight. Electrical faults caused by bird excreta being deposited on electricity infrastructure show that birds could also have negative impacts on transmission lines. Baseline avifauna studies did not identify any bird migratory routes / breeding sites along the transmission line route. Large waterfowl/raptors are also not predominant in the area.This impact is ranked as medium.

Mitigation:

- It is not considered practical to recommend marking all line through open areas to mitigate for bird collisions, as this would be a large proportion of the line, and the risk does not warrant it. Also it will create a negative visual impact on those people living nearby. Instead it is recommended that the routine line patrols by PHCN maintenance crew be used to detect any bird collisions. If any collision "hot spots" are identified, these can be mitigated reactively.

Implementation of the above measures reduces the impact to negligible.

5.7.3 Hydrology and Aquatic Systems

Activity	Constructing the transmission line in sensitive hydrological and surface water resources along the route
Impact	• Leakage of fuel or lube oil onto land or into water bodies during transportation and storage may lead to increased chemical toxicity • Contamination of surface water as a result of siltation caused by increased erosion, during site preparation. • Erosion of stream banks resulting in increased sedimentation in adjoining surface water bodies • Disturbance of hydrological regimes and drainage patterns on a micro-

	scale.

The activities involved in these phases of the development may cause a negative short to long-term impact on the surface hydrology and ground water quality along the project area. This will be as a result of activities which are slated to take place which include storage of hazardous substances on the site such as diesel and motor oil for the operation of machinery and stand-by generators, and similar materials for the construction of towers and foundations.

Wetlands in the area include perennial rivers and streams, mangrove swamps, seasonal rivers and streams and several creeks and creeklets. Rivers are exposed to anthropogenic impacts, including water pollution, and shoreline erosion, etc.

Construction Phase

Erosion of stream banks

Access of construction vehicles and construction personnel onto the stream banks, and swampy areas can result in the onset of erosion. The clearance of vegetation will reduce the capacity of the land surface to retard the flow of surface water, thus decreasing infiltration, and increasing both the quantity and velocity of surface water runoff and erosion. Human activities, which disturb the soil structure, such as the compaction of soil along footpaths and vehicle tracks, and the disturbance of soil structure through movement of soil, can result in increased susceptibility to erosion. Roads and pathways created during the construction phase have the potential to become preferred drainage lines, resulting in gully erosion. This impact has been ranked to possess a medium significance level.

Mitigation measures include:

- Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in adjacent aquatic areas.
- Construction on steep slopes and in soft or erodible material will require erosion control measures and correct grassing methods.
- Where possible contractor shall reclaim de-vegetated areas with topsoil, reclaim compacted floors with native plant species, etc.
- Auditing EPC contractor to verify reclamation of work sites, marshalling yards, lay-down areas etc
- Appropriate flow diversion and erosion control structures i.e. earth embankments must be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc.

Implementation of the above measures reduces the impact to negligible.

Sedimentation of streams and rivers

Clearance of existing vegetation will expose the upper layers of the soil horizon to soil erosion. The transport of eroded soil into the surface water resources, especially the rivers will impact on water quality. The movement of construction vehicles and personnel can also result in the onset of erosion and associated sedimentation of streams and rivers. The stockpiling of excavated earth and construction materials can result in contamination of runoff, through erosion of stockpiles. On the overall, impacts resulting to sedimentation problems as a result of soil erosion are adjudged to have a medium significance.

Mitigation measures include:

- Implement where appropriate sediment run-off controls and visually inspect after rainfall events
- Laydown areas/Marshalling yards are designed to include erosion control
- Reclaim as practicable topography of excavated or compacted upland areas upon completion of activities
- Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in adjacent aquatic areas.
- Construction on steep slopes and in soft or erodible material will require erosion control measures and correct grassing methods.
- Avoid crossing permanent waterways with machinery; if necessary, locate the crossing where the banks are stable and the waterway at the most narrow part of the water way.

Implementation of the above measures reduces the impact to negligible.

Aquatic Life disturbance

The riparian zone is an important corridor for the movement of wildlife, and as such the construction activities may temporarily impact on the movement of certain faunal species along the Riverine corridor. The construction related activities that will result in a deterioration of the water quality, will ultimately influence aquatic species such as macro-invertebrates, fish, amphibians and birds. This impact would however be limited in terms of duration and is ranked at a medium significance level.

Mitigation measures will include:

- Limit work areas outside vegetation along water bodies and near wetlands.
- Avoid crossing permanent waterways with machinery; if necessary, locate the crossing where the banks are stable and the waterway at the most narrow part of the water way.
- Provide workers at the development site with mobile toilets during this phase of the development. A reasonable ratio would be ten (10) workers per toilet. Periodic transfer of sewage in tanks to the QIPP-PP base for treatment is planned.
- If diesel and motor oil are to be stored on site, ensure that they are properly contained in a bunded area (with capacity to contain 1½ times the amount of substances stored). This area must be situated away from all water bodies and signs indicating the storage of these substances erected.

Implementation of the above measures reduces the impact to negligible.

Surface water pollution

Hydrocarbons-based fuels or lubricants spilled from construction vehicles, construction materials that are not properly stockpiled, and litter deposited by construction workers may be washed into the surface water bodies. Should appropriate toilet facilities not be provided for construction workers at the construction crew camps, the potential exists for surface water resources and surroundings to be contaminated by untreated sewage effluents, lubricants and other hazardous substances from accidental leaks and spillages. Depending on the nature of the contaminant the impact could range from either medium significance to major significance categories.

Mitigation measures proffered include:

- Safe operating practices are enforced during construction activities.
- project emergency/spill response measures and equipment are available, and personnel are capable of effectively using it for cases of accidental spill.
- hydrocarbon/chemical spill containment and prevention measures and equipment are functional and effective on site and for equipment and vehicles
- hydrocarbon and chemical transfers in safely contained areas
- Double handling to be avoided where possible
- When transfer has to take place, ensure it is effected in lined and secured areas where containment is possible
- Educate personnel on hydrocarbon and chemical handling risks/hazards, through SHE briefings/tool box meetings
- Implement where appropriate sediment run-off controls and visually inspect after rainfall events
- Plan and set on-site sanitary facilities for the disposal of wastewater.
- Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (lube oils, chemicals, etc.)
- Ensure safe management of hazardous materials (chemical s, etc.)
- If diesel and motor oil are to be stored on site, ensure that they are properly contained in a bunded area (with capacity to contain 1½ times the amount of substances stored). This area must be situated away from all water bodies and signs indicating the storage of these substances erected.
- train personnel in safe fuel handling procedures of chemicals and hydrocarbons
- Monitoring during maintenance of equipment to ensure that there is no discharge to the environment
- Enforce good environmental demobilisation procedures (e.g. cleaning sites and reclaiming to original status)
- Use of drip pans during transfer of fuels and hazardous substances
- Carry out internal environmental auditing to check activities of construction team and status of lay-down areas, marshalling yards, tower sites, etc prior to demobilisation.

Implementation of the above measures reduces the impacts from low to negligible.

Disturbance of Hydrological Regimes and Drainage Patterns

The presence of construction vehicles, personnel and material in floodplains and riparian zones, can result in a local change in flow patterns. This can result in a change in the flow patterns in these areas due to the presence of obstructions (i.e. vehicles, construction material, construction crew camps etc.). Human activities, which disturb the soil structure, such as the compaction of soil along footpaths and vehicle tracks, and the disturbance of soil structure through movement of soil, can also result in a change in the micro scale hydrology. Impact significance is ranked as major.

Mitigation measures will include:

- Do not hamper drainage of surface water and plan for reclamation measures after construction.
- Avoid crossing permanent waterways with machinery; if necessary, locate the crossing where the banks are stable and the waterway at the most narrow part of the water way.
- Limit work areas outside vegetation along water bodies and near wetlands.
- Maintain a minimum flow to prevent salt water intrusion through standard procedures

Implementation of the above measures reduces the impacts to negligible.

Operation and Maintenance Phase

The presence of the transmission power line and associated towers would not result in a substantial increase in erosion during the operational phase. Erosion of stream banks would mainly take place during this phase as a result of the movement of maintenance vehicles and personnel. No impact is anticipated and no mitigation proffered.

Floral disturbance (riparian zone and floodplains)

The presence of the transmission line will result in a disturbance of the flora found in the riparian zone and floodplains. Clearing of the ROW to prevent fire hazard, will result in floral disturbance. This will however be limited to the footprint area of the ROW. Access roads to the TL may also need to pass through wetland areas and / or the riparian zone, which will also result in floral disturbance. A medium significance level was assigned to this impact.

Mitigations measure includes:

- Periodically carry out ROW maintenance activities to manage growths of weeds and other creeping plants on the tower bases in a manner that minimizes adverse impacts on vegetation.

Implementation of the above measures reduces the impacts to negligible.

5.7.4 Air Quality and Noise Pollution

Activity	Site preparation and construction of ~58km QIT-Ikot Abasi transmission line.
Impact	• Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting public and wildlife. • Increase of dust particles and vehicular emissions. • Noise and attendant vibration effects from, piling activities, fabrication and associated welding equipments.

Status Quo - Air Quality

Air pollution is a major criterion for the design of transmission line insulators. Pollution has a negative effect on the insulation system of power lines, which could result in the shutdown of the power line. The baseline data on the level of pollutant gases along the transmission line route has been assessed and found to be compliant to set regulatory limits for their natural environment (see **Table 4.4,** chapter 4). Data obtained were also consistent with past studies around the project area (IPC 2005).

Construction Phase

The construction of the approximately 58km QIT-Ikot Abasi transmission line will generate minor amounts of pollutant gases (SO_x, NO_x, VOCs, etc) from fuel combustion (light fuel oil) used for supply trucks and heavy duty equipments. Such pollutants will include airborne particulates that would especially result during dry/windy conditions as a result of equipment movements and localised earthworks. Emissions during construction activities will be localised and short termed, impact will therefore be minor.

In addition, it is expected that there would be increase in dust particles (SPM) along earthed access roads and also on the generality of the ROW during construction activities. Increase in SPM levels will specifically result from vehicular movements and construction earthworks (excavations, trenching, etc). These are expected to last for a short term and have a minor significance ranking.

Mitigation measures include:

- Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced.
- Extra care must be taken to reduce dust in periods when wind speed are greatest and the rainfall amounts are lowest which is between November and February (dry season), e.g. This will involve extra wetting of the construction area to suppress dust particles.
- Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping.
- All staff employed at the construction site must be provided with dust masks and be asked to use them.
- Implement a traffic system that involves use of appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area.

- Reduce speed along earth roads
- Plan journey to reduce travel times
- Vehicles carrying earth materials should be covered
- Install and operate air pollution control equipment e.g. mufflers.

Implementation of the above measures reduces the impacts to negligible.

Operation and Maintenance Phase

The only anticipated impact is pollutant gases falling on insulators to produce a conductive film on the surface which causes the surface leakage current to increase, eventually resulting in flashover / local arcing on insulators. Flashovers occur mainly on transmission lines when, in combination with condensation, light rain or ash or dust build-up cause arcing across insulators and dips and spikes in power supplies. This weakens the insulators, and repeated arcing can cause the shutdown of the power line. However, dust and emissions generation during operations is envisaged to be low and requires no mitigation.

Noise

Noise has the potential to damage health, to detract from the quality of life, and to disturb or affect wildlife. During the wet season the baseline noise levels along the project area were within acceptable limits. Results from dry season measurements show significant increase but remained within acceptable limits.

Construction Phase

Presently, the study area is impacted by minimal noise from the surrounding land uses as populated settlements are 1 to approximately 2.5km north of the transmission line ROW except in some few sections (in Eket and Onna LGA where settlements have been identified to approximately 100m to 300m away from the ROW). However, agricultural activities are taking place within the study area notably along the palm forest areas of Mkpat Enin, the farmlands along the Ibom Power Tline road crossing into Uta Ewa axis of Ikot Abasi area as well as the tie in location into the proposed sub-station near ALSCON. Topographical survey charts showing land use pattern along the proposed 58km ROW have been included in **Appendix 5.1**.

The construction period could result in a temporary increase of the noise levels due to construction and delivery vehicles moving to and from the site as well as general installation activities. Increase in traffic flow within the study area could increase the nuisance levels in terms of noise generation. These impacts from increase in noise levels are evaluated and ranked to pose minor significance levels during construction period as they will be short termed.

Mitigation measures will include:

- Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact.

- Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact shall be reduced by engaging workers on shift basis.
- Regularly maintain construction equipment to optimal function
- Limit heavy duty construction works to day hours only where practicable
- Ensure use of appropriate PPEs (ear plugs) by workers in areas with noise level above FMENV (90dBA) hourly work area limits.
- Conduct daily SHE briefings prior to work
- Plan work activities to avoid heavy duty movement during peak hours

Operation Phase

During operation phase, some noise is generated by the corona in form of humming sound around the live conductors. Studies of a 400kv (NIPP 2007) which is quite similar in terms of voltage to the proposed 330kv line showed that the noise level, at 25m from the live conductor ranges between 53 dB(A) on a rainy weather and 33 dB(A) on a dry weather. These modest noise levels will have limited impact on the health of people who live closest to the ROW (100m) or to the wildlife that will occasionally venture pass the ROW. The impact as ranked with a minor significance level.

Mitigation measure includes:

- The design of the transmission line shall be in line with standards observed by International bodies.

Implementation of the above measures reduces the impacts to negligible.

5.7.5 Health, Safety and Security Aspects

Activity	Site preparation and construction of ~58km QIT-Ikot Abasi transmission line.
Impact	• Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset • Risks of armed robbery attack and hostage taking leading to injury/ death of personnel • Work place accidents/incidents from the use of cranes, forklifts, etc. during loading and offloading of materials/equipment as well as construction and maintenance operations. • Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites • Waste Disposal (scrap metal, wood, sand, concrete, paper, domestic waste from lay-down area from grubbing of ROW. • Risk of electrocution and burns (to onsite workers) from welding flashes and high currents during welding • Workplace accidents / incidents (trip/falls etc) from heights during conductor wire stringing and bolt/nuts tightening project activities. • Risks of injury / death and loss of assets resulting from accidents

	associated with road transportation to and fro construction sites • Risks of fire/explosions resulting from accidental ignition of onsite diesel storage tanks • Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding in swamp areas as well as water borne diseases e.g. diarrhoea and cholera associated with poor sanitary conditions • Risk of collision of low flying air planes with transmission towers and lines

Construction Phase

In any civil works, public as well as construction staff SHE risks can arise from various constructions activities such as earth works, operation, and movement of heavy equipment and vehicles, storage of hazardous materials, traffic, waste disposal etc. Because of the long duration of the construction phase, such activities need to be controlled and consequently the associated risks reduced to as low as reasonably practicable.

Transportation Related Aspects

Construction and transportation activities will increase traffic congestion, risk of injuries, hostage and kidnapping as well as damage to assets. These impacts are expected to be of medium to major significance depending on the severity of the impact. Accidents arising from road trips (transport of materials and personnel) along mobilisation routes may result in injury or loss of life of personnel as well as damage to company assets. The possibility of hostage taking of expatriate personnel or locals during the construction of the project is likely. This may also result to injuries or fatality. These impacts are ranked from medium to major significance.

Mitigation measures will include:

- All vehicles and boats are certified road / water worthy prior to being mobilized for work activities.
- Compliance to all roads and water ways safety transport rules including speed limits
- Competency training and certification of drivers before mobilisation.
- Limit movement to day time only
- Setting and enforcing speed limits of 100km/hr (major roads) 40-60km/hr (built-up areas) and 10-30km/hr (construction sites);
- Develop a project security plan that addresses all project related security concerns
- Ensure security procedures are strictly enforced and continually improved based on updated risk information.
- Consultation and good public relation with the stakeholder communities.
- Ensure government approved security personnel is used on transport vehicles and boats when warranted
- Coordinate work activities to avoid heavy traffic periods
- Use warning signs and traffic wardens/directors
- Ensure activities causing blockages at road crossings are carried out within shortest time practicable

- In the case of longer blockages, divert traffic to approved alternate routes in liaison with appropriate authorities
- Consult with affected communities prior to road closures to provide warnings and alternatives.

Implementation of the above measures reduces the impacts to negligible.

Workplace Accidents

The probability of an accident occurring at the project site during the phases of the development is high. This is due to the intense use of machinery and other heavy-duty equipment used especially in the construction phase.

Work related incidents and accidents resulting from trips, falls, object at height during construction activities are likely to occur. These impacts pose a medium to major significance ranking all depending on the severity of the impact. If the impact results in fatality it is ranked as a major significant impact.

Mitigation measures proffered will include:

- All personnel are qualified and certified for their relevant works
- Approved safe work procedures are provided and complied with at all times
- prior to commencement of work
- PHCN shall ensure SHE briefings, job hazards identification and controls, prior to commencement of work activities
- Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site
- Limit work activities to daytime only
- Ensure availability of first aid facilities onsite
- Ensure retainer clinics are engaged and site medical personnel are available in case of accidents
- Maintain medical emergency response plan so that injured or ill persons can promptly access appropriate care.
- PHCN shall design work area to internationally acceptable standards

Implementation of the above measures reduces the impacts to negligible.

Communicable Diseases

Construction activities have the potential to create new malaria vector (mosquito) habitats. An influx of workers with no partial immunity to malaria parasite (*Plasmodium sp*) increases the risk of serious illness which may result to death. This impact if not managed is expected to pose a major significance characteristic.

Influx of resident and non resident workers into the project area also increases the risks of sexually transmitted diseases (STDs) and could impact adversely on the spread of these illnesses especially relating to Acquired Immunodeficiency Syndrome (AIDS). This impact if left unmanaged may result in long term health issues which may eventually lead to fatality. Impact arising from this is ranked as major.

Mitigation measures include:

- Project will develop a health plan to address potential health issues
- Initiate /enforce PHCN corporate health awareness programs for malaria, AIDS, etc)
- Provision of site medical personnel to attend to emergency situations
- Engage the services of retainer clinics to manage health issues
- Educate workforce on the prevention of malaria as well as encourage the use of mosquito nets in construction camps.
- Ensure personnel use appropriate PPE
- Project shall prepare and implement emergency response plan
- Ensure availability of first aid facilities onsite
- Provide appropriate domestic water supply to address additional needs.
- Facilitate the implementation of appropriate toilet and other sanitation facilities.
- Provide information, education and communication about safe uses of water and occupational hygiene and safety
- Environmental management for vector control; avoidance via settlement location and design and use of bed nets and repellents; rapid diagnosis and treatment; focal insecticide and molluscicide application.
- Develop and implement safe food storage and handling practices.

Implementation of the above measures reduces the impacts to low.

Fires and Explosions

Fire and explosions may be described as technological hazards, which can cause serious injury or result in loss of lives and damage to properties and the environment. Flammable substances including diesel and motor oil may be stored or used on the project site for heavy-duty equipment. These substances are precursors for fires and explosions. Envisaged impacts from accidental explosions resulting in fire have been ranked with a major significance level.

Mitigation measures will include:

- All fuel storage tanks are kept at safe distances from work areas
- Storage areas will be identified with caution signs.
- Educate workforce on risks associated around storage areas and prohibit activities (such as smoking) that can ignite storage tanks
- Designate no-smoking and smoke areas
- Hold SHE meetings and talks on fire hazard
- Design work area to internationally acceptable standards

Implementation of the above measures reduces the impacts to negligible.

Waste Handling and Disposal

A significant amount of solid waste (including, wood, metal scarps, office and domestic wastes, etc.) will be generated in this phase of the project. The methods put in place for handling and disposing of these wastes to be generated play an important role in the significance of impacts expected from wastes management. Waste handling and disposal have been assessed to pose a medium impact to the environment.

Mitigation measures will include:

- Develop project specific waste management plan and ensure proper implementation
- Provide adequate containers for waste collection
- Periodically audit contractor activities to check the level of compliance to regulatory and PHCN waste management requirements.
- Design work area to internationally acceptable standards
- Ensure engagement of government approved waste management contractors
- Safe operating practices are enforced during construction

Implementation of the above measures reduces the impacts to negligible.

Operation Phase

During the operational phase, public and occupational SHE risks are not as significant as during the construction phase. The design clearances according the PHCN Standard guarantee safe limits for the possibility of farming and also cattle rearing.

Collisions

After the transmission line has been constructed and is put into operation there is the possibility of low flying aircraft colliding with the towers. If this happens, it will result to injury, asset damage as well fatality in the worst case. Impacts resulting from collision of aircraft with towers have been ranked at major significance level.

Mitigation measures will include:

- Alternative analysis of the ROW options ensured minimal to no interference with air traffic (see **section 2.3.1** in chapter 2).

- PHCN shall provide Aircraft Warning spheres and tower signs in areas where air traffic might occur in order to minimize risk of low flying aircraft colliding with towers and wires.

Implementation of the above measures reduces the impacts to negligible.

Collapse of Transmission Towers

There exists the possibility of shock and burns to unauthorised ROW users or visitors due to collapse of transmission line towers which could lead to injury or fatality of affected persons. This is a major significant impact.

Mitigation measures will include:

- Towers shall be installed following the best engineering standards
- Towers shall be collapse tested to prove the tower design is in line with the PHCN requirements
- PHCN shall carry out routine inspection of towers in order to allow early detection of damaged towers
- Reported cases of damaged or fallen towers shall be promptly attended to.
- Adequate and automatic fault/damage detection system shall be installed.
- Personnel shall be trained on the detection/handling of such emergencies arising from accidental damage

Implementation of the above measures reduces the impacts to negligible.

Electromagnetic Fields

The electromagnetic effects of a transmission line on the environment have been a concern in the last decades. Intense electric fields may occur at the surface of conductors and other “live “elements of transmission lines. Several studies with varying conclusions have been carried out on harmful consequences that the electrical and magnetic fields produced by overhead lines could have on humans, animals and plants. In view of this, the electric industry including national and international, established maximum acceptable limits for biological effects of transmission lines, which should be complied with when a new overhead transmission line is designed and constructed (Cigre, 1992).

The magnitude of electrical and magnetic fields in proximity to a transmission line is dependent on the superposition of the fields due to the three-phase conductors. Usually, limitations are imposed to the maximum electrical field at the edge of or within the right-of-way. There will be no testing after commissioning to confirm that electrical field and magnetic induction do indeed fall below the safe limits. This is because clearances according the PHCN Standard guarantee the safe limits. This is the case for clearances in all international standards. The range of maximum electrical and magenetic fields below overhead lines is given in **Table 5.6** below.

Table 5.6: Range of Maximum Electrical and Magnetic Fields

Voltage (kV)	Electrical Field (at ground level under a line) (kV/m)	Magnetic Induction (at ground level) (uT)
765	8-13	28-32
525	5-9	25-30
420	4-8	22-28
245	2-3.5	20-25
123	1-2	12-15
70	1-1.5	2-2.5

Source: ICNIRP, 1998

In line with set precaution values for a 420Kv transmission line, the electromagnetic impact of the proposed 330kV transmission line still falls below set limits and thereby ranked as a minor significant impact.

Table 5.7: Precaution Values for Low Frequency Electro-magnetic Fields – 420kV

Source	Low Frequencies	Occupational Exposure		General Public Exposure	
		Permanently	Few hours per day	Permanently	Few hours per day
IRPA/WHO	Electrical Fields (kV/m)	10	130	5	10
	Magnetic Induction (uT)	500	5000	100	1000
Europe	Electrical Fields (kV/m)	-	-	5	5
	Magnetic Induction (uT)	-	-	100	100
USA	Electrical Fields (kV/m)	8-11	7-11	1-9	-
	Magnetic Induction (uT)	1000	-	400	-

Source: ICNIRP, 1998

Mitigation measures will include:

- Alternative analysis of the ROW options ensured minimal to no exposure of public to electromagnetic fields by selecting the farthest routing option from human settlements and activities.
- Provide and ensure use of appropriate PPE for maintenance workers
- Transmission line has been designed in line with ICNIRP/WHO standards for biological exposures

Implementation of the above measures reduces the impacts to negligible.

As a conclusion, proper supervision, high workmanship performance, and provision of adequate safety measures will alleviate public and occupational SHE risks.

5.7.6 Decommissioning

Activity	Demolition of structures, transportation of demolished structures, restoration, etc.
Impact	• Increased sedimentation process close to river banks and floodplains along the tower sites. • Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages and wastes from decommissioning. • Increase in ambient noise levels and pollutant gases above baseline

	conditions from movement and activities of decommissioning equipments and vehicles. • Risk of accident and injury to worker during demolition of structures

The decommissioning phase refers to all the activities which relate to the proposed transmission line when it is no longer in use. Potential issues that relate to the decommissioning phase refers to impacts such as the towers lying strewn around, lack of rehabilitation of the access roads, overgrown vegetation along the ROW etc.

During the decommissioning phase, the demolition activities are likely to have similar impacts on the environment as were identified for the construction phase. These include potential impacts such as sedimentation, surface water, visual impact, dust and noise pollution, a risk of fires and explosions, safety and security and traffic impacts etc. Impacts arising from decommissioning activities have been ranked with significance levels of minor to major.

Mitigation measures for impacts during decommissioning will be implemented in line with practices as at the time of decommissioning. However, to a minimum the following mitigation measures have been put in place for impacts arising due to decommissioning process:

- Develop and implement a decommissioning plan in line with requirements as at the time of decommissioning.
- Ensure that excavated and stockpiled soil material is stored and bermed on the higher lying areas along the site and not in any run-off channels where it is likely to cause erosion.
- Decommissioning activities should preferably take place during the dry season months to prevent soil erosion caused by heavy rains.
- Wet all unprotected cleared areas and stockpiles with water to suppress dust pollution.
- Institute noise control measures (e.g. regular equipment maintenance) throughout the decommissioning phase for all applicable activities.
- Take cognisance of peak traffic times and plan transportation of decommissioned structures and personnel so as to avoid obstruction of local traffic by vehicles, heavy machinery/trucks.
- The decommissioning contractor as at the time of decommissioning will have to develop a decommissioning security plan and implement its use.
- Ensure effective waste management from cradle to grave for all wastes generated during and after the decommissioning period.
- Enforce proper waste management policies in line with FMENV standards and requirements as at time of decommissioning.
- Ensure use of road worthy vehicles and equipment as well as skilled operators and drivers

Implementation of the above measures reduces the impacts from to negligible.

5.8 Cumulative Impacts

Cumulative impacts result from actions, which may not be significant on their own, but which are significant when added to the impact of other similar actions. In this instance, the cumulative impacts may arise from the existing Ibom Power Transmission Line (running parallel to the proposed QIT –Ikot Abasi Transmission line on the other side of the Eket – Ikot Abasi road as well as the road crossing to connect the proposed substation), the ongoing Septa Energy Pipeline (also parallel to the proposed QIT – Ikot Abasi transmission line around the Ibeno axis, but outside the ROW, before the transmission line crosses the pipeline at tower 23 location near Eket) as well as the proposed Ikot Abasi – Ikot Ekpene Transmission line which will run parallel to the line from the road crossing area around Ete town in Ikot Abasi through to where it branches adjacent to the proposed Ikot Abasi sub-station. These impacts have been assessed to pose beneficial to medium significant adverse impacts. Cumulative impacts relating to the construction of the proposed transmission power line include:

- Erosion and contamination of the surface water resources in the study area due to vegetation clearing and other earthwork activities.
- Small-scale impacts of a socio-economic nature on the lives and means of livelihood of the communities in the proposed project area.
- Aesthetic value of transmission line ROW due to the presence of additional power lines and underground pipelines in an area where there are existing transmission and distribution lines.

Proposed mitigation measures to address the above identified cumulative impacts that may arise from existing, ongoing and future facilities along the project area are presented below:

- the cumulative effects resulting to erosion and contamination of surface water resources in the study area as well as aesthetic value of the area will be minimised by synergising PHCN project activities with other stakeholder activities (IPC, NIPP, Septa Energy, FGN, etc). This will allow for the consolidation and reduction of incremental impacts associated with past, present and future actions in the project area.
- by consolidating these facilities within established utility corridors, future developments can be planned to benefit from already existing facilities or utilities thereby reducing their cumulative effects.

Other cumulative impacts of the proposed transmission line corresponding to earlier identified potential and associated impacts in this text will also be mitigated / enhanced as proffered in earlier sections of the report (e.g. socio-economic impacts such as local employment opportunities, etc).

CHAPTER SIX

IMPACT MITIGATION MEASURES

CHAPTER SIX

IMPACTS MITIGATION AND RESIDUAL RANKING

6.1 General

EIA has as its principal and most important objective the development and establishment of suitable procedures (mitigation measures) for the identified significant and adverse impacts of a proposed project. Equally identified is the aim of enhancing the potentially beneficial aspects of the development.

This chapter thus, presents the mitigation measures proffered for the identified potential and associated impacts (**chapter five**) of the proposed 58km 330kv QIT – Ikot Abasi Transmission Line project. The mitigation measures have been proffered to prevent, eliminate or minimise the impacts and their effects to levels that are considered as low as reasonably practicable (ALARP). In proffering mitigation measures, the primary objectives were:

Prevention – methods aimed at impeding the occurrence of negative impacts, and/or preventing such occurrence from having harmful environmental/social outcomes.

Reduction – limiting or reducing the degree, extent, magnitude, or duration of adverse impacts. Reduction can be achieved by scaling down, relocating, or redesigning elements of a project.

Control – ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

The framework for determining the form of mitigation measures to be applied for the significant impacts identified for the project is presented below (**Figure 6.1**). The frequency, severity, sensitivity, scale, magnitude and nature of the impacts were taken into consideration during these assessments.

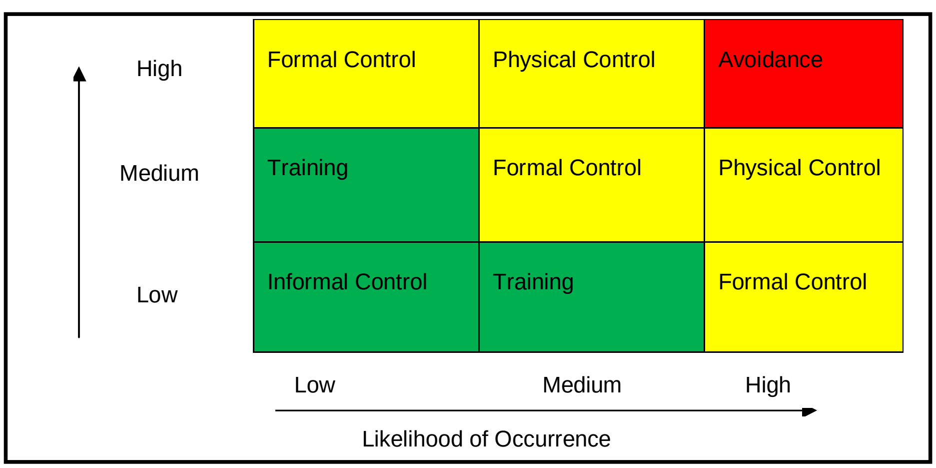


Figure 6.1: Mitigation Definition Criteria

Informal Control

This involves the application of sound judgment and best practice in mitigating the impacts of project activities.

Formal control

This involves the application of documented policy, process or procedure in mitigating the impacts of the project activities. It ensures that residual associated impacts are reduced to an acceptable level.

Physical control

This involves the application of physical processes, barriers or instruments (pegs, fence, gates, sign post etc), not necessarily requiring any special technology, in order to mitigate the impacts of the project.

Avoidance

This involves the modification of plans, designs or schedules in order to prevent the occurrence of an impact or impacts.

Subsequently, the specific mitigation measures satisfying the mitigation criteria were established putting the following into consideration.

- regulatory requirements
- available resources and competencies;
- on-site conditions;
- technology and
- public concerns

6.2 Impact Mitigation Procedure

The procedures employed for the establishment of mitigation measures for the identified impacts is presented in **Figure 6.2**. Mitigation measures were subsequently proffered for adverse significant potential impacts. These measures (prevention, reduction and control strategies) were developed for the project through review of industry practice (past project experience), consultations and expert discussions with multi-disciplinary team of engineers, scientists and environmentalist.

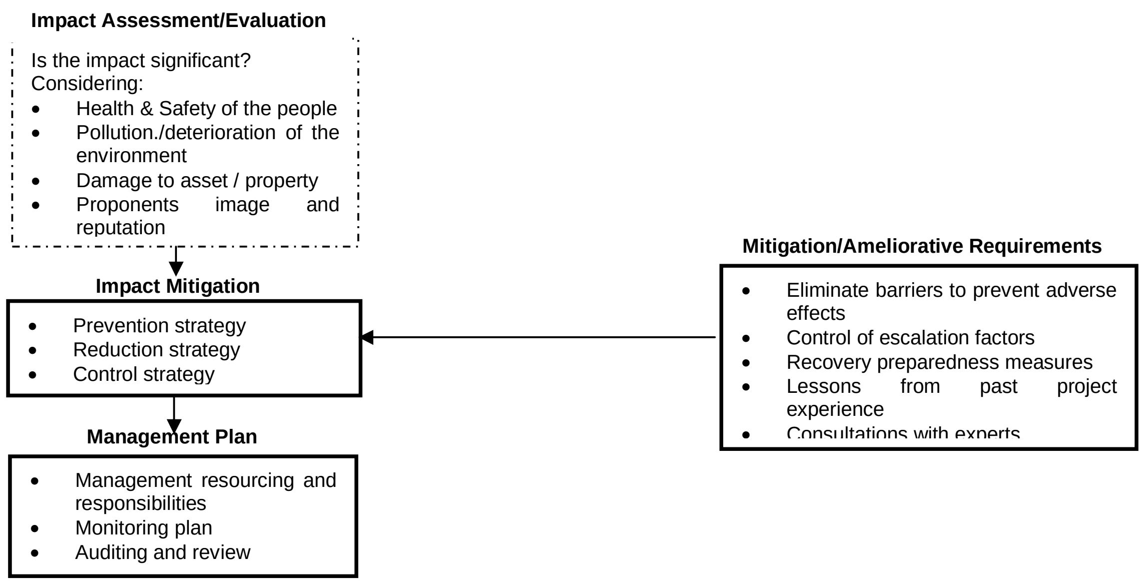


Figure 6.2: Procedure for Mitigation Measures

6.3 Proffered Mitigation Measures

Accordingly, this section presents the mitigation measures proffered for the identified impacts of the proposed transmission line project. These cost effective measures have been proffered with reference to best industry practice, national guidelines as well as PHCNs SHE considerations. PHCN as proponent is responsible for implementation of stipulated mitigation measures.

Based on the impact assessment overall significance rating in c**hapter five**, the impact significance **Major**, **Medium** or **Minor** was established for each identified impact. The proffered mitigation measures and expected residual ranking (**Negligible**, **Low** and **Moderate**) for the identified potential and associated impacts are presented in **Table 6.1** below.

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
		Pre-Construction		
Permitting & ROW Acquisition • Consultations • Acquisition of license to operate • Stakeholder identification • ROW Acquisition	Acceptance and co-operation/ participation from stakeholders (communities and government) leading to peaceful and timely execution of the project	Beneficial	PHCN and EPC contractor shall: • All relevant stakeholders are identified • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed	Beneficial
	Uncertainty and increased perturbation due to a lack of information and communication.	Medium	PHCN shall: • Early engagement of stakeholders • Establish and publicize grievance procedure • Provide the opportunities for all affected groups (women, youths, religious, etc) to participate in consultations and ensure that all concerns are duly addressed. • Plan and execute consultations to educate community members and stakeholders on project activities, schedules and potential impacts. • Ensure consultation throughout project life span.	Negligible
	Integration of men and women concerns into the project design	Beneficial	PHCN and EPC contractor shall: • Due consultation of relevant groups at all phases of the project. • Provide the opportunities for all affected groups to participate in consultations and that all concerns are duly addressed. • Establish and publicize grievance procedure	Beneficial
	Exclusion of vulnerable groups from consultations which may lead to strife	Medium		Negligible

	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	Major	PHCN and EPC contractor shall: • Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities (see Appendix 5.2) • Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • Establish and publicize grievance procedure • Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.	Negligible
	Improvement in quality of life for adequately compensated individuals	Beneficial	• Consulting all relevant stakeholders and legacy issues identified early, clearly defined , and agreed on • Fair compensations in line with national standards are agreed upon and paid	Beneficial
Transport of Personnel and Construction Elements • Ikot Abasi – Eket Federal Highway • Eket – Ibeno road • Inland water ways (River crossing sites e.g. Qua Iboe River).	Increased traffic during mobilisation on road with risks of accidents leading to injury/death and loss of asset.	Major	PHCN and its contractors shall ensure; • All vehicles and boats are certified road / water worthy prior to being mobilized for work activities. • Compliance to all roads and water ways safety transport rules including speed limits • Competency training and certification of drivers before mobilisation. • Limit movement to day time only	Negligible
	Risks of armed robbery attack and hostage taking leading to injury/ death of personnel	Major	• Develop a project security plan that addresses all project related security concerns • Ensure security procedures are strictly enforced and continually improved based on updated risk information. • Consultation and good public relation with the stakeholder communities. • Ensure government approved security personnel is used on transport vehicles and boats when warranted • Limit movements of personnel and equipment to daytime only	Moderate

	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting public and wildlife.	Medium	PHCN and EPC contractor shall: • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible. • Plan work activities to avoid heavy duty movement during peak hours • Consult with host communities and plan project activities accordingly • Limit movement and work activities to daytime only • Ensure equipments are properly maintained	Negligible
	Increase of dust particles and vehicular emissions.	Minor	PHCN and EPC contractor shall: • Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind speed are greatest and the rainfall amounts are lowest which is between November and February (dry season), e.g. This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • All staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along earth roads • Plan journey to reduce travel times • Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. mufflers.	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Pre-Construction				
Transport of Personnel and Construction Elements • Ikot Abasi – Eket Federal Highway • Eket – Ibeno road • Inland water ways (River crossing sites e.g. Qua Iboe River).	Work place accidents/incidents from the use of cranes, forklifts, etc. during loading and offloading of materials/equipment.	Medium	PHCN and its contractors shall ensure; • All personnel are qualified and certified for their relevant works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site • Limit work activities to daytime only	Negligible
	Obstruction of/damage to existing roads due to increased usage during mobilisation.	Medium	PHCN and EPC contractors shall: • Roads to be assessed prior to commencement of work to establish the status and its capability to safely handle material and personnel transportation, and after completion to determine extent of impact and where necessary, take steps to reclaim areas damaged by project activities • Plan work execution to reduce travels and restrict where necessary, use of access roads.	Negligible
	Interference with other road users along mobilisation route.	Medium	PHCN and its contractors shall ensure that • Equipment, materials and personnel are mobilised after due consultation with relevant transportation authorities (FRSC, NMA, NURTW, etc) and other stakeholders to minimise interference along mobilisation routes. • Travels to and from sites shall be planned to maximize each trip and minimize number of travels	Negligible
	Leakage of fuel or lube oil onto land or into water bodies during transportation and storage may lead to increased chemical toxicity.	Medium	PHCN and EPC contractor shall ensure: • Safe operating practices are enforced during mobilisation • Implementation of project specific spill and emergency response plan • hydrocarbon/chemical spill containment and prevention measures and equipment are functional and effective on site and for equipment and vehicles • hydrocarbon and chemical transfers in safely contained areas • Double handling to be avoided where possible • When transfer has to take place, ensure it is effected in lined and secured areas where containment is possible • Educate personnel on hydrocarbon and chemical handling risks/hazards, through SHE briefings/tool box meetings	Negligible

Recruitment of Labour	Employment opportunities arising from recruitment of technical and non technical transmission line workers	Beneficial	PHCN and EPC contractor shall: enhance this beneficial impact by • Creating requirements for contractors to hire local labour • Ensure skills acquisition and development • Recognise and commend personnel with outstanding performance	Beneficial
	Skill acquisition and enhancements to local indigenes and workforce.	Beneficial		
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure	Medium	PHCN and EPC contractor shall: • Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Continuous consultation while project is in progress • Implementation of community relations and engagement plan (see Appendix 5.2) • Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project to discourage preventable influx of persons • Work with contractors to ensure that specialised skill workers from outside the areas have access to proper accommodations and other basic infrastructure • Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job • Maintain medical emergency response plan so that all injured or ill personnel can promptly access appropriate care •	Negligible
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites	Medium	PHCN and EPC contractor shall: • Project will develop a health plan to address potential health issues • Carry out health awareness program (malaria, corporate stop AIDS program, etc) • Provision of site medical personnel to attend to emergency situations • Engage the services of retainer clinics to manage health issues • Educate workforce on the prevention of malaria as well as encourage the use of mosquito nets in construction camps.	Negligible
	Increase in social vices (like theft, prostitution) resulting from increased number of people	Medium	PHCN and EPC contractor shall: • Ensure its personnel and contractors undergo pre-employment background screening as required • Periodically discuss health and social education issues during toolbox/SHE meetings • Promptly deal with reported cases of misconduct to check recurrences	Negligible

	Conflicts/community agitations over employment issues (quotas and methods)	Major	PHCN and EPC contractor shall: • Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities (see Appendix 5.2) • Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons • Establish and publicize grievance procedure • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • All affected stakeholders and legacy issues are identified early, clearly defined , and agreed on. • Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.	Low

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Pre-Construction				
Site Preparation • Access to ROW creation • Service roads • Camping and campsites	Business opportunities for local contractors through sub contracting activities	Beneficial	PHCN and EPC contractor shall: • Encouraging indigenous contractors and suppliers providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour • Workers are paid promptly as at when due	Beneficial
	Local support services from road side supply markets and shops etc	Beneficial		
	Contamination of surface water as a result of siltation caused by increased erosion, during site preparation.	Medium	PHCN and EPC contractor shall: • Employ appropriate industry practices in transmission line construction and ancillary facilities in order to avoid adverse alteration drainage pattern • Implement where appropriate sediment run-off controls and visually inspect after rainfall events • Laydown areas/Marshalling yards are designed to include erosion control • Reclaim as practicable topography of excavated or compacted upland areas upon completion of activities.	Negligible
	Disturbance of the vegetation cover / loss of forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation.	Medium	PHCN and EPC contractor shall: • Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by EPC contractors to ensure appropriate flora and fauna management. • Vegetation clearing will be limited to minimum required for work • Felling of trees of >30cm girth is to be minimized during • vegetation clearing to only unavoidably necessary ones. This should be done with considerations to environmental protection. • Utilisation of existing accessible tracks as much as possible • Establish a perimeter of protection around sensitive ecosystems such as mangroves along Ibeno and Ikot Abasi and their unique habitats. • Plan work activities to minimise presence and duration of work in ecologically sensitive areas (mangrove paths, river banks, fresh water swamps).	Negligible
	Loss/disturbance of wildlife due to habitat loss/fragmentation from vegetation clearing along ROW and access roads	Medium		

	Soil compaction, destabilisation from excavation and runoff erosion resulting in sedimentation problems.	Medium	PHCN and EPC contractor shall: • Implement where appropriate sediment run-off controls and visually inspect after rainfall events • Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in adjacent aquatic areas. • Construction on steep slopes and in soft or erodible material will require erosion control measures and correct grassing methods. • Laydown areas/Marshalling yards are designed to include erosion control • Reclaim as practicable topography of excavated or compacted upland areas upon completion of activities	Negligible
	Fragmentation of wildlife habitats/increase in poaching due to an easier access for the local population and non-resident workers.	Medium	• Where possible plan site clearing to allow species the opportunity to relocate to suitable nearby habitats and to reduce the shock to the various habitats that may be disturbed. • Relocate non-motile and weak species to safe grounds prior to commencement of work • Allow re-growth, within height restrictions, of native ground cover beneath lines (along ROW, lay-down areas and access roads) • Prohibit poaching particularly by workers and educate workers on good biodiversity conservation policies.	Negligible
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • Waste from laydown area from grubbing of ROW (Material and wood)	Medium	PHCN and EPC contractor shall : • Develop project specific waste management plan (**Chapter 7**) and ensure proper implementation • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and PHCN waste management requirements. • Safe operating practices are enforced during construction • Ensure use of only government approved waste management contractors	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Fabrication and Metal works • Cutting, bending and welding tower steel components • Painting • Handling of conductor wires, strings, insulators and fittings	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	Major	PHCN and its contractors shall ensure; • All personnel are qualified and certified for their relevant works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site • Limit work activities to daytime only where practicable	Negligible
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities	Beneficial	PHCN and its contractors shall enhance this beneficial impact by • Creating requirements for contractors to hire local labour • Ensure skills acquisition and development	Beneficial
	Risk of electrocution and burns (to onsite workers) from welding flashes and high currents during welding	Major	PHCN and its contractors shall ensure; • All personnel are qualified and certified for metal works • That approved safe work procedures are provided and complied with at all times • Use of appropriate personal protective equipment (PPE) e.g. rubber hand gloves, hard hats, safety goggles, etc. by all metal works personnel	Negligible
	Noise and attendant vibration effects from fabrication and associated welding equipments	Minor	PHCN and EPC contractor shall: • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible. • • Ensure use of appropriate PPEs (ear plugs) by workers in areas with noise level above FMENV (90dBA) hourly work area limits. • Conduct daily SHE briefings prior to work	Negligible

	Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of tower components	Medium	PHCN shall and its contractors shall: • Utilise environmentally friendly electrodes, spray and paint liquids for welding as well as painting. • Use of appropriate personal protective equipment such as welding masks by welders shall be enforced. • PHCN shall also install fume expellers or blowers at confined welding areas. • Implement appropriate work-site practices.	Negligible
	Generation of metal scraps from conductor wires, strings and steel elements associated with fabrication of tower components.	Medium	PHCN and EPC contractor shall : • Develop project specific waste management plan and ensure proper implementation • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and PHCN waste management requirements. • Safe operating practices are enforced during construction • Ensure use of only government approved waste management contractors	Negligible
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting	Beneficial	PHCN shall enhance this by: • Encouraging indigenous contractors and suppliers providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour •	Beneficial
	increase in revenue opportunities for local population due to presence of non-resident workers and travellers	Beneficial		
	Interruption of surface water flows and potentials for salt-water intrusion in identified tidal zones of Eket and Ikot Abasi areas during construction.	Major	PHCN and EPC contractor shall: • Do not hamper drainage of surface water and plan for reclamation measures after construction. • Avoid crossing permanent waterways with machinery; if necessary, locate the crossing where the banks are stable and the waterway at the most narrow part of the water way. • Limit work areas outside vegetation along water bodies and near wetlands. • Maintain a minimum flow to prevent salt water intrusion through standard procedures	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Foundation / Earth Works • On-site geotechnical tastings • Tower foundations • Pilings and trenching, etc	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	Major	PHCN and EPC contractor shall: • Plan and set on-site sanitary facilities for the disposal of wastewater. • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (lube oils, chemicals, etc.) • Ensure safe management of hazardous materials (chemical s, etc.) • Ensure handling of fuels such as fuelling of vehicles and machinery, and fuels transfers, take place in contained areas, where sufficient measures are in place to ensure containment of spills. • Plan emergency response measures and equipment are available, and personnel are capable of effectively using it for cases of accidental spill.	Low
	Increased jobs and job opportunities from local labour hire and sub-contracting to indigenous suppliers.	Beneficial	PHCN and EPC contractor shall enhance this by: • Encouraging indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards	Beneficial

	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.	Minor	PHCN and EPC contractor shall: • Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind speed are greatest and the rainfall amounts are lowest which is between November and February (dry season), e.g. This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • All staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along earth roads • Plan journey to reduce travel times • Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. mufflers. •	Negligible
	Flora/habitat loss and disturbance through vegetation clearing and earthworks along ROW, access roads and at tower sites	Medium	PHCN and EPC contractor shall: • Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by EPC contractors to ensure appropriate flora management. • Limit vegetation clearing to footprint required for construction purposes o minimize disturbances along proposed transmission line ROW. • Much of the low-lying mangrove vegetation will not be cleared and will be covered with construction material; • provision of adequate culverts to maintain natural drainage channels and tidal flushing along the mangrove paths as much as practicable; • Clear briefings and instructions to EPC regarding the clearance procedures will be undertaken to minimise any mangrove area that may be disturbed; • Allow re-growth, within height restrictions, of native ground cover beneath lines (along ROW, lay-down areas and access roads)	Negligible

	Fauna disturbance and displacement as a result of migration away from construction activity area (this include impact on bird life)	Medium	PHCN and EPC contractor shall: • Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by EPC contractors to ensure appropriate flora management. • Plan and execute construction works to minimize interference on wildlife • Maintain construction equipments to optimal function conditions • Monitor presence of wildlife species during construction activities	Negligible
	Potential collapse of transmission towers as a result of unsuitable geotechnical conditions	Medium	PHCN and EPC contractor shall : • Carry out side by side geotechnical investigations during construction to determine suitability of soil to carry towers • Recommendations from geotechnical appraisals shall be appropriately implemented • Construction of tower foundations shall follow good industry engineering practices.	Negligible
	Reduction in wildlife population as a result of poaching due to easier access created by ROW clearing	Medium	PHCN and EPC contractor shall: • Prohibit poaching by personnel • Periodically educate workforce on good principles of biodiversity conservation • Limit workforce concentration to project area and prohibit the possession of fire arms by members of workforce • Practice wildlife conservation principles (e.g. release back into the wild any wildlife incidentally caught by dug-up foundations or tranches.	Negligible
	Noise nuisance (including impulsive noise) from construction activities (e.g. piling) resulting to temporary migration of sensitive mammals and rodents.	Minor	PHCN and EPC contractor shall : • Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. • Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. Prolonged exposure to this impact should be reduced where possible. • • Regularly maintain construction equipments to optimal function • Limit heavy duty construction works to day hours only where practicable	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Anti climbing guards and step bolts • Insulators and fittings • Conductor wire stringing • Connectors fixing, etc	Pollution of soil/water as a result spilled fuel and other waste oil discharge during tower construction and installation processes	Major	PHCN and EPC contractor shall: • Develop and implement spill response plan • maintain storage facilities at optimal holding condition • train personnel in safe fuel handling procedures of chemicals and hydrocarbons • ensure all fuel storage facilities are bunded and lined with impermeable materials • vehicle and equipment maintenance activities implemented using proper containment or other strategies to guide against spills • Monitoring during maintenance of equipment to ensure that there is no discharge to the environment	Low
	Traffic diversion and congestion along local roads during installation at road crossings.	Minor	PHCN and EPC contractor shall : • Coordinate tower construction and stringing activities to avoid heavy traffic periods • Use warning signs and traffic wardens/directors • Ensure activities causing blockages at road crossings are carried out within shortest time practicable • In the case of longer road blockages, divert traffic to approved alternate routes in liaison with appropriate authorities • Consult with affected communities prior to closures to provide warnings and alternatives.	Negligible
	Workplace accidents / incidents (trip/falls etc) from heights during conductor wire stringing and bolt/nuts tightening project activities.	Medium	• PHCN shall ensure SHE briefings prior to commencement of work activities • Develop standard work procedures where work hazards are identified and addressed • PHCN shall ensure personnel use appropriate PPE • PHCN shall design work area to internationally acceptable standards • Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available in case of accidents • Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care.	Negligible

	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro construction sites	Medium	PHCN and its contractors shall ensure; • All vehicles and boats are certified road worthy prior to being mobilized for work activities. • Compliance to all roads safety transport rules including speed limits • Competency training and certification of drivers before mobilisation. • Limit movement to day time only	Negligible
	Risks of fire/explosions resulting from accidental ignition of onsite diesel storage tanks	Major	PHCN and its contractors shall ensure; • All fuel storage tanks are kept at safe distances from work areas • Educate workforce on risks associated around storage areas and prohibit activities (such as smoking) that can ignite storage tanks • Designate no-smoking and smoke areas • Hold SHE meetings and talks on fire hazard	Negligible
	Waste Disposal • scrap metal, wood, sand, concrete, paper, domestic waste • used oil and replaced/obsolete equipment pars that may contaminate soil/groundwater • Waste from lay-down area and tower sites from grubbing of ROW	Medium	PHCN and EPC contractor shall : • Develop and implement a waste management plan • Provide adequate containers for waste collection • Periodically assess contractor activities to check the level of compliance to regulatory and PHCN waste management requirements. • Ensure engagement of government approved waste management contractors	Negligible
	Localised economic benefits from materials supplies by local contractors	Beneficial	PHCN and its contractors shall enhance this by: • Encouraging indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards • Encourage contractors to hire and to develop local labour	Beneficial
	Induced secondary development within the neighbouring host communities from increased economic activities.	Beneficial		

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Tower Construction and Erection • Crane lifting and erections • Bolts and nuts tightening • Anti climbing guards and step bolts • Insulators and fittings • Conductor wire stringing Connectors fixing, etc	Socio-cultural conflicts between the construction team and indigenous populace due to contrasts in believes and traditions	Medium	PHCN and its contractors shall • Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles • Establish and publicize grievance procedure • Continuous consultation while project is in progress • Implementation of community relations and engagement plan (see Appendix 5.2)	Negligible
	Visual intrusion as a result of alterations to normal landforms and aesthetic beauty of construction sites	Minor	• Where practically possible, provide a minimum of 1 km buffer area between the transmission line camp sites and sensitive visual receptors; and • Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil. • Existing facilities might be used for lay-down and camp site areas	Negligible
	Increased demand on existing infrastructure (roads, housing, medical facilities, etc) due to influx of workers / induced secondary development in the area during construction activities resulting in squatter settlements.	Medium	PHCN shall • Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project • Work with contractors to ensure that specialised skill workers from outside areas have access to proper accommodations and other basic infrastructure • Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job • Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care	Negligible
	Permanent loss of land (some with arable potentials) potentials along the transmission line ROW	Medium	• The final ROW shall traverse in an existing disturbance corridor like other transmission lines or pipelines, where farming activities have already been impacted. In this way negative agricultural economic impacts would be minimised. • Land owners shall be compensated for potential loss in revenue • Compensation shall be agreed between PHCN and the landowner and implemented accordingly	Negligible

	Site conditions leading to increased malaria epidemic from uncontrolled mosquito breeding in swamp areas, snake bites, as well as water borne diseases e.g. diarrhoea and cholera associated with poor sanitary conditions	Major	PHCN shall ensure: • Develop project health and safety plan to address all potential health issues • PHCN shall ensure personnel use appropriate PPE • Provide on-site emergency response plan • Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available to attend to emergency cases • Ensure that workers are provided with training on health risks, exposure, and management • Provide appropriate domestic water supply to address additional needs. • Facilitate the implementation of appropriate latrines and other sanitation facilities. • Provide information, education and communication about safe uses of water and occupational safety. • Environmental management for vector control; avoidance via settlement location and design and use of bed nets and repellents; rapid diagnosis and treatment; focal insecticide and molluscicide application. • Safe food storage and handling.	Low

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Construction				
Demobilisation • Demobilisation after construction phase	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	Medium	• PHCN shall ensure SHE briefings prior to commencement of work activities • Develop standard work procedures where work hazards are identified and addressed • PHCN shall ensure personnel use appropriate PPE • PHCN shall design work area to internationally acceptable standards • Ensure availability of first aid facilities onsite • Ensure retainer clinics are engaged and site medical personnel are available in case of accidents • Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care.	Negligible
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	Major	• PHCN shall enforce good environmental demobilisation procedures (e.g. cleaning sites and restoring to original status) • Use of drip pans during transfer of fuels and hazardous substances • Reclaim storage tank areas or contaminated soils • Carry out internal environmental assessment to check activities of construction team and status of lay-down areas, marshalling yards, tower sites, etc prior to demobilisation.	Negligible
	Traffic congestion during transportation of demobilised equipments and personnel	Minor	PHCN and EPC contractor shall : • Coordinate demobilisation activities to avoid heavy traffic periods • Use warning signs and traffic wardens/directors • Ensure activities causing blockages at road crossings are carried out within shortest time practicable • Consult with affected communities prior to demobilisation to provide warnings and alternatives.	Negligible

	Generation of dust and automobile / heavy duty equipment emissions.	Minor	• Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. • Extra care must be taken to reduce dust in periods when wind speed are greatest and the rainfall amounts are lowest which is between November and February (dry season), e.g. This will involve extra wetting of the construction area to suppress dust particles. • Ensure that all material (sand and aggregate) stockpiled along the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. • All staff employed at the construction site must be provided with dust masks and be asked to use them. • Implement a traffic system that involves appropriate signals and signs to ensure the smooth flow of traffic. This will reduce the idling of vehicles that may occur and therefore reduce the emissions in the area. • Reduce speed along earth roads • Plan journey to reduce travel times • Vehicles carrying earth materials should be covered • Install and operate air pollution control equipment e.g. mufflers.	Negligible
	Reclamation of marshalling yards, tower sites, access roads (to prevent unauthorised access) and lay-down areas	Beneficial	PHCN shall enhance this by: • Where possible contractor shall reclaim de-vegetated areas with topsoil, • Where possible, reclaim compacted floors with native plant species, etc. • Audit EPC contractor to verify reclamation of work sites, marshalling yards, lay-down areas etc	Beneficial
	Waste disposal (scrap metal, wood, sand, concrete, paper, domestic waste)	Medium	PHCN and EPC contractor shall : • Provide adequate containers for waste collection • Ensure all waster are removed from site • Audit contractor on waste disposal activities to check the level of compliance to regulatory and PHCN waste management requirements before leaving site.	Negligible
	Loss of employment and business opportunities due to completion of construction phase	Medium	PHCN and EPC contractor shall • Shall ensure skills acquisition and enhancement programs to further empower the workforce for meaningful employment opportunities after the project • Establish and publicize grievance procedure • Pay due wages for worked period and settle all financial commitments to workforce before demobilisation	Negligible

	Illegal access to transmission line towers leading to accident, sabotage, asset damage, and loss	Major	PHCN and EPC contractor shall : • Provide warning signs at access roads created to warn against dangers associated with transmission lines • Through consultations, sensitize stakeholders and members of the communities on need to stay clear of the transmission line and hazards associated with it • As much as practicable provide restrictions (e.g. anti-climbers) to unauthorised access to transmission lines	Low
	Soil runoff and erosion resulting in sedimentation problems	Medium	PHCN shall: • Install siltation traps within the drainage design to collect silt and sediments ensuring that they do not end up in adjacent aquatic areas. • Construction on steep slopes and in soft or erodible material will require erosion control measures and correct grassing methods. • Where possible contractor shall reclaim de-vegetated areas with topsoil, reclaim compacted floors with native plant species, etc. • Appropriate flow diversion and erosion control structures i.e. earth embankments must be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc. • Auditing EPC contractor to verify reclamation of work sites, marshalling yards, lay-down areas etc	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
		Operation		
Operations • Commissioning and testing • Testing and Turnover	Community dissatisfaction regarding the conduct of PHCN on compensation issues may lead to strife before full operations of transmission line	Major	• Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities (see Appendix 5.2) • Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons • Establish and publicize grievance procedure • Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. • All affected stakeholders and legacy issues are identified early, clearly defined, and agreed on. • Stakeholders (communities, Govt., land owners, etc.) are adequately consulted and relevant issues addressed • Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. • As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development	Negligible
	Development of agricultural land due to easier access and consequent discovery of new arable lands for farming	Beneficial	• Take into account the various land uses while designing the project in order to minimise the loss of land, particularly productive land. • Timely completion of the project so that associated benefits such as reduction in environmental pollution, business opportunities, quality of life, etc shall take effect.	Beneficial
Operations • Electric power transmission using the installed lines after commissioning.	Increased electricity transmission and distribution capacities within the national grid	Beneficial		
	Increased business opportunities and quality of life (small, medium, large scale) due to enhanced power delivery	Beneficial		
	Improvement in environmental standards due to reduced emission from standby diesel or fuel generators, use of fuel wood.	Beneficial		
	Reduced demand on petrol and diesel used for power generation and further reduction in greenhouse gases and noise emissions.	Beneficial		

	Uncertain effects of electromagnetic radiation on ROW users exposed to (and residents near to) transmission line generating electromagnetic field	Medium	• Provide and ensure use of appropriate PPE • Alternative analysis of the ROW options ensured minimal to no exposure of public to electromagnetic fields • Also transmission line has been designed in line with ICNIRP/WHO standards for biological exposures	Negligible
	Risk of collision of low flying air planes with transmission towers and lines	Major	• Alternative analysis of the ROW options ensured minimal to no interference with air traffic • PHCN shall provide Aircraft Warning spheres and tower signs in areas where air traffic might occur in order to minimize risk of low flying aircraft colliding with towers and wires.	Negligible
	Electric shock and burns to members of the public in the event of tower collapse or damage to transmission wires	Major	• Towers shall be installed following the best engineering standard • Towers shall be collapse tested to prove the tower design is in line with the PHCN requirements • PHCN shall carry out routine inspection of towers in order to allow early detection of damaged towers • Reported cases of damaged or fallen towers shall be promptly attended to • Adequate and automatic fault/damage detection system shall be installed. • Personnel shall be trained on the detection/handling of such emergencies arising from accidental damage	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Operation				
Operations • Electric power transmission using the installed lines after commissioning.	Unchecked encroachment on the ROW, leading to land-use conflicts and accident.	Medium	PHCN and EPC contractor shall : • Provide warning signs at access roads to warn against unauthorised entry • Through consultations, sensitize stakeholders and members of the communities on government policies along established ROW	Negligible
	Noise along the transmission line due to corona effects (humming sound)	Minor	• The design of the transmission line shall be in line with standards observed by International bodies as well as PHCN. • PHCN shall assure during transmission line component testing that national and international standards and limits are complied with.	Negligible
	Distortion of transmission signals and electrostatic circuit due to electromagnetic induction.	Medium		
	Use of track corridors for other facilities (TLine, communication cables as well as water pipes etc)	Beneficial	PHCN shall enhance this : • By providing platform for consultation and communication to future developments along the project area	Beneficial
	Local fauna disturbances from electromagnetic field along the TL ROW	Medium	• The design of the transmission line shall be in line with standards observed by International bodies as well as PHCN. • PHCN shall assure during transmission line component testing that national and international standards and limits are met.	Negligible
	Mortality of birds, due to collision with earth wires on towers.	Medium	The routine line patrols by PHCN maintenance crew will look out for any bird collisions. If any collision "hot spots" are identified, these can be mitigated reactively.	Negligible
	Effectively evacuate power to be generated by QIPP in Ibeno for further distribution within the national grid.	Beneficial	Impact is beneficial and shall be enhanced by sustaining the transmission line life span, through adequate and effective maintenance activities as well as complying with federal government's policies and laws on power transmission and distribution.	Beneficial
	Add to FGN plan to meet 20,000MW electric power capacity by year 2020.	Beneficial		
	Development of new infrastructures or improvement to existing ones.	Beneficial		

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
Operation				
Maintenance • Tower inspection and checks • Line element replacements • ROW maintenance • Substation maintenance	Proliferation of weeds around towers and below ROW	Minor	PHCN shall to extent practicable periodically carry out ROW maintenance activities to manage growths of weeds and other creeping plants on the tower bases in a manner that minimizes adverse impacts on vegetation.	Negligible
	Disturbance of bird habitats and avifauna from activities of maintenance crew.	Medium	• Disturbance of grassland during construction and operation should be kept to a minimum. • The activities of the construction and operations staff shall be restricted to the ROW and immediate surrounds. • Develop policies that prohibiting hunting by staffs	Negligible
	Development of local maintenance activities to encourage employment and empowerment within the communities.	Beneficial	• Ensure the participation of men and women in local maintenance activities such as weeding of the ROW.	Beneficial
	Interference with local traditional festivals or activities by unscheduled maintenance work and failure to keep to management plans may lead to community strife.	Major	• Plan activities to minimize work activities during local events • Operators will obtain information about planned local activities and avoid disturbing them by shifting maintenance activities to other days whenever possible • Formal notice of any maintenance work should be given in advance to the communities along the area. Access to the line must be via the approved access roads and corridors (agreed with the host communities). • The notice shall give details of the purpose of the access, the contact person and number of people to be involved, time frames and machinery that will be used. • schedule and implement recommendations of the Community Relations and Engagement Plan and approved work procedures	Low
	Maintenance of towers within sensitive environments e.g. mangrove swamps, river banks may lead to disturbance of hydrological regime (micro scale) in river banks	Medium	• Appropriate flow diversion and erosion control structures i.e. earth embankments shall be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc. • Access into the riparian zone and floodplains of rivers should be prevented as far as possible. Where access into these areas is required a preferred corridor should be determined. No deviation from these corridors should be allowed. • Areas to be rehabilitated should be identified and reclaimed.	Negligible
	Lack of maintenance along TL ROW may lead to collision of wildlife with the stays that are not visible in the dense vegetation	Medium	Anchors shall be marked with material that will be visible to animals and PHCN shall ensure that regular clearance of vegetation takes place around the towers.	Negligible

	Limited knowledge on safety measures and behaviours associated with line operation that can lead to accidents	Medium	Plan information, education and communication activities during and after project implementation to increase awareness of all users (men and women) on dangerous behaviours and safety measures required.	Negligible

Table 6.1: Proffered Mitigation Measures for the Proposed Transmission Line Project Cont'd

Project Activities / Environmental Aspects	Potential and Associated Impacts	Significance Before Mitigation	Mitigation / Enhancement Measures	Residual Ranking
		Decommissioning and Abandonment		
Decommissioning / Abandonment • Unstringing of conductor wires • Tower / facilities removal • Waste generation •	Increased sedimentation process close to river banks and floodplains along the tower sites.	Medium	• Ensure that excavated and stockpiled soil material is stored on the higher lying areas of the site and not in any storm-water run-off channels or any other areas where it is likely to cause erosion or where water would naturally accumulate. • Decommissioning activities should preferably take place during the dry season months to prevent soil erosion caused by heavy thunderstorms associated with the rainy season in the project area. • The area shall be graded and re-vegetated to ensure that rainwater drains gradually over the site without creating erosion gullies.	Negligible
	Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages and wastes from decommissioning.	Major	• Ensure that no wastes and hazardous materials generated on the site are dumped or deposited on adjacent/surrounding surface waters including roads or public places during or after the decommissioning period. • Enforce proper waste management policies in line with FMENV standards and requirements. • Ensure that all project associated wastes and hazardous materials are disposed off in line with project waste management plan.	Negligible
	Increased dust and vehicular emissions during transport.	Minor	• Wet all unprotected cleared areas and stockpiles with water to suppress dust pollution. • Cover materials such as sand and other rubble during transport to and from the site with a tarpaulin. • Ensure use of road worthy vehicles and equipment as well as skilled operators and drivers • Limit speed of vehicles and travel time to and from decommissioning site.	Negligible
	Increase in ambient noise levels above baseline conditions from movement and activities of decommissioning equipments and automobiles.	Minor	• Limit work activities to daytime only • Ensure maintenance of vehicles and equipments • Provide and encourage use of PPEs.	Negligible

	Traffic obstruction from transportation of decommissioned structures and equipments to receiving hub.	Medium	• Plan decommissioning activities in consideration of peak traffic times. • Ensure that the handling of equipment and materials is supervised. • Use signs, posts, and guides to manage traffic and direct users accordingly	Negligible
	Risk of accident and injury to worker during demolition of structures	Medium	• Develop a work plan for safe demolition • Ensure hazards are identified and addressed prior to commencement of work. • Provide and enforce the use of PPE • Ensure that decommissioning and demobilisation vehicles are under the control of competent personnel. • Provide adequate facilities on site to treat emergencies to staff.	Negligible
	Risks of pirate attacks and possible hostage taking which may lead to injury or fatality of personnel.	Major	• PHCN and contractors shall ensure: • Ensure implementation of project security plan during decommissioning • Approved procedures are strictly enforced and continually improved based on updated risk information. • Maintain ongoing cordial relationships with the stakeholder communities. • Certify government approved security guards are used on demobilisation vehicles when warranted • when necessary PHCN shall activate its emergency response procedure • Implement effective journey management plan.	Low
	Availability of land for alternative uses	Beneficial	This is a beneficial impact and PHCN, relevant government agencies together with stakeholders shall work out processes for land relinquishment or alternative uses as at the time of decommissioning.	Beneficial

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN

7.1 General

This chapter presents the Environmental Management Plan (EMP) developed for the proposed 58km 330kv QIT – Ikot Abasi Transmission Line project.

EMP is developed to ensure that the mitigation measures as described in **chapter six** of this report and monitoring requirements as outlined in this EIA and any environmental compliance review shall actually be carried out in subsequent stages of the project. EMP is therefore an important management tool which sets out conditions and targets to be met during project implementation. This EMP contains among others the following key items:

- Summary of potential impacts
- Planned mitigation measures
- Planned environmental monitoring
- Planned public consultation process
- Responsibilities and authorities for implementation of mitigation measures and monitoring requirements
- Mechanisms for feedback and adjustment

7.2 EMP Objective

The EMP is designed to:

- ensure progressive reduction of the impacts of the project activities on the biophysical, socio-economic and health environment with the ultimate aim of eliminating them;
- ensure that all mitigation and enhancement measures prescribed during the impact assessment process for eliminating or minimising the adverse project impacts as well as optimally enhancing the beneficial impacts are fully implemented; and
- provide part of the basis and standards needed for overall planning, monitoring, auditing and review of environmental and socio-economic performance throughout the project life cycle.

These objectives shall be achieved by:

- ensuring compliance with all stipulated legislation on protection of health, safety and environment policies;
- integrating environmental issues fully into the project development and operational philosophies;
- promoting environmental management awareness among workers;
- rationalising and streamlining existing environmental activities to add value to efficiency and effectiveness; and
- ensuring that only environmentally sound procedures should be employed during the project.

7.3 Environmental Management and Administration

The organogram showing the PHCN line of authority and implementation of the EMP guidelines is shown in **Figure 7.1**. FMENV would closely monitor the EMP implementation and this shall involve a two-way information flow between PHCN and the regulatory body.

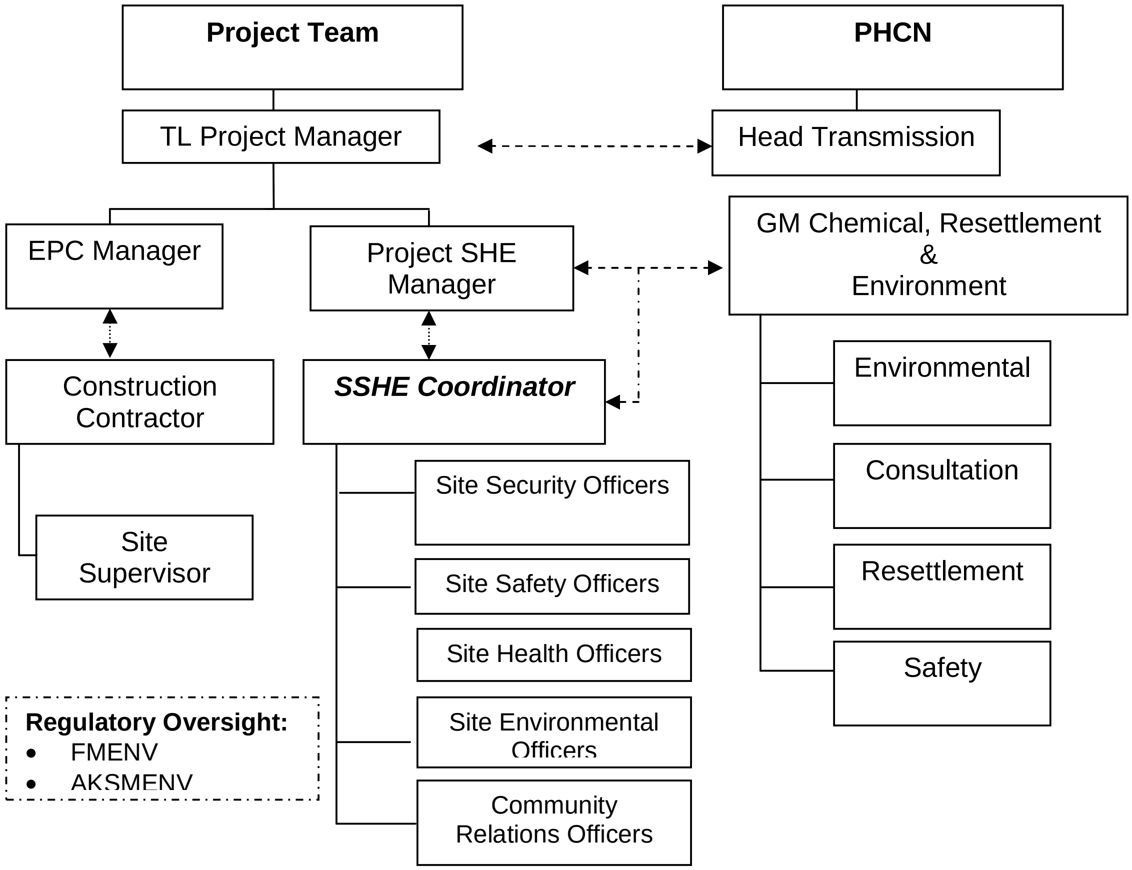


Figure 7.1: Project/EMP Implementation Organogram

- The FMENV has the responsibility of enforcing national environmental laws including international environmental laws which Nigeria has subscribed to;
- The FMENV will serve as a regulatory oversight to the EMP implementation of this project;
- The FMENV shall in coordination with the AKSMEMR ensure that PHCN periodically make available, documentations in form of monthly/quarterly reports or as may be required showing evidences of caring out monitoring requirements, etc

GM Chemical, Resettlement and Environment

The GM CR&E shall be responsible for ensuring that all environmental standards and guidelines throughout the project life cycle are followed and implemented. The GM shall be responsible for environmental operation, including environmental supervision of contractors. He shall ensure implementation of the environmental management plan during the project phases. The GM is also responsible for liaising with the relevant stakeholders as well as the local community members.

SHE Coordinator

The SHE coordinator shall report directly to the transmission line Project Manager (PM). The coordinator shall have the authority to stop work or any activity which poses danger to the environment, workers, or the general public during the project construction phase, until measures are instituted to eliminate the dangers or threats. His responsibilities shall include:

- ensure that mitigation measures outlined in the EIA are implemented;
- liaise with the GM CR&E , contractors, and other supervisors to ensure as far as reasonably practical, environmental protection, safe and healthy conditions at all work sites;
- coordinate environmental and safety activities between PHCN, and all contractors/organisations providing services at the project site;
- ensure clear communication of safety, health and environmental and socio-cultural information to all categories of workers;
- liaise with management in deciding which environmental and safety concerns could be handled in-house and which matters shall require external assistance; and
- co-ordinate, investigate and review environmental and safety incidents and complaints and maintain separate site incident and complaint records.

7.4 Awareness Creation and Training

During the construction phase of the project, the following environmental awareness and trainings programs shall be conducted:

Induction Briefing

An induction briefing shall be a requirement for every construction worker to be engaged in the project and shall be provided by the contractors. The briefing shall include:

- the proposed tasks for new workers;
- safe work procedures;
- use of personal protective equipment
- emergency responses and warning notices;
- personal hygiene and site sanitation issues;
- environmental protection ; and
- hazard recognition and incident reporting.

Weekly Safety and Environmental Forum

There shall be a weekly environmental and safety awareness forum for construction workers during the construction activities at the project site. PHCN shall be responsible for coordinating these meetings.

During the operation phase of the project, PHCN shall educate all its workers on environment, health, and safety issues using the following means to disseminate information to staff and workers:

- staff and workers meetings;
- local area network and the internet; and
- annual bulletins on PHCN operations.

7.5 Public Participation/Involvement

PHCN shall welcome suggestions and information from relevant stakeholders, contractors, visitors and the general public, which shall help improve its operations in order to minimise impact on the environment and worker health and safety. The office of the transmission manager shall be open to the general public for complaints and suggestions

Complaints received from the public shall be documented and follow-ups made to ensure that such grievances are addressed accordingly and in line with the PHCN's grievance redress mechanism.

7.6 Monitoring

Project activities shall be monitored in order to:

- ensure that the EMP is implemented; and
- assess the efficiency of mitigation actions;
- provide updates where necessary

All contractors shall be required to self-monitor their performance with respect to environmental and social performance. The PHCN SHE Engineer shall also undertake quarterly environmental assessment and random walk throughs and spot checks throughout the project lifecycle. Assessment findings shall be reviewed by the project management team and where corrective actions are necessary, specific plans (with designated responsibility and timing) shall be developed to ensure continuous performance improvement.

In addition to assessing operational aspects and monitoring, assessments shall also consider compliance with agreed objectives and targets, and the effectiveness of the EMP and its implementation. The EMP shall, therefore, be subject to ongoing review and development to ensure that it remains appropriate for all aspects of the project. As is typical with all Federal Ministry of Environment approved projects, the ministry will carry out an assessment before the end of the project to confirm compliance of project activities to the terms and conditions of the EIA approval.

7.7 Reporting

EPC contractor shall be required to provide monthly reports on environmental and social monitoring and performance. The report shall include compliance status of the mitigation and monitoring requirements of the project EMP as well as other project related regulatory requirements. PHCN shall also develop a system of internal reporting that provides robust internal communication on the full range of environmental and socio-economic issues and monthly assessments of the effectiveness of the management programme.

7.8 Uncertainty and Change Management

Uncertainty in the development of the transmission line project derives from a number of factors including:

- unconfirmed final design features;
- detailed data on geotechnical conditions; and
- unforeseen events.

A key element of ongoing environmental and social management is to address uncertainty through collecting information, additional assessment and, where necessary, the development of further mitigation and management measures.

The process of environmental assessment does not stop with submission of the reports to the authorities, or with government approval. This EMP shall require a mechanism to manage change. Sometimes these changes may be material ones that could influence the original findings of the environmental assessment and hence the basis for its approval.
PHCN shall therefore, implement a Change Management System to ensure that changes to the scope of the project, or any new information, are subjected to an assessment process. All changes shall be evaluated for their degree of significance, and incorporated into the appropriate project documentation as follows:

- minor changes shall be reflected in updates to the EMP; and
- substantive changes that might potentially alter the environmental assessment findings (i.e. result in changes to the predicted significance of environmental and socio-economic impacts) shall be subject to re-assessment, including the possibility of further stakeholder consultation, supplementary reporting and revision of the project's EMP. There shall be a reporting system between PHCN, the government and any other interested and affected parties.

7.9 Environmental Aspect Management Guideline

PHCN has set objectives and targets in managing significant environmental aspects in line with ISO 14001 Environmental Management System requirement for the proposed project during construction and operation phases. Commensurate resources shall be allocated to meet specific plans. These plans shall be reviewed yearly by PHCN management to monitor progress.

PHCN management through SHE engineer shall be responsible for implementing the mitigation measures for environmental aspects/impacts of the proposed transmission line.

This shall be within the scope of relevant SHE policies and regulatory requirement as well as standard industry practice. At construction phase however, the EPC contractor shall be responsible for ensuring that all SHE requirements are met. The contractor shall report to the PHCN management through the SHE engineer.

7.9.1 Environmental Management

The environmental aspects that are likely to be significantly impacted by all the phases of the project such as pre-construction, construction, operation, and decommissioning have been identified and addressed in the environmental management plan. In addition to this, project specific plans that will incorporate implementation of recommended measures for each work phase and aspect will be developed by the contractors to ensure that all health, safety, and environmental concerns are fully covered for the entire project. Since these plans will be developed at stages where specific project details are available, they will therefore present comprehensive steps for the implementation, monitoring, and reporting from inception to projects completion and decommissioning.

Based on project related information available at the time of this study, the management objectives, set target, required actions, monitoring and reporting for various aspects/impacts are also presented below.

Air Quality Management Plan

Objective	To minimise the release of emissions (combustion products and particulate/dust) to air during all construction phases of the project
Target	Limit emissions of pollutant gases like NOx, SOx, CO, in addition to dust, smoke, and fumes, within acceptable standards through all construction phases of the project work activities
Action	• Maintenance programme shall be developed and implemented for all associated power generators and heavy duty equipment • Controlling fuel consumption for all equipment and vehicles through prudent work execution and effective journey management • Implement basic environmental awareness management program • Limit use of diesel powered generators to minimum required to sustain uninterrupted operation. • Vehicle speeds in construction area and unpaved local roads shall be limited to a maximum of 30km/h. • Where practicable, vehicles and machinery that are used intermittently should not be left idling for long periods of time. • Re-vegetate disturbed areas as soon as possible. • Wet areas that have the potential of raising significant dusts during work activities • No open burning of waste to be undertaken.
Monitoring	Visual inspection shall be undertaken by the SHE focal person/Contractors to check for evidence of excessive dust generation. If necessary, dust monitoring shall be undertaken in areas likely to generate dust that would affect nearby residents and workplaces to determine whether controls are being applied effectively. Maintenance schedule and records shall be kept
Indicator Parameters	Fuel consumption of equipment which allow for determination of parameters like SPM, NOx, SOx, COx,
Responsibility	Site Environmental Officer
Reporting	Maintain a log book for site fuel consumption and estimate emission from consumption. All issues shall be documented, acted on and reported in accordance with site procedures.

Noise and Vibration Management Plan

Objective	To minimise the generation of noise emissions during all the construction phases of activities and to mitigate any potential noise impacts.
Target	Construction activities undertaken to comply with FMENV recommended ambient noise level guidelines
Action	Contractors during the construction phase shall implement the following strategies: • Notify residents in affected areas of the project prior to commencement of construction. The notification would include the type of works to be undertaken, the duration of the proposed works, and a contact for any questions or concerns that may arise in the course of the work • Ensure that all equipment have effective noise control measures. Effective noise controls include: o Monthly inspection and maintenance of all vehicle and construction equipment and generators used in operation. o Use of sound suppressive device such as mufflers and silencers where possible. o Where practicable, vehicles and machinery that are used intermittently should not be left idling for long periods of time. • Noisy activities during construction/decommissioning shall be conducted during the day. • Best available work practices shall be engaged on-site to minimise occupational noise levels. • Haul routes for construction traffic entering and leaving the site shall be selected in a way that ensures noise levels at noise sensitive receptors are kept at a minimum. • Use of personal protective equipment(PPE) e.g. ear plugs for personnel working in areas where noise is a concern i.e. above 90dB(A) • Define high noise level working areas by engineering analysis of equipment for which hearing protection is required and provide appropriate warning signs
Responsibility	Site Safety, Health and Environmental Officers
Monitoring	Monitor high noise areas for proper use of PPE equipment in accordance with WHO / FMENV guidelines and standards. Schedule maintenance shall be undertaken for construction equipment and power generators to ensure an optimal working condition.
Reporting	All complaints shall be documented, acted on and reported in accordance with site procedures.

Water Quality Management Plan

Objective	Avoid the contamination of surface water during construction.
Target	Surface water is not contaminated during construction activities
Actions	• Implement controls such as berming, use of secondary containment and trays to ensure all transfer of fuels and chemicals are properly managed to prevent spillage outside of bunded areas. • Provide bunded storage areas for fuels and hazardous substances with spill cleanup kits in accordance with FMENV requirements/standards. • The project shall ensure that measures are adopted to avoid incursion into areas adjacent to the work site or any secondary effects from pollution, sedimentation, or accidental spills. • Suitable site drainage system to be constructed in lay-down areas and marshalling yards
Monitoring	Inspections of construction areas and assessment of the condition and operability of site drains shall be conducted. Weekly inspection of all fuels and chemicals storage areas to ensure adequate containment and handling.
Responsibility	Site Health and Environmental Officers
Reporting	All complaints shall be documented, acted on and reported in accordance with site procedures. • Incidents of water contamination or spills • Results of inspections • Results of any corrective actions

Soil Contamination Management Plan

Objective	Prevent soil contamination
Target	• No incidents of soil contamination by hazardous substances (diesel, petrol, hydraulic oil, lubricants and paints)
Actions	Avoid the risk of soil contamination from all construction activities. Measures to be adopted shall include: • Construct spill containment facilities (containment walls). • Train operators on safe handling of chemicals and enforce the implementation of safe work practices/procedures. • Develop and implement site specific emergency and spills response plan • Provide emergency and spills response equipment and training of personnel on effective and timely use • Use drip pans during fuel transfer operations • Identified contaminated area shall be promptly cleaned up, reported and monitored in accordance with regulatory and project approved requirements
Monitoring	• Weekly inspection of all fuels and chemicals storage areas.
Responsibility	• Site Environmental Officers
Reporting	• Maintain records of inspections. • During construction, records of any contamination incidents shall be reported according to approved procedures

Flora Management Plan

Objective	To minimise disturbance and loss of local flora population.
Target	No disturbance of flora outside of designated construction areas.
Action	• Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by EPC contractors to ensure appropriate flora management. This plan shall indicate lists of animals and plant species of concern, development and implementation of a training program that would include photos and other information to identify the various species, procedures for responding if one of the species is found (such as contacts, stopping work until relocation or protection is effected, reporting the incident in routine progress reports, etc.), where appropriate to ensure the designation of certain areas as sanctuaries for species that may be displaced by the project and requirement for a survey by qualified biologist(s) ahead of ROW clearing, as well as strict prohibition for the workforce on killing or capturing any of the species. • Limit construction of lay-down areas, marshalling yards, access road, ROW clearing etc. to maximum foot print required for safe operation. • Areas of terrestrial habitat that were temporarily disturbed during construction (lay-down areas, marshalling yards, etc) will be reclaimed (e.g. topsoil replacement, backfilling trenches, etc). • The project specific emergency and spill response plan will cover hazardous materials management plan such as fuels, oil, and other potentially hazardous materials on the site. • A project specific waste management plan shall address adequate management of potential wastes to be generated by the project
Monitoring	Periodic inspection of the site area. (6 monthly to a year depending on the phase of project to check for disturbances to floristic composition)
Responsibility	Site Environmental Officers
Reporting	Any incidents of invasive species shall be reported in accordance with site reporting procedures along the ROW.

Fauna Management Plan

Objective	To minimise temporary disturbance of terrestrial fauna during transmission line construction and operations
Target	Minimise impact on the local fauna
Actions	• Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental Management Plan to be developed by EPC contractors to ensure appropriate fauna management. This plan shall indicate lists of animals and plant species of concern, development and implementation of a training program that would include photos and other information to identify the various species, procedures for responding if one of the species is found (such as contacts, stopping work until relocation or protection is effected, reporting the incident in routine progress reports, etc.), where appropriate to ensure the designation of certain areas as sanctuaries for species that may be displaced by the project and requirement for a survey by qualified biologist(s) ahead of ROW clearing, as well as strict prohibition for the workforce on killing or capturing any of the species. • Work activities to be limited within minimum area required for operations to minimize disturbance to wildlife habitats • Workforce shall be educated on biodiversity and good conservation practices. • Construction workers shall be prevented from transporting or keeping pets in the construction camp. • Species identified to be unable to move from the project site shall be safely relocated prior to commencement of work in the area
Monitoring	Monitoring for evidence of habitat disturbance or invasive species shall be undertaken
Responsibility	Site Environmental Officers
Reporting	• Incidents of non-approved disturbance of fauna shall be reported and addressed to prevent repetition. • Vulnerable species in line with Nigerian conservation ranking (Act 11, 1985, see **Table 4.12**) sighted shall be reported. . Report should include the date and location (latitude/longitude) of the animal.

Aesthetics Management Plan

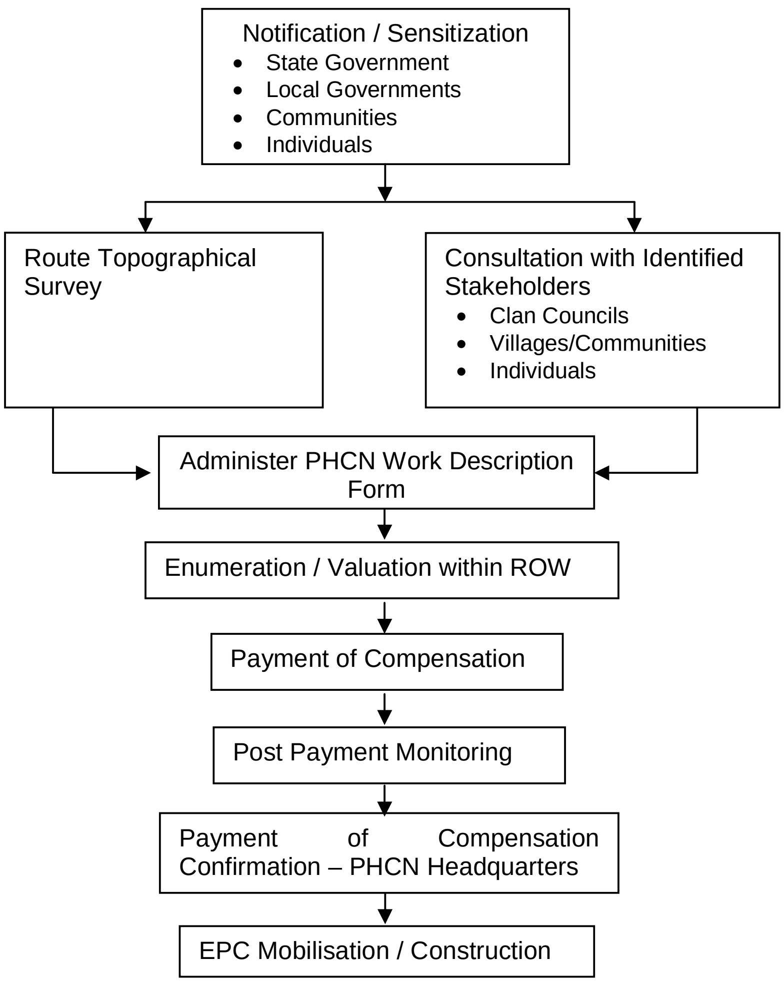
Objective	Minimise the visual impact of the transmission line corridor on surrounding areas.
Target	Minimize visual impacts as practical
Actions	Landscaping where necessary on the acquired ROW • Identify and incorporate plant species with the potential to effective screening. • Utilise indigenous species, preferably those that are endemic to the area • • Good housekeeping practices shall be maintained accordingly to reduce poor aesthetic conditions around construction sites.
Monitoring	Inspection of the health and vigour of the landscaping/planting areas.
Responsibility	Site Environmental Officers
Reporting	Any improvement or deterioration shall be reported in accordance with site reporting procedures

Social-cultural Management Plan

Objective	• To ensure that there are no adverse effects on the region's cultural values. • Minimise social and/or community impacts associated with all work activities. • Maximise opportunities for local engagement and businesses opportunities during the various project phases especially during the construction period.
Target	• Cultural values understood and protected by PHCN • Receive and respond to complains about social or community management issues
Actions	• Develop and implement community relations and engagement plan (see Appendix 5.2) • Develop a RAP in line with OP 4.12 for The World Bank's approval. Ensure ROW acquisition strategies in line with the approved RAP prior to commencement of work. • No unauthorised disturbance of cultural activities by the transmission line works • Plan activities in recognition of indigenous cultural activities. • Continue to consult with the indigenous communities. • Accommodation shall be provided for some construction workers (not from surrounding communities) to minimise pressure on existing infrastructure • Basic health and medical services (first level assist, first aid) shall be available to reduce the demand on existing health facilities. • Specify and implement the behaviour standards expected from all construction workers. This shall be formalised in a code of conduct that shall be agreed to and signed by every employee and sub contractor. • Complaints about unacceptable behaviour from construction workers shall be investigated and, appropriate action taken. • Use a wide range of communication tools to ensure that community is kept informed of project progresses. • Offer opportunities for the involvement of local businesses and for the employment of local residents.
Monitoring	Review feedback from the traditional rulers and the community groups and related Government/non-Governmental Organisations. Monitoring shall be by stakeholder feedback and by review of complaints.
Responsibility	Community Relations Officer
Reporting	All complaints received shall be reported to the project manager. Monthly reports shall be prepared on social and cultural management issues and any corrective actions undertaken

Since no physical cultural features have been identified so far by the EIA, a Chance Finds Procedure will be developed by the EPC contractor to ensure that any such findings that will be affected by the project are protected. The Chance Finds Procedure will include sufficient information to guide equipment operators and other personnel on how to recognize things that might be of cultural importance and the relevant actions to take such as stopping work immediately, notification of appropriate authorities, and protection of the area as well as the discovered resource for the determination of the value and subsequent actions prior to commencement of work.

As a key part of the social-cultural management plan, a summary of the process for enumeration/valuation and compensation programme of PHCN that will be developed for the project is presented below.



Details on step by step implementation are provided in Resettlement Action Plan document for the proposed project (**Document No: C658-FNL-AD-6047**).

A Grievance Redress Committee will be set up by PHCN to address complaints from compensation issues. Its members will include legal and accounts representatives of

PHCN and PAP Committee. The traditional line of authority equally plays a significant role in the grievance redress mechanism by mediating between the PAPs, nominated family and community representatives and the grievance redress committee. The functions of the Grievance Redress Committee are:

- Provide support to PAPs on problems arising from loss of private properties and business area.
- Record the grievance of the PAPs, categorize and prioritize the grievances that need to be resolved by the committee; and
- Report to the aggrieved parties about the developments regarding their grievances and the decision of the project authorities.

Security, Health, Safety, and Environmental Management Plan

Objective	To ensure that the project does not adversely affect the security, health, safety of the employees, contractors or the general public as well as the environment.
Target	Zero reportable injuries, spills, and work-related illnesses
Actions	• The EPC contractor shall be required to prepare a project specific Security, Health, Safety, and environmental Management Plan in accordance with the requirements of PHCN management system. • Site specific Environmental Management Plan to be prepared by the EPC contractors will be developed prior to construction activities, after specific areas have been determined for project activities to ensure appropriate environmental management strategies. • All workers on the project shall go through a compulsory orientation programme before they start work. • Environmental,, Health, Safety, and Security plans, programs, and regulations governing the project would be implemented and complied with. • Every worker would be made to sign a personal commitment to individual and corporate safety while at work. • Health, Security, Safety, and environmental awareness programs e.g. AIDS, and malaria awareness) shall be organized for personnel.
Monitoring	The security, safety, health, and environmental performance shall be monitored in accordance with the project and corporate procedures and reported to the project management team.. Monthly/Quarterly audits shall be executed
Responsibility	PHCN CR&E unit, Project SSHE Manager, and Project Manager
Reporting	Monthly reports shall be prepared on health, security, environment and safety performance along incidents and corrective actions undertaken

AIDS / Malaria Education and Prevention Program – Workplace Framework

PHCN recognises the devastating impact that HIV/AIDS as well as malaria can have on peoples' lives. Ninety percent of malaria-related deaths occur in sub-Saharan. Around 40 million people are living with HIV/AIDS worldwide. Sub-Saharan Africa is the most severely impacted region in the world with more than 26 million people infected and more than two million deaths in 2003 (UN AIDS Epidemic Update 2003)

The project Health Management Plan to be developed by the EPC will identify strategies for the management of potential project health related issues (such as malaria, HIV/AIDS, etc.). The contractor will be responsible for the implementation, while monitoring will be coordinated by PHCN.

Public health risks present significant issues for PHCN operations. PHCN management as well as employees and contractors will be committed to working actively together to mitigate the impact of infectious diseases such as HIV/AIDS and of malaria.

The programme is envisaged to build on PHCNs commitment to the health and safety of our employees. The primary aim of the programme is to provide a consistent and effective prevention education message that is based on identified best practices available for local adaptation, as appropriate, by each unit and entirety of its employees and contractors. The programme elements will address:

- Workplace prevention education programme to encourage safer behaviour, and.
- Medical policies in which HIV/AIDS as well as malaria are addressed like other illnesses

Regulatory Compliance Plan

Project-specific compliance requirements such as laws, regulations, permit and approval requirement and conditions, shall be identified and documented in a Regulatory Compliance Plan (RCP). This plan will comprise of a spreadsheet that lists the identified obligations along with responsible persons and timings. It will be approved by the Project manager while the site environmental officers will be responsible for its implementation, monitoring, and reporting.

Security Plan

The project will develop a security plan that identifies and address security challenges of the project. A site security officer will be responsible for the implementation, reporting, and monitoring of this plan. SHE Manager shall ensure that adequate security resources are provided to handle security-related incidents effectively. The security activities will be in line with PHCN's security guidelines.

In addition, EPC contractor will be required to prepare and submit the project security plan to PHCN for review and approval before mobilisation to site. The project team will also organise a security workshop to identify, evaluate and recommend contingency plans for all security risks.

7.9.1.1 Responsibilities and Cost for EMP Implementation and Monitoring

Majority of the identified impacts would take place during preconstruction and construction phases. Impacts identified for the operation phase are minimal. Mitigation measures for each of the phases have been presented in **Chapter 6**. The EPC contractor will be directly responsible for financing the implementation of mitigation and monitoring measures from inception to the completion of the transmission line project. The cost of impacts mitigation monitoring will be included in the EPC contract value and will be monitored by PHCN designated representatives assigned to the project.

PHCN shall be responsible for auditing of the activities of the EPC and for the associated funding. Annual auditing of the facilities and activities from inception to completion of the Project is estimated to cost about N15,000,000. During operations, PHCN will be responsible for financing and managing mitigation measures and monitoring activities in line with their established practices nationwide.

Part of the conditions of the approval of the EIA by the Federal Ministry of Environment (FMENV) is that there will be regulatory monitoring of the approved project impacts mitigations and monitoring measures. The timing and frequency of the monitoring is determined by the FMENV. FMENV works closely with the state Ministry of Environment in monitoring the implementation of the EIA approval terms and conditions. Funding of the Impacts Mitigation and Monitoring (IMM) is borne by the proponent, in this case, PHCN. Prior to now, FMENV will request funding for the monitoring while the project is in progress and the monitoring activity will be carried out after payment of the requested fund. Current practice is that FMENV now issues a pre-approval letter which includes the cost of IMM and other conditions that has to be fulfilled prior to the issuance of the approval. Meeting the conditions, along with payment of the funds have therefore become prerequisites to the issuance of the EIA approval. Payment prior to approval also ensures that the funding for monitoring is secured and the activity effected as at when due. The current cost is about N500,000.00.

7.9.2 Guideline for Waste Management

Waste shall be managed in accordance with Federal Ministry of Environment guidelines and PHCN waste management procedures. The principle of waste reduction, recycling, recovery and reusing shall be practiced. In addition to the regulations of FMENV, the project will also comply with other national and international environmental standards that are binding on all staff and contractors involved in the proposed project with respect to the following:

- emission or release of pollutant, exhaust and/or fugitive gases;
- discharge or spill of effluent into surface water, swamp or land; and
- discharge of solid wastes (including domestic waste) into surface water, swamp or land;

The EPC contractor is also expected to develop and submit for approval to PHCN a comprehensive waste management plan to be used during the project. This waste management plan shall be in line with PHCN SHE Management System and well as comply with national and international waste management standards.

Waste Handling

For proper handling and disposal, wastes shall be well defined at source and the definition transmitted along with the waste to the final disposal points. EPC contractor and PHCN personnel shall define and document all wastes generated during all operational processes. The required basic information that would be provided, as a minimum, for adequate definition of wastes include:

- waste type identification;
- proper waste categorisation;
- waste segregation information;
- location of generation, and
- recommended management practices.

Waste Minimisation

Waste minimisation involves reduction to as low as practicably possible volume or toxicity of waste materials. The four principles of waste minimisation process; recycle, reduce; reuse and recovery shall be adopted as applicable. In order to achieve a significant reduction in waste volume during the proposed project, the functions of activity level, age depreciation and maintenance level of facilities and operating equipment would be closely monitored. A large proportion of excavated material shall be used for landscaping or other remedial works on site. The key elements of the four waste minimisation/management principles/practices are outlined below.

Category	Definition
Reduce	• Process modification / design change • Material elimination • Inventory control and management • Material substitution • Improved housekeeping
Reuse	• Chemical/oil containers • Re-use waste heat
Recycle/Recover	• Recycle scrap material • Recycle paper • Burn waste lubricating oil for energy recovery • Recover oil from tank bottoms

Waste Segregation

For effective implementation of appropriate waste disposal methods, it is important that wastes be segregated, preferably at source into clearly designated bins at strategic locations (**Figure 7.2**)

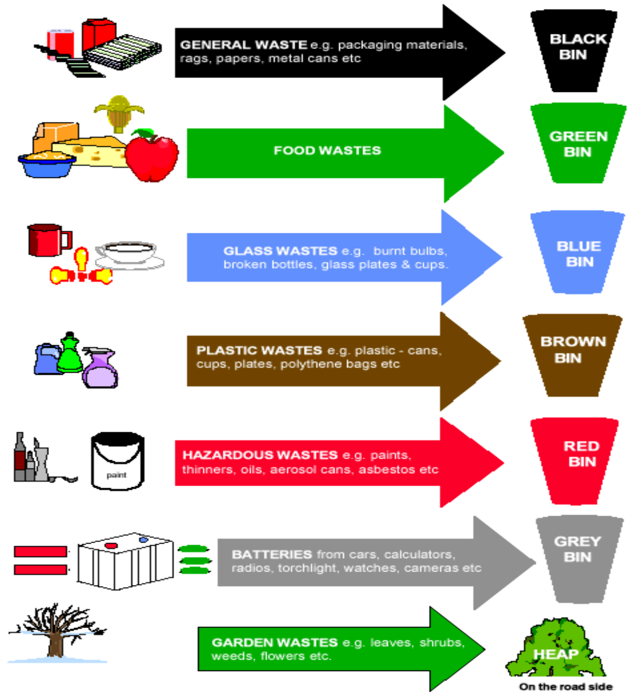


Figure 7.2: Waste Segregation Strategy

Wastes Inventory

An inventory of waste generated shall be maintained. Weighing scales or measuring devices shall be provided to measure quantities of waste generated/discharged. Records of waste generated, treated and sent for disposal shall be maintained on site. Wastes to be transferred from rig to offsite facilities for treatment and disposal shall be done in accordance with the PHCN waste transfer process and in line with statutory requirements.

Waste Disposal

All debris, spoil materials, rubbish and other waste, except excavated soil and rock, shall be cleared regularly from the site and sent to the disposal facilities. Instructions on material safety handling sheet shall be strictly adhered to and shall form the basis for the disposal of wastes related to such products. Wastes in transit shall be accompanied and tracked by consignment notes. The waste consignment notes shall contain the following information as a minimum:

- type of waste
- date of dispatch;
- description of waste;
- waste quantity/container type;
- Location of generation/collection
- designated treatment and disposal site and method;
- consignee /driver name and means of transportation; and
- confirmation of delivery and actual disposal (time and date).

Only government approved waste management contractors shall be engaged for the waste categories they are licensed to dispose. Waste management audit of contractors' facilities shall be carried out in consultation with the CR&E department of PHCN, and findings shall be properly documented and followed up. Accommodations, catering services and work sites shall maintain acceptable standards of hygiene and good housekeeping.

7.9.2.1 Operational Wastes and Disposal Methods

Waste shall be managed in accordance with Federal Ministry of Environment and PHCN waste management guidelines and procedures. The EPC contractor will develop a Waste Management Plan to be approved by PHCN and will be responsible for the management of all wastes from cradle to grave using licensed third party waste management contractors and facilities. Detailed inventory of the waste types, sources, and planned management practices during the proposed transmission line project is presented in **Table 7.1**.

Table 7.1: Waste Stream Management Guideline for Proposed 58km 330kv QIT – Ikot Abasi Transmission Line Project

Waste / Emission	Category	Hazard	Origin	Disposal Option(s)
Empty drums & aerosol cans (plastic & steel)	Potentially Hazardous (non-combustible)	Dependent of original contents of drum	Packaging of lubricating oil, fuel and corrosion chemicals	Residue from drums shall be purged and cleaned before reuse (subject to quality assurance). Return empty gas cylinders to supplier(s) for refilling. Return drums, barrels, and used containers to vendor or crush at site for recycling
Oil & fuel filter cartridges, waste water filters	Hazardous (combustible)	Potential water and sediment contamination from hydrocarbons	Internal combustion engines, equipment maintenance and repairs	Collect in properly labelled metal or plastic drums placed at designated strategic locations. Store in sealed, properly labelled metal or plastic drums placed in a closed container located within the designated hazardous waste storage area for evacuation to incineration sites.
Oily rags & sorbents; used protective clothing (hand gloves, coveralls, shoes, rainwear, etc	Hazardous (combustible)	Potential water & sediment contamination from hydrocarbons	Maintenance & spill clean-up operations, regular work wear	Where possible, oily rags and protective clothing shall be washed and reused at site. Otherwise, these wastes shall be drained of excess hydrocarbon, packaged separately and contained safely for incineration in approved facilities.
Scrap metal chippings, scrap cables	Non-hazardous (combustible)	Safety risks	Scrapped equipment / engine parts / miscellaneous refuse metal	Recycled or re-used.. Non reusable materials shall be stored in the designated containers for evacuation and disposal at recycling facilities.
Medical waste (soiled dressings, empty drug containers, used needles & syringes, expired drugs, blood & blood products, cultures and stocks)	Hazardous (combustible)	Potential health risk	PHCN clinics / health centers, site first-aid treatment	All medical waste shall be packaged separately and safely contained in designated containers for incineration at approved facilities.
				Empty drug carton/bottles may be re-used at the clinics subject to quality assurance.
				Used syringes/needles, containers for storing blood

				& its products, and culture/ stocks media shall be autoclaved (sterilised) shall be safely contained in designated containers for incineration at approved facilities. Expired tables/capsules may be crushed/dissolved using hot water before flushing down the drain with expired syrups
Sanitary wastewater	Hazardous (non combustible)	Potential to contaminate water column & sediment	Black waters (urinals, toilet) & gray waters (sinks, showers)	At camps, treated in sewage treatment plant to regulatory limits with certified equipment before discharge if feasible. Otherwise shall be collected and taken offsite to approved sewage treatment facilities and treated to meet regulatory requirements before discharge offsite.
Diesel fuel spill/leaks	Hazardous (combustible)	Potential to contamination of soil, water bodies & sediment	Fuel storage/transfer lines, leaking pipes, equipments, etc.	Store in sealed drums for recycling.
Contaminated soil affected by spills/leak	Hazardous (combustible)	Potential to to contaminate groundwater	Top soil removed from spill/leak site	safely contained in sealed designated containers for evacuation to incineration facilities
Domestic waste (empty food containers, food waste, used cooking oils, office wastes, construction)	Non-hazardous (combustible, biodegradable)	Attracts rodent	Accommodation, office, canteen, worksite	Manually sort plastics and metals for recycling. Appropriate segregate and contain for evacuation to approved incineration facilities
Batteries: (lead-acid, nickel-	Toxic and corrosive	Corrosive adverse	Warning equipment,	Lead-acid and NiCd batteries shall be safely kept

cadmium)		environmental, health & safety effects. Lead or heavy metals may cause contamination to surface water/sediment	portable & emergency electrical tools & electronics, construction & transmission facilities	at designated storage locations for evacuation to facilities where they will be recycled, incinerated and safely disposed.
Spent lubricants	Hazardous (combustible)	Potential for water, soil, and sediment contamination by hydrocarbons	Engine and rotating equipment, lubricating system, etc	Collect in properly labelled metal or plastic drums placed at designated strategic locations and sealed to prevent spill during evacuation.. To be recycled or incinerated in approved facilities.
Wood scraps, pallets and packaging materials	Non-hazardous (combustible)	Attracts rodents	Wooden crates, paper cartons/sacks, plastic wrappings, Styrofoam, etc	Wood pallets/paper cartons shall be returned to the supplier and non reusable one safely contained and evacuated to approved facilities for incineration
Paint & paint-related materials	Hazardous (combustible)	Potential to contaminate soil	Paint cans, spent thinner, epoxides, latex, etc	Safely contained in designated containers and locations prior to evacuation to approved facilities for recycling or incineration.
Refrigerants (HCFC)	Non-combustion source-emission	Stratospheric ozone depletion, formation of photochemical smog;	Refrigerants & air conditioners	Safely contain in designated locations for return to manufacturer, or to approved reuse, and recycling facilities

7.10 Emergency Response Plan

In order to safe guard the lives of personnel and contractors during emergency situation, EPC contractor shall develop and implement an emergency response plan in addition to the following.

Emergency training shall be conducted by the SHE Manager to enhance workers preparedness to respond appropriately to emergencies.

Emergency drill shall be conducted periodically and such drill shall include fire, oil spill, abandon as well as first aid emergencies.

Response time and roll call shall be monitored and recorded by the SHE Manager, supervisor or fire warden as required, at each drill/training to ensure compliance.

All drills and training exercise shall be documented by the SHE Manager or the supervisor and copies sent to PHCN.

In situations where evacuation of personnel is necessary as a result of fire or any other related accidents, PHCN shall follow the emergency medical evacuation procedure with responsible parties.

Table 7.2: Personnel Responsibilities during Emergency Evacuation

Action Party	Responsibility
Personnel at scene of incident	• Maintain calmness and alert people around • Contact site nurse or first aider/supervisor/safety officer • Begin mustering action
Medical personnel on site	• Arrange and administer first aid for sick/injured
Site supervisor/safety officer	• Contact project engineer / safety manager and report the following; • precise location and time of incidence; • site condition • patient(s)/injured or casualty; and • other pertinent information
Site Supervisor	• Arrange for medical evacuation after due consultation with management
SHE Manager	• To liaise with management to arrange for medical evacuation • Furnish management with available particulars/report about the emergency as provided by the site supervisor/safety officer • Conclude medical evacuation by ensuring the casualty is transferred from the first aid clinic (after a life saving treatment) to PHCNs retainer clinic.

Fire Prevention/Contingency

The overall goal of the fire prevention system shall be to:

- continuously monitor all areas of the installation where either a fire hazard may exist or an accumulation of flammable gas may occur;
- alert personnel at the location of the presence, location and nature of the fire or emergency;
- automatically activate fixed fire protection systems, and
- reduce the risk to personnel by implementing executive automated systems.
- Ensure that all personnel are safely evacuated

Fire detectors (smoke, heat, flame, gas, etc) shall be installed at appropriate areas . The fire shall be detected by the quickest, most reliable means.

7.11 Environmental Audit and Assessment

SHE audits of the facility activities shall be conducted in order to ascertain extent of compliance with set guidelines, policies and requirements. The audits shall be carried out by certified auditors (both in-house and independent auditors) and in accordance with regulatory requirement and ISO 14001 guidelines. The scope of the audit shall include the following:

- compliance with all necessary codes, standards and procedures;
- examination of line management systems, operations, monitoring practices etc.;
- identification of current and potential environmental problems especially during the operational phase of the project;
- checking the predictions in EIA and assure implementations and application of recommended practices and procedures; and
- make recommendation for the improvement of the management system of the operation.

Also, as part of audit and review this EMP shall be reviewed annually to determine its adequacy/suitability for continuous use.

Capacity Assessments

Capacity assessment and development process for those to be charged with managing the mitigation measures and grievance procedures is usually a cyclical process. Such a cycle will comprise several steps, from recognition of capacity deficiencies/efficiencies to the implementation of capacity development initiatives.

Part of the Invitation to Tender and Contract Agreement requirement is that the EPC submit the resume of key personnel, especially for those who would be directly responsible for the implementation, reporting, and monitoring of the EIA impacts mitigation and monitoring measures. Approval of personnel will depend on their proven experiences and capability to manage the recommended measures. Those whose capabilities are determined to meet the requirement will be approved for engagement in the project but those whose experiences and skill are determined to be insufficient will not be approved.

The implication is that the EPC may retain and engage their services if it so wishes but they will not be engaged for this project.

EPC deliverables will include engagement of sufficient and skilled personnel for key project areas, especially in the SHE and socio economic sections to ensure effective implementation of the project impacts mitigation and monitoring measures. The Project and EPC's Environmental Management Plan will specify the roles and responsibilities of those charged with SHE duties, especially for those responsible for implementing the mitigation and monitoring measures. The EMP will also include training programs for such personnel in order to enhance their capabilities and performance.

The project specific plans to be developed by the EPC such as the Environmental Management Plan, Waste Management Plan, Regulatory Compliance Plan, Socioeconomic/Community Relations and Engagement Plan, and Spill Response Plan will be submitted to PHCN project management team for review and approval prior to implementation. This will ensure that the key elements are captured in the plans. It will also ensure well-coordinated execution of project activities as well as confirm harmonized implementation of EPC's documented strategies, in accordance with the terms and conditions of the approved project EIA.

PHCN CR&E Department shall be responsible for capacity assessment of EPC personnel responsible for the management and monitoring of impacts mitigation measures as documented in this EMP and as regularly updated to cover for the project life span. Capacity assessments and other trainings as well as competency certification and validations of personnel shall progress from before the commencement of the project, through construction and operation phases. Assessment shall also form part of the auditing/training program to be developed by the project.

In addition to overseeing the implementation of the mitigation and monitoring measures, PHCN CR&E will also be responsible for operation of the grievance procedures. In order to assure the competency of PHCN personnel charged with the above responsibilities, experienced personnel will be engaged for the execution of the project. Capacities of personnel assigned to the project will be assessed prior to their involvement in the project and appropriate trainings provided to cover identified capacity gaps. PHCN shall engage reputable consultancy firms to provide such capacity enhancement trainings and certifications.

Federal Ministry of Environment (FMEnv) will be responsible for the regulatory monitoring of the implementation of the project EIA approved mitigation and monitoring measures. The Ministry assigns personnel with proven competencies to such tasks.

7.12 Decommissioning and Abandonment Plan

The design of the transmission line facilities (tower, conductors, substation, etc) shall take due recognition of the need for decommissioning at the end of project operational life (25years). However, in Nigeria, transmission lines are designed to last more than the set operational life and as such appraisals will be conducted periodically in line with international and PHCN standards to assess the condition of the transmission line prior to revalidation or decommissioning.

PHCN shall set up strategies to checkmate project abandonment. In the unfortunate event of abandonment, a project abandonment plan shall be prepared in line with applicable national and international legislative requirements, in addition to implementing measures to mitigate the impact of such abandonment. The design of the facilities shall take due recognition of the need to decommission any ancillary facilities at the end of their operational life.

Temporary structures (camp, storage yard, site offices, etc.) installed at the construction phase to support construction activities shall be cleared and cleaned and safely disposed or reuse.

CHAPTER EIGHT

CONCLUSION

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The EIA of the proposed approximately 58km long 330kv QIT – Ikot Abasi Transmission Line has been carried out using data from a two season environmental field survey as well as research / literature survey on regional studies within Niger-delta, Nigeria. The overall goal of the EIA is to ensure that potential environmental and social impacts of the proposed project are identified and evaluated and adequate mitigation measures proffered for significant impacts. Thus, it provides necessary data / evidence that will ensure the issuance of an environmental impact statement (EIS) and certification for the project.

The biophysico-chemical characterization of soil, surface water and sediment along the transmission line route showed that the soil, surface water, and surficial sediment were consistent across sampling stations and compared well with values recorded in previous studies around similar environments in Niger-delta. Analysis of the water and sediment samples for plankton and benthic fauna respectively, indicated unique assemblage of plankton and benthic species with abundances that relate to the nutrients and chemical composition of the ecosystems. Studies on biodiversity along the transmission line area and immediate environment was consistent with reports of previous studies carried out in the area. Wildlife data indicated that no specie was endangered (as per IUCN 2006) though some were classified as locally vulnerable (Act 11, 1985). Socio-economic studies across affected communities revealed that the generality of the people are of the Ibibio ethnic group situated along the coastal areas of Akwa Ibom State.

The potential and associated impacts assessment of the proposed development indicated that the project would beneficially and significantly impact on national energy and power transmission and the overall economic and social benefits accruable from power supply to the Nigerian people. It would also result in provision of direct and indirect employment opportunities as well as skill acquisition for Nigerians.

The adverse impacts of the project may result from injury due to operational accidents/incidents, health condition for onsite personnel due to exposure to communicable diseases and increased noise and emissions. Perturbation of surface water and aquatic fauna and flora resulting from disturbances to nearby aquatic ecosystems due to oil leaks, wastes and other associated sources during construction. However, majority of these adverse impacts are temporal, and mitigation measures have been recommended for both short- and long-term to reduce the adverse impacts to negligible limits.

Consequently, the EMP was developed to ensure effective implementation of prescribed mitigation measures and for proactive environmental management from project inception to conclusion. Implementation of these measures will ensure a successful execution of QIT – Ikot Abasi Transmission Line project in an environmentally safe and sustainable manner.

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APPENDIX 1.1

TERMS OF REFERENCE

TERMS OF REFERENCE (TOR)

FOR

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

OF

PROPOSED 58KM QUA IBOE TERMINAL – IKOT ABASI 330KV TRANSMISSION LINE PROJECT

SUBMITTED BY

POWER HOLDING COMPANY OF NIGERIA (PHCN)

MAITAMA - ABUJA

March, 2010

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EXECUTIVE SUMMARY

The Federal Government of Nigeria opened up the Electricity Market for private sector participation due to the ever-increasing electricity demand by consumers. A joint venture of Nigerian National Petroleum Corporation (NNPC) and Mobil Producing Nigeria (MPN) known as the Joint Venture Power Project (JVPP) intends to construct a 500MW thermal power plant adjacent to MPN existing Oua Iboe Terminal (QIT) in Ibeno Local Government Area, Akwa Ibom State.

To evacuate the power generated from this proposed power station, Power Holding Company of Nigeria (PHCN) has proposed to construct a 58km 330kv Transmission Line from MPN's QIT to Ikot Abasi in Akwa Ibom State.

Prior to this, PHCN intends to conduct an Environmental Impact Assessment (EIA) of the project area. This document presents the Terms of Reference (ToR) for the EIA of QIT - Ikot Abasi 330KV Transmission Line.

The ToR highlights the statutory (Legal and Administrative) frame work, EIA workscope, Methodology, Project description, Description of the baseline Environmental components, Assessment of Associated and Potential Impacts, Impacts Mitigation / Ameliorative Measures, Consultation with Stakeholders as well as Environmental Management Plan (EMP).

The EIA procedure shall conform to the requirements of the Federal Ministry of Environment (FMENV) Environmental Impact Assessment (EIA) Procedural/Sectoral Guidelines for the Power Generation and Transmission Projects, Power Holding Company of Nigeria (PHCN) Environmental Policy, as well as other international environmental standards referred to at the back of this document.

The EIA findings will be used as a basis for communication to obtain relevant approvals and to achieve productive interactions between all stakeholders with reference to issues identified during the course of study.

1.0 INTRODUCTION

The Federal Government of Nigeria opened up the Electricity Market for private sector participation due to the ever-increasing electricity demand by consumers. A joint venture of Nigerian National Petroleum Corporation (NNPC) and Mobil Producing Nigeria (MPN) known as the Joint Venture Power Project (JVPP) intends to construct a 500MW thermal power plant adjacent to MPN existing Oua Iboe Terminal (QIT) in Ibeno Local Government Area, Akwa Ibom State.

To evacuate the envisaged power output by NNPC/MPN JV Power Plant adjacent to MPN's Qua Iboe Terminal, the Power Holding Company of Nigeria Plc (PHCN) intends to construct a 58km 330kV transmission line from MPN's QIT in Ibeno LGA to Ikot Abasi in Ikot Abasi LGA.

The project is aimed at evacuating the power from the NNPC/MPN 500MW JV Power Plant; increase the capacity of the transmission network, as well as strengthening and improving system reliability, stability and operational efficiency of the national grid.

PHCN recognizes the importance of comprehensive Environmental Planning and Management to the success of any project and is committed to the necessary studies to understand the environmental system of the project area in order to address areas where significant environmental impacts (Natural, Physical and Social) may occur.

In pursuance of this, PHCN intends to conduct an Environmental Impact Assessment (EIA) of the project area prior to the commencement of the project. This intention is in line with statutory requirement for environmental management in Nigeria as contained in the Environmental Impact Assessment (EIA) Act No 86 of 1992, as well as other international environmental standards.

2.0 PROJECT DESCRIPTION

The transmission line project will commence at MPN's Oua Iboe Terminal in Ibeno Local Government and traverse communities in Ibeno, Eket, Onna, Mkpat Local Governments, and terminate at Ikot Abasi in Ikot Abasi Local Government Area of Akwa Ibom State as in indicated in Figure 1.

The transmission line route is mainly characterized by secondary rain forest vegetations with economic trees and farmlands. A fraction of the route particularly the segment nearer the coast is characterized by marsh and mangrove habitats.

The construction of the ~58km 330kV QIT - Ikot Abasi transmission line will involve:

- Clearing the Transmission Line Right of Way (~290 hectares) of all vegetation.
- Construction of transmission line towers, their foundations and stringing of the line.
- Development of land access (from nearby roads) to ROW to facilitate construction and maintenance in upland areas.
- Construction of Transmission line support towers for water-prone areas.
- Filling or dredging of marsh and mangrove areas to provide water access for ROW clearing, tower installation and line maintenance activities. Such filling or dredging activities will be minimized as much as possible.
- Construction of a new substation at QIT and extension of Ikot Abasi Substation.
- Provision of associated digital communication facilities at the substations.

The Transmission Line Right of Way (TLROW) to be acquired for the project is 58km in length and 50m wide, thereby giving a total area of about 2,900,000m^2 (290Ha).

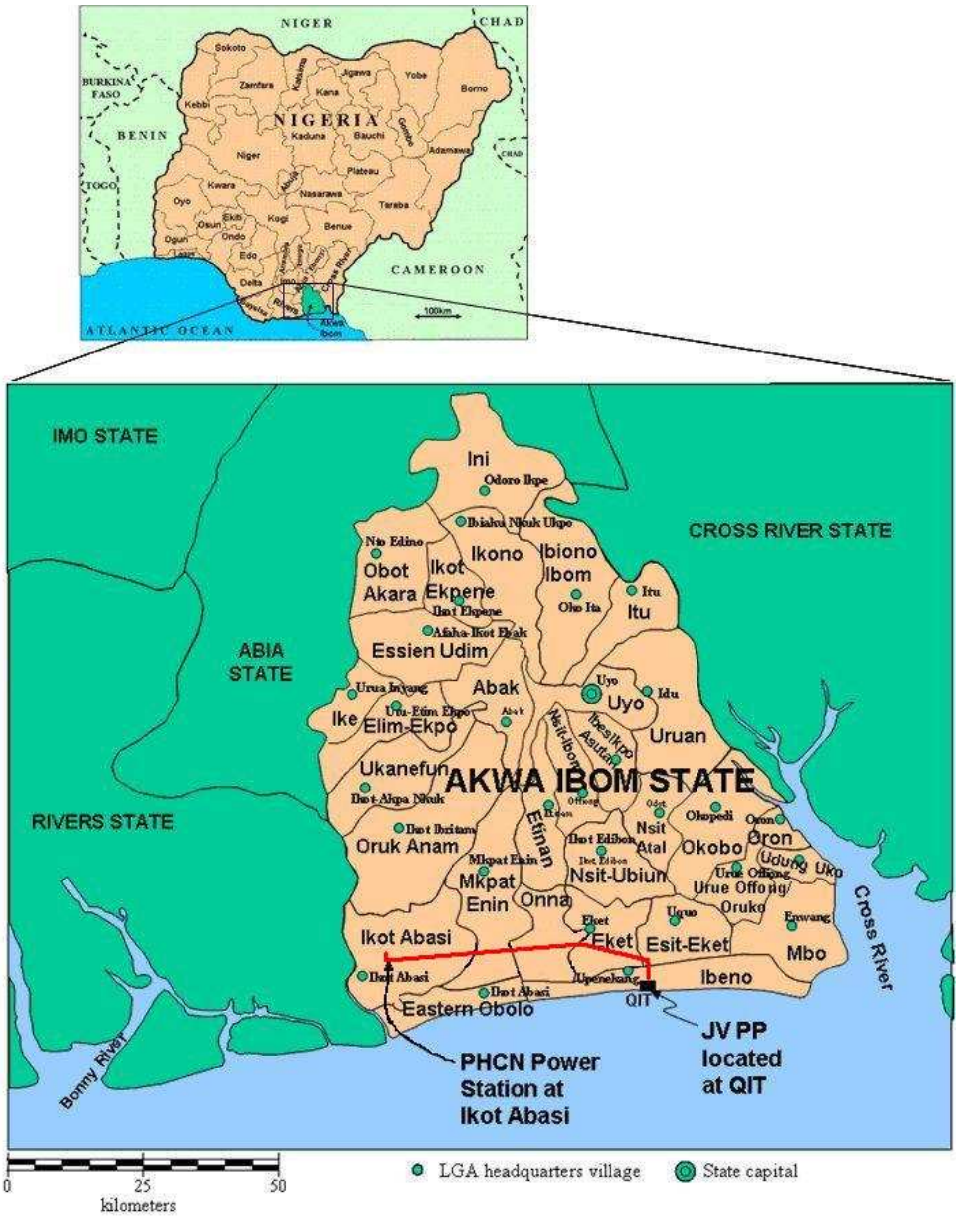

Figure 1 - Approximate location of considered routes for the proposed transmission line from MPN's Qua Iboe Terminal to Ikot Abasi within Akwa Ibom State, Nigeria

Figure 2: Locations of environmental baseline study sampling stations relative to routes proposed for QIT to Ikot Abasi Transmission Line Project.

3.0 PROJECT OBJECTIVES

- Enable the evacuation of power to be generated by MPN/NNPC Joint Venture Power Plant (JVPP) in Ibeno LGA to the national power grid.
- Add value to the economy by way of improved power supply
- Improvement of the socio-economic status of the nation.
- Generation of employment opportunities.

4.0 PROJECT IMPLEMENTATION

In pursuing the above objectives, the project proponent (PHCN) shall:

- Recognize and comply with all applicable regulations, guidelines and standards of the Federal Republic of Nigeria as represented by Federal Ministry of Environment (FMENV), Akwa Ibom State Ministry of Environment and Mineral Resources (AKSMEMR), and the affected Local Government Areas (Ibeno, Eket, Onna, Mkpat Enin and Ikot Abasi) as well as International Conventions/Guidelines/Agreements to which Nigeria is a signatory.
- Undertake extensive Consultations with all Stakeholders in the project.
- Develop and implement an Environmental Management Plan (EMP) as an integral part of the EIA document in accordance with FMENV regulations.
- Follow strictly PHCN's Occupational Health and Safety, and Environment Policy. It shall be the responsibility of the Project Proponent to educate all parties on such policies.

To ensure that this proposal is in accordance with statutory requirements and PHCN's Corporate Policies, the services of a reputable and FMENV accredited Environmental Consultant will be engaged to conduct the Environmental Impact Assessment (EIA) studies of the proposed project. The result of the EIA study will be translated into specific actions and will be used as the basis for communication to obtain relevant approvals from regulatory agency i.e. FMENV. This will also be used to satisfy public information needs on the project.

This Terms of Reference (ToR) document has therefore been developed to:

- Outline the general scope of EIA study including the overall data requirements on the proposed project and affected environment.

- Define the procedures/protocols for identification and assessment of associated and potential impacts.
- Select appropriate mitigation measures for such impacts and develop an effective Environmental Management Plan (EMP) for the project.
- Define framework for interaction and integration of views of a multi-disciplinary project team with regulators, host communities and other stakeholders.
- Define the relevant framework of legal and administrative requirements of the project.

The ToR shall be used as a guide in executing and implementing the EIA study of the proposed 58km QIT - Ikot Abasi 330kV transmission line construction and operation.

The EIA shall comply with the FMNEV Environmental Impact Assessment Procedural/Sectoral Guidelines for Power Generation and Transmission (1995).

5.0 TERMS OF REFERENCE

5.1 STATUTORY (LEGAL AND ADMINISTRATIVE) FRAMEWORK

The statutory (legal and administrative) frameworks within which the EIA study shall be executed are provided by the following regulations, guidelines and standards:

- Federal Ministry of Environment (FMENV) guidelines and standards on power transmission activities in Nigeria.
- The regulations, guidelines and standards of the Akwa Ibom Ministry of Environment. And Mineral Resources
- World Bank Operational Directive 4.01 ‘Environmental Assessment’ 1991.
- African Development Bank (ADB) Environmental and Social Assessment Procedures. (June, 2001)
- All International Conventions on Environmental Protection to which Nigeria is a signatory.

Specifically, some of these statutes are:

- Environmental Impact Assessment Act No. 86 of 1992.

- EIA Procedural Guidelines of 1995.
- Waste Management and Hazardous Waste Regulations (S.1.15) 1991.
- EIA Sectoral Guidelines for Power Generation and Transmission Projects, 1995.
- Interim Guidelines and Standards for Environmental Pollution Control in Nigeria, 1990.
- Landuse Act, 1990.
- Nigeria Inland Waterways Authority (NIWA) Act, 1987.
- Forest Act, 1937.
- Wild Animals Preservation Act, 1916.
- Endangered Species (Control of International Trade and Traffic) Act, 1985.
- Kyoto Protocol, 1997.
- Stockholm Convention on Human Environment (1972).
- World Summit on Sustainable Development (Rio, 1992).
- World Bank Operational Directive 4.01 'Environmental Assessment' (1991).

5.2 OBJECTIVES OF THE EIA

The objectives of the EIA are as follows:

- Establish the existing biological, physical, social and economic conditions of the project area.
- Characterize the environment thereby identifying the resultant hazards (including social) associated with the transmission line.
- Identify and predict the positive and or negative impacts likely to result from the project construction and operational phases.
- Proffer mitigation measures to enhance the positive impacts and minimize the unavoidable negative impacts of the project on the entire ecosystem.
- Develop a feasible and cost effective Environmental Management Plan (EMP) to manage and monitor the environmental parameters throughout the lifecycle of the project.
- Ensure proper consultation with all stakeholders including the communities bordering the proposed Transmission Line Right of Way (TLROW) to make for project acceptability.
- Obtain EIA project certification and other associated environmental permits.

5.3 SCOPE OF WORK

The scope of work for the EIA shall involve but not limited to the under listed:

- Comprehensive literature review to generate background information on the environmental characteristics of the study area.
- Review of national and international environmental regulations on transmission lines' construction.
- Identification of all communities within the project area and other Stakeholders for effective consultation.
- A two season detailed environmental baseline data collection and laboratory analysis to fill information/data gaps (field studies to be supervised by Chemistry, Resettlement and Environment Division).
- Identification of potential and associated impacts.
- Potential impacts prediction, interpretation and evaluation of their significance using appropriate models.
- Development of effective mitigation, enhancement and control measures.
- Development of a comprehensive Environmental Management Plan (EMP) and Environmental and Social Management Plan (ESMP), which will include remediation, monitoring and decommissioning/abandonment plans.
- Preparation of field, draft, final draft and final EIA reports that conform to the FMENV's standards, regulations and guidelines.

5.4 METHODOLOGY

The methodology for conducting the EIA shall involve:

5.4.1 Literature Review:

This shall be undertaken to acquire an environmental database required for the EIA studies. This will involve study of existing literature particularly, from reports of previous EIA studies (if any) and other relevant studies on the environmental characteristics of the study area. Materials to be reviewed shall include textbooks, reports, survey maps, aerial photographs, articles and other international journals.

5.4.2 Reconnaissance Survey:

A reconnaissance survey shall be undertaken to familiarize the EIA Team with the proposed project area. This will help them in the concept design of field research execution.

5.4.3 <u>EIA Study Consultation Programme</u>:

Consultations shall be carried out throughout the project lifecycle with all stakeholders. The Stakeholders shall include but not limited to the following:

- Federal Ministry of Environment
- Federal Ministry of Agriculture, and Rural Development
- Akwa Ibom State Government
- Akwa Ibom State Ministry of Environmental and Mineral Resources (AKMEMR)
- Akwa Ibom State Ministry of Lands and Housing
- Affected Local Government Areas (namely Ibeno, Eket, Onna, Mkpat Enin and Ikot Abasi)
- Project Affected Persons (PAPs)
- Community Based Organizations
- RUSAL (Alscon Smelter Plant)
- Ibom Power (responsible for Akwa Ibom State Eket - Ikot Abasi 132kV transmission line)
- Non-Governmental Organizations

5.4.4 <u>Fieldwork Activities/Laboratory Analysis</u>:

Fieldwork activities (which shall be for two seasons i.e. wet and dry seasons), and Laboratory analysis shall be carried out to verify data gathered from literature review and to collect additional data to fill information gaps. All positions for sampling shall be referenced to the geographical coordinates. The activities (see Section 5.6) shall be carried out in accordance with the FMENV, World Bank, ADB, and other international standards and guidelines. Field sampling methods and laboratory procedures shall be consistent with established and standard methodologies (ASTM, APHA, and USEPA).

The fieldwork plan shall be:

i) Approved by the Chemistry, Resettlement and Environment Division of PHCN.

ii) Supervised by the Chemistry, Resettlement and Environment Division of PHCN.

5.4.5 <u>Potential and Associated Impact Analysis</u>:

Potential and associated impact identification and evaluation will be carried out using a methodology that is applicable, verifiable, specific and quantifiable (such as the ISO 14001 standard and Hazards and Effect Management Process - HEMP).

The ‘Strength of Relationship Matrix Approach, Risk Assessment Matrix (RAM) methods and other methods
that define numerically the degree of interdependence of the various environmental parameters to be considered could be used in the overall assessment of impacts. The impact evaluation results shall form the basis for developing the EMP for the proposed project.

5.5 PROJECT DESCRIPTION

The EIA shall document a clear description of the proposed 58km QIT - Ikot Abasi transmission line and associated substation project in a manner comprehensible to all stakeholders. Specifically the factors to be considered and described shall include but not limited to:

- Description of project location and geographical scale
- Description of transmission line design basis, design parameters, specifications, criteria and technology
- Description of construction materials, energy requirement, construction/installation facilities and equipment
- Description of operations and maintenance facilities and equipment
- Description and analysis of project environmental risks and hazards
- Description of contingency plans and emergency response philosophy
- Description of project risk and hazard management philosophy
- Description of project schedule

5.6 DESCRIPTION OF SOCIAL AND ENVIRONMENTAL COMPONENTS

The description of the project area environmental baseline conditions shall include but not limited to:

5.6.1 <u>Physical Characteristic</u>:

Climate/meteorology

- Temperature
- Rainfall
- Sunshine
- Cloudiness
- Wind speed
- Wind direction

- Seasonal variation and extreme microclimates and determining factors.

Air Quality

- Ambient air pollution: NO, NO_2, SO_2, H_2S, CH_4, VOC, particulates, temperature
- Inversion potential

Noise

- Ambient Noise Levels
- Noise sources
- Proximity of human and ecological habitats to noise sources

Sediment Studies

- Physico-chemical: pH, total hydrocarbon content, electrical conductivity, redox potentials, particle size, aliphatic hydrocarbons, aromatic hydrocarbons, etc
- Sediment microbiology: hydrocarbon utilizing bacteria, total heterotrophic bacteria, etc
- Metals: Mn, Fe, Cu, Zn, Ag, Pb, Ni, Cd, Cr, Co, Ca, Mg, K, Na, Ba
- Hydrobiology: benthic macrofauna

Water Studies

- Water Physico-chemical: Total dissolved solids, turbidity, chemical oxygen demand, oil and grease, chloride, phenols, nitrate, sulfate, pH, temperature, conductivity, phenols, salinity, dissolved oxygen, redox potential
- Water microbiology: Total heterotrophic bacteria, hydrocarbon utilizing bacteria, etc
- Metals: Mn, Fe, Cu, Zn, Ag, Mi, Cd, Pb, Cr, Ca, Mg, K, Na
- Hydrobiology: phytoplankton and zooplankton
- Aquatic Ecosystem Sensitivity
- Economic importance of aquatic ecosystem.

Soil Studies

- Soil Physico-chemical: pH, total hydrocarbon content, electrical conductivity, redox potentials, particle size, aliphatic hydrocarbons, aromatic hydrocarbons, etc

- Soil microbiology: hydrocarbon utilizing bacteria, total heterotrophic bacteria, etc
- Soil morphological characterization
- Land use description
- Agriculture
- Land route/access.

Geology/Hydrogeology

- Description of principal rock types
- Identification of rock sequence
- Identification of activities likely to cause subsidence
- Identification of ground water types
- Determination of flow direction
- Determination of aquifer level

Oceanographic

- Waves, tides, current, speed, water masses, sea water temperature, surface water
- Water depth, topography

5.6.2 Natural and Archaeological Characteristics

Protected and restricted areas

- Archeological interest
- Parks, designated area of environmental/amenity value
- Nature reserves
- Heritage sites
- Restricted areas (shrines)

Biotopes

- Open waters
- Estuaries
- Shorelines

5.6.3 Biological Characteristics

Biota:

- Fisheries resources
- Plankton

- Benthic Communities
- Littoral communities
- Birds
- Aquatic habitats and potentials for disturbance
- Seasonal restriction due to breeding, migration or spawning etc.
- Population of rare, unique and endangered species.

Land Use and Agriculture

- Land use description
- Agriculture
- Land route/access.

Wildlife/Forestry

- Identification of wildlife species
- Estimation of wildlife species population
- Identification of wildlife species behavioral patterns and habitat requirements
- Identification of economic species
- Identification of protected trees

5.6.4 Social Characteristics

Socio – Cultural

- Cultural and/or religious issues
- Traditional fishing rights, customs etc.

Population

- Demographic: Description of population distribution, main centers urban/rural split
- Communities, social organization etc.
- Education/Health Services and Infrastructure, disease vectors, etc.
- Key stakeholders that are likely to be interested in the project

Socio – Economics

- Means of livelihood, economic base
- Description of settlement and man made features
- Description of economic and historical sites
- Description of income distribution

- Description of transportation system
- Description of tourism and recreational facilities
- Description of social organizations and institutions
- Description of occupation and employment structure
- Description of host community health status and facilities
- Description of project health risks
- Description of community health needs and concerns of host communities.

5.6.5 <u>Waste Inventory</u>

- Waste generation
- Disposal systems
- Waste management plan

6.0 ASSESSMENT OF ASSOCIATED AND POTENTIAL IMPACTS

The identification and evaluation of associated and potential impacts shall be carried out in accordance with the following standard methodology.

- Identification of Impact Sources – Check List
- Identification of Impact Indicators – Check List
- Prediction of impact magnitude
- Evaluation of importance of environmental components – consensus of opinions
- Evaluation of impacts – “The Strength of Relationship Matrix”
- Evaluation of Impacts - “Risk Assessment Matrix”
- Identification of mitigation measures, avoidance/ elimination/minimization and enhancement strategies.

The associated and potential impact of the proposed transmission line shall be described for the various phases of the project and with particular reference to construction project activities as follows:

- Impacts resulting from project location/siting
- Impacts resulting from project construction activities
- Impacts resulting from project operation activities
- Impacts resulting from project abandonment.

The impacts shall further be classified as:

- Incremental, Cumulative and Residual Impact

- Adverse and Beneficial Impacts
- Short Term or Long Term Impacts
- Normal or Abnormal Impacts
- Temporary (Reversible) or Permanent (Irreversible) Impacts
- Direct or Indirect Impacts
- Impacts associated with project risks and hazards

Where impacts are uncertain, the uncertainty will be made explicit and in this respect, risk assessment method will be applied.

7.0 IMPACT MITIGATION MEASURES AND ALTERNATIVES

All negative impacts identified shall be considered for mitigation and control through preventive and mitigation measures. These measures shall be incorporated in the proposed development to minimize or completely eliminate the key negative impacts. Some of the measures will include:

- Emergency response and waste management procedures
- Pollution abatement/procedures at all times (construction, operations and maintenance)
- Environmental and Social awareness programmes for construction and operation staff
- Practical measures for rehabilitation to impaired features after project construction
- Proposal of changes in schedule of associated activities
- HIV/AIDS awareness programme for construction, operation staff/project recipient population/communities.

Where the effectiveness of mitigation measures is uncertain, or depends on assumptions about operational procedures, monitoring programmes or management procedure will be defined. Otherwise, the following alternatives will be considered:

- No project option
- Alternative routes

8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An EMP developed for the project shall be integrated into the EIA report. The EMP shall clearly specify guidelines to ensure conformity with the project implementation procedure, practices and recommendations outlined in the EIA reports.

The Plan shall as a minimum include the following:

- Guidelines for ensuring conformity of detailed design with concept design
- Guidelines for ensuring conformance of constructions/installation activities with specified standard practices and philosophies
- Guidelines for ensuring conformance to operational and maintenance activities with specified standard practices and philosophies
- Guidelines for personnel and assignment of responsibilities and accountabilities
- Guidelines on procedures for dealing with changes and modification of project
- Guidelines for implementation programme
- Guidelines for contingency plan
- Guidelines for waste management plan
- Guidelines for inspection, auditing and monitoring of all phases of project
- Guidelines for decommissioning and abandonment of project and remediation plan after decommissioning.

9.0 CONSULTATIONS

9.1 CONSULTATIONS WITH REGULATORY AGENCIES AND OTHER STAKEHOLDERS:

Throughout the duration of the project, an effective communications with regulatory agencies at the Federal, State and Local Government levels on the proposed transmission line shall be maintained.

The Stakeholders shall include the following:

- Akwa Ibom State Government
- Federal Ministry of Environment
- Federal Ministry of Agriculture, Forestry and Natural Resources
- Ministry of Lands and Survey (Federal and State)
- Akwa Ibom State Ministry of Environment and Mineral Resources
- Ibeno Local Government
- Eket Local Government
- Onna Local Government
- Mkpat Enin Local Government

- Ikot Abasi Local Government
- Community Based Organizations
- Non-Governmental Organizations.

This Consultation is aimed at:

- Addressing issues promptly to avoid conflict
- Building consensus on potential impacts identified and proffering mitigation measures before the project gets underway.
- Avoid any misunderstanding about the development
- Ensure that any apprehension and fears about the project, nature, scale and impact of the operation have been addressed.

9.2 EIA PUBLIC FORUM

- A Public Forum involving all stakeholders shall be organized in or close to the project site so as to acquaint them with the project. This shall be in conjunction with the EIA Consultant.
- Comments and recommendations made by stakeholders at the Public Forum shall be incorporated into the project EIA report.

9.3 EIA PANEL REVIEW

- The EIA Consultant shall on behalf of PHCN present (with the aid of audio-visual) and defend EIA draft report at the FMENV's EIA Panel Review Meeting.

10.0 MONITORING PLAN

This shall be carried out to provide specific information on the characteristics and functioning of environmental and social variables in space and time.

11.0 DELIVERABLES / DOCUMENTATION

The deliverables shall be reports written and produced in accordance with the FMENV (EIA) report writing standards.

The Reports shall be produced in phases indicated below:

- **<u>Field Report</u>**

  Two (2No) copies of each of the wet and dry seasons' field observations report shall be submitted by the EIA Consultant. This will fill data gaps identified during desktop study/literature review. It will include safety/quality assurance method, sampling method, preservation methods, data of in-situ analysis and equipment etc.

- **<u>Initial Draft EIA Report</u>**

  Two (2No) hard copies and one (1No) electronic copy of the initial draft EIA shall be submitted by the EIA Consultant for PHCN review.
  Thereafter, twenty (20No) hard copies and one (1No) electronic copy shall be submitted for FMENV Panel Review.

- **<u>Draft Final EIA Report</u>**

  Two draft final EIA reports addressing all comments/observations raised on the draft EIA report by the FMENV and other stakeholders shall be submitted by the EIA Consultant for vetting.

- **<u>Final EIA Report</u>**

  Two (2No) electronic copies and forty (40No) hard copies of the final EIA reports shall be submitted for certification purpose.

12.0 CONCLUSION

A detailed description of the scope of work for the Environmental Impact Assessment (EIA) study of the proposed QIT - Ikot Abasi transmission line has been covered in this Terms of Reference (ToR) prepared by Power Holding Company of Nigeria (PHCN). The EIA work scope considered the existing laws, guidelines and standards on which the project shall be carried out. The key result of the EIA will be used as a basis of communication to obtain relevant approvals and to obtain productive interaction with the public.

Consequently, PHCN believes that the adoption of this ToR shall enhance early commencement of the EIA study as well as the execution of the proposed transmission line, which will be of collective benefit to the Stakeholders.

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APPENDIX 3.1

APPLICABLE CODES AND STANDARDS

APPLICABLE CODES AND STANDARDS

In general the PHCN Standard applies for the Transmission line and is herein referred to. The following Standards are excerpts from the PHCN standards:

Quality Assurance and Safety

- Local Norms, Rules and Regulations for Health, Safety and Environmental Protection; Environmental Guidelines and Standards for Petroleum Industry in Nigeria, Ministry of Petroleum Resources- "Revised Edition 2002";
- Workmen's Compensation Decree/1987;
- Electrical Regulations/1988.
- Land Use act of 1998
- Power Reform Decree of 2005

- BS EN ISO 9001 Quality System – Model for Quality Assurance in Design, Development, Production, Installation and Servicing Safety Management
- OHSAS18001:2007 Occupational Health and Safety Management Systems Requirements;
- ISO9001:2008 Quality management systems: Requirements
- ISO14001:2004 Environmental management systems: Requirements with guidance for use;
- ICAO Internationcal Civil Aviation Organisation Annex 14

Civil

- ACI 301 Specifications for Structural Concrete for Buildings
- ACI 318 Building Code Requirements for Reinforced Concrete
- ACI Committee 543 title no. 70-50 1974 "Recommendations for Design, Manufacture, and Installation of Concrete Piles".
- BS 4-1 1993 Structural steel sections. Part 1. Specification for hot rolled sections
- BS 12 1996 Specification for Portland cement
- BS 410-1 2000 Test sieves –Technical requirements and testing Part 1- Test sieves of metal wire cloth, Part 2- Test sieves of perforated metal plate
- BS 812 Part 100 Testing aggregates, General requirements for apparatus and calibration, Part 101 Guide to sampling and testing aggregates, Part 103.1 Sieve tests, Part 103.2- Sedimentation tests, 105.1 Flakiness index, 105.2 Elongation index of coarse aggregate, Part 106 Determination of shell content , Part 109 Determination of moisture content, Part 110, Determination of aggregate crushing value, Part 111- Ten percent fines value, Part 112- Aggregate impact value, Part 113- Aggregate abrasion value, Part 117- Water soluble chloride salts, Part 118- Determination of sulphate content, Part 119- Determination of acid soluble material in fine aggregate. Part 120- Drying Shrinkage , Part 121- Determination of soundness, Part 123-Determination of alkali silica reactivity, Part 2, Determination of density.
- BS 882 Specification for aggregates from natural sources for concrete
- BS 1014 Pigments for Portland cement and Portland cement products

- BS 1139-1.2 Metal scaffolding Part 1-Tubes, Aluminium tube, Part 2, Couplers, Specification for steel and aluminium couplers, fittings and accessories for use in tubular scaffolding, Part 4, Prefabricated steel splithears and trestles
- BS 1881 All Parts Testing concrete, Method of sampling fresh concrete on site
- BS 3416 Bitumen based coatings for cold application suitable for use in contact with potable water
- BS 4027 Sulphate resisting Portland cement
- BS 4483 Steel fabric for the reinforcement of concrete
- BS 5075-2 Concrete admixtures- for air entraining admixtures
- BS 5328 Concrete Part 1- Guide to specifying concrete, Part 2- Methods for specifying concrete mixes, Part 3- Procedures to be used in producing and transporting concrete, Part 4- Procedures to be used in sampling, testing and assessing compliance of concrete.
- BS 5390 Code of practice for site investigations
- BS 8004 Code of Practise for Foundations
- BS 8110 Structural use of concrete Part 1 ,Part 2 and Part 3.
- BS 8666 Specification for scheduling , dimensioning , bending and cutting of steel reinforcement for concrete.

Mechanical

- ANSI B18.21.1 Lock Washers
- ANSI B18.5.1 Square and Hex Bolts and Screws
- ANSI B18.2.2 Square and Hex Nuts
- ASCE Manual 10-90 Guide for Design of Steel Transmission Towers
- ASTM-A123 Standard Specification for Zinc (Hot Galvanized) Coatings on products fabricated from Rolled, Pressed and Forged Steel Shapes, Bars and Strip
- ASTM-A153 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- ASTM-A572 Standard Specification for High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
- ASTM-A325 Standard Specification for High Strength bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers
- ISO 898-1 Mechanical properties of fasteners, Bolts Screws and Studs
- ISO 630- Structural Steel-plates, wide flats,bars, sections and profiles.
- ISO 7411- Hexagoanl bolts for high strength structural bolting with large widths across flats
- ISO 657-5, Hot rolled structural steel sections equal and unequal leg angles
- ISO 7452- Hot rolled structural steel tolerances on dimensions and shapes
- ASTM-A394 Standard Specification for Galvanized Steel Transmission Tower Bolts and Nuts

- BS 4 Part 1 Structural Steel Sections, Hot Rolled Sections
- BS 729 Hot Dip Galvanized Coatings on Iron and Steel Articles
- BS 1856 General Requirements for the Metal-Arc Welding of Mild Steel
- BS 2642 General Requirements for the Arc Welding of Carbon Manganese Steel
- BS 4360 Weld able Structural Steel
- IEC 61284 Overhead lines- requirements and test for fittings.
- BS 729 Hot Dip Galvanized Coatings on Iron and Steel Articles.
- BS EN 1481 Hot dip galvanized coating on fabricated iron and steel articles , specification and test method.

Electrical

- IEC 270 Partial Discharge Measurements
- IEC 61232 Aluminium-Clad Steel wires for Electrical Purposes.
- IEC 60121 Recommendation for commercial annealed aluminium electrical conductor wire
- IEC 61089 Round wire concentric lay overhead electrical stranded conductors.
- IEC 60889 Hard drawn aluminium wire for overhead line conductors
- IEC 61394 Characteristics of greases of aluminium, aluminium alloy and steel bare conductors.
- IEC 61395 Overhead electrical conductors - Creep test procedures for stranded conductors
- IEC 60270 High voltage techniques- Partial Discharge Measurements.
- IEC 61897 Overhead lines - Requirements and tests for Stockbridge type aeolian vibration dampers
- IEC 61894 Overhead lines - Requirements and tests for spacers
- IEC /TR 62263 Guidelines for installation and maintenance of optical fibre cables
- IEC 60793 Measurement and test procedures Part 1
- IEC 60794 Optical Fibres Part 1-2, General Specification
- IEC 1232 Aluminium Clad Steel Wire for Electrical purpose
- IEC 60874 Part 0-2 Connector for optical fibres and cables
- IEC 60120 Recommendations for Ball and Socket Couplings of String Insulator Units.
- IEC-60383-1 Insulators for overhead lines with a nominal voltage greater than 1000V. Ceramic or Glass units for ac systems acceptance criteria.
- IEC-60383-2- Insulators for overhead lines with a nominal voltage greater than 1000V. Insulator strings and insulator sets for ac systems test methods and acceptance criteria.
- IEC-60071-2- Insulation Coordination Part 2. Application guide

- IEC 60591 Sampling rules and acceptance criteria when applying statistical control methods for mechanical and electromechanical tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.
- IEC-60437 Radio Interference Test on High Voltage Insulators.
- IEC 61467- Insulators for overhead lines with nominal voltage greater than 1kV, power arc test on insulators sets
- IEC 60575- Thermal mechanical performance test and mechanical performance test on string insulator units
- IEC 60270- Partial discharge measurements
- IEC-60305 Insulators for overhead lines with a nominal voltage above 1kV-Cermaic or glass insulators for ac systems- characteristics of insulators units of cap and pin type.
- IEC /TR 62263 Guidelines for installation and maintenance of optical fibre cables
- IEC 60793 Measurement and test procedures Part 1
- IEC 60794 Optical Fibres Part 1-2, General Specification
- IEC 1232 Aluminium Clad Steel Wire for Electrical purpose
- IEC 61284 Overhead lines- requirements and test for fittings.
- IEC 60372 Locking device for ball and socket couplings of string insulator units.
- IEC 60672 Specification for ceramic and glass insulating material
- IEC 60874 Part 0-2 Connector for optical fibres and cables
- IEC 61211 Insulator of ceramic or glass for overhead lines with a nominal voltage greater than 1000V-Puncture testing
- BS 215 Part 1 & 2 Aluminum stranded conductors, steel reinforced
- BS 3288 Insulator and conductor fittings for overhead power lines.
- BS 729 Hot Dip Galvanized Coatings on Iron and Steel Articles.
- BS 443 Specification for zinc coatings on steel wire and for quality requirements
- BS 183 General purpose galvanized steel wire
- BS 1559 Reels and drums for bare conductors
- BS-137 Insulators of Ceramic Material or Glass for Overhead Lines with a nominal voltage greater than 1000 V.
- BS 3288 Part 1- Part 4. Performance and general requirements for insulators and conductor erhead power lines.
- BS EN ISO1461 Hot dip galvanized coatings on fabricated iron and steel articles Specifications and test methods
- BS EN 50189 Conductors and overhead lines — Zinc coated
- BS EN 1481 Hot dip galvanized coating on fabricated iron and steel articles , specification and test method.
- IEEE Std 524-1980 Guide to installation of overhead Transmission line conductors
- IEEE 31TP65-156 Standardization of Conductor Vibration Measurements.
- IEEE 1138 Standard construction of composite fibre optic ground wire
- IEEE 812 Standard fibre optics , Definition of terms

- IEEE 524a-1993- IEEE Guide to Grounding During the Installation of Overhead Transmission Line Conductors
- TU TG 652 & 654 Characteristics of single mode optical fibre and cable
- IEEE 1138 Standard construction of composite fibre optic ground wire
- IEEE 812 Standard fibre optics , Definition of terms
- ITU TG 652 & 654 Characteristics of single mode optical fibre and cable

APPENDIX 4.1

STUDY METHODOLOGY

STUDY METHODOLOGY

1.1 General

FNL adopted a QHSE management system approach in executing the field data gathering campaign. This approach assured that the required data and samples were collected in accordance with agreed requirements (contractual, scientific and regulatory) using the best available equipment, materials and personnel. The approach also assured that the safety and health of personnel, public, environment and assets were not compromised at any time. The following sections outline the methodology and procedures employed in the ecological data gathering and descriptions of laboratory analytical methods as well as the detection limits for the various parameters analysed. Also presented, is an overview of the general QHSE plan adopted for field data gathering exercise.

1.2 Methodology

The methods employed during the field data gathering campaign was accomplished in line with the requirements of THE Federal Ministry of Environment (FMENV), and other requirements of various international bodies which include sampling and analysis methods of the American Society for Testing and Materials (ASTM), United States Environmental Protection Agency (USEPA) and American Public Health Association (APHA).

The main objective of the field data acquisition was to establish the physical, chemical and biological status of the surface water, soil, sediment as well as the air quality characteristics of the study area through visual observations, measurements and laboratory testing and analyses.

1.3 Study Team

The field data gathering campaign for the first season (wet) was carried out between 4th and 14th, August, 2011. The study team comprised of FNL personnel who are experts in areas such as biodiversity and wildlife, socio-economic, chemistry, geology, and engineering. Also parts of the study team were representatives of PHCN E&R Division, and staff of ILF Engineers. The team members and their responsibilities are presented in **Table 1.1**:

Table 1.1: Study Team

S/N	Name	Designation	Responsibilities
FNL Field Team			
1	Mr. Kaine Edike	Ecologist	Team leader, field data collection/QHSE and instrumentation
2	Mr. Daniel Joel	Lab. Technologist	Air quality/Noise Measurements and instrumentation.
3.	Benard Obi	Field Sampler	Water/sediment and plankton/benthos collection
4.	Celestine Etim	Field Sampler	Soil Collection / In-situ measurements
3	Dr Godfrey Akani	Vegetation and wildlife	Biodiversity data collection
4	Prof. Ini Akpabio	Socio-economics	Socio-economic/health survey
Compliance supervision (PHCN)			
1	Mrs I B A Ruskin	PHCN-CR&E	Client Coordinator/supervision
2	Mrs B E Olubalusi	PHCN CR&E	supervision
ILF Engineers Staff			
	Mr. Aniefiok Isang	Community Relations	Observer

FNL equipment/materials used during the sampling activities are presented in **Table 1.2** below:

Table 1.2: Field Data Collection Equipment/Materials

Equipments / Materials	Uses
Digital camera	Photographs
Plastic basins	Collection of sediment samples
Sieve (1.0mm)	Sieving for benthic organisms
WTW Multi-Meter	Measurement of samples pH
Coolers	Storage of samples
GPS (Garmin 60xMaps)	Determination of co-ordinates / positioning
Soil colour chart	Description of sediment / soil
Hand augering set	Soil Sampling
2L plastic bottles	Collection of water for physico-chemistry
1L glass bottles	Collection of water for hydrocarbon
500ml plastic	Collection of filtered water for zoo/phytoplankton
500ml plastic	Collection of sieved sediment for benthos
200ml glass	Collection of water for microbiology
1L sampling bottles	Collection of water for heavy metals
Sampling bags	Collection of sediment/soil for physico -chemistry/heavy metals
60ml plastic containers	Collection of sediment/soil samples for microbiology
100ml glass containers	Collection of sediment/soil samples for THC
PPE (coverall, hard hat and safety shoe.)	Sampling activities, protection for field personnel
Markers/masking tapes	Identification of sample ID
Labels	Identification of sample ID
Notebooks and biros	Data / Information logging
Forms (daily project update form, chain of custody form and incident/hazard form)	Quality control
Sulphuric acid	Preservation of samples
Nitric acid	
10% Formaldehyde	
Conductivity/pH/redox standards	Quality control
Aerocet 531 particulate meter	SPM measurement
Ogawa Passive Samplers	SO_X, NO_X measurments
Pulsar II Digital Sound Level Meter	Noise measurement
Portassen II Gas Analyser	Air quality measurement (CO, CO_X, etc)
Disposable hand gloves	Use when handling chemicals
25ml beaker/250ml beaker	Insitu analysis
100ml volumetric flask, pipettes: 10ml, 5ml	Insitu analysis
Distilled water	Insitu analysis/QC
Scoop and hand trowel	Soil/sediment samples collection
Eckman grab	Collection of sediment samples
First aid box	Emergency treatment
Plankton net	Zoo / Phyto Plankton
Serviette	Tool cleaning

1.4 Sampling Design

Field data gathering was designed to representatively cover the ROW of the line. Soil sample stations were established to ensure the major soil types that characterise the area were adequately covered. Also, surface water and sediment sampling as well as hydro-biological studies were carried out along the surface water stations while air quality/noise stations were distributed to ensure the entire area is representatively covered. Further, socioeconomic survey is still in progress and expected to cover affected communities along the line in five local government areas (LGA) in Ibeno, Eket, Onna, Mkapat Enin and Ikot Abasi.

On the whole, the following sample requirements were established:

- Sampling obtained from 23 (23) soil stations (O-15cm and 15-30cm);
- Surface water/sediment sampling in five (5) stations;
- Air quality measurement in ten (10) stations;
- Noise level measurement in ten (10) stations; and
- Vegetation / Wildlife studies in six (6) transects

The coordinates of sample stations, sample types is presented in **Table 1.3.**

Table 1.3: Sampling Stations, Co-ordinates and Requirements

Sample Station	X	Y	Sampling Requirements
SS1	8.017689	4.5547	Soil, air quality, surface water, sediments, plankton, benthos, and vegetation / wildlife
SS2	8.014047	4.574551	Soil
SS3	8.00702	4.580751	Soil, air quality, surface water, sediments, planktons and benthos
SS4	7.975522	4.593437	Soil
SS5	7.951704	4.601806	Soil
SS6	7.929443	4.605578	Soil, air quality, surface water, sediments, plankton, benthos and vegetation / wildlife
SS7	7.903185	4.610608	Soil
SS8	7.877946	4.608265	Soil
SS9	7.855727	4.605624	Soil
SS10	7.830177	4.602537	Soil, air quality, and vegetation / wildlife
SS11	7.804106	4.599754	Soil
SS12	7.781543	4.597345	Soil
SS13	7.755541	4.594568	Soil, air quality
SS14	7.73346	4.592209	Soil
SS15	7.707511	4.589435	Soil
SS 16	7.685672	4.5871	Soil, air quality, and vegetation / wildlife
SS17	7.660048	4.58436	Soil
SS18	7.634816	4.58166	Soil, air quality
SS19	7.606547	4.570064	Soil, air quality, surface water, sediments, plankton and benthos
SS20	7.591482	4.565826	Soil, air quality, surface water, sediments, plankton and benthos
SS21	7.581876	4.565826	Soil
SS22	8.017601	4.55901	Soil
SS23	7.578101	4.566132	Soil, air quality, and vegetation / wildlife

The spatial distribution of sample stations within the lease is presented in **Figure 1.1.**

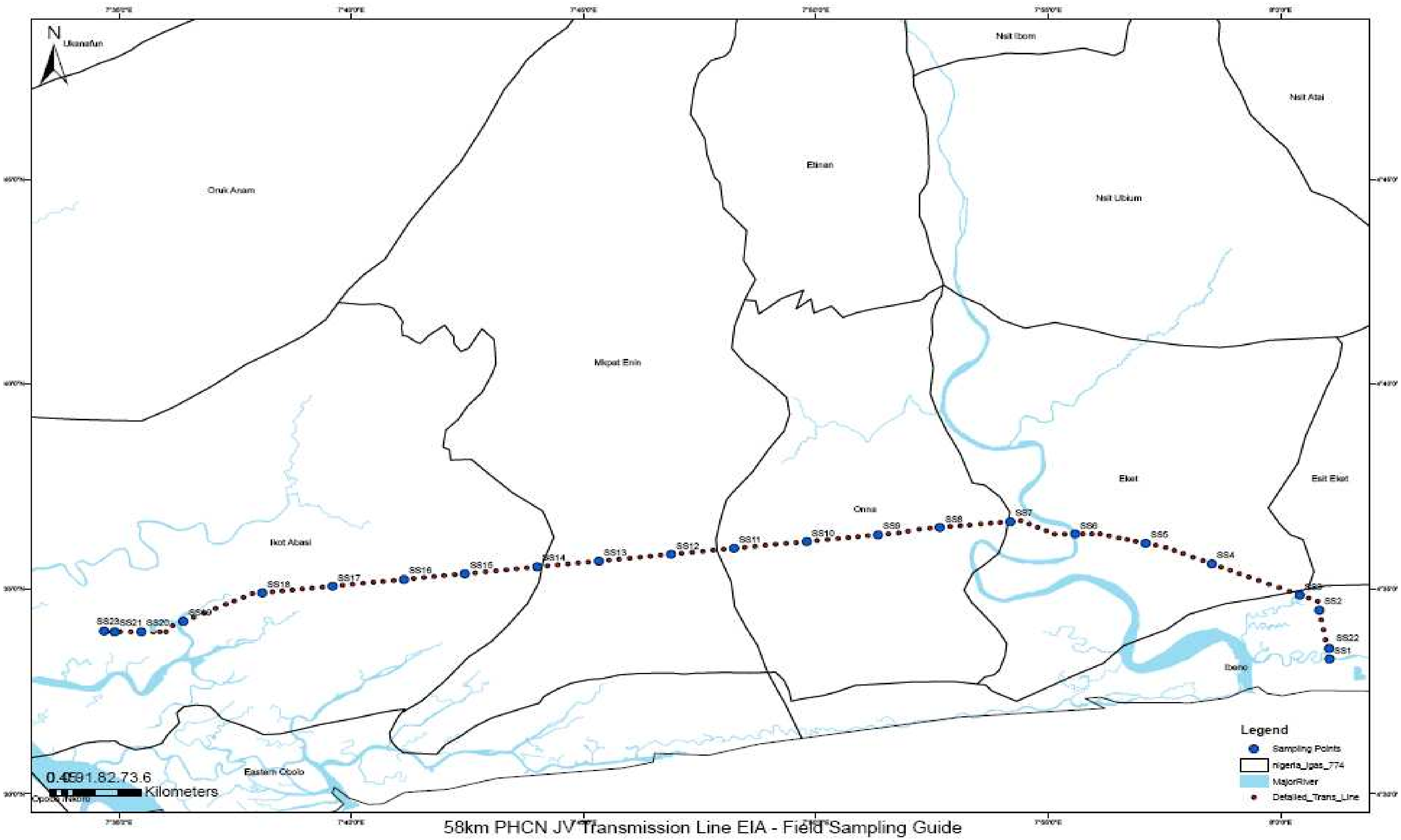

Figure 1.1: Spatial Distribution of Sample Stations

1.5 Mobilisation to Field

Conversations were held between PHCN/ILF and FNL to conclude the work plan and best approach and also to ensure that all sampling requirements and logistics have been properly met by the team. Meetings extensively covered aspects on safety and project description, project objectives, and sampling approach.

Thereafter, Job hazard analysis (JHA), consultation with the host communities (still on-going), site verification was carried out by FNL team before mobilisation from FNL office in Port Harcourt to study area in Akwa Ibom state.

Project kick off / HSE meeting was held on the 3rd August, 2011 at Darrel hotels, Eket which had FNL field team (survey and EIA) and representative of PHCN, MPN and ILF in attendance. Everyone present was briefed on appropriate safety measures and work procedures for the various field activities. This was to familiarize the study team on the need to be safety conscious while at work.

1.6 Staking/Geo-referencing

Twenty three (23 sampling stations were designated for the collection of ecological samples across the proposed project area and environs. Summary of activities and amount of ecological data collected during the sampling exercise is presented on **Table 1.4**

Table 1.4: Summary of Ecological Data Obtained

Parameter	Sample Number	Sample Stations
Soil	23 (0-15 & 15-30cm)	All Stations
Surface water	5	SS1, SS 3, SS 6, SS 19 & SS 20
Sediment	5	SS1, SS 3, SS 6, SS 19 & SS 20
Plankton	5	SS1, SS 3, SS 6, SS 19 & SS 20
Benthos	5	SS1, SS 3, SS 6, SS 19 & SS 20
Air Quality	Measurement Stations - 10	SS1, SS 3, SS 6, SS 10, SS 13, SS 16, SS 18, SS 19, SS 20 & SS 23
Vegetation / wildlife	Transects - 6	SS1, SS 6, SS 10, SS13, SS 16, & SS 23

1.7 In-situ Measurements

In other to ascertain the actual readings of the parameters taken on the field, in-situ measurements were taken for soil, water, sediment, and ambient air quality. Specifically Ogawa passive samplers (SOx, NO_2, NH_3 and NOx) were installed and retrieved after a 30day period along the line for both wet season and dry season .

1.8 Sample Preservation

As part of FNL preservative measures, immediately after sampling, each sample was properly labeled, arranged and preserved in accordance with FNL work instructions. The detailed sample handling procedures as contained in FNL work instruction (WI01) is presented in **Table 1.5.**

Table 1.5: Method of Storage and Preservation of Samples

Soil / Sediments				
Parameter	**Minimum Sample Volume**	**Container**	**Preservative**	**Container Pre-treatment**
General Appearance, Colour, Odour, Depth,	Record observation on site in a note book using relevant charts.	-	-	-
Metals (, Cu, Zn, Ag, Pb, Ni, Cd, , Mg, K, Na, Ba, Mn, Fe, , Cr, Co, Ca, , As, Hg, V)	1.0L	Plastic	Ice below 0℃	Rinsed with HNO_3
Physico-chemical (%TOC, pH, Sulphate, Conductivity, Particle size, Nitrate, redox potential, PAH,EC, Moisture content)	2.0L	Plastic	Cool below 0℃	Rinsed with distilled water
TPH (Total phosphorous and hydrocarbon)	200ml	Glass	Cool below 0℃	Rinsed with distilled water
Microbiology (HUB, HUF, THF, THB)	60ml	Plastic	Cool below 0℃	Sterilized
Water Samples				
Parameter	**Minimum Sample Volume**	**Container**	**Preservative**	**Container Pre-Treatment**
DO, salinity, Turbidity, Conductivity, Temperature, TDS, Ph, BOD chloride	Insitu Measurements	-	-	-
Metals (Mn, Fe, Cu, Zn, Ag, Pb, Ni, Cd, Cr, Co, Ca, Mg, K, Na)	1.0L	Plastic	Add 2ml conc. HNO_3 & cool, $4^oC \pm 2^oC$	Rinsed with 1+1HNO_3
TPH	1000ml	Glass bottle	Cool, $4^oC \pm 2^oC$ -	Rinsed with distilled water
Microbiology (HUB, HUF, THF, THB)	200ml	Wide mouthed glass bottles	Cool, $4^oC \pm 2^oC$	Sterilized
Air and Noise Studies				
Parameter	**Minimum Sample Volume**	**Container**	**Preservative**	**Container Pre-Treatment**
NO_2, SO_2, CO, H_2S, CH_4, VOC, particulates, temperature, wind speed, wind direction. Noise	Insitu Measurements	-	-	-

2.0 FIELD WORK ACTIVITIES

Sample collection was done in line with recommended procedures and practices for environmental data collection in Nigeria. The sampling procedures for each parameter and observation made are discussed in the following sub-sections.

2.1 Soil Samples

Using a hand auger (**Figure 1.2)** soil samples were collected from the different sampling points for laboratory analysis. In other to ensure optimum result, soil samples of not less than 500g were collected from 0-15cm and 15-30cm. Samples for physico-chemical analysis were collected and placed in polyethylene bags, those for microbiology analysis where collected in 100ml sterilized plastic bottles, while samples for hydrocarbon analysis were collected in 100ml screw-capped glass bottles.

Figure 1.2: Soil Sample Collection

2.2 Surface Water Samples

Surface water sampling was carried out by collecting water samples from designated surface water bodies along the transmission line using a beaker. The beaker was lowered into the river, in order to collect surface water samples. Water samples were transferred directly into various ampoules for preservation and subsequent analysis. *In-situ* analyses were immediately carried out to determine the following parameters with short holding time; pH, redox potential, temperature, turbidity, conductivity, total dissolved solids and dissolved oxygen. Water samples for heavy metal analysis were collected in 2ml plastic bottles and acidified with 10% HNO_3.

Figure 1.3: Surface Water Collection

In-situ analyses for pH and redox potential were determined using a multi meter logger. Temperature, dissolved oxygen (DO), turbidity, conductivity, salinity and total dissolved solids were measured by attaching the probe of corresponding meter to samples.

Groundwater samples were earlier proposed to be taken, boreholes to be installed by the geotechnical investigations. There were no groundwater wells encountered along the line or in close proximity to the ROW.

Hydrobiology

Zooplankton

Zooplankton samples were collected by lowering plankton net of mesh size of 0.063 mm to an approximate depth of 1 m – 2 m below surface water and pulled vertically on to the surface of the river for collection of samples. A weight (iron rod) was attached to the cord holding the net.

Figure 1.4: Zooplankton Collection

After each drag, zooplankton were collected using labeled wide mouth plastic containers and preserved with 10% buffered formalin, the net was thoroughly washed so that particles adhering to the net was washed into the collecting bottle for analysis.

Phytoplankton

Phytoplankton sample collection was done by lowering the plankton net to about 0.5m on the water surface and towed (horizontally) on the waterway at a speed of about 1.5knots per hour for 5 minutes. The phytoplankton samples were collected in clearly labeled containers and preserved in Lugol's iodine solution.

Figure 1.5: Phytoplankton Collection

2.3 Sediment

Sediment samples from the project area were carried out in five corresponding surface water sampling stations in the area. Standard practice using an Eckman grab was employed.

Figure 1.6: Eckman Grab

The top surface of sediment was collected in a plastic basin and homogenized for the analysis of physico-chemical parameters, organics, Polyaromatic hydrocarbon (PAH), micro-biology and heavy metals.

Samples for physico-chemical analyses were collected in polythene bags and stored for the analysis of particle size, total organic matter, total extractable matter, trace metals, total phosphorous and hydrocarbon. The sediment samples for microbial analyses were collected in a sterile McCartney bottles. The samples were stored in coolers containing ice block while residual sediment were washed for benthos.

After each sampling, the grab sampler was washed thoroughly with water from the river to remove adhering particles prior to each sampling. Results of the physicochemical analysis will be documented in the draft report. Detailed laboratory analyses of all samples are discussed fully in the EIA report.

2.4 Benthic Macrofauna

A pragmatic approach was taken in acquiring benthic macro fauna samples, as benthos were obtained by washing residual sediment samples through a 1 mm-mesh sieve using water obtained from the beach at the site. This was carried in order not to destroy the integrity of the benthic organisms. The benthos samples obtained were placed in a plastic container and preserved in 20% buffered formal saline and stored in the ice coolers.

Figure 1.7: Benthos Sieving

Washing of the samples commenced as soon as the sediment sample were placed in containers. After each grab it was ensured that each mesh was properly washed .for quality assurance.

2.5 Air Quality and Noise Measurements

Measurement of atmospheric gas pollutants (NO_x, SO_x, CO_2, CO, and H_2S), suspended particulate matter, volatile organic compounds as well as noise levels were carried out in ten sample stations.

Figure 1.8: Installation of Ogawa Passive Samplers

Atmospheric gasses were measured with the aid of portassen air analyser. This equipment was calibrated and a sensor connected to the equipment, the equipment was then held at arms length towards the direction of the prevailing wind. The value of the atmospheric concentrations of each gaseous pollutant was read off directly on the equipment screen after 10 - 15 minutes.

The sampling protocol entailed washing and drying, assembly of sampler, and loading with the pre-coated filters. These were carried out in clean areas free from air contaminants and mounted at strategic positions (10 stations) for 30 days. Thereafter, the pads were removed and put in a vial containing 8ml of water before transportation to the laboratory for analysis.

The level of suspended particulate matter was established using the Aerocet 53i Particulate Counter. The equipment was switched on and exposed to the atmosphere for about 5 minutes the result obtained was read off from the meter after putting it on.

Figure 1.9: Air Quality Measurements

The amount of volatile organic compound in the atmosphere was measured using a Phochec meter. The meter has a detachable probe which serves as the sensor and it is attached to the meter before being placed towards the prevailing wind at arms length. The result is then read directly from the meter.

The ambient noise level was measured with the aid of a Pulsar II Meter. The noise level was coded to run for 30mins at each sampling point. The readings were stored in the memory of the noise meter, were it will be extracted from a computer back in the office

Figure 1.10: Noise Measurements

2.6 Vegetation Survey

Qualitative and quantitative features of the vegetation were studied at geo-referenced sampling points (marking out transects) along the line. Transects were run at five corresponding sampling stations as required in the approved in the ToR. The physiognomy and other descriptive vegetation characteristics were taken with standard methodology. Details of study methodology and results are discussed in the full EIA report.

Figure 1.11: Vegetation Studies

Sampling points were established at intervals of approximately 10 km, alternating on the right and left flanks of the proposed route and including, as much as possible, all vegetation types along the proposed route.

2.7 Wildlife Survey

The standard study methods of structured interviews with hunters, field sightings, bird calls, animal remains and spur marks were used to identify faunal groups in the study area. The area appeared undisturbed from outside the forest; however, the noise from logging activities has driven large animals away. Some reptiles and several insect groups were sighted. Details of their conservation status and likely impacts of the projects on these are provided in the full report.

2.8 Consultation / Sensitization

Consultation involves stakeholder/public gathering or meeting where opinions of a proposed project that may impact on them are discussed and other issues addressed. Prior to field study, consultation which has been on-going at the local government and Clan levels for the time being would continue throughout the project life span. The key objectives of consultation include:

- ensure all communities and all stakeholders are given early and adequate information on the details of the project;
- obtaining stakeholders approval of the proposed project;
- early identification of issues and concerns in order to avoid delays in project implementation;
- establishing the trust and co-operation of local communities;
- provide a framework for improving the understanding of the potential impacts of the proposed project on the socio-economics and biophysical environment;
- capture stakeholders views and concerns as part of the EIA process especially as it concerns the potential impacts;
- identify alternative sites or designs, and mitigation measures, in order to improve environmental and social soundness;
- obtaining local knowledge of the area
- increasing project success;
- promoting sustainability; and
- ensuring transparency and increasing accountability.
- establish transparent procedures for carrying out the proposed projects; and
- create accountability and a sense of local ownership during project implementation thus minimising communities conflicts and project delays that may result thereof.

Stakeholders involved in the Power Transmission Line Project include:

- The host communities (Chiefs, Women's Group, Youth Council etc):
- Government agencies (FMENV, Akwa Ibom State Ministry for Environment);
- Non- Governmental Organizations (NGOs);
- The general public

Local Governments were chosen according to current political maps in Nigeria. All affected/relevant LGA's and villages were informed prior to commencement of the study. Details of consultations carried out for the projects as well as accompanying evidences are provided in the EIA report (**Appendix 4.5**).

	**Consultation at Ikpa Ibom Clan, Mkpat Enin LGA / Clan Council– 14/07/11.**
	**Consultation at Onna TRC– 13/07/11.**
	**Consultation at Ibeno TRC / Clan Council– 21/07/11.**

	**Consultation at Afaha-Eket Clan Council – 08/07/11.**
	**Consultation at Ikpa Ibekwe Clan Council, Ikot Abasi – 13/07/11.**

Figure 3.11: Consultations Sessions

2.9 Socio-economic and health Study

Socio-economic and health assessment involved studying affected host communities in the six identified LGA (Ibeno, Esit Eket, Eket, Onna, Mkpat Enin and Ikot – Abasi). Information on socio-economics and community health data was acquired using household questionnaires as well as other relevant socio-economic and health survey tools (see EIA report, **Appendix 4.6**). Key informant interviews and focus group discussions, physical evaluation of health status as well as consultations with the various sections of the host communities provided relevant information on socio-economics and health profile of the area.

3.0 Laboratory Analytical Methods and Procedures

The following subsections present synoptic descriptions of the laboratory analytical methods for the various physical, chemical and biological parameters of samples obtained from the study area. The equipment detection limits of parameters analysed in surface water and sediment samples are also presented.

Conductivity and pH

20.0g of fresh sediment sample was weighed into a 50ml beaker and 20ml of distilled water added to the beaker. The mixture was thoroughly stirred and allowed to stand for 30 minutes and the Multi-Parameter Water Quality Monitor was then used to measure the above parameters directly. The APHA 2510A and APHA 4500H $^{+}$B (for water) were used for conductivity and pH determinations.

Total Suspended Solid

Total suspended solids content of the water samples was determined with a membrane filter apparatus, in accordance with APHA 25400. A 100ml aliquot of the water sample was filtered through dried pre-weighed 0.45f.lm filter paper, through which clean distilled water not less than 100ml and subsequently passed to remove salt.

The filter was then oven dried at 105 ± 5℃ for one hour. After drying, the filter paper was cooled and weighed. The difference in filter weights before and after filtering was used to calculate the TSS.

The TSS content was calculated as follows:

$$\text{TSS (mg/l)} = \frac{(A - B)}{\text{Sample volume (ml)}} \times 1000$$

Where A = weight of filter paper (mg) + residue (mg)
B = weight of filter paper (mg)

Chemical Oxygen Demand

Chemical oxygen demand (COD) of surface water was determined titrimetrically according to CAEM. In this method, organic matter was oxidized to carbon dioxide using acid dichromate as the oxidizing agent and its consumption which is equivalent to COD concentration was measured by titrating against a standard ferrous ammonium sulphate solution.

The chemical oxygen demand was calculated as follow:

$$\text{COD (mgll)} = \frac{\text{B - S(ml) x titrant molarity x 8 x 1000}}{\text{Volume of sample}}$$

B =Titre for Blank
S =Titre for Sample
8 =Atomic mass of Oxygen
1000 =Conversion to litre

Biological Oxygen Demand

BOD_5 of surface water was determined in accordance with APHA 5210B. This was done electro metrically with the OxiTOP BOD instrument in the presence of sodium hydroxide. Each sample was allowed to attain a temperature of within 2℃ of its incubation temperature (20℃). 95ml of the samples were measured into BOOTrak sample bottles with channel num!1er tags and magnetic stirrers inserted in each sample bottle. Test duration of 5 days for the sample was selected from the channel key. The test was initiated by pressing the channel number and selecting the BOD range required. The analysis results at the expiration of the set period were reported in mg/1. At the end of 5 days incubation, the readings were taken from the BOD device and multiplied by a factor of 20.

Total Organic Carbon in Sediment Samples
TOC was determined following BS 1377 method.

TOC is calculated thus:

$$\text{Organic Carbon (g/kg)} = \frac{(\text{meq } K_2Cr_2O_7 - \text{meg } FeSO_4) \times 0.003 \times 1000 \times 1.3}{\text{Weight of water free sample (g)}}$$

Total Organic Matter (g/kg) = Total organic carbon (g/kg) x 1.729

Where,
meq K_2CrO_7 = 1N x 10ml
meq $FeSO_4$ = 0.5N x volume of titrant in ml
0.003 = milliequivalent weight of carbon
1.30 = Correction factor
1000 = Conversion factor to kg

Phosphate - Phosphorus
The test method for Phosphate - phosphorus in sediment samples was based on APHA 4500-PD/CAEM. The Stannous Chloride Reduction Method, based on the method described in the Chemical Analyses of Ecological Materials (2nd edition), was applied. Phosphate - phosphorus content of sediment samples was calculated as follows.

$$\text{Phosphate - phosphorus (mg/kg)} = \frac{\text{C (mg/l) x Solution Volume (l) x 1000}}{\text{Aliquot x Sample weight (g)}}$$

Where C = mg phosphate obtained from calibration graph using the UV/Visible spectrometer and Vision software version 3

$$\text{Aliquot} = \frac{\text{Volume (ml) of extract used for analyses}}{\text{Volume (ml) of extractant used for the extraction}}$$

1000 = conversion factor to kg

Nitrate
The USEPA 3521 in combination with the Chemical Analysis of Ecological Matter (second edition) test methods were used to determine the nitrate content of sediment samples. N was calculated as follows.

$$\text{N (mg/kg)} = \frac{\text{mg (N) from calibration graph}}{\text{Aliquot (ml) x Sample weight (g)}} \times 1000$$

Where the 1000 is the conversion factor to kg
Aliquot = volume of extract used/volume of extractant.

Exchangeable Cations

Exchangeable cations (Mg, Ca, K, and Na) were determined as described by APHA 20th edition 3111 Band ASTM D3561. The concentrations were calculated thus:

$$\text{Concentration (mg/l)} = C \quad x \quad \frac{C \times Y}{X}$$

Where C=concentration of cation determined from calibration curve
Y=final volume. Ml
X=volume of sample, ml

Cd, Zn, Mn, Cu, Cr, Ni and: APHA 3111 B (20th edition)
Ba: ASTM D3651
V: APHA 3111 D (20th edition)
Hg APHA 3112B

$$\text{Metal concentration of water samples (mg/l)} = \frac{C \times Y}{X}$$

Where C=concentration of cation determined from calibration curve
Y =Final volume made-up (ml)
X = Sample of volume (ml)

Hg is determined using' APHA 3112B 20ed test method

$$\text{Hg concentration, ug/l} = \frac{(A-B)}{D}$$

Where A = concentration of mercury in sample, µg/l as determined by AAS (Instrument Reading)
B = concentration of mercury found in blank, µg/l.
D =. Volume of sample in litres

Heavy Metals in Sediment Samples

Heav'y metal content of sediment samples was determined using Perkin Elmer Atomic Absorption Spectrophotometer, Model Analyst 200. The sample digestion/preparation procedure followed is described in ASTM D5198/D3974. AAS measurement of heavy metal content sediment samples was done following the procedures indicated below.

Cd, Zn, Mn, Fe, Cu, Cr, Ni and: APHA 20th edition 3111 B
Ba: ASTM D3651
V: APHA 20th edition 3111 D

$$\text{Metal concentration of sediment samples (mg/kg)} = \frac{(A - B) \times C}{D}$$

Where A =Concentration of metal in sample (mg/l) as determined by AAS
B =Concentration of the metal found in blank (mg/l)
C=Volume of extract (ml)
D = Weight of dry sample (g)

Hg: APHA 3112B & ASTM D3223

Mercury (Hg) concentration is determined thus, µg/g = (A - B) C D

Where A = concentration of mercury in sample, µg/ml as determined by AAS (Instrument reading)
B = concentration of mercury found in blank, µg/ml (Procedural blank)
C = volume of extract, (ml)
D = weight of dry sample, (g)

Particle Size Distribution
The test method is based on the BS1377 (Part 2; 1990) which is in accordance with the Dutch RAW and the American ASTM D422. PSD was determined using the hydrometer method followed by sieving recommended for sediment samples containing more than 35% fine particles, i.e., clays and silts.

Total Microbial Count (Surface water and Sediment Samples)
Indirect cell count on sediment and water samples was carried out to determine the total viable microbial populations. The test methods used are the ASTM D5465 - 93: Determining Microbial Colony Counts from Water Analysed by Plating Methods, and APHA 907: Standard Plate Count.

Total microbial colonies were calculated as follows:

$$\text{Plate Count (cfu/ml)} = \text{Vol plated} \times \text{Number of cells} \times \frac{(1)}{\text{dilution}} \times \text{dilution factor}$$

Faecal Coliform
Faecal coliform were determined using the multiple tube technique in accordance with ASTM D5392-93. 10ml of sample was inoculated into five tubes containing 10ml of double strength presumptive broth (Mac Conkey broth). The tubes were shaken to distribute the sample evenly. The tubes were inoculated at 35℃ - 37℃ for 24hours. At the end of 24hrs each tube was checked for gas or any effervescence (streams of tiny bubbles), then the numbers of positive tubes were recorded after 24hrs. Negative tubes were re-incubated for another 24hrs and the numbers of positive after 48hrs were also recorded.

A confirmatory test was carried out by transferring one or two drops from each presumptive positive tube to a corresponding sterile confirmative 10ml tube containing BGB broth. Gas presence in the subculture tubes after 24hrs at 44 ± 5℃ confirms the presence of faecal coliforms.

The number of positive findings (either presumptive or confirmed) is computed in terms of the Most Probable Number (MPN). The MPN was estimated by Thomas' simple formula:

$$\text{MPN/100ml} = \frac{\text{No. of positive tubes} \times 100}{\sqrt{\text{ml sample in negative tubes} \times \text{ml sample in all tubes}}}$$

Benthos Analyses
The benthic macrofauna were obtained by sieving the grab samples through a 1.0 mm mesh. The residue retained by the two sieves after sieving were poured into plastic containers and was preserved in 10% formalin to which rose bengal satin had been

added. The preserved benthic were taken to laboratory for sorting and identification.

In the laboratory, sorting and counting was done by using a hand lens and a binocular microscope. Identification was done after Gosner (1971), Bernhard G. (1974) and KObina and Mike (2001). Ecological indices, such as margalef species richness index and Shannon Weiener diversity index were used in statistical analysis

Sample Handling
Chain of custody forms were used for logging and tracking of samples from the point of collection in the field to the laboratory where analysis was carried out. Samples were preserved in accordance with FMENV recommended procedure.

Laboratory Analyses
Quality Assurance and Quality Control (QA/QC) measures adopted for laboratory analysis were in line with standard practices and included collection and analysis of duplicate samples to establish analytical precision. Other QA/QC measures adopted include:

Only adequately trained personnel were used at all phases of the study;

- Written analytical standard operating procedures were followed during analyses;
- Routine auditing and checking of analyses results, were introduced into every batch or five samples collected.

Data Management
Standard data spreadsheets were used for recording and transmitting analytical results. Presentation of results was carried out following written standard operating procedures. Final results were issued only after a general QA/QC check and validation has been carried

APPENDIX 4.2

SURFACE-WATER/SEDIMENT CHARACTERISTICS

WET SEASON – SURFACEWATER / SEDIMENT CHARACTERISTICS

Table 1a: PHCN-JV ILF PROJECT Water Physicochemical Characteristics

Parameter	Method	Sample Station Result		
		SS 1	SS 3	SS 6
Co-ordinates		X: 8.017689 Y: 4.5547	X: 8.00702 Y: 4.580751	X: 7.926443 Y: 4.605578
pH	APHA 4500H^+B	6.86	6.53	6.63
Temperature (^oC)	APHA 2550B	25.9	25.8	26.3
Electrical Conductivity (µS/cm)	APHA 2510A	439	21.4	12.1
Salinity (ppt)	APHA 2520	<0.10	<0.10	<0.10
DO (mg/l)	APHA 4500-OG	5.95	5.72	5.56
Turbidity (NTU)	APHA 2130B	34.0	26.0	29.0
Redox Potential	ASTM D1498	121	136	140
TOC (g/L)	BS 1377	<1.00	<1.00	<1.00
TDS (g/L)	APHA 2510A	235	11.6	7.25
TSS (mg/l)	APHA 2540D	7.00	4.00	2.00
BOD_5 (mg/l)	APHA 5220D	<0.50	20.0	<0.50
COD (mg/l)	APHA 5220D	<0.80	30.8	<0.80
Total Hardness (mg/l)	APHA 2340C	42.2	3.84	1.92
Oil & Grease (mg/l)	ASTM D 3921	<1.00	<1.00	<1.00
Chloride (mg/l)	APHA 4500 Cl^-	120	1.76	1.76
Nitrate (mg/l)	EPA 352.1	0.15	0.14	0.27
Sulphate (mg/l)	APHA 4500-SO_4	9.25	0.14	0.12
Magnesium (mg/l)	APHA 3111B/ASTM D 3561	6.46	0.46	0.36
Potassium (mg/l)	APHA 3111B/ASTM D 3561	3.46	0.73	1.18
Sodium (mg/l)	APHA 3111B/ASTM D 3561	41.6	1.80	1.69
Calcium (mg/l)	APHA 3111D	2.70	1.02	0.80
Cadmium (mg/l)	APHA 3111B	<0.02	<0.02	<0.02
Total Chromium (mg/l)	APHA 3111C	<0.10	<0.10	<0.10
Copper (mg/l)	APHA 3111B	<0.05	<0.05	<0.05
Total Iron (mg/l)	APHA 3111B	2.51	1.91	4.18
Lead (mg/l)	APHA 3111B	<0.20	<0.20	<0.20
Nickel (mg/l)	APHA 3111B	<0.10	<0.10	<0.10
Zinc (mg/l)	APHA 3111B	<0.05	<0.05	<0.05
Silver (mg/l	APHA 3111B	<0.10	<0.10	<0.10
Manganese (mg/l)	APHA 3111B	<0.10	<0.10	<0.10
Mercury (mg/l)	APHA 3112B	<0.0002	<0.0002	<0.0002
Vanadium (mg/l)	APHA 3111D	<0.20	<0.20	<0.20

- ASTM = American Society for Testing and Material (1999 Edition)
- APHA = American Public Health Association (20^{th} Edition 1998)
- EPA = Environmental Protection Agency (2^{nd} Edition 1996)
- BS = British Standard

Table 1a: PHCN-JV ILF PROJECT Water Physicochemical Characteristics

Parameter	Method	Sample Station Result	
		SS 19	SS 20
Co-ordinates		X: 7.606547 Y: 4.570064	X: 7.0591482 Y: 4.565826
pH	APHA 4500H$^+$B	6.21	6.09
Temperature (^oC)	APHA 2550B	27.6	27.6
Electrical Conductivity (µS/cm)	APHA 2510A	94.0	20.8
Salinity (ppt)	APHA 2520	<0.10	<0.10
DO (mg/l)	APHA 4500-OG	5.81	5.78
Turbidity (NTU)	APHA 2130B	21.0	15.0
Redox Potential	ASTM D1498	1.55	168
TOC (g/L)	BS 1377	<1.00	<1.00
TDS (g/L)	APHA 2510A	52.8	11.8
TSS (mg/l)	APHA 2540D	7.00	5.00
BOD_5 (mg/l)	APHA 5220D	<0.50	10.0
COD (mg/l)	APHA 5220D	<0.80	15.9
Total Hardness (mg/l)	APHA 2340C	9.60	7.68
Oil & Grease (mg/l)	ASTM D 3921	<1.00	<1.00
Chloride (mg/l)	APHA 4500 Cl^-	22.9	3.52
Nitrate (mg/l)	EPA 352.1	0.26	0.33
Sulphate (mg/l)	APHA 4500-SO_4	1.77	0.28
Magnesium (mg/l)	APHA 3111B/ASTM D 3561	1.52	0.46
Potassium (mg/l)	APHA 3111B/ASTM D 3561	1.49	0.84
Sodium (mg/l)	APHA 3111D	12.7	8.49
Calcium (mg/l)	APHA 3111B	1.27	0.89
Cadmium (mg/l)	APHA 3111C	<0.02	<0.02
Total Chromium (mg/l)	APHA 3111B	<0.10	<0.10
Copper (mg/l)	APHA 3111B	<0.05	<0.05
Total Iron (mg/l)	APHA 3111B	0.84	1.42
Lead (mg/l)	APHA 3111B	<0.20	<0.20
Nickel (mg/l)	APHA 3111B	<0.10	<0.10
Zinc (mg/l)	APHA 3111B	<0.05	<0.05
Silver (mg/l	APHA 3111B	<0.10	<0.10
Manganese (mg/l)	APHA 3112B	<0.10	<0.10
Mercury (mg/l)	APHA 3111D	<0.0002	<0.0002
Vanadium (mg/l)	APHA 4500H$^+$B	<0.20	<0.20

- ASTM = American Society for Testing and Material (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- EPA = Environmental Protection Agency (2nd Edition 1996)
- BS = British Standard

Table 1b: PHCN-JV ILF PROJECT Sediment Physicochemical Characteristics

Parameter	Method	Sample Station Result		
		SS 1	SS 3	SS 6
Co-ordinates		X: 8.017689 Y: 4.5547	X: 8.00702 Y: 4.580751	X: 7.926443 Y: 4.605578
pH (H_2O) @ 22.7°C	ASTM D 4972	4.71	4.40	3.79
Electrical Conductivity (µS/cm)	APHA 2510A	2,330	345	539
TOC (g/kg)	BS 1377	11.8	4.62	25.0
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	-42.0	-81.0	-34.0
PSD Clay (%)	ASTM D 422	20.0	25.0	18.0
Silt (%)		15.0	44.0	11.0
Sand (%)		65.0	31.0	71.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.67	1.84	1.28
Extractable Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	1,325	250	275
Extractable Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.64	3.04	1.49
Magnesium (mg/kg)	USEPA 6200	3,914	2,936	1,852
Potassium (mg/kg)	USEPA 6200	12,250	11,730	4,680
Sodium (mg/kg)	USEPA 6200	7,320	7,250	3,470
Calcium (mg/kg)	USEPA 6200	2,620	1,634	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	16.8	11.1	17.2
Copper (mg/kg)	USEPA 6200	3.80	4.90	6.50
Total Iron (mg/kg)	USEPA 6200	26,150	14,860	21,970
Lead (mg/kg)	USEPA 6200	9.50	11.3	8.90
Nickel (mg/kg)	USEPA 6200	11.0	5.70	21.6
Zinc (mg/kg)	USEPA 6200	21.0	18.2	18.4
Barium (mg/kg)	USEPA 6200	350	170	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	306	163	79.2
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	27.7	<1.00	56.3

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency

Table 1b: PHCN-JV ILF PROJECT Sediment Physicochemical Characteristics

Parameter	Method	Sample Station Result	
		SS 19	SS 20
Co-ordinates		X: 7.606547 Y: 4.570064	X: 7.0591482 Y: 4.565826
pH (H_2O) @ 22.9	ASTM D 4972	5.04	5.21
Electrical Conductivity (µS/cm)	APHA 2510A	1,436	20.7
TOC (g/kg)	BS 1377	14.2	0.53
THC (mg/kg)	ASTM D 3921	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	-41.0	-22.0
PSD Clay (%)	ASTM D 422	30.0	2.00
Silt (%)		10.0	16.0
Sand (%)		60.0	82.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.80	1.54
Extractable Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	400	100
Extractable Phosphate (mg/kg)	CAEM/APHA 4500 PD	2.35	2.57
Magnesium (mg/kg)	USEPA 6200	3,712	347
Potassium (mg/kg)	USEPA 6200	8,292	4,878
Sodium (mg/kg)	USEPA 6200	3,380	3,000
Calcium (mg/kg)	USEPA 6200	309	<10.0
Cadmium (mg/kg)	USEPA 6200	2.60	<2.00
Total Chromium (mg/kg)	USEPA 6200	22.3	7.80
Copper (mg/kg)	USEPA 6200	8.10	2.30
Total Iron (mg/kg)	USEPA 6200	32,610	9,674
Lead (mg/kg)	USEPA 6200	10.6	7.00
Nickel (mg/kg)	USEPA 6200	24.3	3.10
Zinc (mg/kg)	USEPA 6200	28.9	6.00
Barium (mg/kg)	USEPA 6200	48.3	<2.00
Silver (mg/kg)	USEPA 6200	1.90	<2.00
Manganese (mg/kg)	USEPA 6200	90.2	108
Mercury (mg/kg)	USEPA 6200	1.30	<1.00
Vanadium (mg/kg)	USEPA 6200	51.3	<1.00

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency

Table 2a: PHCN-JV ILF PROJECT Water Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/l)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03

Table 2b: PHCN-JV ILF PROJECT Sediment Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03

Table 3a: PHCN-JV ILF PROJECT Surface Water Determination of Phenols

Parameter	Method	Sample Station Result (mg/l)				
		SS 1	SS 3	SS 6	SS 19	SS 20
4–Chloro –3–cresol	USEPA 8040	<0.01	<0.01	<0.01	<0.01	<0.01
o-Cresol		<0.01	<0.01	<0.01	<0.01	<0.01
2-Cyclohexyl-4,6-dinitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dichlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2-Methyl-4,6-dinitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
o-Nitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
p- Nitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2,4,6-Trichlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
Phenol		<0.01	<0.01	<0.01	<0.01	<0.01
Total		-	-	-	-	-

- USEPA = United States Environmental Protection Agency

Table 4b: PHCN-JV ILF PROJECT Sediment Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02

USEPA = United States Environmental Protection Agency

Table 5b: PHCN-JV ILF PROJECT -Sediment Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	0.15
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	0.37	<0.01	0.21
n-Eicosane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Henelcosane		0.33	<0.01	0.49	<0.01	0.32
n-Docosane		0.23	0.32	<0.01	0.31	<0.01
n-Tricosane		0.26	0.44	<0.01	<0.01	0.39
n-Tetracosane		0.34	0.49	1.05	0.52	0.53
n-Pentacosane-		0.42	0.64	0.43	0.68	0.57
n-Hexacosne		0.12	0.20	<0.01	<0.01	0.26
n-Heptacosane		0.23	0.31	<0.01	<0.01	0.36
n-Octacosane		0.27	0.71	<0.01	<0.01	0.34
n-Nonacosane		0.20	0.23	<0.01	<0.01	0.11
n-Triacontane		0.23	0.23	<0.01	0.20	0.19
n-Hentriacontane		0.16	0.18	0.32	0.18	<0.01
n-Dotriacotane		0.20	0.23	1.06	1.00	<0.01
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentatriacontane		0.16	0.51	1.46	<0.01	0.68
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		0.13	1.35	1.59	2.27	1.17
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.64**	**5.53**	**7.72**	**5.17**	**5.31**

- USEPA = United States Environmental Protection Agency

Table 7a: PHCN-JV ILF PROJECT Surface Water Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/ml)	Hydrocarbon Utilising Bacteria	Count (cfu/ml)	Heterotrophic Fungi	Count (cfu/ml)	Hydrocarbon Utilising Fungi	Count (cfu/ml)
SS1	Pseudomonas sp	7.80×10^2	Pseudomonas sp	1.24×10^2	Mucor sp, Candida sp Rhodotorula sp, Aspergillus sp	6.7×10^1	Mucor sp, Candida sp Rhodotorula sp, Aspergillus sp	6.2×10^1
SS3	Pseudomonas sp Bacillus sp	8.00×10^2	Pseudomonas sp	9.0×10^1	Aspergillus sp Mucor sp	2.7×10^1	Aspergillus sp Mucor sp	1.5×10^1
SS 6	Pseudomonas sp Bacillus sp	1.59×10^3	Pseudomonas sp	5.6×10^1	Mucor sp	1.8×10^1	Mucor sp	1.6×10^1
SS 19	Pseudomonas sp Bacillus sp	1.25×10^3	Pseudomonas sp	4.4×10^1	Rhodotorula sp Mucor sp Candida sp	3.5×10^1	Rhodotorula sp Mucor sp Candida sp	3.2×10^1
SS 20	Pseudomonas sp Bacillus sp	6.40×10^2	Pseudomonas sp	3.7×10^1	Rhodotorula sp Mucor sp	1.1×10^1	Rhodotorula sp Mucor sp	7

Table 7b: PHCN-JV ILF PROJECT Sediment Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 1	Pseudomonas sp	4.00×10^4	Pseudomonas sp	6.60×10^2	Aspergillus sp	2.0×10^1	Aspergillus sp	1.0×10^1
SS 3	Pseudomonas sp	2.00×10^4	Pseudomonas sp	7.70×10^2	Mucor sp Candida sp	2.0×10^1	Mucor sp Candida sp	2.0×10^1
SS 6	Pseudomonas sp	1.80×10^5	Pseudomonas sp	7.60×10^2	Candida sp Mucor sp	1.20×10^2	Candida sp Mucor sp	4
SS 19	Pseudomonas sp	6.00×10^4	Pseudomonas sp	1.80×10^2	Mucor sp Aspergillus sp Candida sp	4.80×10^2	Mucor sp Aspergillus sp Candida sp	4.00×10^2
SS 20	Pseudomonas sp	6.40×10^5	Pseudomonas sp	9.60×10^2	Aspergillus sp Mucor sp Candida sp	9.10×10^2	Mucor sp Candida sp	2.30×10^2

DRY SEASON – SURFACEWATER / SEDIMENT CHARACTERISTICS

Table 1a: PHCN-JV ILF PROJECT Water Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result		
		SS 1	SS 3	SS 6
Co-ordinates		X: 8.017689 Y: 4.5547	X: 8.00702 Y: 4.580751	X: 7.926443 Y: 4.605578
pH	APHA 4500H$^+$B	6.08	6.53	6.49
Temperature (^oC)	APHA 2550B	28.3	28.6	28.9
Electrical Conductivity (µS/cm)	APHA 2510A	7.710	543	11.0
Salinity (ppt)	APHA 2520	4.40	0.20	<0.10
DO (mg/l)	APHA 4500-OG	3.60	4.23	4.06
Turbidity (NTU)	APHA 2130B	35.0	39.0	21.0
Redox Potential	ASTM D1498	125	138	145
TOC (g/L)	BS 1377	<1.00	<1.00	<1.00
TDS (g/L)	APHA 2510A	4,620	326	6.60
TSS (mg/l)	APHA 2540D	14.0	17.0	3.00
BOD_5 (mg/l)	APHA 5220D	80.0	60.0	<0.50
COD (mg/l)	APHA 5220D	112	96.0	<0.80
Total Hardness (mg/l)	APHA 2340C	176	58.9	<1.00
Oil & Grease (mg/l)	ASTM D 3921	<1.00	<1.00	<1.00
Chloride (mg/l)	APHA 4500 Cl^-	2,421	94.2	1.61
Nitrate (mg/l)	EPA 352.1	0.02	0.17	0.08
Sulphate (mg/l)	APHA 4500-SO_4	13.5	0.53	0.13
Magnesium (mg/l)	APHA 3111B/ASTM D 3561	161	8.20	0.15
Potassium (mg/l)	APHA 3111B/ASTM D 3561	94.6	4.14	0.40
Sodium (mg/l)	APHA 3111B/ASTM D 3561	1,761	72.4	1.11
Calcium (mg/l)	APHA 3111D	34.6	2.53	0.71
Cadmium (mg/l)	APHA 3111B	<0.02	<0.02	<0.02
Total Chromium (mg/l)	APHA 3111C	<0.10	<0.10	<0.10
Copper (mg/l)	APHA 3111B	<0.05	<0.05	<0.05
Total Iron (mg/l)	APHA 3111B	1.59	2.25	2.46
Lead (mg/l)	APHA 3111B	<0.20	<0.20	<0.20
Nickel (mg/l)	APHA 3111B	<0.10	<0.10	<0.10
Zinc (mg/l)	APHA 3111B	<0.05	<0.05	<0.05
Silver (mg/l	APHA 3111B	<0.10	<0.10	<0.10
Manganese (mg/l)	APHA 3111B	<0.10	<0.10	<0.10
Mercury (mg/l)	APHA 3112B	<0.0002	<0.0002	<0.0002
Vanadium (mg/l)	APHA 3111D	<0.20	<0.20	<0.20

- ASTM = American Society for Testing and Material (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- EPA = Environmental Protection Agency (2nd Edition 1996)
- BS = British Standard

Table 1a: PHCN-JV ILF PROJECT Water Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result	
		SS 19	SS 20
Co-ordinates		X: 7.606547 Y: 4.570064	X: 7.0591482 Y: 4.565826
pH	APHA 4500H^+B	6.31	5.41
Temperature (^oC)	APHA 2550B	30.1	29.9
Electrical Conductivity (µS/cm)	APHA 2510A	94.2	24.8
Salinity (ppt)	APHA 2520	0.70	<0.10
DO (mg/l)	APHA 4500-OG	5.46	5.17
Turbidity (NTU)	APHA 2130B	12.0	13.0
Redox Potential	ASTM D1498	158	170
TOC (g/L)	BS 1377	<1.00	<1.00
TDS (g/L)	APHA 2510A	56.5	14.8
TSS (mg/l)	APHA 2540D	9.00	8.00
BOD_5 (mg/l)	APHA 5220D	<0.50	20.0
COD (mg/l)	APHA 5220D	<0.80	32.0
Total Hardness (mg/l)	APHA 2340C	133	2.85
Oil & Grease (mg/l)	ASTM D 3921	<1.00	<1.00
Chloride (mg/l)	APHA 4500 Cl^-	29.3	<1.00
Nitrate (mg/l)	EPA 352.1	<0.02	0.03
Sulphate (mg/l)	APHA 4500-SO_4	0.99	0.10
Magnesium (mg/l)	APHA 3111B/ASTM D 3561	2.09	0.28
Potassium (mg/l)	APHA 3111B/ASTM D 3561	9.40	0.56
Sodium (mg/l)	APHA 3111D	17.3	0.55
Calcium (mg/l)	APHA 3111B	7.21	0.76
Cadmium (mg/l)	APHA 3111C	<0.02	<0.02
Total Chromium (mg/l)	APHA 3111B	<0.10	<0.10
Copper (mg/l)	APHA 3111B	<0.05	<0.05
Total Iron (mg/l)	APHA 3111B	0.44	1.63
Lead (mg/l)	APHA 3111B	<0.20	<0.20
Nickel (mg/l)	APHA 3111B	<0.10	<0.10
Zinc (mg/l)	APHA 3111B	<0.05	<0.05
Silver (mg/l	APHA 3111B	<0.10	<0.10
Manganese (mg/l)	APHA 3112B	<0.10	<0.10
Mercury (mg/l)	APHA 3111D	<0.0002	<0.0002
Vanadium (mg/l)	APHA 4500H^+B	<0.20	<0.20

ASTM = American Society for Testing and Material (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- EPA = Environmental Protection Agency (2nd Edition 1996)
- BS = British Standard

Table 1b: PHCN-JV ILF PROJECT Sediment Physicochemical Characteristics

Parameter	Method	Sample Station Result		
		SS 1	SS 3	SS 6
Co-ordinates		X: 8.017689 Y: 4.5547	X: 8.00702 Y: 4.580751	X: 7.926443 Y: 4.605578
pH (H_2O) @ 24.9°C	ASTM D 4972	6.20	6.47	5.17
Electrical Conductivity (µS/cm)	APHA 2510A	202	124	101
TOC (g/kg)	BS 1377	22.7	40.6	38.0
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	-50.0	-75.0	-45.0
PSD Clay (%)	ASTM D 422	10.0	5.00	10.0
Silt (%)		10.0	25.0	10.0
Sand (%)		80.0	70.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	0.99	0.90	1.18
Extractable Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	221	169	209
Extractable Phosphate (mg/kg)	CAEM/APHA 4500 PD	1.37	6.59	10.8
Magnesium (mg/kg)	USEPA 6200	3,919	2,129	1,859
Potassium (mg/kg)	USEPA 6200	13,400	11,110	5,094
Sodium (mg/kg)	USEPA 6200	7,660	3,530	3,510
Calcium (mg/kg)	USEPA 6200	3,558	2,273	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	2.50	26.3	93.5
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	21,410	21,990	24,270
Lead (mg/kg)	USEPA 6200	6.70	8.90	4.60
Nickel (mg/kg)	USEPA 6200	20.6	27.3	49.2
Zinc (mg/kg)	USEPA 6200	14.3	87.5	9.00
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	111
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	375	300	89.7
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	25.9	<1.00	76.3

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency

Table 1b: PHCN-JV ILF PROJECT Sediment Physicochemical Characteristics

Parameter	Method	Sample Station Result	
		SS 19	SS 20
Co-ordinates		X: 7.606547 Y: 4.570064	X: 7.0591482 Y: 4.565826
pH (H_2O) @ 24.0^oC	ASTM D 4972	6.63	6.51
Electrical Conductivity (µS/cm)	APHA 2510A	174	121
TOC (g/kg)	BS 1377	20.9	8.91
THC (mg/kg)	ASTM D 3921	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	-51.0	-25.6
PSD Clay (%)	ASTM D 422	10.0	5.00
Silt (%)		10.0	15.0
Sand (%)		80.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	<0.02	0.94
Extractable Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	170	224
Extractable Phosphate (mg/kg)	CAEM/APHA 4500 PD	17.2	3.59
Magnesium (mg/kg)	USEPA 6200	3,746	637
Potassium (mg/kg)	USEPA 6200	8,103	4,731
Sodium (mg/kg)	USEPA 6200	3,510	2,700
Calcium (mg/kg)	USEPA 6200	170	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	99.0	7.10
Copper (mg/kg)	USEPA 6200	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	30,200	10,010
Lead (mg/kg)	USEPA 6200	5.60	3.90
Nickel (mg/kg)	USEPA 6200	52.3	21.7
Zinc (mg/kg)	USEPA 6200	29.3	5.50
Barium (mg/kg)	USEPA 6200	161	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	101	123
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	66.7	<1.00

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency

Table 2a: PHCN-JV ILF PROJECT Water Volatile Hydrocarbon Profile (BTEX) Dry Season

Parameter	Method	Sample Station Result (mg/L)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2b: PHCN-JV ILF PROJECT Sediment Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03

- o USEPA = United States Environmental Protection Agency

Table 3a: PHCN-JV ILF PROJECT Surface Water Determination of Phenols

Parameter	Method	Sample Station Result (mg/L)				
		SS 1	SS 3	SS 6	SS 19	SS 20
4–Chloro –3–cresol	USEPA 8040	<0.01	<0.01	<0.01	<0.01	<0.01
o-Cresol		<0.01	<0.01	<0.01	<0.01	<0.01
2-Cyclohexyl-4,6-dinitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dichlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2-Methyl-4,6-dinitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
o-Nitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
p- Nitrophenol		<0.01	<0.01	<0.01	<0.01	<0.01
2,4,6-Trichlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol		<0.01	<0.01	<0.01	<0.01	<0.01
Phenol		<0.01	<0.01	<0.01	<0.01	<0.01
Total		-	-	-	-	-

- USEPA = United States Environmental Protection Agency

Table 4b: PHCN-JV ILF PROJECT Sediment Polyaromatic Hydrocarbon Profile (PAH) Dry Season

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 5b: PHCN-JV ILF PROJECT -Sediment Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)				
		SS 1	SS 3	SS 6	SS 19	SS 20
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		0.22	<0.01	1.64	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		0.12	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	0.22	<0.01	<0.01	<0.01
n-Eicosane		0.29	1.11	0.58	<0.01	1.26
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		0.45	<0.01	<0.01	<0.01	<0.01
n-Tricosane		0.41	0.27	0.28	<0.01	<0.01
n-Tetracosane		1.09	0.25	0.30	0.15	0.19
n-Pentacosane-		1.25	0.50	0.57	0.36	<0.01
n-Hexacosne		20.7	0.25	0.14	<0.01	0.20
n-Heptacosane		1.98	0.37	0.62	<0.01	<0.01
n-Octacosane		1.53	0.21	0.78	<0.01	<0.01
n-Nonacosane		1.59	0.26	0.51	<0.01	<0.01
n-Triacontane		0.99	0.09	0.12	0.24	<0.01
n-Hentriacontane		0.62	0.23	0.36	0.18	0.22
n-Dotriacotane		0.47	0.33	0.28	0.85	<0.01
n-Tritriacontane		0.23	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		0.69	0.81	3.84	<0.01	0.49
n-Pentatriacontane		0.56	0.65	0.27	<0.01	0.32
n-Hexatriacontane		<0.01	<0.01	0.71	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01
Total		**33.3**	**5.56**	**8.00**	**1.78**	**2.71**

- USEPA = United States Environmental Protection Agency

Table 7a: PHCN-JV ILF PROJECT Surface Water Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/ml)	Hydrocarbon Utilising Bacteria	Count (cfu/ml)	Heterotrophic Fungi	Count (cfu/ml)	Hydrocarbon Utilising Fungi	Count (cfu/ml)
SS1	*Pseudomonas sp*	$1.56x10^3$	*Pseudomonas sp*	$5.0x10^1$	*Mucor sp* *Candia sp* *Rhodotorula sp*	$1.2x10^1$	*Mucor sp* *Candida sp* *Rhodotorula sp*	9.0
SS3	*Pseudomonas sp* *Bacillus sp*	$1.10x10^3$	*Pseudomonas sp*	$6.5x10^1$	*Aspergillus sp* *Mucor sp*	8.0	*Aspergillus sp* *Mucor sp*	7.0
SS 6	*Pseudomonas sp* *Bacillus sp*	$9.70x10^2$	*Pseudomonas sp*	$3.4x10^1$	*Mucor sp* *Candida sp*	$1.3x10^1$	*Mucor sp* *Candida sp*	6.0
SS 19	*Pseudomonas sp*	$1.36x10^3$	*Pseudomonas sp*	$2.5x10^1$	*Mucor sp*	4.0	*Mucor sp*	3.0
SS 20	*Pseudomonas sp*	$8.00x10^2$	*Pseudomonas sp*	$4.3x10^1$	*Mucor sp*	5.0	*Mucor sp*	4.0

Table 7b: PHCN-JV ILF PROJECT Sediment Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 1	*Pseudomonas sp* *Bacillus sp*	$9.10x10^{5}$	*Pseudomonas sp*	$6.80x10^{2}$	*Mucor sp* *Aspergillus sp* *Fusarium sp*	$7.0x10^{1}$	*Mucor sp* *Aspergillus sp*	$6.0x10^{1}$
SS 3	*Pseudomonas sp* *Bacillus sp*	$2.30x10^{5}$	*Pseudomonas sp*	$2.20x10^{2}$	*Mucor sp* *Penicillium sp*	$1.000x10^{2}$	*Mucor sp*	$6.0x10^{1}$
SS 6	*Pseudomonas sp*	$6.50x10^{5}$	*Pseudomonas sp*	$6.20x10^{2}$	*Mucor sp*	$4.0x10^{1}$	*Mucor sp*	$4.0x10^{1}$
SS 19	*Pseudomonas sp* *Chromobacterium sp*	$1.60x10^{5}$	*Pseudomonas sp*	$1.10x10^{3}$	*Candida sp* *Mucor sp*	$3.50x10^{2}$	*Candida sp* *Mucor sp*	$1.50x10^{2}$
SS 20	*Pseudomonas sp*	$1.34x10^{5}$	*Pseudomonas sp*	$1.28x10^{3}$	*Rhodotorula sp* *Candida sp* *Mucor sp*	$2.30x10^{2}$	*Rhodotorula sp* *Candida sp* *Mucor sp*	$1.80x10^{2}$

APPENDIX 4.3

SOIL CHARACTERISTICS

WET SEASON – SOIL CHARACTERISTICS

Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 1 (0-15)	**SS 1 (15-30)**	**SS 2 (0-15)**	**SS 2 (15-30)**
Co-ordinates		X: 8.017689 Y: 4.5547		X: 8.014072 Y: 4.574551	
pH (H_2O) @ 23.0°C	ASTM D 4972	4.78	4.85	5.23	5.21
Elect. Conductivity (µS/cm)	APHA 2510A	166	45.7	50.7	18.1
TOC (g/kg)	BS 1377	15.3	12.3	4.27	2.89
THC (mg/kg)	ASTM D 3921	<!0.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	25.0	64.0	48.0	59.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	-	-
Sand (%)		100	100	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.49	0.41	0.30	0.20
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	10.4	10.0	11.1	10.6
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	7.00	7.13	7.75	1.62
Magnesium (mg/kg)	USEPA 6200	562	531	271	271
Potassium (mg/kg)	USEPA 6200	6,513	5,853	2,514	2,301
Sodium (mg/kg)	USEPA 6200	3,610	3,630	2,970	2,720
Calcium (mg/kg)	USEPA 6200	1,396	917	150	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	9.60	9.30	7.70	4.40
Copper (mg/kg)	USEPA 6200	2.70	2.20	1.40	3.30
Total Iron (mg/kg)	USEPA 6200	9,536	9,457	4,981	5,332
Lead (mg/kg)	USEPA 6200	5.20	5.90	3.40	3.90
Nickel (mg/kg)	USEPA 6200	1.30	<0.50	<0.50	<0.50
Zinc (mg/kg)	USEPA 6200	4.80	5.30	3.30	6.00
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	155	151	173	183
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	10.2	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 3 (0-15)	SS 3 (15-30)	SS 4 (0-15)	SS 4 (15-30)
Co-ordinates		X: 8.00702 Y: 4.580751		X: 7.975522 Y: 4.593437	
pH (H_2O) @ 22.7°C	ASTM D 4972	4.83	4.21	4.59	4.61
Elect. Conductivity (µS/cm)	APHA 2510A	46.1	25.2	34.5	25.7
TOC (g/kg)	BS 1377	9.02	5.49	28.2	25.3
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	101	106	28.0	29.0
PSD Clay (%)	ASTM D 422	5.00	9.00	-	-
Silt (%)		7.00	15.0	-	-
Sand (%)		88.0	76.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	1.10	1.74	0.24	0.32
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	13.2	15.5	10.3	10.5
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	17.0	14.0	3.00	3.25
Magnesium (mg/kg)	USEPA 6200	1,072	1,013	293	419
Potassium (mg/kg)	USEPA 6200	12,020	13,480	2,411	2,417
Sodium (mg/kg)	USEPA 6200	5,010	5,700	1,860	1,610
Calcium (mg/kg)	USEPA 6200	2,579	2,339	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	3.40
Total Chromium (mg/kg)	USEPA 6200	11.5	9.20	17.0	19.9
Copper (mg/kg)	USEPA 6200	0.80	5.20	1.60	3.90
Total Iron (mg/kg)	USEPA 6200	22,110	12,980	8,923	9,079
Lead (mg/kg)	USEPA 6200	9.00	11.9	9.40	9.30
Nickel (mg/kg)	USEPA 6200	5.30	4.00	12.0	19.5
Zinc (mg/kg)	USEPA 6200	15.9	7.30	17.1	17.1
Barium (mg/kg)	USEPA 6200	90.7	184	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	237	174	264	225
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 5 (0-15)	SS 5 (15-30)	SS 6 (0-15)	SS 6 (15-30)
Co-ordinates		X: 7.951704 Y: 4.601806		X: 7.926443 Y: 4.605578	
pH (H_2O) @ 22.2^oC	ASTM D 4972	4.99	5.07	5.02	4.95
Elect. Conductivity (µS/cm)	APHA 2510A	22.2	19.4	115	56.4
TOC (g/kg)	BS 1377	10.1	10.8	9.36	7.50
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	30.0	34.0	48.0	56.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	-	-
Sand (%)		100	100	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.36	0.27	0.22	0.26
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	10.2	10.6	11.1	10.4
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.38	2.69	1.63	1.50
Magnesium (mg/kg)	USEPA 6200	549	595	626	621
Potassium (mg/kg)	USEPA 6200	5,925	6,050	10,940	10,160
Sodium (mg/kg)	USEPA 6200	3,120	3,060	3,480	3,160
Calcium (mg/kg)	USEPA 6200	<10.0	162	760	133
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	10.5	9.10	10.7	11.6
Copper (mg/kg)	USEPA 6200	3.10	3.60	7.60	5.00
Total Iron (mg/kg)	USEPA 6200	8,250	8,659	10,350	11,260
Lead (mg/kg)	USEPA 6200	4.50	5.60	10.0	9.50
Nickel (mg/kg)	USEPA 6200	5.90	4.50	11.6	15.3
Zinc (mg/kg)	USEPA 6200	8.20	8.60	39.7	33.9
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	25.2	50.6
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	140	167	149	97.3
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	18.1	29.8

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 7 (0-15)	SS 7 (15-30)	SS 8 (0-15)	SS 8 (15-30)
Co-ordinates		X: 7.903185 Y: 4.610608		X: 7.877946 Y: 4.608265	
pH (H_2O) @ 22.4°C	ASTM D 4972	4.57	4.54	4.67	4.59
Elect. Conductivity (µS/cm)	APHA 2510A	80.8	41.3	35.4	70.8
TOC (g/kg)	BS 1377	6.80	5.97	6.00	7.97
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	27.0	31.0	56.0	61.0
PSD Clay (%)	ASTM D 422	5.00	9.00	-	-
Silt (%)		15.0	13.0	10.0	10.0
Sand (%)		80.0	78.0	90.0	90.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.13	1.21	0.67	0.70
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	12.6	13.5	12.1	12.4
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.38	6.13	4.63	7.63
Magnesium (mg/kg)	USEPA 6200	844	1,148	534	543
Potassium (mg/kg)	USEPA 6200	2,752	3,150	1,459	1,559
Sodium (mg/kg)	USEPA 6200	3,070	3,430	3,010	3,040
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	11.4	14.7	8.70	9.40
Copper (mg/kg)	USEPA 6200	3.30	5.30	6.80	7.50
Total Iron (mg/kg)	USEPA 6200	13,370	18,450	12,530	15,200
Lead (mg/kg)	USEPA 6200	4.10	6.80	4.90	6.80
Nickel (mg/kg)	USEPA 6200	11.8	18.3	4.40	9.90
Zinc (mg/kg)	USEPA 6200	9.40	13.5	9.20	12.4
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	53.4	72.7	94.6	104
Mercury (mg/kg)	USEPA 6200	<1.00	1.40	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	16.2	54.1	<1.00	20.4

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 9 (0-15)	SS 9 (15-30)	SS 10 (0-15)	SS 10 (15-30)
Co-ordinates		X: 7.855727 Y: 4.605264		X: 7.830177 Y: 4.602537	
pH (H_2O) @ 22.4°C	ASTM D 4972	4.48	4.43	4.45	4.47
Elect. Conductivity (µS/cm)	APHA 2510A	87.2	57.9	65.4	77.4
TOC (g/kg)	BS 1377	10.1	6.32	10.7	7.57
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	21.0	24.0	44.0	48.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	20.0	20.0
Sand (%)		100	100	80.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	0.39	0.24	1.11	1.13
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	10.0	10.4	12.2	12.5
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	8.25	4.25	3.88	4.13
Magnesium (mg/kg)	USEPA 6200	561	251	306	336
Potassium (mg/kg)	USEPA 6200	2,958	3,351	2,362	2,910
Sodium (mg/kg)	USEPA 6200	3,030	3,110	2,890	2,910
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	10.4	13.0	6.80	5.70
Copper (mg/kg)	USEPA 6200	7.00	8.00	3.30	1.60
Total Iron (mg/kg)	USEPA 6200	14,050	17,040	3,331	3,774
Lead (mg/kg)	USEPA 6200	5.20	5.30	4.60	6.80
Nickel (mg/kg)	USEPA 6200	9.50	10.4	0.60	1.30
Zinc (mg/kg)	USEPA 6200	10.2	12.8	4.00	3.60
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	89.5	108	93.5	109
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	19.7	30.2	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 11 (0-15)	SS 11 (15-30)	SS 12 (0-15)	SS 12 (15-30)
Co-ordinates		X: 7.804106 Y: 4.599754		X: 7.781543 Y: 4.597345	
pH (H_2O) @ 22.4°C	ASTM D 4972	4.77	5.17	4.58	4.60
Elect. Conductivity (µS/cm)	APHA 2510A	51.2	216	96.6	76.8
TOC (g/kg)	BS 1377	7.14	13.1	12.1	10.0
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	40.0	40.0
Redox Potential (mV)	ASTM D1498	61.0	68.0	57.0	58.0
PSD					
Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	10.0	-	-
Sand (%)		100	90.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.41	0.90	0.35	0.32
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	10.1	12.5	10.3	10.0
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	7.88	6.63	6.63	4.73
Magnesium (mg/kg)	USEPA 6200	639	726	464	304
Potassium (mg/kg)	USEPA 6200	1,277	1,691	1,689	1,689
Sodium (mg/kg)	USEPA 6200	3,350	3,460	3,270	2,660
Calcium (mg/kg)	USEPA 6200	917	674	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	9.90	16.9	6.50	4.40
Copper (mg/kg)	USEPA 6200	6.50	8.30	1.50	2.40
Total Iron (mg/kg)	USEPA 6200	14,180	22,500	4,260	3,628
Lead (mg/kg)	USEPA 6200	5.30	10.1	6.80	8.10
Nickel (mg/kg)	USEPA 6200	7.10	20.4	2.10	1.70
Zinc (mg/kg)	USEPA 6200	39.0	69.1	3.90	3.50
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	97.4	123	121	107
Mercury (mg/kg)	USEPA 6200	<1.00	1.40	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	24.1	59.4	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 13 (0-15)	SS 13 (15-30)	SS 14 (0-15)	SS 14 (15-30)
Co-ordinates		X: 7.755541 Y: 4.594568		X: 7.73346 Y: 4.592209	
pH (H_2O) @ 22.4^oC	ASTM D 4972	4.68	4.75	4.38	4.38
Elect. Conductivity (µS/cm)	APHA 2510A	74.2	73.9	63.4	33.6
TOC (g/kg)	BS 1377	5.44	5.07	8.92	5.38
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	21.0	26.0	77.0	79.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	20.0	20.0
Sand (%)		100	100	80.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	0.41	0.39	1.01	0.98
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	10.2	10.4	12.4	13.1
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.63	2.94	8.69	9.00
Magnesium (mg/kg)	USEPA 6200	463	228	814	644
Potassium (mg/kg)	USEPA 6200	2,302	1,108	1,965	1,882
Sodium (mg/kg)	USEPA 6200	3,070	2,700	3,360	3,460
Calcium (mg/kg)	USEPA 6200	129	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	2.40	<2.00
Total Chromium (mg/kg)	USEPA 6200	2.50	7.80	23.4	18.9
Copper (mg/kg)	USEPA 6200	<0.50	1.40	10.9	10.2
Total Iron (mg/kg)	USEPA 6200	7,049	3,905	28,350	25,380
Lead (mg/kg)	USEPA 6200	6.90	2.60	8.10	7.30
Nickel (mg/kg)	USEPA 6200	2.90	0.80	29.3	25.0
Zinc (mg/kg)	USEPA 6200	7.90	2.40	23.4	21.4
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	219	91.0	114	109
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	1.10	1.20
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	78.1	70.1

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 15 (0-15)	SS 15 (15-30)	SS 16 (0-15)	SS 16 (15-30)
Co-ordinates		X: 7.707511 Y: 4.589435		X: 7.685672 Y: 4.5871	
pH (H_2O) @ 22.4°C	ASTM D 4972	4.68	4.91	4.61	4.65
Elect. Conductivity (µS/cm)	APHA 2510A	113	55.8	19.5	44.1
TOC (g/kg)	BS 1377	11.6	9.73	9.17	8.44
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	80.0	81.0	61.0	66.0
PSD Clay (%)	ASTM D 422	-	-	20.0	18.0
Silt (%)		10.0	10.0	5.00	2.00
Sand (%)		90.0	90.0	75.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	0.84	0.85	1.09	1.02
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	15.0	15.2	12.6	11.4
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	2.24	10.8	7.99	6.95
Magnesium (mg/kg)	USEPA 6200	2,839	3,428	966	792
Potassium (mg/kg)	USEPA 6200	10,420	9,559	6,168	6,571
Sodium (mg/kg)	USEPA 6200	6,950	6,760	3,430	1,910
Calcium (mg/kg)	USEPA 6200	2,910	2,544	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	23.1	22.1	11.3	10.3
Copper (mg/kg)	USEPA 6200	13.1	10.2	3.60	3.30
Total Iron (mg/kg)	USEPA 6200	27,060	24,350	9,885	7,338
Lead (mg/kg)	USEPA 6200	14.6	12.2	5.90	8.60
Nickel (mg/kg)	USEPA 6200	25.6	24.1	15.7	12.5
Zinc (mg/kg)	USEPA 6200	46.1	37.7	12.6	11.9
Barium (mg/kg)	USEPA 6200	71.9	76.8	20.9	24.5
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	281	231	53.5	45.4
Mercury (mg/kg)	USEPA 6200	1.40	1.30	<1.00	1.60
Vanadium (mg/kg)	USEPA 6200	81.0	49.9	14.0	4.70

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 17 (0-15)	SS 17 (15-30)	SS 18 (0-15)	SS 18 (15-30)
Co-ordinates		X: 7.660048 Y: 4.58436		X: 7.634816 Y: 4.58166	
pH (H_2O) @ 22.4^oC	ASTM D 4972	4.41	4.44	4.57	4.52
Elect. Conductivity (µS/cm)	APHA 2510A	102	92.5	152	59.3
TOC (g/kg)	BS 1377	13.0	6.71	10.2	6.04
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	11.0	20.0	60.0	66.0
PSD Clay (%)	ASTM D 422	11.0	18.0	9.00	19.0
Silt (%)		21.0	29.0	11.0	13.0
Sand (%)		68.0	53.0	80.0	68.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.75	2.00	1.08	1.68
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	18.5	22.4	12.8	17.5
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.62	3.69	4.85	2.06
Magnesium (mg/kg)	USEPA 6200	934	1,003	890	1,126
Potassium (mg/kg)	USEPA 6200	5,240	5,508	7,536	8,101
Sodium (mg/kg)	USEPA 6200	3,260	3,920	3,260	3,500
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	6.60	8.00	6.80	8.40
Copper (mg/kg)	USEPA 6200	4.20	3.80	3.90	6.00
Total Iron (mg/kg)	USEPA 6200	13,730	16,970	8,722	10,990
Lead (mg/kg)	USEPA 6200	8.10	8.10	6.50	7.70
Nickel (mg/kg)	USEPA 6200	6.40	9.70	4.20	8.70
Zinc (mg/kg)	USEPA 6200	9.60	12.7	9.40	10.9
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	48.7	82.7
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	81.5	84.6	72.3	67.9
Mercury (mg/kg)	USEPA 6200	<1.00	1.30	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	10.2	2.40	4.80

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 19 (0-15)	SS 19 (15-30)	SS 20 (0-15)	SS 20 (15-30)
Co-ordinates		X: 7.606547 Y: 4.570064		X: 7.591482 Y: 4.565826	
pH (H_2O) @ 22.4°C	ASTM D 4972	4.56	4.59	4.48	4.38
Elect. Conductivity (µS/cm)	APHA 2510A	101	49.9	36.7	40.5
TOC (g/kg)	BS 1377	7.75	3.07	6.63	4.09
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	74.0	75.0	80.0	88.0
PSD Clay (%)	ASTM D 422	28.0	30.0	19.0	20.0
Silt (%)		7.00	9.00	3.00	4.00
Sand (%)		65.0	61.0	78.0	76.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.84	1.92	1.42	1.46
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	18.7	20.1	14.5	13.6
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	5.48	5.58	3.48	3.57
Magnesium (mg/kg)	USEPA 6200	1,550	1,618	1,148	1,196
Potassium (mg/kg)	USEPA 6200	5,677	5,521	8,790	8,082
Sodium (mg/kg)	USEPA 6200	3,740	3,550	3,470	4,020
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	14.2	14.5	11.6	12.2
Copper (mg/kg)	USEPA 6200	2.90	3.10	5.20	5.20
Total Iron (mg/kg)	USEPA 6200	21,100	22,330	13,960	14,490
Lead (mg/kg)	USEPA 6200	5.70	6.50	7.10	7.70
Nickel (mg/kg)	USEPA 6200	17.2	17.1	14.9	16.2
Zinc (mg/kg)	USEPA 6200	14.8	15.0	12.7	13.8
Barium (mg/kg)	USEPA 6200	22.1	<2.00	87.7	69.1
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	60.9	63.6	75.5	67.2
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	1.60	1.40
Vanadium (mg/kg)	USEPA 6200	33.2	44.2	11.6	21.7

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result			
		SS 21 (0-15)	SS 21 (15-30)	SS 22 (0-15)	SS 22 (15-30)
Co-ordinates		X: 7.581876 Y: 4.565826		X: 8.017601 Y: 4.55901	
pH (H_2O) @ 22.5°C	ASTM D 4972	4.80	5.10	5.13	5.08
Elect. Conductivity (µS/cm)	APHA 2510A	73.5	60.0	18.8	25.5
TOC (g/kg)	BS 1377	5.03	9.76	3.15	1.04
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	102	106	21.0	28.0
PSD					
Clay (%)	ASTM D 422	9.00	5.00	-	-
Silt (%)		18.0	17.0	-	-
Sand (%)		73.0	78.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	1.58	1.29	0.54	0.46
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	15.5	14.6	10.7	10.5
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	1.05	2.36	0.74	1.76
Magnesium (mg/kg)	USEPA 6200	1,519	977	639	578
Potassium (mg/kg)	USEPA 6200	12,180	12,190	8,685	8,839
Sodium (mg/kg)	USEPA 6200	3,880	3,480	3,950	4,000
Calcium (mg/kg)	USEPA 6200	52.9	<10.0	974	945
Cadmium (mg/kg)	USEPA 6200	2.20	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	13.6	9.30	8.30	8.00
Copper (mg/kg)	USEPA 6200	6.30	2.80	1.50	1.40
Total Iron (mg/kg)	USEPA 6200	14,200	8,137	5,157	6,084
Lead (mg/kg)	USEPA 6200	11.0	8.90	3.70	2.90
Nickel (mg/kg)	USEPA 6200	20.1	7.60	<0.50	<0.50
Zinc (mg/kg)	USEPA 6200	17.4	7.60	5.60	5.00
Barium (mg/kg)	USEPA 6200	241	147	14.6	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	64.8	70.0	49.0	58.2
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	35.6	7.60	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics

Parameter	Method	Sample Station Result	
		SS 23 (0-15)	SS 23 (15-30)
Co-ordinates		X: 7.578101 Y: 4.566132	
pH (H_2O) @ 22.6°C	ASTM D 4972	4.53	4.55
Elect. Conductivity (µS/cm)	APHA 2510A	30.3	25.2
TOC (g/kg)	BS 1377	10.5	8.16
THC (mg/kg)	ASTM D 3921	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	92.0	96.0
PSD Clay (%)	ASTM D 422	10.0	18.0
Silt (%)		21.0	19.0
Sand (%)		69.0	63.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.66	1.55
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	15.6	18.0
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	1.51	4.36
Magnesium (mg/kg)	USEPA 6200	843	856
Potassium (mg/kg)	USEPA 6200	8,041	9,655
Sodium (mg/kg)	USEPA 6200	3,320	2,160
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	9.20	10.1
Copper (mg/kg)	USEPA 6200	3.20	4.10
Total Iron (mg/kg)	USEPA 6200	9,124	10,950
Lead (mg/kg)	USEPA 6200	6.30	4.70
Nickel (mg/kg)	USEPA 6200	6.00	8.10
Zinc (mg/kg)	USEPA 6200	8.00	10.6
Barium (mg/kg)	USEPA 6200	43.4	72.4
Silver (mg/kg)	USEPA 6200	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	51.3	62.4
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	7.40	27.1

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	SS 4 15-30	SS 5 0-15	SS 5 15-30	SS 6 0-15	SS 6 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

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Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	SS 4 15-30	SS 5 0-15	SS 5 15-30	SS 6 0-15	SS 6 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	0.18
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		0.37	<0.01	<0.01	0.16	0.24	0.35
n-Eicosane		<0.01	<0.01	<0.01	0.12	<0.01	0.15
n-Henelcosane		0.33	0.27	0.25	0.25	0.25	0.30
n-Docosane		0.41	0.32	0.31	0.34	0.31	0.48
n-Tricosane		<0.01	0.44	0.40	0.45	0.41	0.63
n-Tetracosane		0.65	<0.01	0.48	<0.01	0.53	0.87
n-Pentacosane-		0.72	0.48	0.47	<0.01	0.49	0.96
n-Hexacosne		0.14	0.34	0.24	0.37	0.31	0.33
n-Heptacosane		0.51	0.41	0.46	0.52	0.37	0.87
n-Octacosane		0.72	0.30	0.38	0.39	0.30	0.56
n-Nonacosane		0.28	0.22	0.26	0.26	0.19	0.49
n-Triacontane		0.25	0.21	0.20	0.34	0.16	0.33
n-Hentriacontane		0.20	0.15	0.17	0.15	<0.01	0.35
n-Dotriacotane		0.74	0.46	0.24	0.76	0.16	<0.01
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		0.32	<0.01	<0.01	0.42	<0.01	<0.01
n-Pentatriacontane		0.94	0.83	0.53	<0.01	0.77	1.36
n-Hexatriacontane		0.44	<0.01	<0.01	<0.01	<0.01	0.47
n-Heptatriacontane		0.96	0.78	1.35	1.66	1.13	1.47
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**7.99**	**5.27**	**5.80**	**5.71**	**5.69**	**10.3**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	**SS 4 15-30**	**SS 5 0-15**	**SS 5 15-30**	**SS 6 0-15**	**SS 6 15-30**
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		0.28	0.22	0.20	0.34	<0.01	<0.01
n-Eicosane		0.13	0.13	<0.01	0.12	0.14	0.18
n-Henelcosane		0.34	0.30	0.25	0.30	0.30	0.29
n-Docosane		0.38	0.40	0.33	0.41	0.39	0.39
n-Tricosane		0.59	0.57	0.42	<0.01	0.51	0.48
n-Tetracosane		0.57	0.69	0.67	<0.01	0.70	0.65
n-Pentacosane-		<0.01	<0.01	0.56	<0.01	0.74	0.67
n-Hexacosne		<0.01	<0.01	0.59	0.39	0.36	0.68
n-Heptacosane		<0.01	<0.01	0.46	0.67	0.62	0.61
n-Octacosane		0.42	0.47	0.30	0.45	0.42	0.43
n-Nonacosane		0.46	0.45	0.28	0.40	0.38	0.40
n-Triacontane		0.26	0.27	0.17	0.26	0.25	0.26
n-Hentriacontane		0.44	0.34	0.20	0.28	0.23	0.27
n-Dotriacotane		<0.01	0.53	0.48	<0.01	0.37	<0.01
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	0.24
n-Tetratriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentatriacontane		0.59	<0.01	0.89	0.40	0.50	0.73
n-Hexatriacontane		<0.01	<0.01	<0.01	0.42	<0.01	<0.01
n-Heptatriacontane		1.66	1.19	1.18	1.19	1.34	1.58
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**6.16**	**5.14**	**7.03**	**4.55**	**7.32**	**7.92**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	0.18	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	0.12	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		0.24	0.25	<0.01	0.30	<0.01	<0.01
n-Eicosane		0.16	0.16	<0.01	<0.01	<0.01	<0.01
n-Henelcosane		0.31	0.25	0.22	0.34	0.24	0.15
n-Docosane		0.41	0.32	0.28	0.45	0.29	0.21
n-Tricosane		0.54	0.41	0.38	<0.01	0.40	0.29
n-Tetracosane		0.71	0.54	0.50	<0.01	0.56	0.44
n-Pentacosane-		0.74	0.60	0.49	<0.01	0.56	0.32
n-Hexacosne		0.28	0.19	0.19	<0.01	0.17	0.19
n-Heptacosane		0.62	0.54	0.39	1.00	0.46	0.23
n-Octacosane		0.43	0.41	0.26	0.40	0.32	0.14
n-Nonacosane		0.36	0.35	0.24	0.37	0.26	0.10
n-Triacontane		0.25	0.24	0.16	0.26	0.16	<0.01
n-Hentriacontane		0.25	0.23	0.16	0.25	0.19	<0.01
n-Dotriacotane		<0.01	<0.01	<0.01	0.40	<0.01	<0.01
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentatriacontane		0.87	0.65	0.89	0.78	0.53	0.48
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		1.47	1.02	1.12	0.27	1.53	1.32
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**7.70**	**6.54**	**5.33**	**5.37**	**5.70**	**3.91**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Eicosane		<0.01	<0.01	0.12	0.13	0.13	<0.01
n-Henelcosane		0.23	0.17	0.26	0.28	0.26	0.17
n-Docosane		0.27	0.22	0.35	0.33	0.29	0.18
n-Tricosane		0.39	0.33	0.41	0.45	0.41	0.29
n-Tetracosane		0.49	0.38	0.64	0.62	0.51	0.33
n-Pentacosane-		0.54	0.38	0.59	0.57	0.53	0.36
n-Hexacosne		0.15	0.13	0.71	0.37	0.32	0.33
n-Heptacosane		0.49	0.30	0.55	0.46	0.38	0.28
n-Octacosane		0.28	0.20	035	0.29	0.19	0.16
n-Nonacosane		0.29	0.20	0.40	0.31	0.15	0.16
n-Triacontane		0.16	<0.01	0.20	0.13	<0.01	<0.01
n-Hentriacontane		0.24	0.15	0.23	0.19	0.20	0.15
n-Dotriacotane		<0.01	<0.01	0.53	0.38	0.29	<0.01
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	<0.01	0.25	<0.01	<0.01	<0.01
n-Pentatriacontane		0.53	0.37	<0.01	0.50	0.75	<0.01
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		0.16	1.13	2.12	0.23	1.72	1.27
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.81**	**3.97**	**7.78**	**7.42**	**6.19**	**3.73**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Eicosane		<0.01	<0.01	<0.01	<0.01	0.19	0.18
n-Henelcosane		0.13	<0.01	0.25	0.24	0.29	0.27
n-Docosane		0.31	<0.01	0.29	0.30	0.34	0.31
n-Tricosane		0.45	<0.01	0.39	0.42	0.45	0.40
n-Tetracosane		0.53	0.53	0.59	0.63	0.66	0.68
n-Pentacosane-		0.52	0.58	0.61	0.64	0.68	0.70
n-Hexacosne		0.11	0.13	0.26	0.38	0.33	0.25
n-Heptacosane		0.39	0.48	0.53	0.55	0.57	0.52
n-Octacosane		0.26	0.32	0.36	0.41	0.38	0.32
n-Nonacosane		0.24	0.28	0.29	0.35	0.33	0.29
n-Triacontane		0.16	0.18	0.20	0.24	0.20	0.23
n-Hentriacontane		0.17	0.18	0.18	0.22	0.20	0.19
n-Dotriacotane		<0.01	<0.01	0.29	<0.01	0.47	0.54
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentatriacontane		0.73	0.51	0.54	0.70	0.42	0.43
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	0.46	0.48
n-Heptatriacontane		0.16	1.11	1.18	1.11	1.53	1.55
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.97**	**4.33**	**6.02**	**6.26**	**7.55**	**7.46**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	0.35	<0.01	<0.01	<0.01
n-Eicosane		<0.01	0.21	0.26	<0.01	<0.01	<0.01
n-Henelcosane		<0.01	0.25	0.43	<0.01	0.27	<0.01
n-Docosane		<0.01	0.32	<0.01	0.17	0.29	0.09
n-Tricosane		<0.01	0.42	<0.01	0.29	0.37	0.16
n-Tetracosane		<0.01	0.66	<0.01	0.34	0.44	0.29
n-Pentacosane-		<0.01	0.77	<0.01	0.33	<0.01	0.28
n-Hexacosne		<0.01	0.24	0.21	0.27	<0.01	0.10
n-Heptacosane		<0.01	0.74	0.27	0.29	<0.01	0.20
n-Octacosane		<0.01	0.40	0.46	0.22	<0.01	0.18
n-Nonacosane		<0.01	0.12	0.52	0.19	<0.01	0.19
n-Triacontane		<0.01	0.24	0.30	<0.01	<0.01	<0.01
n-Hentriacontane		<0.01	0.32	0.27	<0.01	<0.01	<0.01
n-Dotriacotane		<0.01	0.34	0.35	<0.01	<0.01	<0.01
n-Tritriacontane		<0.01	<0.01	0.20	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	<0.01	0.83	<0.01	<0.01	<0.01
n-Pentatriacontane		<0.01	0.75	<0.01	0.57	<0.01	<0.01
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	0.17	2.58	0.16	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**-**	**7.55**	**5.01**	**4.31**	**1.39**	**1.37**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		0.42	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	0.14	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	0.08	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		0.71	<0.01	<0.01	<0.01	<0.01	<0.01
n-Eicosane		0.57	<0.01	<0.01	<0.01	<0.01	<0.01
n-Henelcosane		<0.01	0.21	<0.01	0.23	<0.01	0.18
n-Docosane		<0.01	0.13	0.13	0.15	0.23	0.22
n-Tricosane		<0.01	0.23	0.23	0.26	0.20	0.21
n-Tetracosane		<0.01	0.42	0.43	0.48	0.25	0.48
n-Pentacosane-		<0.01	0.46	0.47	0.50	0.45	0.37
n-Hexacosne		0.32	0.31	0.34	0.40	0.46	0.29
n-Heptacosane		0.32	0.35	0.36	0.43	0.47	0.29
n-Octacosane		0.36	0.32	0.24	0.30	0.26	0.18
n-Nonacosane		<0.01	0.22	0.20	0.25	0.31	0.15
n-Triacontane		0.26	0.13	0.14	0.17	0.18	0.10
n-Hentriacontane		0.30	0.14	0.16	0.17	0.30	<0.01
n-Dotriacotane		0.15	0.28	0.30	0.28	0.47	0.30
n-Tritriacontane		1.20	<0.01	<0.01	<0.01	0.20	<0.01
n-Tetratriacontane		0.22	<0.01	<0.01	<0.01	0.33	<0.01
n-Pentatriacontane		0.65	0.56	<0.01	<0.01	<0.01	<0.01
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.54**	**3.95**	**3.05**	**3.66**	**4.17**	**2.83**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	0.23	<0.01
n-Hexadecane		<0.01	<0.01	0.44	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	0.22	0.82	0.29
n-Octadecane		<0.01	<0.01	0.50	0.10
n-Phytane		<0.01	0.15	0.13	0.11
n-Nonadecane		<0.01	<0.01	0.29	0.25
n-Eicosane		<0.01	<0.01	0.25	0.19
n-Henelcosane		<0.01	0.17	0.27	0.33
n-Docosane		<0.01	0.20	0.20	0.28
n-Tricosane		0.08	0.20	0.25	0.34
n-Tetracosane		0.28	0.23	0.36	0.55
n-Pentacosane-		0.17	0.38	0.36	0.57
n-Hexacosne		0.14	0.25	0.24	0.30
n-Heptacosane		0.16	0.31	0.24	0.41
n-Octacosane		0.17	0.21	0.16	0.18
n-Nonacosane		0.16	0.19	0.14	0.21
n-Triacontane		<0.01	0.14	<0.01	0.11
n-Hentriacontane		<0.01	0.15	0.12	0.19
n-Dotriacotane		0.27	0.66	0.29	0.43
n-Tritriacontane		<0.01	<0.01	<0.01	<0.01
n-Tetratriacontane		<0.01	0.31	<0.01	<0.01
n-Pentatriacontane		<0.01	<0.01	<0.01	0.46
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01
Total		**1.37**	**3.83**	**5.36**	**5.39**

- USEPA = United States Environmental Protection Agency

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 1 0-15	*Pseudomonas sp* *Chromobacterium sp*	$8.00x10^5$	*Pseudomonas sp*	$1.58x10^3$	*Mucor sp* *Candida sp*	$3.40x10^2$	*Mucor sp* *Candida sp*	$3.30x10^2$
SS 1 15-20	*Pseudomonas sp*	$2.00x10^5$	*Pseudomonas sp*	$1.20x10^3$	*Mucor sp* *Rhodotorula sp* *Candida sp*	$1.80x10^3$	*Mucor sp* *Rhodotorula sp* *Candida sp*	$1.25x10^3$
SS 2 0-15	*Pseudomonas sp*	$4.00x10^5$	*Pseudomonas sp*	$3.80x10^2$	*Mucor sp* *Rhodotorula sp* *Candida sp*	$1.62x10^3$	*Mucor sp* *Rhodotorula sp* *Candida sp*	$6.80x10^2$
SS 2 15-30	*Pseudomonas sp*	$1.32x10^6$	*Pseudomonas sp*	$9.00x10^2$	*Fusarium sp* *Mucor sp* *Rhodotorula sp* *Penicillium sp*	$3.60x10^2$	*Mucor sp* *Aspergillus sp*	$1.60x10^2$
SS 3 0-15	*Pseudomonas sp* *Actinomyces sp* *Chromobacterium sp*	$1.90x10^5$	*Pseudomonas sp*	$5.20x10^2$	*Mucor sp* *Candida sp*	$4.50x10^2$	*Mucor sp* *Candida sp*	$3.60x10^2$
SS 3 15-30	*Pseudomonas sp* *Actinomyces sp* *Chromobacterium sp*	$3.50x10^5$	*Pseudomonas sp*	$6.70x10^2$	*Mucor sp* *Candida sp* *Penicillium sp*	$6.0x10^1$	*Mucor sp* *Candida sp*	$6.0x10^1$
SS 4 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	$8.90x10^4$	*Pseudomonas sp*	$9.20x10^2$	*Mucor sp* *Aspergillus sp*	$1.40x10^2$	*Mucor sp* *Aspergillus sp*	$1.30x10^2$
SS 4 15-30	*Pseudomonas sp* *Bacillus sp*	$1.62x10^5$	*Pseudomonas sp*	$2.70x10^2$	*Mucor sp* *Aspergillus sp*	$2.0x10^1$	*Mucor sp* *Aspergillus sp*	$2.0x10^1$
SS 5 0-15	*Pseudomonas sp* *Bacillus sp*	$7.00x10^4$	*Pseudomonas sp*	$1.23x10^3$	*Mucor sp* *Rhodotorula sp* *Fusarium sp* *Aspergillus sp* *Candida sp*	$7.00x10^2$	*Mucor sp* *Aspergillus sp*	$3.20x10^2$
SS 5 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	$8.90x10^4$	*Pseudomonas sp*	$7.10x10^2$	*Fusarium sp* *Aspergillus sp* *Mucor sp*	$2.70x10^2$	*Aspergillus sp* *Mucor sp*	$1.00x10^2$

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 6 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.76×10^5	*Pseudomonas sp*	1.29×10^3	*Mucor sp* *Rhodotorula sp* *Aspergillus sp* *Candida sp*	3.00×10^2	*Mucor sp* *Rhodotorula sp* *Aspergillus sp* *Candida sp*	2.60×10^2
SS 6 15-20	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	6.10×10^4	*Pseudomonas sp*	1.02×10^3	*Mucor sp* *Aspergillus sp* *Candida sp*	2.20×10^2	*Mucor sp* *Aspergillus sp* *Candida sp*	2.20×10^2
SS 7 0-15	*Pseudomonas sp* *Bacillus sp*	2.00×10^5	*Pseudomonas sp*	1.70×10^3	*Candida sp* *Mucor sp*	4.0×10^1	*Mucor sp*	3.0×10^1
SS 7 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.59×10^5	*Pseudomonas sp*	1.41×10^3	*Candida sp* *Mucor sp*	8.0×10^1	*Mucor sp*	6.0×10^1
SS 8 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	8.00×10^5	*Pseudomonas sp*	2.86×10^3	*Candida sp* *Mucor sp* *Aspergillus sp*	3.80×10^2	*Candida sp* *Mucor sp* *Aspergillus sp*	2.00×10^2
SS 8 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	2.06×10^5	*Pseudomonas sp*	2.72×10^3	*Mucor sp* *Aspergillus sp*	2.20×10^2	*Mucor sp* *Aspergillus sp*	1.70×10^2
SS 9 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.24×10^5	*Pseudomonas sp*	2.60×10^3	*Candida sp* *Aspergillus sp* *Mucor sp*	3.30×10^2	*Candida sp* *Aspergillus sp* *Mucor sp*	3.00×10^2
SS 9 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.19×10^5	*Pseudomonas sp*	2.49×10^3	*Candida sp* *Aspergillus sp* *Mucor sp*	1.00×10^2	*Candida sp* *Aspergillus sp* *Mucor sp*	8.0×10^1
SS 10 0-15	*Pseudomonas sp*	6.30×10^5	*Pseudomonas sp*	1.22×10^3	*Candida sp* *Aspergillus sp* *Mucor sp* *Rhodotorula sp*	7.60×10^2	*Aspergillus sp* *Rhodotorula sp*	3.10×10^2
SS 10 15-30	*Pseudomonas sp*	1.08×10^5	*Pseudomonas sp*	3.80×10^2	*Mucor sp*	2.0×10^1	*Mucor sp*	2.0×10^1

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 11 0-15	*Pseudomonas sp* *Bacillus sp*	8.00×10^4	*Pseudomonas sp*	1.04×10^3	*Candida sp* *Geotrichum sp* *Mucor sp*	2.00×10^2	*Candida sp* *Mucor sp*	1.90×10^2
SS 11 15-20	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	7.00×10^4	*Pseudomonas sp*	3.50×10^2	*Aspergillus sp* *Geotrichum sp* *Mucor sp*	2.20×10^2	*Aspergillus sp* *Mucor sp*	1.80×10^2
SS 12 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.46×10^5	*Pseudomonas sp*	1.36×10^3	*Candida sp* *Mucor sp* *Aspergillus sp*	2.10×10^2	*Candida sp* *Mucor sp* *Aspergillus sp*	2.10×10^2
SS 12 15-30	*Pseudomonas sp* *Bacillus sp*	1.04×10^5	*Pseudomonas sp*	8.00×10^2	*Cladsporium sp* *Mucor sp*	5.40×10^2	*Mucor sp*	3.20×10^2
SS 13 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.30×10^5	*Pseudomonas sp*	1.16×10^3	*Mucor sp* *Aspergillus sp*	8.0×10^1	*Mucor sp* *Aspergillus sp*	8.0×10^1
SS 13 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	1.10×10^5	*Pseudomonas sp*	1.30×10^3	*Mucor sp* *Aspergillus sp*	8.00×10^2	*Mucor sp* *Aspergillus sp*	5.50×10^2
SS 14 0-15	*Pseudomonas sp* *Actinomyces sp*	3.70×10^4	*Pseudomonas sp*	2.90×10^3	*Mucor sp* *Aspergillus sp*	1.00×10^2	*Mucor sp* *Aspergillus sp*	8.0×10^1
SS 14 15-30	*Pseudomonas sp*	4.00×10^4	*Pseudomonas sp*	2.40×10^2	*Mucor sp*	7.0×10^1	*Mucor sp*	6.0×10^1
SS 15 0-15	*Pseudomonas sp* *Bacillus sp*	7.70×10^4	*Pseudomonas sp*	6.00×10^2	*Mucor sp* *Aspergillus sp* *Candida sp*	4.30×10^2	*Mucor sp* *Aspergillus sp* *Candida sp*	3.80×10^2
SS 15 15-30	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	7.20×10^4	Pseudomonas sp	2.30×10^3	*Rhodotorula sp* *Penicillium sp* *Mucor sp* *Aspergillus sp* *Candida sp*	6.40×10^2	*Mucor sp* *Aspergillus sp*	2.80×10^2

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 16 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	$9.80x10^4$	*Pseudomonas sp*	$1.20x10^3$	*Mucor sp* *Aspergillus sp*	$2.50x10^2$	*Mucor sp*	$2.00x10^2$
SS 16 15-20	*Pseudomonas sp* *Bacillus sp*	$1.52x10^5$	*Pseudomonas sp*	$9.90x10^2$	*Mucor sp* *Aspergillus sp*	$2.10x10^2$	*Mucor sp*	$1.90x10^2$
SS 17 0-15	*Pseudomonas sp*	$7.20x10^5$	*Pseudomonas sp*	$1.48x10^3$	*Mucor sp*	$1.0x10^1$	*Mucor sp*	$1.0x10^1$
SS 17 15-30	*Pseudomonas sp*	$2.00x10^4$	*Pseudomonas sp*	$1.88x10^3$	*Mucor sp*	$1.0x10^1$	*Mucor sp*	$1.0x10^1$
SS 18 0-15	*Pseudomonas sp*	$1.13x10^6$	*Pseudomonas sp*	$9.50x10^2$	*Candida sp* *Aspergillus sp* *Mucor sp*	$6.80x10^2$	*Candida sp* *Mucor sp*	$5.00x10^2$
SS 18 15-30	*Pseudomonas sp*	$6.90x10^5$	*Pseudomonas sp*	$1.08x10^3$	*Rhizobium sp* *Penicillium sp* *Mucor sp*	$1.20x10^2$	*Mucor sp*	$1.00x10^2$
SS 19 0-15	*Pseudomonas sp*	$3.00x10^4$	*Pseudomonas sp*	$5.20x10^2$	*Mucor sp*	$9.0x10^1$	*Mucor sp*	$9.0x10^1$
SS 19 15-30	*Pseudomonas sp*	$3.60x10^4$	*Pseudomonas sp*	$8.60x10^2$	*Fusarium sp* *Mucor sp*	$1.30x10^2$	*Mucor sp*	$1.00x10^2$
SS 20 0-15	*Pseudomonas sp*	$6.80x10^5$	*Pseudomonas sp*	$3.20x10^2$	*Mucor sp* *Aspergillus sp*	$2.80x10^2$	*Mucor sp* *Aspergillus sp*	$2.60x10^2$
SS 20 15-30	*Pseudomonas sp* *Micrococcus sp*	$1.74x10^4$	*Pseudomonas sp*	$3.00x10^2$	*Candida sp* *Mucor sp* *Aspergillus sp*	$3.0x10^1$	*Candida sp* *Mucor sp* *Aspergillus sp*	$3.0x10^1$

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 21 0-15	*Pseudomonas sp* *Bacillus sp*	$7.30x10^5$	*Pseudomonas sp*	$1.190x10^3$	*Candida sp* *Rhodotorula sp* *Mucor sp*	$2.06x10^3$	*Candida sp* *Rhodooturla sp* *Mucor sp*	$1.95x10^3$
SS 21 15-20	*Pseudomonas sp* *Bacillus sp*	$3.00x10^4$	*Pseudomonas sp*	$1.11x10^3$	*Candida sp* *Aspergillus sp* *Mucor sp*	$5.50x10^2$	*Candida sp* *Aspergillus sp* *Mucor sp*	$3.70x10^2$
SS 22 0-15	*Pseudomonas sp* *Actinomyces sp* *Bacillus sp*	$4.60x10^4$	*Pseudomonas sp*	$7.00x10^2$	*Mucor sp* *Aspergillus sp*	$6.40x10^2$	*Mucor sp* *Aspergillus sp*	$5.50x10^2$
SS 22 15-30	*Pseudomonas sp* *Bacillus sp*	$4.10x10^4$	*Pseudomonas sp*	$6.40x10^2$	*Mucor sp* *Aspergillus sp*	$6.00x10^2$	*Mucor sp* *Aspergillus sp*	$3.40x10^2$
SS 23 0-15	*Pseudomonas sp*	$6.20x10^5$	*Pseudomonas sp*	$1.80x10^3$	*Rhodotorula sp* *Candida sp* *Mucor sp*	$1.88x10^3$	*Rhodotorula sp* *Candida sp* *Mucor sp*	$7.30x10^3$
SS 23 15-30	*Pseudomonas sp*	$1.10x10^5$	*Pseudomonas sp*	$6.60x10^2$	*Aspergillus sp* *Rhodotorula sp* *Candida sp* *Mucor sp*	$1.51x10^3$	*Candida sp* *Mucor sp* *Aspergillus sp*	$1.06x10^3$

DRY SEASON – SOIL CHARACTERISTICS

Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 1 (0-15)	**SS 1 (15-30)**	**SS 2 (0-15)**	**SS 2 (15-30)**
Co-ordinates		X: 8.017689 Y: 4.5547		X: 8.014072 Y: 4.574551	
pH (H_2O) @ 23.5°C	ASTM D 4972	3.24	3.26	3.20	5.47
Elect. Conductivity (µS/cm)	APHA 2510A	45.3	45.0	32.8	28.7
TOC (g/kg)	BS 1377	18.0	8.94	4.38	6.62
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	30.0	75.0	50.0	60.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	-	-
Sand (%)		100	100	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.96	0.94	0.29	0.60
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	4.75	5.22	11.1	4.73
Magnesium (mg/kg)	USEPA 6200	552	416	408	267
Potassium (mg/kg)	USEPA 6200	6,832	6,472	1,692	2,049
Sodium (mg/kg)	USEPA 6200	3,830	3,580	3,460	2,960
Calcium (mg/kg)	USEPA 6200	1,739	1,317	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	<1.00	1.90	<1.00	<1.00
Copper (mg/kg)	USEPA 6200	12.5	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	8,896	8,390	5,380	6,429
Lead (mg/kg)	USEPA 6200	3.20	2.80	<1.00	1.70
Nickel (mg/kg)	USEPA 6200	20.6	20.8	18.6	16.5
Zinc (mg/kg)	USEPA 6200	34.5	17.7	33.9	56.5
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	210	206	218	269
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency
- EXT. = Extractable

Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 3 (0-15)	SS 3 (15-30)	SS 4 (0-15)	SS 4 (15-30)
Co-ordinates		X: 8.00702 Y: 4.580751		X: 7.975522 Y: 4.593437	
pH (H_2O) @ 23.6^oC	ASTM D 4972	5.40	5.47	5.29	5.33
Elect. Conductivity (µS/cm)	APHA 2510A	71.0	52.7	72.0	35.8
TOC (g/kg)	BS 1377	14.0	13.5	32.3	35.0
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	98.0	100	30.0	31.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		5.00	5.00	-	-
Sand (%)		90.0	90.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.75	0.91	0.92	0.77
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	0.32	4.23	4.51	10.8
Magnesium (mg/kg)	USEPA 6200	1,056	1,011	299	445
Potassium (mg/kg)	USEPA 6200	10,830	11,470	2,464	2,819
Sodium (mg/kg)	USEPA 6200	4,670	4,620	1,570	1,920
Calcium (mg/kg)	USEPA 6200	2,320	2,754	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	10.6	42.9	92.2	154
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	17,250	23,580	9,176	10,180
Lead (mg/kg)	USEPA 6200	6.10	9.10	5.90	6.40
Nickel (mg/kg)	USEPA 6200	21.6	23.0	33.4	42.9
Zinc (mg/kg)	USEPA 6200	31.0	56.7	66.9	47.3
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	228	341	297	273
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency
- EXT. = Extractable

Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 5 (0-15)	SS 5 (15-30)	SS 6 (0-15)	SS 6 (15-30)
Co-ordinates		X: 7.951704 Y: 4.601806		X: 7.926443 Y: 4.605578	
pH (H_2O) @ 23.7°C	ASTM D 4972	5.51	5.33	5.79	5.89
Elect. Conductivity (µS/cm)	APHA 2510A	124	109	56.3	48.6
TOC (g/kg)	BS 1377	26.9	18.6	9.89	9.85
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	35.0	39.0	45.0	59.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	-	-
Sand (%)		100	100	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	0.36	0.35	0.34	1.18
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	1.63	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	7.80	1.67	0.36	4.72
Magnesium (mg/kg)	USEPA 6200	561	622	645	744
Potassium (mg/kg)	USEPA 6200	5,552	9,610	9,136	11,590
Sodium (mg/kg)	USEPA 6200	3,180	2,940	3,160	3,270
Calcium (mg/kg)	USEPA 6200	205	468	751	526
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	7.70	11.8	14.8	30.3
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	5,796	7,060	8,000	9,936
Lead (mg/kg)	USEPA 6200	2.20	4.60	2.80	<1.00
Nickel (mg/kg)	USEPA 6200	22.2	23.8	28.4	34.2
Zinc (mg/kg)	USEPA 6200	13.0	16.5	20.9	19.8
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	44.7
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	110	154	91.2	126
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	8.40	28.5

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 7 (0-15)	SS 7 (15-30)	SS 8 (0-15)	SS 8 (15-30)
Co-ordinates		X: 7.903185 Y: 4.610608		X: 7.877946 Y: 4.608265	
pH (H_2O) @ 23.6°C	ASTM D 4972	5.33	5.33	5.42	5.38
Elect. Conductivity (µS/cm)	APHA 2510A	32.9	60.2	218	64.5
TOC (g/kg)	BS 1377	<1.00	7.93	33.6	17.8
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	30.0	41.0	60.0	65.0
PSD Clay (%)	ASTM D 422	10.0	5.00	-	-
Silt (%)		10.0	15.0	-	-
Sand (%)		80.0	80.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	2.76	0.43	5.23	2.09
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	24.3	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	1.92	3.33	11.4	0.04
Magnesium (mg/kg)	USEPA 6200	817	926	1,469	1,281
Potassium (mg/kg)	USEPA 6200	3,112	3,195	3,018	3,340
Sodium (mg/kg)	USEPA 6200	3,430	3,190	3,510	3,840
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	664	245
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	41.0	53.1	139	173
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	11.7	13.5
Total Iron (mg/kg)	USEPA 6200	12,000	14,540	34,630	36,100
Lead (mg/kg)	USEPA 6200	2.00	3.40	11.4	8.20
Nickel (mg/kg)	USEPA 6200	30.7	34.4	54.7	63.6
Zinc (mg/kg)	USEPA 6200	<0.50	5.40	73.4	45.1
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	68.3	61.0	208	154
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	23.2	22.0	88.5	78.3

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 9 (0-15)	SS 9 (15-30)	SS 10 (0-15)	SS 10 (15-30)
Co-ordinates		X: 7.855727 Y: 4.605264		X: 7.830177 Y: 4.602537	
pH (H_2O) @ 23.7°C	ASTM D 4972	5.33	5.42	5.47	5.27
Elect. Conductivity (µS/cm)	APHA 2510A	52.0	53.5	100	100
TOC (g/kg)	BS 1377	6.04	5.62	17.3	13.8
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	28.0	29.0	48.0	50.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	10.0	10.0
Sand (%)		100	100	90.0	90.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.09	1.50	0.14	0.18
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	42.5
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.19	1.68	0.21	6.16
Magnesium (mg/kg)	USEPA 6200	560	691	402	602
Potassium (mg/kg)	USEPA 6200	3,033	3,281	2,262	3,659
Sodium (mg/kg)	USEPA 6200	3,100	3,220	3,050	3,150
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	60.7	67.0	3.20	13.2
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	17,950	20,770	4,627	6,270
Lead (mg/kg)	USEPA 6200	4.20	4.20	2.00	4.50
Nickel (mg/kg)	USEPA 6200	33.7	36.2	22.1	21.1
Zinc (mg/kg)	USEPA 6200	8.80	9.80	5.40	18.5
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	99.3	132	110	156
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	27.7	38.5	<1.00	<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 11 (0-15)	SS 11 (15-30)	SS 12 (0-15)	SS 12 (15-30)
Co-ordinates		X: 7.804106 Y: 4.599754		X: 7.781543 Y: 4.597345	
pH (H_2O) @ 23.6°C	ASTM D 4972	6.66	6.42	6.37	6.24
Elect. Conductivity (µS/cm)	APHA 2510A	86.8	93.7	31.3	33.3
TOC (g/kg)	BS 1377	13.8	15.3	19.3	11.7
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	65.0	70.0	60.0	59.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	-	-
Sand (%)		100	100	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	1.41	1.63	0.05	0.11
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	4.17	1.99	5.46	6.15
Magnesium (mg/kg)	USEPA 6200	709	742	345	345
Potassium (mg/kg)	USEPA 6200	1,461	1,596	2,388	1,625
Sodium (mg/kg)	USEPA 6200	3,470	3,400	3,030	3,010
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	72.8	92.1	12.9	<1.00
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	22,550	25,170	4,977	3,058
Lead (mg/kg)	USEPA 6200	8.40	10.2	4.10	<1.00
Nickel (mg/kg)	USEPA 6200	37.3	43.8	22.7	20.4
Zinc (mg/kg)	USEPA 6200	50.6	57.7	9.60	<0.50
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	103	121	119	96.9
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	58.6	58.9		<1.00

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 13 (0-15)	SS 13 (15-30)	SS 14 (0-15)	SS 14 (15-30)
Co-ordinates		X: 7.755541 Y: 4.594568		X: 7.73346 Y: 4.592209	
pH (H_2O) @ 23.6^oC	ASTM D 4972	6.28	6.67	6.39	6.61
Elect. Conductivity (µS/cm)	APHA 2510A	36.8	33.9	87.7	79.7
TOC (g/kg)	BS 1377	3.90	5.36	13.6	6.46
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	25.0	28.0	81.0	80.0
PSD Clay (%)	ASTM D 422	-	-	-	-
Silt (%)		-	-	10.0	10.0
Sand (%)		100	100	90.0	90.0
Nitrate (mg/kg)	APHA 4500-NO_3	<0.02	0.11	3.70	0.13
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	8.35	3.42	1.71	1.62
Magnesium (mg/kg)	USEPA 6200	459	463	785	742
Potassium (mg/kg)	USEPA 6200	1,635	1,705	2,058	1,794
Sodium (mg/kg)	USEPA 6200	3,050	3,130	3,370	2,920
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	<1.00	<1.00	114	113
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	2.60	0.60
Total Iron (mg/kg)	USEPA 6200	4,944	5,636	25,810	24,920
Lead (mg/kg)	USEPA 6200	1.00	4.00	4.40	4.30
Nickel (mg/kg)	USEPA 6200	18.2	18.1	51.8	49.9
Zinc (mg/kg)	USEPA 6200	15.8	19.3	27.2	19.6
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	165	186	111	91.0
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	<1.00	<1.00	65.5	70.0

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 15 (0-15)	SS 15 (15-30)	SS 16 (0-15)	SS 16 (15-30)
Co-ordinates		X: 7.707511 Y: 4.589435		X: 7.685672 Y: 4.5871	
pH (H_2O) @ 23.^{0}C	ASTM D 4972	5.76	6.28	5.73	5.77
Elect. Conductivity (µS/cm)	APHA 2510A	43.8	63.4	61.2	51.1
TOC (g/kg)	BS 1377	13.6	5.89	12.9	11.1
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	85.0	88.0	65.0	68.0
PSD Clay (%)	ASTM D 422	-	-	5.00	5.00
Silt (%)		-	-	15.0	15.0
Sand (%)		100	100	80.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.02	1.46	2.12	1.44
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.14	4.48	7.49	2.70
Magnesium (mg/kg)	USEPA 6200	905	779	1,211	1,297
Potassium (mg/kg)	USEPA 6200	2,232	2,425	3,692	5,452
Sodium (mg/kg)	USEPA 6200	3,410	3,200	4,800	4,740
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	564	1,131
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	134	153	110	95.3
Copper (mg/kg)	USEPA 6200	15.1	13.6	5.50	<0.50
Total Iron (mg/kg)	USEPA 6200	32,870	32,520	24,160	22,260
Lead (mg/kg)	USEPA 6200	6.40	6.60	5.50	6.30
Nickel (mg/kg)	USEPA 6200	58.0	60.9	50.9	43.5
Zinc (mg/kg)	USEPA 6200	42.8	41.9	30.0	21.1
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	15.5
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	145	157	133	112
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	92.6	98.5	54.2	73.1

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Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result			
		SS 17 (0-15)	**SS 17 (15-30)**	**SS 18 (0-15)**	**SS 18 (15-30)**
Co-ordinates		X: 7.660048 Y: 4.58436		X: 7.634816 Y: 4.58166	
pH (H_2O) @ 22.5^oC	ASTM D 4972	5.64	5.58	5.54	4.94
Elect. Conductivity (µS/cm)	APHA 2510A	28.4	44.2	36.5	38.6
TOC (g/kg)	BS 1377	9.42	7.88	9.89	4.82
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	14.0	28.0	75.0	70.0
PSD Clay (%)	ASTM D 422	10.0	10.0	10.0	10.0
Silt (%)		20.0	20.0	10.0	10.0
Sand (%)		70.0	70.0	80.0	80.0
Nitrate (mg/kg)	APHA 4500-NO_3	2.23	2.07	2.55	0.27
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	4.08	10.9	2.62	5.49
Magnesium (mg/kg)	USEPA 6200	1,274	967	882	1,060
Potassium (mg/kg)	USEPA 6200	4,274	3,027	7,632	8,809
Sodium (mg/kg)	USEPA 6200	4,180	3,610	3,590	3,420
Calcium (mg/kg)	USEPA 6200	1,972	2,370	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	73.1	63.5	9.00	21.8
Copper (mg/kg)	USEPA 6200	10.2	5.70	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	16,010	14,610	8,026	10,940
Lead (mg/kg)	USEPA 6200	5.60	8.50	4.10	5.80
Nickel (mg/kg)	USEPA 6200	41.6	39.8	22.7	28.3
Zinc (mg/kg)	USEPA 6200	59.4	369	5.60	8.70
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	201	539	72.9	75.1
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	27.5	24.4	2.40	<1.00

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Parameter	Method	Sample Station Result			
		SS 19 (0-15)	SS 19 (15-30)	SS 20 (0-15)	SS 20 (15-30)
Co-ordinates		X: 7.606547 Y: 4.570064		X: 7.591482 Y: 4.565826	
pH (H_2O) @ 23.5^oC	ASTM D 4972	6.22	6.32	6.25	6.47
Elect. Conductivity (µS/cm)	APHA 2510A	124	213	179	103
TOC (g/kg)	BS 1377	<1.00	1.95	<1.00	3.57
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	65.0	78.0	83.0	85.0
PSD Clay (%)	ASTM D 422	15.0	20.0	19.0	20.0
Silt (%)		15.0	5.00	3.00	4.00
Sand (%)		70.0	75.0	78.0	76.0
Nitrate (mg/kg)	APHA 4500-NO_3	0.17	1.54	1.30	0.88
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	2.76	6.35	7.03	2.99
Magnesium (mg/kg)	USEPA 6200	1,274	1,393	821	1,023
Potassium (mg/kg)	USEPA 6200	5,980	5,985	7,113	8,924
Sodium (mg/kg)	USEPA 6200	3,710	3,590	3,350	3,430
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	35.1	48.4	15.8	33.9
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	16,450	18,950	9,791	13,000
Lead (mg/kg)	USEPA 6200	3.90	3.30	2.90	1.40
Nickel (mg/kg)	USEPA 6200	32.4	34.4	27.9	33.9
Zinc (mg/kg)	USEPA 6200	4.80	6.60	3.40	4.20
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	57.5	61.0	58.1	69.8
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	23.8	35.0	18.0	27.3

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Parameter	Method	Sample Station Result			
		SS 21 (0-15)	SS 21 (15-30)	SS 22 (0-15)	SS 22 (15-30)
Co-ordinates		X: 7.581876 Y: 4.565826		X: 8.017601 Y: 4.55901	
pH (H_2O) @ 23.4°C	ASTM D 4972	6.77	6.42	5.96	5.88
Elect. Conductivity (µS/cm)	APHA 2510A	213	165	213	176
TOC (g/kg)	BS 1377	4.71	<1.00	<1.00	<1.00
THC (mg/kg)	ASTM D 3921	<10.0	<10.0	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	104	108	25.0	30.0
PSD Clay (%)	ASTM D 422	5.00	5.00	-	-
Silt (%)		15.0	15.0	-	-
Sand (%)		80.0	80.0	100	100
Nitrate (mg/kg)	APHA 4500-NO_3	2.17	1.16	0.99	1.07
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	10.3	6.32	2.34	6.17
Magnesium (mg/kg)	USEPA 6200	806	1,017	661	642
Potassium (mg/kg)	USEPA 6200	9,884	9,316	10,820	13,140
Sodium (mg/kg)	USEPA 6200	3,200	3,290	3,680	3,380
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0	1,906	2,106
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	9.50	18.9	<1.00	<1.00
Copper (mg/kg)	USEPA 6200	<0.50	<0.50	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	6,344	8,101	6,673	7,728
Lead (mg/kg)	USEPA 6200	3.90	4.80	1.50	<1.00
Nickel (mg/kg)	USEPA 6200	24.7	28.8	18.8	20.3
Zinc (mg/kg)	USEPA 6200	<0.50	18.8	8.80	<0.50
Barium (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	65.0	56.4	104	114
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	3.60	11.3	<1.00	2.40

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- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency
- EXT. = Extractable

Table 1c: PHCN-JV ILF PROJECT Soil Physicochemical Characteristics Dry Season

Parameter	Method	Sample Station Result	
		SS 23 (0-15)	SS 23 (15-30)
Co-ordinates		X: 7.578101 Y: 4.566132	
pH (H_2O) @ 23.6^oC	ASTM D 4972	6.58	4.87
Elect. Conductivity (µS/cm)	APHA 2510A	225	307
TOC (g/kg)	BS 1377	<1.00	3.17
THC (mg/kg)	ASTM D 3921	<10.0	<10.0
Redox Potential (mV)	ASTM D1498	104	108
PSD Clay (%)	ASTM D 422	10.0	10.0
Silt (%)		20.0	20.0
Sand (%)		70.0	70.0
Nitrate (mg/kg)	APHA 4500-NO_3	1.10	<0.02
Ext. Sulphate (mg/kg)	CAEM/APHA 4500 SO_4^{2-}E	<0.02	<0.02
Ext. Phosphate (mg/kg)	CAEM/APHA 4500 PD	3.50	4.01
Magnesium (mg/kg)	USEPA 6200	816	829
Potassium (mg/kg)	USEPA 6200	9,119	9,412
Sodium (mg/kg)	USEPA 6200	3,340	3,430
Calcium (mg/kg)	USEPA 6200	<10.0	<10.0
Cadmium (mg/kg)	USEPA 6200	<2.00	<2.00
Total Chromium (mg/kg)	USEPA 6200	6.80	23.5
Copper (mg/kg)	USEPA 6200	<0.50	<0.50
Total Iron (mg/kg)	USEPA 6200	8,035	11,000
Lead (mg/kg)	USEPA 6200	1.20	<1.00
Nickel (mg/kg)	USEPA 6200	23.4	27.8
Zinc (mg/kg)	USEPA 6200	<0.50	0.80
Barium (mg/kg)	USEPA 6200	<2.00	<2.00
Silver (mg/kg)	USEPA 6200	<2.00	<2.00
Manganese (mg/kg)	USEPA 6200	53.4	61.5
Mercury (mg/kg)	USEPA 6200	<1.00	<1.00
Vanadium (mg/kg)	USEPA 6200	6.60	5.20

- ASTM = American Society for Testing and Materials (1999 Edition)
- APHA = American Public Health Association (20th Edition 1998)
- CAEM = Chemical Analysis of Ecological Materials 2nd Edition 1989
- USEPA = United States Environmental Protection Agency
- EXT. = Extractable

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX) Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	SS 4 15-30	SS 5 0-15	SS 5 15-30	SS 6 0-15	SS 6 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 2c: PHCN-JV ILF PROJECT Soil Volatile Hydrocarbon Profile (BTEX)

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
Benzene	USEPA 8240	<0.03	<0.03	<0.03	<0.03
Toluene		<0.03	<0.03	<0.03	<0.03
Ethylbenzene		<0.03	<0.03	<0.03	<0.03
p-xylene		<0.03	<0.03	<0.03	<0.03
m-xylene		<0.02	<0.02	<0.02	<0.02
o-xylene		<0.03	<0.03	<0.03	<0.03

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	SS 4 15-30	SS 5 0-15	SS 5 15-30	SS 6 0-15	SS 6 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 4c: PHCN-JV ILF PROJECT Soil Polyaromatic Hydrocarbon Profile (PAH)

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
Naphthalene	USEPA 8270B	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene		<0.02	<0.02	<0.02	<0.02
Acenapthylene		<0.02	<0.02	<0.02	<0.02
Acenaphthene		<0.02	<0.02	<0.02	<0.02
Fluorene		<0.02	<0.02	<0.02	<0.02
Phenanthrene		<0.02	<0.02	<0.02	<0.02
Anthracene		<0.02	<0.02	<0.02	<0.02
Fluoranthene		<0.02	<0.02	<0.02	<0.02
Pyrene		<0.02	<0.02	<0.02	<0.02
Benzo(a)anthracene		<0.02	<0.02	<0.02	<0.02
Chrysene		<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene		<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene		<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene		<0.02	<0.02	<0.02	<0.02
Dibenzo(a,h)anthracene		<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene		<0.03	<0.03	<0.03	<0.03
Indeno(1,2,3-d)pyrene		<0.02	<0.02	<0.02	<0.02

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 1 0-15	SS 1 15-30	SS 2 0-15	SS 2 15-30	SS 3 0-15	SS 3 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	3.00	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	0.21	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Eicosane		<0.01	0.34	0.30	0.62	0.79	1.12
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tricosane		0.30	0.15	0.08	0.11	0.12	0.11
n-Tetracosane		0.08	0.14	0.05	0.34	0.13	0.33
n-Pentacosane-		0.82	0.50	0.23	0.42	0.44	0.42
n-Hexacosne		0.17	0.10	0.83	0.37	0.15	0.25
n-Heptacosane		0.84	0.60	<0.01	0.58	0.28	0.32
n-Octacosane		0.14	0.04	<0.01	0.58	<0.01	1.59
n-Nonacosane		0.57	0.34	0.26	0.75	0.18	0.19
n-Triacontane		0.17	0.11	0.19	0.67	0.15	0.23
n-Hentriacontane		0.64	0.37	0.28	0.79	0.20	0.21
n-Dotriacotane		0.23	0.18	0.53	0.57	0.39	0.57
n-Tritriacontane		0.62	0.36	0.39	0.54	0.19	0.23
n-Tetratriacontane		0.19	0.66	0.57	0.38	0.54	0.59
n-Pentatriacontane		0.63	0.52	0.46	0.61	0.43	0.43
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.45**	**4.46**	**3.46**	**7.54**	**4.03**	**6.62**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 4 0-15	SS 4 15-30	SS 5 0-15	SS 5 15-30	SS 6 0-15	SS 6 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	0.35
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	0.16
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	0.19
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	0.35
n-Nonadecane		<0.01	<0.01	0.22	<0.01	<0.01	0.22
n-Eicosane		<0.01	<0.01	1.14	0.44	0.73	0.59
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		0.84	<0.01	<0.01	<0.01	0.13	0.35
n-Tricosane		0.27	0.30	0.23	0.14	0.10	0.86
n-Tetracosane		0.12	0.10	0.33	0.30	0.47	0.18
n-Pentacosane-		0.67	0.54	0.49	0.28	0.28	0.63
n-Hexacosne		1.09	0.14	<0.01	0.11	0.25	0.68
n-Heptacosane		0.18	0.12	<0.01	<0.01	0.21	0.67
n-Octacosane		0.08	0.07	<0.01	<0.01	<0.01	0.24
n-Nonacosane		0.32	0.12	0.20	0.16	0.20	0.18
n-Triacontane		0.11	0.20	<0.01	<0.01	0.24	0.14
n-Hentriacontane		0.44	0.16	0.22	0.44	0.18	0.10
n-Dotriacotane		0.17	0.29	<0.01	<0.01	0.52	0.07
n-Tritriacontane		0.23	<0.01	<0.01	<0.01	0.42	0.47
n-Tetratriacontane		0.21	0.41	0.35	0.77	0.66	0.25
n-Pentatriacontane		0.34	<0.01	<0.01	0.42	0.53	0.24
n-Hexatriacontane		0.44	<0.01	<0.01	<0.01	<0.01	0.12
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	0.14
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**4.82**	**2.48**	**3.22**	**3.09**	**4.97**	**7.18**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 7 0-15	SS 7 15-30	SS 8 0-15	SS 8 15-30	SS 9 0-15	SS 9 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		1.55	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	0.10	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	0.10	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	0.19	<0.01	<0.01	<0.01
n-Eicosane		0.61	1.16	1.25	1.28	1.12	0.97
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		<0.01	0.12	0.25	0.09	0.12	<0.01
n-Tricosane		0.12	0.12	0.17	0.15	0.10	0.06
n-Tetracosane		0.16	0.43	0.15	0.16	0.20	0.40
n-Pentacosane-		0.40	0.25	0.44	0.38	0.29	0.21
n-Hexacosne		0.29	0.18	0.16	0.13	0.11	0.11
n-Heptacosane		0.70	0.16	0.38	0.34	0.18	<0.01
n-Octacosane		0.28	0.09	0.18	0.25	0.06	<0.01
n-Nonacosane		0.41	0.13	0.20	0.27	0.10	0.17
n-Triacontane		0.10	0.08	0.18	0.09	0.14	<0.01
n-Hentriacontane		0.11	0.14	0.26	0.34	0.17	0.11
n-Dotriacotane		0.23	0.92	0.18	0.14	0.35	0.31
n-Tritriacontane		0.16	0.59	0.29	1.12	0.21	<0.01
n-Tetratriacontane		0.77	0.82	0.29	0.69	0.85	0.73
n-Pentatriacontane		<0.01	0.46	0.64	0.95	0.51	0.39
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	0.69	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**5.92**	**5.71**	**5.48**	**7.11**	**4.55**	**3.47**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 10 0-15	SS 10 15-30	SS 11 0-15	SS 11 15-30	SS 12 0-15	SS 12 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		<0.01	<0.01	0.19	0.17	1.89	0.56
n-Eicosane		<0.01	0.11	0.96	1.03	1.60	0.13
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		<0.01	<0.01	<0.01	<0.01	<0.01	0.14
n-Tricosane		0.18	0.28	0.21	0.23	0.23	0.19
n-Tetracosane		0.10	0.09	0.17	0.27	0.0.08	0.16
n-Pentacosane-		0.56	0.59	0.45	0.49	0.48	0.41
n-Hexacosne		0.31	0.18	0.10	0.12	0.09	0.31
n-Heptacosane		0.29	0.18	0.22	0.25	0.29	0.24
n-Octacosane		0.14	0.08	0.12	0.79	0.10	0.07
n-Nonacosane		0.29	0.22	0.19	0.21	0.20	0.24
n-Triacontane		0.14	0.10	0.12	0.14	0.97	0.08
n-Hentriacontane		0.26	0.12	0.16	0.17	0.12	0.18
n-Dotriacotane		0.24	0.24	0.27	0.51	0.41	0.34
n-Tritriacontane		0.21	<0.01	<0.01	0.31	<0.01	<0.01
n-Tetratriacontane		0.15	0.59	0.44	0.47	0.39	0.23
n-Pentatriacontane		0.32	0.34	<0.01	<0.01	<0.01	0.63
n-Hexatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	0.42
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**3.22**	**3.48**	**3.65**	**4.47**	**2.88**	**4.35**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 13 0-15	SS 13 15-30	SS 14 0-15	SS 14 15-30	SS 15 0-15	SS 15 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	0.11
n-Heptadecane		<0.01	<0.01	<0.01	<0.01	<0.01	0.97
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		3.01	<0.01	0.20	0.13	<0.01	0.68
n-Eicosane		2.51	<0.01	1.19	0.25	<0.01	0.43
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		0.27	<0.01	<0.01	0.18	0.08	0.14
n-Tricosane		0.37	0.24	0.29	0.19	0.35	0.59
n-Tetracosane		0.63	0.09	0.14	0.19	0.33	0.23
n-Pentacosane-		0.78	0.54	0.61	0.32	0.64	0.12
n-Hexacosne		0.17	0.21	0.12	0.16	0.21	0.27
n-Heptacosane		0.23	0.29	0.15	0.24	0.20	0.20
n-Octacosane		0.38	0.17	0.12	0.14	0.21	0.14
n-Nonacosane		0.31	0.15	0.21	0.13	0.23	0.46
n-Triacontane		0.12	0.13	0.14	0.14	0.16	0.17
n-Hentriacontane		0.27	0.13	0.13	0.14	0.19	0.42
n-Dotriacotane		0.17	0.29	0.12	0.27	0.22	0.21
n-Tritriacontane		0.24	<0.01	<0.01	<0.01	0.19	0.19
n-Tetratriacontane		0.65	0.43	0.60	0.77	0.59	0.32
n-Pentatriacontane		0.43	0.33	0.38	0.46	0.38	0.64
n-Hexatriacontane		<0.01	<0.01	0.25	0.44	<0.01	0.40
n-Heptatriacontane		0.65	<0.01	0.68	<0.01	1.03	1.40
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**6.26**	**3.04**	**5.38**	**4.21**	**5.04**	**8.04**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 16 0-15	SS 16 15-30	SS 17 0-15	SS 17 15-30	SS 18 0-15	SS 18 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		0.10	<0.01	<0.01	<0.01	<0.01	<0.01
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		0.19	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		0.19	<0.01	<0.01	<0.01	<0.01	<0.01
n-Phytane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonadecane		0.29	<0.01	0.64	<0.01	0.09	0.09
n-Eicosane		0.19	0.68	0.18	0.57	0.73	0.53
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Docosane		0.16	0.28	0.17	0.39	0.35	0.21
n-Tricosane		0.16	0.18	0.13	0.10	0.12	0.23
n-Tetracosane		0.56	0.47	0.47	0.16	0.46	0.27
n-Pentacosane-		0.42	0.35	0.28	0.29	0.35	0.43
n-Hexacosne		0.16	0.14	0.45	0.14	0.17	0.25
n-Heptacosane		0.36	0.13	<0.01	0.18	0.26	0.43
n-Octacosane		0.10	0.02	<0.01	0.11	0.08	0.13
n-Nonacosane		0.37	0.18	0.16	0.85	0.22	0.15
n-Triacontane		0.10	0.75	0.29	0.10	0.42	0.14
n-Hentriacontane		0.61	0.12	0.68	0.16	0.21	0.13
n-Dotriacotane		0.45	0.22	<0.01	0.47	1.01	0.11
n-Tritriacontane		0.99	0.20	0.33	<0.01	0.22	<0.01
n-Tetratriacontane		0.58	0.31	0.92	0.46	0.65	0.78
n-Pentatriacontane		0.58	0.62	0.57	0.49	0.66	0.53
n-Hexatriacontane		0.49	<0.01	0.43	<0.01	<0.01	<0.01
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total		**7.31**	**4.72**	**5.69**	**3.74**	**6.00**	**4.41**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)					
		SS 19 0-15	SS 19 15-30	SS 20 0-15	SS 20 15-30	SS 21 0-15	SS 21 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	<0.01	<0.01	<0.01	<0.01	0.12
n-Hexadecane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Heptadecane		<0.01	<0.01	<0.01	0.27	0.18	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	<0.01	0.13	0.11	0.07
n-Phytane		<0.01	<0.01	<0.01	0.30	0.20	<0.01
n-Nonadecane		0.22	<0.01	0.51	0.12	0.37	0.26
n-Eicosane		1.14	<0.01	0.97	0.70	0.44	0.19
n-Henelcosane		<0.01	<0.01	<0.01	<0.01	0.13	<0.01
n-Docosane		0.20	<0.01	<0.01	0.48	0.38	0.25
n-Tricosane		0.34	<0.01	0.10	0.42	0.37	0.21
n-Tetracosane		0.22	<0.01	0.19	0.52	0.58	0.19
n-Pentacosane-		0.65	<0.01	0.27	0.45	0.32	0.45
n-Hexacosne		0.26	<0.01	0.11	0.32	0.25	0.31
n-Heptacosane		0.63	0.10	0.21	0.33	0.19	0.28
n-Octacosane		<0.01	<0.01	<0.01	0.12	0.27	0.08
n-Nonacosane		0.44	<0.01	0.21	0.16	0.17	0.26
n-Triacontane		0.26	<0.01	<0.01	0.12	0.26	0.13
n-Hentriacontane		0.26	<0.01	0.30	0.13	0.14	0.28
n-Dotriacotane		0.85	<0.01	0.33	0.34	0.31	0.14
n-Tritriacontane		0.87	0.64	<0.01	<0.01	0.25	0.99
n-Tetratriacontane		1.62	0.38	0.78	0.70	0.89	0.28
n-Pentatriacontane		0.78	<0.01	0.50	0.58	0.35	0.42
n-Hexatriacontane		0.83	<0.01	0.39	0.48	<0.01	0.47
n-Heptatriacontane		0.46	<0.01	<0.01	<0.01	<0.01	0.47
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
n-Tetracontane		0.06	1.85	<0.01	<0.01	<0.01	<0.01
Total		**9.01**	**2.97**	**4.89**	**6.70**	**6.20**	**5.86**

- USEPA = United States Environmental Protection Agency

Table 5c: PHCN-JV ILF PROJECT -Soil Aliphatic Hydrocarbon Profile Dry Season

Parameter	Method	Sample Station Result (mg/kg)			
		SS 22 0-15	SS 22 15-30	SS 23 0-15	SS 23 15-30
n-Octane	USEPA 1625	<0.01	<0.01	<0.01	<0.01
n-Nonane		<0.01	<0.01	<0.01	<0.01
n-Decane		<0.01	<0.01	<0.01	<0.01
n-Undecane-		<0.01	<0.01	<0.01	<0.01
n-Dodecane-		<0.01	<0.01	<0.01	<0.01
n-Tridecane-		<0.01	<0.01	<0.01	<0.01
n-Tetradecane		<0.01	<0.01	<0.01	<0.01
n-Pentadecane		<0.01	0.11	0.11	<0.01
n-Hexadecane		<0.01	<0.01	0.45	<0.01
n-Heptadecane		<0.01	<0.01	1.02	<0.01
n-Pristane		<0.01	<0.01	<0.01	<0.01
n-Octadecane		<0.01	<0.01	0.67	<0.01
n-Phytane		<0.01	<0.01	0.33	<0.01
n-Nonadecane		0.82	0.22	0.40	0.50
n-Eicosane		0.89	0.68	0.49	0.74
n-Henelcosane		<0.01	<0.01	<0.01	<0.01
n-Docosane		0.16	0.22	0.33	0.25
n-Tricosane		0.13	0.22	0.37	0.15
n-Tetracosane		0.54	0.42	0.33	0.35
n-Pentacosane-		0.39	0.71	0.65	0.36
n-Hexacosne		0.33	0.16	0.35	0.14
n-Heptacosane		0.15	0.94	0.25	0.23
n-Octacosane		0.07	0.79	0.14	<0.01
n-Nonacosane		0.18	0.84	0.29	0.21
n-Triacontane		0.46	0.81	0.17	0.14
n-Hentriacontane		0.13	0.19	0.32	0.18
n-Dotriacotane		0.17	0.51	0.15	0.42
n-Tritriacontane		0.14	0.31	0.54	0.20
n-Tetratriacontane		0.99	0.45	0.72	0.85
n-Pentatriacontane		0.71	0.79	0.89	0.65
n-Hexatriacontane		0.52	0.49	0.53	0.23
n-Heptatriacontane		<0.01	<0.01	<0.01	<0.01
n-Octatriacontane		<0.01	<0.01	<0.01	<0.01
n-Tetracontane		<0.01	<0.01	<0.01	<0.01
Total		**6.82**	**8.91**	**9.50**	**5.71**

- USEPA = United States Environmental Protection Agency

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 1 0-15	*Pseudomonas sp* *Bacillus sp*	$9.00x10^4$	*Pseudomonas sp*	$1.96x10^3$	*Mucor sp* *Candida sp* *Aspergillus sp*	$4.20x10^2$	*Mucor sp* *Aspergillus sp*	$3.20x10^2$
SS 1 15-20	*Pseudomonas sp* *Bacillus sp*	$7.00x10^4$	*Pseudomonas sp*	$9.20x10^2$	*Mucor sp* *Candida sp* *Aspergillus sp*	$1.50x10^2$	*Candida sp* *Mucor sp* *Aspergillus sp*	$1.10x10^2$
SS 2 0-15	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	$2.20x10^5$	*Pseudomonas sp*	$1.23x10^3$	*Mucor sp* *Candida sp* *Aspergillus sp*	$3.90x10^2$	*Mucor sp* *Candida sp*	$3.00x10^2$
SS 2 15-30	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	$1.80x10^5$	*Pseudomonas sp*	$7.20x10^2$	*Mucor sp* *Candida sp* *Aspergillus sp*	$5.40x10^2$	*Mucor sp* *Candida sp* *Aspergillus sp*	$3.30x10^2$
SS 3 0-15	*Pseudomonas sp* *Bacillus sp*	$6.00x10^4$	*Pseudomonas sp*	$1.58x10^3$	*Mucor sp* *Candida sp* *Aspergillus sp*	$2.20x10^2$	*Mucor sp* *Candida sp*	$1.00x10^2$
SS 3 15-30	*Pseudomonas sp* *Bacillus sp*	$1.00x10^5$	*Pseudomonas sp*	$1.64x10^3$	*Candida sp* *Mucor sp*	$1.70x10^2$	*Mucor sp* *Candida sp*	$8.0x10^1$
SS 4 0-15	*Pseudomonas sp* *Bacillus sp*	$4.60x10^5$	*Pseudomonas sp*	$9.70x10^2$	*Mucor sp* *Aspergillus sp*	$1.40x10^2$	*Mucor sp* *Aspergillus sp*	$7.0x10^1$
SS 4 15-30	*Pseudomonas sp* *Bacillus sp*	$2.60x10^5$	*Pseudomonas sp*	$4.70x10^2$	*Mucor sp* *Aspergillus sp*	$1.0x10^1$	*Mucor sp*	$1.0x10^1$
SS 5 0-15	*Pseudomonas sp* *Bacillus sp*	$2.50x10^5$	*Pseudomonas sp*	$1.96x10^3$	*Mucor sp* *Aspergillus sp*	$4.00x10^2$	*Mucor sp* *Aspergillus sp*	$3.00x10^2$
SS 5 15-30	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	$1.60x10^5$	*Pseudomonas sp*	$1.71x10^3$	*Mucor sp* *Aspergillus sp*	$2.70x10^2$	*Mucor sp* *Aspergillus sp*	$1.10x10^2$

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 6 0-15	*Pseudomonas sp* *Bacillus sp*	2.80×10^5	*Pseudomonas sp*	1.35×10^3	*Aspergillus sp* *Mucor sp*	5.60×10^2	*Aspergillus sp* *Mucor sp*	3.20×10^2
SS 6 15-20	*Pseudomonas sp* *Bacillus sp*	1.10×10^5	*Pseudomonas sp*	1.33×10^3	*Fusarium sp* *Mucor sp* *Aspergillus sp*	2.10×10^2	*Mucor sp* *Aspergillus sp*	1.50×10^2
SS 7 0-15	*Pseudomonas sp* *Bacillus sp*	9.90×10^5	*Pseudomonas sp*	1.53×10^3	*Mucor sp* *Candida sp* *Aspergillus sp*	1.60×10^2	*Mucor sp* *Candida sp*	1.40×10^2
SS 7 15-30	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	1.16×10^6	*Pseudomonas sp*	1.00×10^3	*Candida sp* *Aspergillus sp* *Mucor sp* *Penicillium sp*	1.00×10^2	*Mucor sp*	8.0×10^1
SS 8 0-15	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp* *Actinomyces sp*	1.98×10^6	*Pseudomonas sp*	2.60×10^3	*Aspergillus sp* *Candida sp* *Mucor sp*	3.50×10^2	*Aspergillus sp* *Candida sp* *Mucor sp*	3.00×10^2
SS 8 15-30	*Pseudomonas sp* *Bacillus sp*	7.20×10^5	*Pseudomonas sp*	1.43×10^3	*Aspergillus sp* *Mucor sp*	1.05×10^3	*Mucor sp*	7.90×10^2
SS 9 0-15	*Pseudomonas sp* *Bacillus sp* *Chromobacterium sp*	5.90×10^5	*Pseudomonas sp*	2.90×10^3	*Mucor sp* *Aspergillus sp*	2.90×10^2	*Mucor sp*	2.00×10^2
SS 9 15-30	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	1.80×10^5	*Pseudomonas sp*	2.70×10^3	*Mucor sp* *Aspergillus sp*	2.20×10^2	*Mucor sp* *Aspergillus sp*	1.90×10^2
SS 10 0-15	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp* *Actinomyces sp*	9.60×10^5	*Pseudomonas sp*	2.72×10^3	*Rhodotorula sp* *Aspergillus sp* *Candida sp* *Mucor sp*	2.80×10^2	*Rhodotorula sp* *Aspergillus sp* *Mucor sp*	2.30×10^2
SS 10 15-30	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp*	6.50×10^5	*Pseudomonas sp*	2.38×10^3	*Aspergillus sp* *Mucor sp* *Candida sp*	3.90×10^2	*Aspergillus sp* *Mucor sp* *Candida sp*	3.00×10^2

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 11 0-15	*Pseudomonas sp* *Bacillus sp*	8.00×10^4	*Pseudomonas sp*	2.66×10^3	*Candida sp* *Mucor sp*	2.80×10^2	*Mucor sp* *Candida sp*	2.40×10^2
SS 11 15-20	*Pseudomonas sp*	8.00×10^4	*Pseudomonas sp*	2.35×10^3	*Mucor sp* *Geotrichum sp*	3.10×10^2	*Mucor sp*	2.10×10^2
SS 12 0-15	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp* *Actinomyces sp*	1.20×10^5	*Pseudomonas sp*	2.86×10^3	*Aspergillus sp* *Mucor sp* *Candida sp*	5.90×10^2	*Aspergillus sp* *Mucor sp* *Candida sp*	3.20×10^2
SS 12 15-30	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp*	4.30×10^5	*Pseudomonas sp*	2.06×10^3	*Aspergillus sp* *Mucor sp* *Candida sp*	2.60×10^2	*Aspergillus sp* *Mucor sp*	2.50×10^2
SS 13 0-15	*Pseudomonas sp* *Chromobacterium sp* *Bacillus sp* *Actinomyces sp*	7.70×10^5	*Pseudomonas sp*	2.79×10^3	*Aspergillus sp* *Mucor sp*	5.40×10^2	*Aspergillus sp* *Mucor sp*	2.70×10^2
SS 13 15-30	*Pseudomonas sp* *Chromobacterium sp*	7.10×10^5	*Pseudomonas sp*	2.41×10^3	*Aspergillus sp* *Mucor sp*	3.20×10^2	*Aspergillus sp* *Mucor sp*	2.90×10^2
SS 14 0-15	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	2.13×10^6	*Pseudomonas sp*	6.20×10^2	*Mucor sp* *Candida sp*	3.60×10^2	*Mucor sp* *Candida sp*	1.50×10^2
SS 14 15-30	*Pseudomonas sp* *Bacillus sp*	3.80×10^5	*Pseudomonas sp*	5.20×10^2	*Mucor sp* *Candida sp*	6.0×10^1	*Mucor sp*	4.0×10^1
SS 15 0-15	*Pseudomonas sp* *Bacillus sp*	9.20×10^5	*Pseudomonas sp*	1.36×10^3	*Mucor sp* *Candida sp*	4.80×10^2	*Aspergillus sp* *Mucor sp*	5.0×10^1
SS 15 15-30	*Pseudomonas sp* *Bacillus sp*	3.30×10^5	*Pseudomonas sp*	1.23×10^3	*Aspergillus sp* *Mucor sp* *Candida sp*	3.60×10^2	*Aspergillus sp* *Mucor sp* *Candida sp*	2.30×10^2

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 16 0-15	*Pseudomonas sp* *Bacillus sp*	$9.70x10^5$	*Pseudomonas sp*	$1.54x10^3$	*Aspergillus sp* *Geotrichum sp* *Mucor sp* *Candida sp*	$2.57x10^3$	*Aspergillus sp* *Mucor sp*	$5.90x10^2$
SS 16 15-20	*Pseudomonas sp* *Bacillus sp*	$9.20x10^5$	*Pseudomonas sp*	$1.97x10^3$	*Aspergillus sp* *Geotrichum sp* *Mucor sp* *Candida sp*	$2.24x10^2$	*Candida sp* *Mucor sp*	$1.70x10^2$
SS 17 0-15	*Pseudomonas sp*	$7.20x10^5$	*Pseudomonas sp*	$1.41x10^3$	*Mucor sp* *Aspergillus sp* *Penicillium sp*	$1.60x10^2$	*Aspergillus sp* *Mucor sp*	$1.40x10^2$
SS 17 15-30	*Pseudomonas sp*	$1.47x10^6$	*Pseudomonas sp*	$1.37x10^3$	*Mucor sp* *Aspergillus sp*	$1.00x10^2$	*Aspergillus sp* *Mucor sp*	$1.00x10^2$
SS 18 0-15	*Pseudomonas sp*	$8.90x10^5$	*Pseudomonas sp*	$1.35x10^3$	*Mucor sp*	$1.70x10^2$	*Mucor sp*	$1.20x10^2$
SS 18 15-30	*Pseudomonas sp*	$9.10x10^5$	*Pseudomonas sp*	$9.10x10^2$	*Mucor sp*	$9.00x10^1$	*Mucor sp*	$7.0x10^1$
SS 19 0-15	*Pseudomonas sp* *Bacillus sp*	$1.48x10^6$	*Pseudomonas sp*	$1.61x10^3$	*Mucor sp*	$3.80x10^2$	*Mucor sp*	$1.30x10^2$
SS 19 15-30	*Pseudomonas sp* *Bacillus sp*	$1.14x10^6$	*Pseudomonas sp*	$1.20x10^3$	*Mucor sp* *Aspergillus sp*	$5.0x10^1$	*Aspergillus sp* *Mucor sp*	$5.0x10^1$
SS 20 0-15	*Pseudomonas sp*	$9.80x10^5$	*Pseudomonas sp*	$5.50x10^2$	*Mucor sp* *Aspergillus sp*	$1.23x10^3$	*Aspergillus sp* *Mucor sp*	$5.60x10^2$
SS 20 15-30	Pseudomonas sp	$1.00x10^5$	*Pseudomonas sp*	$1.66x10^3$	*Mucor sp*	$2.0x10^1$	*Mucor sp*	$2.0x10^1$

Table 7c: PHCN-JV ILF PROJECT Soil Microbiological Characteristics Dry Season

Parameter Sample Station	Heterotrophic Bacteria	Count (cfu/g)	Hydrocarbon Utilising Bacteria	Count (cfu/g)	Heterotrophic Fungi	Count (cfu/g)	Hydrocarbon Utilising Fungi	Count (cfu/g)
SS 21 0-15	*Pseudomonas sp* *Bacillus sp*	$8.10x10^5$	*Pseudomonas sp*	$1.49x10^3$	*Mucor sp* *Candida sp*	$1.00x10^2$	*Mucor sp* *Candida sp*	$8.0x10^1$
SS 21 15-20	*Pseudomonas sp* *Bacillus sp*	4.40x10	*Pseudomonas sp*	$1.10x10^3$	*Mucor sp* *Candida sp*	$1.20x10^2$	*Mucor sp* *Candida sp*	$1.00x10^2$
SS 22 0-15	*Pseudomonas sp*	$1.47x10^6$	*Pseudomonas sp*	$4.50x10^2$	*Mucor sp*	$6.0x10^1$	*Mucor sp*	$5.10x10^2$
SS 22 15-30	*Pseudomonas sp* *Bacillus sp*	$2.10x10^5$	*Pseudomonas sp*	$4.80x10^2$	*Mucor sp* *Aspergillus sp*	$2.00x10^2$	*Mucor sp* *Aspergillus sp*	$4.0x10^1$
SS 23 0-15	*Pseudomonas sp* *Bacillus sp* *Actinomyces sp*	$1.46x10^5$	*Pseudomonas sp*	$9.70x10^2$	*Mucor sp* *Aspergillus sp* *Candida sp*	$2.30x10^2$	*Candida sp* *Mucor sp* *Aspergillus sp*	$6.0x10^1$
SS 23 15-30	*Pseudomonas sp*	$7.00x10^4$	*Pseudomonas sp*	$5.10x10^2$	*Mucor sp* *Aspergillus sp*	$4.60x10^2$	*Mucor sp* *Aspergillus sp*	$4.20x10^2$

APPENDIX 4.4

HYDROBIOLOGY CHARACTERISTICS

WET SEASON – HYDROBIOLOGICALCHARACTERISTICS

Table ( ): Diversity, Abundance and Distribution of Phytoplankton species among the Sampled stations within PHCN TRANSMISSION Line WET SEASON						
S/N	**Station ID**	**Phylum/Division**	**Group/Class**	**Family**	**Species**	**Count/ml**
1	SS1	Algae	Diatom	Thalassiosiraceae	*Cyclotella sp*	10
1	SS1	Algae	Diatom	Melosiraceae	*Melosira granulata*	73
1	SS1	Algae	Diatom	Diatomataceae	*Tabellaria fenestrata*	2
1	SS1	Algae	Diatom	Eunotiaceae	*Eunotia gracilis*	2
1	SS1	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	25
1	SS1	Algae	Green algae	Desmidiaceae	*Staurastrum asterias*	8
1	SS1	Algae	Green algae	Desmidiaceae	*Micrasterias echinulata*	6
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya limnetica*	6
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Oscillatoria princeps*	8
1	SS1	Algae	Green algae	Volvocaceae	*Eudorina elegans*	4
		Total Count				**144**
		Number of Species				**10**
		Margalef species index				**1.81**
2	SS3	Algae	Diatom	Thalassiosiraceae	*Cyclotella sp*	4
2	SS3	Algae	Diatom	Melosiraceae	*Melosira granulata*	60
2	SS3	Algae	Diatom	Bacillariaceae	*Nitzschia closterium*	6
2	SS3	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	28
2	SS3	Algae	Diatom	Eunotiaceae	*Eunotia lunaris*	12
2	SS3	Algae	Diatom	Fragilariaceae	*Fragilaria construens*	10
2	SS3	Algae	Diatom	Naviculaceae	*Gomphonema accuminatum*	4
2	SS3	Algae	Diatom	Naviculaceae	*Navicula radiosa*	10
2	SS3	Algae	Green algae	Volvocaceae	*Volvox aureus*	10
2	SS3	Algae	Green algae	Hydrodictyaceae	*Pediastrum duplex*	8
2	SS3	Algae	Green algae	Desmidiaceae	*Staurastrum asterias*	8
2	SS3	Algae	Blue-green algae	Oscillatoriaceae	*Phormidium tenue*	6
2	SS3	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya contorta*	8
		Total Count				**174**
		Number of Species				**13**
		Margalef species index				**2.33**

3	SS6	Algae	Diatom	Bacillariaceae	*Nitzschia palea*	6
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Oscillatoria limosa*	6
3	SS6	Algae	Diatom	Melosiraceae	*Melosira granulata*	48
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya contorta*	8
3	SS6	Algae	Diatom	Naviculaceae	*Navicula oblonga*	12
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Phormidium tenue*	6
3	SS6	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	18
3	SS6	Algae	Green algae	Desmidiaceae	*Closterium moniliferum*	12
3	SS6	Algae	Green algae	Desmidiaceae	*Staurastrum asterias*	15
3	SS6	Algae	Green algae	Zygnemataceae	*Zygnema sp*	8
3	SS6	Algae	Green algae	Volvocaceae	*Eudorina elegans*	12
		Total Count				**151**
		Number of Species				**11**
		Margalef species index				**1.99**
4	SS19	Algae	Diatom	Melosiraceae	*Melosira granulata*	45
4	SS19	Algae	Diatom	Melosiraceae	*Melosira granulata var.spiroides*	10
4	SS19	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	20
4	SS19	Algae	Diatom	Thalassionemataceae	*Synedra delicatissima*	10
4	SS19	Algae	Diatom	Bacillariaceae	*Nitzschia closterium*	6
4	SS19	Algae	Green algae	Desmidiaceae	*Closterium moniliferum*	10
4	SS19	Algae	Green algae	Hydrodictyaceae	*Pediastrum duplex*	6
4	SS19	Algae	Green algae	Zygnemataceae	*Zygnema sp*	8
4	SS19	Algae	Green algae	Desmidiaceae	*Closterium moniliferum*	8
		Total Count				**123**
		Number of Species				**9**
		Margalef species index				**1.66**

5	SS20	Algae	Green algae	Desmidiaceae	*Staurastrum asterias*	8
5	SS20	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya cylindricum*	8
5	SS20	Algae	Dinoflagellate	Peridiniaceae	*Peridinium balticum*	2
5	SS20	Algae	Diatom	Melosiraceae	*Melosira granulata*	60
5	SS20	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	28
5	SS20	Algae	Diatom	Thalassionemataceae	*Synedra delicatissima*	10
5	SS20	Algae	Diatom	Bacillariaceae	*Nitzschia closterium*	10
5	SS20	Algae	Diatom	Eunotiaceae	*Eunotia lunaris*	10
5	SS20	Algae	Diatom	Naviculaceae	*Navicula radiosa*	15
5	SS20	Algae	Diatom	Naviculaceae	*Gomphonema accuminatum*	8
5	SS20	Algae	Green algae	Desmidiaceae	*Staurastrum asterias*	15
5	SS20	Algae	Green algae	Zygnemataceae	*Zygnema sp*	10
5	SS20	Algae	Green algae	Volvocaceae	*Eudorina elegans*	8
		Total Count				**192**
		Number of Species				**13**
		Margalef species index				**2.28**

Table ( ): Percentage Abundance of each Phylum and Species of Zooplankton observed in all the Sampled Stations within PHCN TRANSMISSION Line WET SEASON						
S/N	**Station ID**	**Phylum/Division**	**Group/Class**	**Family**	**Species**	**Count/ml**
1	SS1	Arthropoda/Crustacea	Copepoda	Temoridae	*Eurytemora lacustris*	2
1	SS1	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	16
1	SS1	Chordata	Pisces	--------	*Fish larvae*	6
1	SS1	Rotifer	Monogononta	Branchionidae	*Keratella valga*	4
1	SS1	Arthropoda/Crustacea	Copepoda	Temoridae	*Temora sp*	4
1	SS1	Rotifer	Monogononta	Branchionidae	*Branchionus angularis*	10
1	SS1	Rotifer	Monogononta	Branchionidae	*Branchionus sp*	4
Total Count						**46**
Number of Species						**7**
Margalef species index						**1.57**
2	SS3	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	16
2	SS3	Rotifer	Monogononta	Branchionidae	*Branchionus falcutus*	6
2	SS3	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Cyclops strenuus*	6
2	SS3	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Eucyclops serrutalus*	2
2	SS3	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Evadne spinifera*	6
2	SS3	Arthropoda/Crustacea	Copepoda	----------	*Nitocra lacustris*	4
Total Count						**40**
Number of Species						**6**
Margalef species index						**1.36**
3	SS6	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	16
3	SS6	Arthropoda/Crustacea	Copepoda	Temoridae	*Eurytemora affinis*	6
3	SS6	Arthropoda/Crustacea	Copepoda	Oithonidae	*Oithona sp*	4
3	SS6	Rotifer	Monogononta	Branchionidae	*Keratella quadrata*	8
3	SS6	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Cyclopina longicornis*	6
Total Count						**40**
Number of Species						**5**
Margalef species index						**1.09**

4	SS19	Mollusca	Gastropoda	-----------	*Gastropod larvae*	4
4	SS19	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	16
4	SS19	Rotifer	Monogononta	Branchionidae	*Branchionus falcutus*	8
4	SS19	Rotifer	Monogononta	Branchionidae	*Branchionus sp*	8
4	SS19	Arthropoda/Crustacea	Cladocera	Bosmidae	*Bosmia sp*	6
4	SS19	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Eucyclops serrutalus*	4
						46
Number of Species						**6**
Margalef species index						**1.31**
5	SS20	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Cyclops strenuus*	6
5	SS20	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	20
5	SS20	Arthropoda/Crustacea	Copepoda	Oithonidae	*Limnoithona sinensis*	14
5	SS20	Arthropoda/Crustacea	Copepoda	Temoridae	*Eurytemora lacustris*	6
5	SS20	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Eucyclops serrutalus*	4
5	SS20	Rotifer	Monogononta	Branchionidae	*Branchionus falcutus*	8
Total Count						**58**
Number of Species						**6**
Margalef species index						**1.23**

Table ( ): Diversity, Abundance and Distribution of Macro Benthos species among the Sampled stations within PHCN TRANSMISSION Line WET SEASON

S/N	Station ID	Phylum/Division	Group/Class	Family	Species	Abundance
1	SS1	--------	--------	--------	NO BENTHOS	---
2	SS3	--------	--------	--------	NO BENTHOS	---
3	SS6	Annelida	Polychaeta	Glyceridae	*Glycera sp*	1
		Total Abundance				**1**
		No. of Species				**1**
		Margalef Index				**0**
		Shannon weiner Index				**0.00**
4	SS19	--------	--------	--------	NO BENTHOS	---
5	SS20	--------	--------	--------	NO BENTHOS	---

DRY SEASON – HYDROBIOLOGICALCHARACTERISTICS

Table ( ): Diversity, Abundance and Distribution of Phytoplankton species among stations within PHCN Transmission line						
S/N	**Station ID**	**Phylum/Division**	**Group/Class**	**Family**	**Species**	**Count/ml**
1	SS1	Algae	Blue-green algae	Nostocaceae	*Anabaena cylindrica*	6
1	SS1	Algae	Blue-green algae	Nostocaceae	*Anabaena spiroides*	12
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya contorta*	15
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya martensiana*	6
1	SS1	Algae	Blue-green algae	Chroococcaceae	*Microcystis aeruginosa*	110
1	SS1	Algae	Blue-green algae	Chroococcaceae	*Microcystis flos-aquae*	28
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Phormidium tenue*	8
1	SS1	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina major*	88
1	SS1	Algae	Diatom	Thalassiosiraceae	*Cyclotella meneghiniana*	6
1	SS1	Algae	Diatom	Thalassiosiraceae	*Cyclotella striata*	6
1	SS1	Algae	Diatom	Melosiraceae	*Melosira granulata*	250
1	SS1	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima*	65
1	SS1	Algae	Diatom	Melosiraceae	*Melosira granulata var.curvata*	34
1	SS1	Algae	Diatom	Bacillariaceae	*Nitzschia vermicularis*	4
1	SS1	Algae	Diatom	Surirellaceae	*Surirella capronii*	8
1	SS1	Algae	Diatom	Thalassionemataceae	*Synedra delicatissima*	4
1	SS1	Algae	Green algae	Desmidiaceae	*Staurastrum anatinum*	4
Total Count						**654**
Number of Species						**17**
Margalef species index						**2.47**

2	SS3	Algae	Blue-green algae	Nostocaceae	*Anabaena flos-aquae*	8
2	SS3	Algae	Blue-green algae	Nostocaceae	*Anabaena spiroides*	15
2	SS3	Algae	Blue-green algae	Chroococcaceae	*Microcystis aeruginosa*	115
2	SS3	Algae	Blue-green algae	Chroococcaceae	*Microcystis flos-aquae*	24
2	SS3	Algae	Blue-green algae	Oscillatoriaceae	*Phormidium tenue*	4
2	SS3	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina major*	96
2	SS3	Algae	Diatom	Melosiraceae	*Melosira granulata*	266
2	SS3	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima*	35
2	SS3	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima f. spiroides*	20
2	SS3	Algae	Diatom	Bacillariaceae	*Nitzschia closterium*	4
2	SS3	Algae	Diatom	Thalassionemataceae	*Synedra ulna*	6
2	SS3	Algae	Diatom	Diatomataceae	*Tabellaria fenestrata*	6
2	SS3	Algae	Dinoflagellate	Peridiniaceae	*Peridinium cintum*	4
2	SS3	Algae	Green algae	Oocystaceae	*Ankistrodesmus sp*	6
2	SS3	Algae	Green algae	Desmidiaceae	*Closterium kuetzingii*	4
2	SS3	Algae	Green algae	Volvocaceae	*Eudorina elegans*	8
2	SS3	Algae	Euglenoid	Euglenaceae	*Euglena acus*	2
2	SS3	Algae	Euglenoid	Euglenaceae	*Euglena caudata*	2
		Total Count				**625**
Species		**Number of**				**18**
		Margalef species index				**2.64**

3	SS6	Algae	Blue-green algae	Nostocaceae	*Anabaena spiroides*	18
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya circumcreta*	10
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya contorta*	6
3	SS6	Algae	Blue-green algae	Chroococcaceae	*Microcystis aeruginosa*	98
3	SS6	Algae	Blue-green algae	Chroococcaceae	*Microcystis flos-aquae*	18
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Phormidium tenue*	10
3	SS6	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina major*	40
3	SS6	Algae	Diatom	Melosiraceae	*Melosira granulata*	185
3	SS6	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima*	25
3	SS6	Algae	Diatom	Melosiraceae	*Melosira granulata var.curvata*	18
3	SS6	Algae	Diatom	Melosiraceae	*Melosira varians*	8
3	SS6	Algae	Diatom	Bacillariaceae	*Nitzschia accicularis*	10
3	SS6	Algae	Diatom	Thalassionemataceae	*Synedra capitata*	6
3	SS6	Algae	Dinoflagellate	Peridiniaceae	*Peridinium cintum*	6
3	SS6	Algae	Euglenoid	Euglenaceae	*Euglena caudata*	4
3	SS6	Algae	Green algae	Hydrodictyaceae	*Pediastrum simplex*	15
3	SS6	Algae	Green algae	Desmidiaceae	*Staurastrum sp*	6
3	SS6	Algae	Green algae	Volvocaceae	*Volvox aureus*	4
Total Count						**487**
Number of Species						**18**
Margalef species index						**2.75**

4	SS19	Algae	Blue-green algae	Nostocaceae	*Anabaena flos-aquae*	8
4	SS19	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya contorta*	10
4	SS19	Algae	Blue-green algae	Chroococcaceae	*Microcystis aeruginosa*	115
4	SS19	Algae	Blue-green algae	Chroococcaceae	*Microcystis flos-aquae*	25
4	SS19	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina major*	28
4	SS19	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina platensis*	18
4	SS19	Algae	Diatom	Thalassiosiraceae	*Cyclotella meneghiniana*	4
4	SS19	Algae	Diatom	Thalassiosiraceae	*Cyclotella striata*	8
4	SS19	Algae	Diatom	Melosiraceae	*Melosira granulata*	220
4	SS19	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima*	25
4	SS19	Algae	Diatom	Melosiraceae	*Melosira varians*	8
4	SS19	Algae	Diatom	Bacillariaceae	*Nitzschia closterium*	6
4	SS19	Algae	Diatom	Rhizosoleniaceae	*Rhizosolenia longiseta*	2
4	SS19	Algae	Diatom	Thalassionemataceae	*Synedra capitata*	2
4	SS19	Algae	Green algae	Desmidiaceae	*Closterium kuetzingii*	10
4	SS19	Algae	Green algae	Desmidiaceae	*Staurastrum anatinum*	8
Total Count						**497**
Number of Species						**16**
Margalef species index						**2.42**

5	SS20	Algae	Blue-green algae	Nostocaceae	*Anabaena flos-aquae*	12
5	SS20	Algae	Blue-green algae	Oscillatoriaceae	*Aphanzomenon fos-aquae*	6
5	SS20	Algae	Blue-green algae	Oscillatoriaceae	*Lyngbya circumcreta*	6
5	SS20	Algae	Blue-green algae	Chroococcaceae	*Microcystis aeruginosa*	105
5	SS20	Algae	Blue-green algae	Chroococcaceae	*Microcystis flos-aquae*	20
5	SS20	Algae	Blue-green algae	Oscillatoriaceae	*Spirulina major*	28
5	SS20	Algae	Diatom	Thalassiosiraceae	*Cyclotella striata*	8
5	SS20	Algae	Diatom	Eunotiaceae	*Eunotia sp*	4
5	SS20	Algae	Diatom	Naviculaceae	*Gomphonema accuminatum*	2
5	SS20	Algae	Diatom	Melosiraceae	*Melosira granulata*	200
5	SS20	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima*	30
5	SS20	Algae	Diatom	Melosiraceae	*Melosira granulata var.angustissima f. spiroides*	15
5	SS20	Algae	Diatom	Naviculaceae	*Navicula oblonga*	8
5	SS20	Algae	Diatom	Thalassionemataceae	*Synedra capitata*	4
5	SS20	Algae	Dinoflagellate	Peridiniaceae	*Peridinium balticum*	4
5	SS20	Algae	Green algae	Hydrodictyaceae	*Pediastrum simplex*	15
5	SS20	Algae	Green algae	Volvocaceae	*Volvox aureus*	8
Total Count						**475**
Number of Species						**17**
Margalef species index						**2.60**

Table ( ): Diversity, Abundance and Distribution of Micro-zooplankton species among stations within PHCN Transmission line

S/N	**Station ID**	**Phylum/Division**	**Group/Class**	**Family**	**Species**	**Count/ml**
1	SS1	Rotifer	Monogononta	Branchionidae	*Branchionus angularis*	12
1	SS1	Rotifer	Monogononta	Branchionidae	*Branchionus falcutus*	6
1	SS1	Arthropoda/Crustacea	Copepoda	Cyclopidae	*Eucyclops serrutalus*	6
1	SS1	Mollusca	Gastropoda	-----------	*Gastropod larvae*	4
1	SS1	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	28
1	SS1	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Evadne tergestina*	3
1	SS1	Mollusca	Gastropoda	----------	*Gastropod larvae*	3
1	SS1	Nematoda	--------	----------	*Nematode larvae*	2
1	SS1	Arthropoda/Crustacea	Copepoda	Oithonidae	*Limnoithona sinensis*	4
		Total Count				**68**
		Number of Species				**9**
		Margalef species index				**1.90**
2	SS3	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Cyclops vicinus*	8
2	SS3	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Mesocyclops sp*	4
2	SS3	Arthropoda/Crustacea	Copepoda	Diaptomidae	*Diaptomus wilsonae*	8
2	SS3	Arthropoda/Crustacea	Copepoda	Diaptomidae	*Diaptomus forbesi*	4
2	SS3	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Eucyclops varicans*	4
2	SS3	Arthropoda/Crustacea	Copepoda	Calanidae	*Sinocalanus dorrii*	6
2	SS3	Rotifer	Monogononta	Branchionidae	*Branchionus falcutus*	8
2	SS3	Arthropoda/Crustacea	Copepoda	-----------	*Copepod nauplius*	20
2	SS3	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Evadne spinifera*	2
2	SS3	Rotifer	Monogononta	Branchionidae	*Keratella valga*	4
		Total Count				**68**
		Number of Species				**10**
		Margalef species index				**2.13**

3	SS6	Arthropoda/Crustacea	Copepoda	Temoridae	*Eurytemora affinis*	10
3	SS6	Arthropoda/Crustacea	Copepoda	Diaptomidae	*Diaptomus forbesi*	6
3	SS6	Arthropoda/Crustacea	Copepoda	Calanidae	*Limnocalanus sp*	6
3	SS6	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Eucyclops serrutalus*	6
3	SS6	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Cyclops vicinus*	4
3	SS6	Rotifer	Monogononta	Branchionidae	*Branchionus sp*	4
3	SS6	Rotifer	Monogononta	Branchionidae	*Branchionus angularis*	12
3	SS6	Rotifer	Monogononta	Branchionidae	*Keratella quadrata*	4
3	SS6	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Polyphemus sp*	2
3	SS6	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	22
		Total Count				**76**
		Number of Species				**10**
		Margalef species index				**2.08**
4	SS19	Chordata	Pisces	--------	*Fish larvae*	6
4	SS19	Arthropoda/Crustacea	Copepoda	Temoridae	*Eurytemora lacustris*	4
4	SS19	Arthropoda/Crustacea	Copepoda	Acartidae	*Acartia sp*	4
4	SS19	Mollusca	Gastropoda	------	*Gastropod larvae*	6
4	SS19	Arthropoda/Crustacea	Copepoda	Calanidae	*Sinocalanus dorrii*	6
4	SS19	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	24
4	SS19	Nematoda	--------	--------	*Nematode larvae*	4
4	SS19	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Polyphemus sp*	8
		Total Count				**62**
		Number of Species				**8**
		Margalef species index				**1.70**
5	SS20	Chordata	Pisces	--------	Fish larvae	4
5	SS20	Arthropoda/Crustacea	Cladocera	Polyphemidae	*Polyphemus sp*	4
5	SS20	Arthropoda/Crustacea	Cladocera	Bosminidae	*Bosmina longirostris*	6
5	SS20	Arthropoda/Crustacea	Copepoda	Cyclopoidae	*Microcyclops sp*	8
5	SS20	Arthropoda/Crustacea	Copepoda	----------	*Copepod nauplius*	22
5	SS20	Rotifer	Monogononta	Branchionidae	*Branchionus sp*	8
5	SS20	Rotifer	Monogononta	Branchionidae	*Branchionus angularis*	8
		Total Count				**60**
		Number of Species				**7**
		Margalef species index				**1.47**

Table ( ): Diversity, Abundance and Distribution of Macro-Benthos species among the Sampled stations within PHCN Transmission line						
S/N	**Station ID**	**Phylum/Division**	**Group/Class**	**Family**	**Species**	**Count/ml**
1	SS1	Mollusca	Gastropoda	Melaniidae	*Pachymelania aurita*	1
1	SS1	Annelida	Oligochaeta	Tubificidae	*Tubifex sp*	3
		Total Abundance				**4**
		Number of Species				**2**
		Margalef Index				**0.72**
		Shannon Weiner Index				**0.80**
2	SS3	**No benthos species**				
3	SS6	**No benthos species**				
4	SS19	Annelida	Polychaeta	Nereidae	*Nereis sp*	2
4	SS19	Annelida	Polychaeta	Spionidae	*Polydora ciliata*	1
		Total Abundance				**3**
		Number of Species				**2**
		Margalef Index				**0.9**
		Shannon Weiner Index				**0.93**
5	SS20	**No benthos species**				

APPENDIX 4.5

EVIDENCE OF CONSULTATIONS

ATTENDANCE TRC, CLAN AND VILLAGE LEVEL CONSULTATIVE MEETING

ATTENDANCE SOCIO-ECONOMIC BASED CONSULTATIVE MEETINGS

ATTENDANCE TRC PUBLIC FORUM MEETING

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
1	Akparawa Peace Alfre	Iman II Ikot Abasi	Ikot Abasi	
2	Emmanuel Okon Sambo	Iman II Ikot Abasi	Ikot Abasi	
3	Roland Udonis	Ikot Umo Essiang	Mkpat Enin	
4	Etidung A. O. EKPE	OBIOAKAMA	IKOT ABASI	
5	Chief Imo Alfred	Obiokama	Ikot Abasi	
6	Emmanuel Danson Akpan	Ndon Village	Mkpat Enin	
7	Etidung Okon Udo Ekpo	Ndon Village	Mkpat Enin	
8	Elder Obot Efagin	Ikpa Ibekwe	Ikot Abasi	
9	ETIDUNG NSIKAN E. UDOM	UBENEKE I	IKOT ABASI	
10	Etukudo Efanga	Ubenekang	IBeno	
11	Imaekop U. Ukang	Iman Ekaobom	Ikot Abasi	
12	Comr. SAMUEL UDOAKPAN	IKOT AKPAN OKOP	MKPAT ENIN	
13	Monday Sampson Iden	Ikot Akpatek	Onna LGA	
14	Chief DAN ABIA	Idung Udo	EKET	
15	Chief Ita Okon	Upenekang	IBeno	
16	Obong Ukot E. Ukot	ATIA/NEW BARRACKS	IBENO	
17	Chief Akpan Thomas	Ikot Otono Okop	Mkpat Enin LGA	
18	Chief Ekwere Jimmy Inoi	Ikot Akpan Okop	Mkpat Enin	
19	Chief Sunday William Udo	IKOT OTONU OKOP	Mkpat Enin	
20	Chief Akpan Malcom Udoka	Ikot Otono Okop	Mkpat Enin	
21	Elijah Sunday	~~Esit~~ ~~Eket~~ Ikonsu	Esit Eket	
22	Etidung A. A Inyang	Mkpa Eto	Onna	
23	Etidung E. D. Akwa	Ikot Eto Ibon	Onna	
24	David E. Daniel	Ikot Ikot Ibon	Onna	
25	Saturday R. Thompson	Ikot Otuokop	Mkpat Enin	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

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ATTENDANCE LIST

S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
26	Monday Uku Udoh	Urua Essien Etuk	IK Abasi	
27	Effete James Usen	Ikot Oyoro	Mkpat Enin	
28	Johnson M. Johnson	Ikot Oyoro	Mkpat Enin	
29	Maria Bassey	Ikot Nsun	Esit Eket	M.B:F
30	CHIEF ESSIEN OBOM	IKOT EKPANG	MKPAT ENIN	
31	Edo Akpan Williamson	Ikot Ekpang	Mkpat ENIN	
32	Aniefiok Albert Abasiuto	Abasiuto Village	Ikot Abasi	
33	Prince Bills Ene	~~ESIT EKET~~ Ukwa Isiedik	ESIT EKET	
34	Elis Emediong Uwa	Afaha Eket	Eket LGA	
35	Moses John Akpan	Idung Offiong	Eket L.G.A	
36	KINGSLEY EKPO	NDON	ONNA	
37	CHIEF JOHN TOM UBOETTE	V/H IDUNG UDO	EKET	
38	HON AWAI M. AWAI	Esit Eket LGA	ESIT EKET	
39	Etiedung Akpan Uwa	Uta Ewa - Ikot Abasi	IKOT ABASI	
40	Chief Samuel Okokon	Ikot Akpan Okop	Mkpat Enin	
41	SAMPSON UDO SAMPSON	Ikot Amang	Onna	
42	NSIKAN JOHNSON BEN	Ikot Amang	Onna	
43	HON Chief Friday Udoessien	Ikot Ebidang	ONNA	
44	Chief Hon Okokon Akpakpan	Ikot Inyang Ottoiikot Skpang	Mkpat Enin	
45	ETIEIDUNG INYANG J. Idiong Akpan	IKOT EBEKPO	ONNA L.G.A	
46	Elder Okon Akpan Udo	Ikpa Ibekwe Clan	Ikot Abasi LGA	
47	Okon Sunday David	Ikot Ebekpo	Onna L.G.A	
48	Nsikak Akpan Udem	Ikot Akpaden	MKPAT ENIN	
49	Uwem Joseph Abraham	Ikot Essien	IKOT ABASI	
50	Obong Friday Inwang	ESIT Eket Trans. Chairman	ESIT Eket	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
51	Okon Abakam	Itak Ifa	Ibeno	
52	Essien A. George	Urua Essien Etuk	IKAbasi	
53	ETEBOM R. UKORIA	Ikot Abasi Village - IKOT ABASI LGA	IKOT ABASI	
54	AKPAN MONDAY OKUBRE	✓ ✓ ✓	IKOT ABASI	
55	AKANIMO TOM ODUNGIDE	Ekpene Afaha Ikot Eket	EKET	
56	JOHN D ESHEET	EKPENE AFAHA EKET	✓	
57	Akpan A. Ntia	Ikot Ataha	Ikot Abasi	
58	Sunday B. John	Ikot Otoro Okop	Mkpat Enin	
59	Obot H. John	Ikot Otoro Okop	Mkpat Enin	
60	Monday D. Ekpo	Ikot Otoro Okop	Mkpat Enin	
61	Isaac Frank	Ehe	Ikot Abasi	
62	Akpan Dick Eno	Eman Eka Obom	IK. Abasi	
63	Chief Wilson Etop Hok	Esit Urua Community	EKET LGA	
64	Akpan Daniel Umoetuk	Esit Urua "	Eket LGA	
65	Ojuekong Johnny Sam	Omok-Eko	Esit Eket LGA	
66	Chief Daniel Afred	Ibeno	Ibeno	
67	Imoh Mbake	IK. Etenye Efe	IK. Abasi	
68	Chief Udofot Ino	Ikot Ekpan	Mkpat Enin	
69	Chief Aniefiok A. Usoro	Ikot Akpan Ata, Ikot Abasi	Ikot Abasi	
70	Chief Uwak Udo Tom	Ikot Etetuk	Ikot Abasi	
71	Tony Michael Akpan	Abasi Village	Ikot Abasi	
72	Hon Udo Smith	Ikot Anang	ONNA	
73	Prince Solomon Friday Esheet	Ebana	Eket	
74	Eld. Essibeng Akpan	Atabong (Esit-Surv. G Values)	Eket	
75	Hon Willie Willie	ONNA	ONNA	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
76	Chief Bassey Etim	Okposo	Ibono	[signature]
77	Obong, Akpan Enefiong	Ikot Inwang	Ibeno	[signature]
78	Chief Nkopan Akpan	Atlo Esik	Ibeno	[signature]
79	Chuka Uwe, Udey	Ikot A(t)pan Imo	Mkpat Enin	[signature]
80	Obong Archibong James	IKO NSONG	Esit Eket	[signature]
81	Sir Ebenge Friday Henry	Iko Nsung	Esit Eket LGA	[signature]
82	Etiedung Ufot Sampson Ufot	Ikot Umanag Okon	Ikot Abasi	[signature]
83	Otorobuk Gilly Ekot	Ekim, M	Mkpat Enin	[signature]
84	Kenneth Etuk	Ekim	Mkpat Enin	[signature]
85	Chief Dr Akpe Abui Abu	~~Esit Eket~~ Uncovided	~~Esit Eket~~	[signature]
86	CHIEF O. H. INYANG	UPENEKANG	IBENO	[signature]
87	E. Eshiet (J.P)	Ikot-EBANA	EKET	[signature]
88	Chief Samuel Maxwell Ekpo	Afaha Ukua Obioidim	Eket	[signature]
89	Udeme Ufot Frank	Ikot Inyang Okop	Mkpat Enin	[signature]
90	Akpan Dick	Odiono Iso Utibe	Ikot Abasi	[signature]
91	Owoidem Udoh	Odiono Iso Utibe	Ikot Abasi	[signature]
92	Etidung Maurice Udombat	Ette village	Ikot Abasi	[signature]
93	Uko Dandy Uko	Odiono Iso Utibe	Ikot Abasi	[signature]
94	Etiedung Paul A. Atwaotala	Umeneke 2	Ik. Abasi	[signature]
95	Chief Sunday Imose	Ikot Nsung	Ikot Abasi	[signature]
96	Elder Idem Udosoro	Essien Etuk village	Esit Eket	[signature]
97	Christopher A. Nda	Ikot Oyoro	Ik. Abasi	[signature]
98	Prince Saturday Nda	Ikot Oyoro	Mkpat Enin	[signature]
99	HON. INYANG EYO-ITA	NKPANAK	Mkpat Enin	[signature]
100	Chief Udo Sunday Enuko	Ikot Obio Ekpong	~~IBENO LGA~~ Mkpat Enin	[signature]

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
101	Wisdom S. Udo	Ikot Etti	Mkpat Enin	[signature]
102	Utitofon S. Ebong.	Uta-Ewa Village Ika.L	Ikot Abasi	[signature]
103	Mr Akama Ukandeng Uk	Ikot Akpanata	Ikot Abasi	[signature]
104	Hon. Peniel Udoniah	Udombon Village	Ikot Abasi	[signature]
105	B S Usa	Ikot Akpan Odi	Eket	[signature]
106	Prince Akpe Imeh	Uda-Iko Eket	Eket L.G.A.	[signature]
107	HRM. Edward U J Matobon	Ikot Abasi	Ikot Abasi.	[signature]
108	Richard Essien	Ikot Abasi Okon	Ikot Abasi	[signature]
109	Obong Isaiah Bob	Uda-Iko Eket	Eket L.G.A	[signature]
110	Chief F. M. Akpadiaha	Idung Imose Eket	Eket L.G.A	[signature]
111	Bennard Emm. Effiik	Idung Imose Eket	Eket LGA	[signature]
112	Samuel Etim Edike	Akpadem – ~~Eket~~	Eket LGA	[signature]
113	Lighted Lighted	Mkpok	Eket	[signature]
114	Enyima E. Mfor	Akpa Imae	Ibono	[signature]
115	Enoq Otu		Ibono	[signature]
116	Eld (Dr) B. S. Udusa	Akpambret Eda	Esit Eket	[signature]
117	Ukana A. Ukana	Ikot ~~Ekong~~	Mkpat Enin LG	[signature]
118	Jude Umoh	Ikot Edor	Onna	[signature]
119	Asuquo I. Etukakpan	Ete Village	Ikot Abasi	[signature]
120	Etebom, Akpan Udo	Ikwa Village	Ikot Abasi	[signature]
121	Elder Umoh Akpan	Ekim Town	Mkpat Enin	[signature]
122	Hon Imowo Udobia	Ndon Ibotio	Mkpat Enin	[signature]
123	Chief Okon S. Akpanowon	Iwuo-Ekpene	Ibeno	[signature]
124	Otuekong Eshett Eshett	Ibeno (Upenekang)	Ibeno	[signature]
125	Prince Ubong George Usen	Ikot Ebok-Eket	Eket LGA	[signature]

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

S/N	NAME	~~ORGANIZATION~~ Community/Village	~~LOCATION~~ L.G.A	SIGN
126	FRIDAY UFOT JONAH	~~Ukat~~ IKOT EBIDANG	ONNA	[signature]
127	EKRETTE UDFO	Ikot Akpatek	ONNA LGA	[signature]
128	Etebom/Ikan C.M. Ekemndu	Ete	Ikot Abasi LGA	[signature]
129	Anthony I. Uko	Ete	Ikot Abasi	[signature]
130	Nsien Samuel	Ebana	EKet	[signature]
131	OKON Eunice	Ibeno	Ibeno	[signature]
132	HON. BASSEY DAVID	IKOT AKPATEK, ~~ONNA~~	ONNA	[signature]
133	Engr. GEORGE LAWRENCE G.	IKOT AKPATEK	ONNA	[signature]
134	Hon. Lucky AKRASI	Chairman, IBENO	IBENO.	[signature]
135	(HRH) Etebom A.J. Umoh	Ikot Obong Nung	Mkpat Enin LGA	[signature]
136	HRM Edidem J.A. Une	IKOT NTOT	Mkpat Enin	[signature]
137	Akpan Harry Nnah	Ikot Obong Nkaya	MKP.	[signature]
138	[illegible]	IKOT NTOT	MKPAT ENIN	[signature]
139	Amankop, Otobong Justice	Ikot Ntot	Mkpat Enin	[signature]
140	Imfon Ekong	Eket SBU Mung Asso	Eket	[signature]
141	Ekong Ahmad Inyang	Eket SBU Mung Asso	Eket	[signature]
142	Ime Akpan Jimmy	Eket Ede-Obukh	Eket	[signature]
143	ANIEDI MICHAEL JAMES	IKPETIM – IKPA IBEKWE CLAN	IKOT ABASI	[signature]
144	Ezekiel V. Nathaniel	~~Ikpetim~~ – Ikpa Ibekwe Clan	Ikot Abasi	[signature]
145	ANIEFIOK USUA UDOFIA	IKPETIM – IKPA IBEKWE	IKOT ABASI	[signature]
146	MACAULAY EDUOK	Iduuno Adiahat	EKET	[signature]
147	HON VINCENT EKWERE	EKPENE OBO	ESIT EKET	[signature]

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
148	1	Etteidung Ekon Idem Mboosoh	V/H Ikot Akpatek	Onna	
149	2	Ernest Udondem	Youth President	Onna	
150	3	Eteidung Akpan Johnson	V/H Ikot Etefe	Ik. Abasi	
151	4	Udo Amos Udoeeh	Chairman Ik. Eteife	Ik. Abasi	
152	5	Godwin Akpan Akpanam	P.A Ibeno L.G.A	Ibeno	
153	6	Peter Akpakip Akpaki	P.A Ibeno LGA	IBeno	
154	7	Udoh Samson Akpan	Ekot Anang	Onna	
155	8.	Chief Pat Umoetuk Joshua	Ik. Akpan Okop	Mkpat Enin	
156	9	CHIEF ENYINNAMA E. ETUKAKPAN	UMUENEGE II VILLAGE	Ikot Abasi	
157	10	[illegible] B. I. Akpanika (SP)	Nlafue	Ibeno	
158	11	Robert Ukot Ikpa Edise	UPENEKANG	IBENO	
159	12	Akpan Napoleon	Ik Akpan Okop	Mkpat Enin	
160	13	Christian Udo Moses	Ikot Akpatak	ONNA	
161	14	Chief Augustine Ckefo Essien	Ikot ~~Abasi~~ Inyang	Ikot Abasi	
162	15	Chief Ufort Tom Okero	Ikot Inoh	Ikot Abasi	
163	16	Prince Ukong Peter Imoh	Ikot Ebidang	ONNA	
164	17	Chief Ekot Akpan Udo	~~Ganga~~ Ikot Akpatek	ONNA	
165	18	Elder Akpan Hanson Itong	IKOT ABA	MKPAT ENIN	
166	19	Chief Joshua W. Idemiebong	Ndung Ekoi [illegible] Akpanikat	Esit Eket LGA	
167	20	Chief Monday Jackson Mkpa	Ik. Esit Village Akpanikat	Esit Eket LGA	
168	21	Uduak Okon Etukakpan	Emen Eyop	Mkpat Enin	
169	22	UDEME GODWIN EDEM	IKOT AKPAN OKOP	MKPAT ENIN	
170	23	Sunday Amos	Ikot Akpan Mkpat	MKPAT ENIN	
171	24	VICTOR ELIJAH WALTER	UPENEKANG	IBENO	
172	25	Benhur James Oduenyie	ATIBE Afaha Eket	Eket LGA	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
173	1	Obong Ita Ndem Etie	IBENO Esuk Ikim Ekpe	IBENO	
174	2	Obong Ukoidem Etie	✓ Iiak Abasi	✓	
175	3	Edidiong Asukpa Tamt	✓ Upenekang	✓	
176	4	Inyang Inyang	Ikot Eko Isen	ONNA	
177	5	Ime Jones Sam	Iman	Ikot Abasi	
178	6	Chief Akpan Abraham	Akpaubiet Idi	Esit Eket	
179	7	Godwin Matthew Udoaka	Ikot Otoni Okop	Mkpat Enin	
180	8	Chief Pius Udosen	Ikot Ebio Ndeho	Mkpat Enin	
181	9	✓ Amoren Evansen	Ikot Ebio Ndeko	Mkpat Enin	
182	10	Mrs Udosen Kate	✓ ✓ ✓	✓	
183	11	Obong Nkparawa O. J. Inyang	Nung Akwang	Eket. L.G.	
184	12	Chief R. P. Ekpo Ikot ~~Ekpang M.E.L.A.~~	Ikot Jekpang M.E.L.A.	M.E.L.G.	
185	13	[illegible] A. Iman	Ukpum Minya Eta	Ikot Abasi LGA	
186	14	Ametie Uko Robert	Esit Urua	Eket	
187	15	Chief (Hon) A. J. Usen	Ikot Nkpep	Mkpat Enin	
188	16	Idorenyin Udoakagha	Afaha Eket	Eket	
189	17	Uret Alfred Akpa	Ikot Ebiaren	ONNA L.G.A	
190	18	Obong (Arc) Mfon Ekanem	Ikot Akpaden Village Head	Mkpat Enin	
191	19	Young Ekanem	Ikot Akpaden	Mkpat Enin	
192	20	INIOBONG ETUK	ATAI NDON	EKET	
193	21	Sesheen Matthew	ATAI NDON	EKET	
194	22	Ch. Nelson Harrison Akpan	Abat	ONNA L.G.A	
195	23	Mr Okon Akpan Nelson	Ikot Enin village	Mkpat Enin	
196	24	Chief Isaac D. Ebionbo	Afaha Idung Udo Eket	Eket	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

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ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
197	1	Macaulay Jumbo Essien	IBOTIO	MKPAT ENIN	
198	2	Monday B. Akpan	Ibotio	Mkpat Enin	
199		~~ENENEYE~~ Ubong Akpekam	IKOROTIOYERO	MKPATENIN	
200	3	Chief E. J. U. Etim Chairman Village Council	IBOTIO	MKPAT ENIN LGA	
201	4	Eteidung Raymond Udia	Ikot Ekong	MKPAT ENIN	
202	5	ETEIDUNG SYLVESTER INYANG	V/H IKOT OYOKO	MKPAT ENIN	
203	6	Eteidung Clement R. Udo	Okpoto Ete - Ik. Abasi	Ikot Abasi	
204	7	Ekanem Imoh Ekanem	Ete - Ik. Abasi	Ikot Abasi	
205	8	Chief F. A. Ukiet (Rep.)	Inian	Ikot Abasi	
206	9	Chief J. A. Etidem	EDIDA EDO	ESIT EKET	
207	10	Chief A. A. Edoho	Nditia Eket	EKET	
208	11	PASTOR A. D. ABANG	IBENO	IBENO	
209	12	Ifonime Udofot Udo	Ikot Abasi	MKpat Enin	
210	13	Samuel E. S. Nyangah	Ideung Agilang	Eket Local govt	
211	14	Chief Richard I. Essien	Ikot Inyang Okop	Mkpat Enin	
212	15	Chief Brown Abel Ekwere	Ikot Inyang Okop	Mkpat Enin	
213	16	HRH Bwong (Dr) Effiong Archibong (JP)	Okposo I Ibeno	Ibeno	
214	17	MR. NSIKAN UKPE	ETE, EKPUK INANG	IKOT ABASI	
215	18	Chief Ufot Akpan Chairman Etik	Ikot Etti	Mkpat Enin	
216	19	Chief Godwin Kuk	Abiaran	Ikot Abasi	
217	20	Chief Obo Akpan Umoh	Abiaran	Ikot Abasi	
218	21	Chief (Hon) Donald Bob	MKPA ETO	ONNA	
219	22	Udo Jacob	AKPADNSUB	EKET	
220	23	UTITOFON S. EBONG	UTA-EWA	Ikot Abasi	
221	24	OBONG SAMUEL UDOKOP	ABAT	ONNA	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

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ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
246	1	Akon Robinson Luke	Idung Adiakod Village	EKET	
247	2	MR BENSON UTAT KOFF	" " "	EKET	
248	3	Chief Okona Nyang	Mkpat Enin Atauna	Mkpat Enin	
249	4	Godwin Udot Jimmy	Edom Adiakod	Eket	
250	5	Chief Barr. Gabriel D. Etuk	Idim Afia, Eket	Eket	

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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

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ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
222	1	OBONG ELDER JOSEPH T. ESHET J.P.	UPENEKANG - IBENO	IBENO	
223	2	[illegible] Akpan Thomas	Ikot Akpan Oduo	Mkpat Enin	
224	3	Engr. Ukpo Ekpe (Representative)	Ikot Abasi, Local Govt	Ikot Abasi	
225		Ekerdeg Michael Sunday Akpan Village	Mkpat Enin L.G.A		
226	4	Aniefon Udo Monte	IKOT ETEBEGHE	IKOT Abasi	
227	5	Akpaluip Nelson Akpan	Upenekang Ibeno	Ibeno	
228	6	Chief Sunday Douglas	Ikot Ekpang, M/Enin	Mkpat Enin	
229	7	ANIETIE ASUQUO MATHEW	UKPA AKPAM NSO	EKET	
230	8	Chief S. U. Etuk	Ede Obuk	Eket	
231	9	ASSAM M. ASSAM	EDE OBUK	EKET	
232	10	Chief Joe Edoho	Atai Ndon/Afaha Eket	EKET	
233	11	Peter Imoedunfen	IKOT Ebidang	ONNA	
234	12	Etiter Udoumoh Peter Udoumoh	Ikot Akpaden	Mkpat Enin	
235	13	HRM [illegible]	[illegible]	D/A Eket	
236	14	Chief Akpan Nelson EKPO	IK. Enin	MKP. Enin	
237	15	Emmanuel Akpan Udong	IK. Enin	MKP. Enin	
238	16	Chief Peter Raymond Ubot	K. Enin	MKP. Enin	
239	17	HE Akwaedidem (Dr.) A.U. UKpa JP, FCE	IKOT EDOR, ONNA LGA	P/RULER, ONNA	
	18	~~HON. (DR.) JOSEPH O. Anyadie~~			
240	19	Chief Kennedy Ben	Ede - Obuk - Eket	EKET	
241	20	Charles Akpan Charles	Ikot Obio Ekpong	Mkpat Enin	
242	21	Samuel Nathaniel Akpan	Effoi - Eket	Eket	
243	22	(REP) PARAMOUNT RULER Obong ASSENTIA Stephen (AKPAUDONG)		ESIT EKET	
244	23	David N Ebitu	Afaha Atai Eket	Eket L.G.A	
245	24	Bassey Ekah	MKPANAK - Ibeno	Ibeno LGA	

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PUBLIC FORUM IN RESPECT OF

58KM QIT – IKOT ABASI 330KV DC TRANSMISSION LINE PROJECT, AKWA IBOM STATE:

DATE: WEDNESDAY, MARCH 21, 2012

ATTENDANCE LIST

	S/N	NAME	COMMUNITY/ VILLAGE	LGA	SIGN
251	1	UBONG INYANG	ESIT URUA	EKET	
252	2	NDEME JACKSON ISEMBE	NKAM	MKPAT ENIN	
253	3	NFFOT EFFIONG SAM	IKOT AKPAN OKOP	MKPAT ENIN	
254	4	Elder Ephraim Etti	Idim Afia	Eket	
255	5	iYakkel G. Esitikot	iKpetim Village	iKot Abasi	
256	6	Chief Eno Isuar	Ikpetim villag	Ikot Abasi	
257	7	Elder Joseph Henry Ikpo	✓	✓	
258	8	Elder E. O Essien village sec.	iKot AKpaeten	MKPat Enin	
259		Ubong Ufot Johnson	Ikot Ekekpo	ONNA	
260		SAM UDOH SAM	IKOT EBIDANG	ONNA	

ATTENDANCE - CONSULTATION UKPUM MINYE CLAN OF OKPAT ENIN

PHCN JV QIPP TRANSMISSION LINE PROJECT

(1) Eteidong / Clan Head Ezice
(1) Obot Akpan Thompson
2 Ekwere Jumbo
3d Sunday William
4 Ekpo Udoimuk
(5) Willie Udo
6 Akpan Markson
7 Friday Jameson
8 Saturday Rufus
9 Sunday Ndarake
10 Akpan Henshaw
11 Iboro Ekpo
12 Peter Slyvanus
13 Friday Udo Ufot
14 Akpan Nafolem
15 Akpan Inyang
16 Gideon Josiah
17 Ufot Effiong
18 Isaac Sambo
19 Monday Douglas 15
20 Ezikiel Sambo
21 Bettle Obot Akpan
22 Friday Ekpo
23 Sunday Markson
24 Ufot Josiah
25 Emmanuel Jameson
26 Ime Okokobioko
27 M. O. Jibril pHead
28 F. K. Ekwuneme pHEN

ATTENDANCE FOR Ibeno LGA

	Name	Designation	Phone no.
1.	HRH Owong (Dr) Effiong Archianga (JP)	Paramount Ruler	08038747469
2.	M.O. Jibril	PHCN	08079505466
3	Sorowito Chukwumenje	PHCN	08037240488
4	F.K. Ekwneme	PHCN	08034953347
5	Uso Smith	✓	08068343164
6	Ajike, U.K	✓	08036737076
7	Sojinmia Oluwole	✓	08033282689
8	Kaine Edine	✓	08035 [illegible]
9	Obong Ukot E. Ukot	V/H ATIA	08020811955
10	Obong Pia Ndem	Village Head	0803750089x
11	Elder Chief Joseph T. Eshett	Village Head elect	08091362213
12.	Chief Mbiyan Akpan	" " "	
13.	Obong Akpan I. Ronyuk	" "	
14.	" Akpan Akpanam	" "	
14.	" Okon Uyine	" "	
15.	" Ukoidem Fotte	" "	
16	Obong Daniel A. Udomfuk	Village Head	08028756534
	Obong Barney I. Akpanika (JP)	✓ ✓	08037985068
18	Obong Akpan Akpanam	✓ Ndito Eka Iba	
19	Chief O. H. Ingyang (N.I.)	Sect, Ibeno Clan	08023599025
20	Chief Barney Efim	V/H Okposo II	

PHCN JV TRANSMISSION LINE QIT - EKET - IKOT ABASI EIA

ATTENDANCE FOR MEETING HELD AT UKPUM - ETE CLAN

S/N	NAME	DESIGNATION	SIGN
1	Eteidung/Barr C. M. Idemudo	Chairman, Clan Council of chiefs	[signature]
2	Ufot Ndah Udo	Village Head, Ikot Akan	
3	Akpan A. Ntia	Ikot Ataha (Secretary)	[signature]
4	Clement Udo	Okpoto Ete	[signature]
5	Maurice Udombat	~~Ete~~ Village Head	[signature]
6	Eteidung Paul ~~Etukafang~~	Village Head Umeneke II	[signature]
7	Obong Enwanikpong Inkpessi	Chairman, Ete Town Council	[signature]
8.	Comrade Andy Ndah	Chairman, Ukpum Ete Youth	[signature]
9	Isang Udo Utere	Abasete Youth Chairman	[signature]
10	Stephen Okon Monday	Ikot Akan youth president	[signature]
11	David Udo Obo	Umeneke Village 2	08184948478
12	Ekong Etuk Udo	Ikot Etene Ete	[signature]
13	Emesi Augustine Effiong	Ikot I Abiaran Village	[signature]
14	Eteyen Etukudo Umoh	Okpoto	[signature]
15	Etiese Udo Etong	Ikot Eteng Ete	[signature]
16	Noikom J. Ufot	Abiaran	[signature]
17	Anwanabasi Akpan Monday	Ete Village	[signature]
18	Itoro Jonah Udom	Umeneke 1 Village	[signature]
19	Akpan Monday Ntime	Ekpuk Inang	[signature]
20	Ekwere A. E.	Abiaran Village	[signature]
21	Anthony Isaac Ukeo	Palace Attendance	Ekwere
22	Jibril M. O.	PHCN	[signature]
23	Madugba, Echefu	PHCN	[signature]
24	Kaine Edike	PHCN	[signature]
25	Isang, A. J.	PHCN	[signature]
26	Kootah Ekong	PHCN Consultant	[signature]

PHCN IV TRANSMISSION LINE QIT - EKET - IKOT ABASI

ATTENDANCE FOR MEETING AT MKPANAK, IBENO

S/N	NAME	DESIGNATION	SIGN
1.	CHIEF EDMUND NNA OKON	CHAIRMAN	
2	✓ N. B. ESSIEN	MEMBER	NBEssien
3	✓ ASUQUO OKON	✓	
4	✓ AKPAOBOT EKPO	✓	
5	✓ MACAULEY EBONG IDIOK	✓	
6	✓ GOYINA ETTE	✓	
7	✓ AKWA UDO AKWA	✓	A.U.AKWA
8	✓ EKPE WILLIAM	✓	
9	HON INYANG EYO-ITA	SECT	
10	Isang, A. J.	PHCN Consultant	AK
11	Jibril M.O.	PHCN	
12	Fh Ekwueme	~~PHCN~~ PHCN	
13	Madugba, Echefu	PHCS	
14	Kaine Edike	PHCN consultant	
-	Ikoofreh Ekong	PHCN Consultant	

PHCN I V TRANSMISSION LINE QIT - EKET - IKOT ABASI

ATTENDANCE FOR CONSULTATION MEETING - ESIT EKET TRC/CLAM

03-08-11

S/N	NAME	DESIGNATION	SIGN
(1)	His Royal majesty Edidem ubong Peter Assam	paramount ~~Esit~~ Ruler Esit Eket, L.G.A	U.P.Assam
(2)	chief Okon Thomas Akpe	village Head Assang Uquo	O.T.A
(3)	chief Johnson	village Head uquo	J
(4)	chief Eyo Etim Imoassam	villag Head Idungimo Assam	Eyo Etim
(5)	chief A.A. Bassey	" " Afaha Ekpedio	A.A.Bassey
(6)	chief S.S EKpo	" " Odoro Nikit	S.S Ekpo
(7)	Okon Edem	student	[illegible]
(8)	Chief Assam.O.Assam	village Head Idung Atauclim	A.O.A
(9)	Kofreh Ekong	PHCN	
(10)	Cyril Nwosu	PHCN	
(11)	F.K. Ekwueme	PHCN	
(12)	M.O. Jibril	PHCN	
(13)	Anefiok Iseng	PHCN	
(14)	Afike U.K	PHCN	
(15)	Daniel Joel	PHCN	
(16)	Kaine Edike	PHCN	
(17)	Rev. Samuel Etim		
(18)	Prince Enefiok Jacob	village chairman	[illegible]
(19)	Nkoyo Bassey	Woman Leader	M.B.

PHCN-JV TRASMISSION LINE QIT-EKET-IKOT ABASI

ATTENDANCE (CONT'D) FOR MEETING AT OKPOM OKON CLAN, IKOT ABASI.

15-07-11

S/N	NAME	DESIGNATION	SIGN
33	Friday Akpan Jack	Udo Mbon Village	for [illegible]
34	Chief Ubon A. Otu	Ikot Ukpong Ekanye Village	[illegible]
35	Eld Gabriel G. Akpan	Okon, Ikot Ekpe	[illegible]
36	Pastor Green	Obom Village	Green
37	Elder & Engr. Samson U. Umoh	Ikot Umiang Village	[illegible]
38	Richard Ekanem Essien	Udo Mbom Village	[illegible]
39	Osborn E. Umoh	Ikot Umiang-Okon	[illegible]
40	Akpan Nelson Ekanem	Ikot Ata Udo	[illegible]
41	Akpan Robson Ukpo	Ikot Atai Ud clan	[illegible]
42	Kootreh Ekong	PHCN Consultant	[illegible]
43	Isang, A.J.	PHCN Consultant	[illegible]

PHCN IV TRANSMISSION LINE OIT - EKET - IKOT ABASI

15-07-11

ATTENDANCE FOR MEETING AT OKPOM OKON CLAN, IKOT ABASI LGA

S/N	NAME	DESIGNATION	SIGN
1	HRM Edidem U. J. Ntuk Obom	Paramount Ruler/clan Head/Village Head	[signature]
2	Chief Ufot Brown		
3	Udo Peter A. Umoesiet	Village Head Ik. Upong	[signature]
4	M. O. Jibril	Obom Village	[signature]
5	Chief Akpan Aaron	PHCN	[signature]
6	Sunday Okon	Ikot Umiaghan	[signature]
7	Udo Smith	PHCN	[signature]
8.	Eld. U. P. Ufot	Ikot Uwiang	[signature]
9	Okon A. Ekanem	Ikot Ata Udo	[signature]
10	Albert S Akpan	Ikot Udo mbon	[signature]
11	Ntiedo Peter	Iman Village	[signature]
12	Akpan Udo Ubok		[signature]
13	Udo Samuel Ufot	Iman Village	[signature]
14	D. F. Essien	Okon Town	[signature]
15	IKO-OBONG B. AKPAN	UDO MBON VILLAGE	[signature]
16	Udo Dickson Eno	Iman Village	[signature]
17	Godwin James	Iman Village	[signature]
20	Anthony James Sam	Iman	[signature]
21	AKPARAWA Alfred Peace	Iman	[signature]
22	Udo Isaac Mbeke	Udo Mbon	[signature]
23	EMOBONG UMOH EKWERE	Ikot UMIANG Okon	[signature]
24	Ernest Jonah Udo	Ikot uta Udo	[signature]
25	Lawrence Udoh	Ikot Ukpong/Ekwere Village	[signature]
26	S. G. Idiong	Chairman	[signature]
27	Friday Herzon Udofa	Obom Village	[signature]
28	OSCAR Teddy Akpan	- Ik. Ukpong/Ekwere Village	[signature]
29	Stanley Udo Robert	- Udo-mbon Village	[signature]
30	Kaine Edike	Obom Village	[signature]
31	Ajike, U.K	PHCN	[signature]
32	Somto Chukwuemeka	PHCN	[signature]
		PHCN	

PHCN JV TRANSMISSION LINE QIT - EKET - IBOT ABASI

ATTENDANCE FOR MEETING WITH CLAN COUNCIL - IKPA IBOM
MKPAT-ENIN L.G.A.

14-07-11

S/N	NAME	DESIGNATION	SIGN
1	HRH. Etebom P.N.J. Udoh	Clan Head - Ikpa Ibom	[signature]
2.	Chief (Hon) A.J. Usen	Secretary Gen - Ikpa Ibom (Enen Eyo?)	[signature]
3	ETEIDUNG FRIDAY William IHOH	Village head - IKOT UKESIA	[signature]
4	ETEIDUNG OKON J. UFOT	VILLAGE HEAD - IKOT AKATA	[signature]
5	" MFON EKANEM	VILLAGE HEAD - IKOT AKPADEN	[signature]
6	Eteidung (Hon) Nse E Ukpe	Village Head Ikot Ebiang Akai	[signature]
7	" Essien Ekwere Uyo	Village Head Ikot Akpan Ekot	[signature]
8	" Michael Sunday Akpan	Village head IKOT ABA	[signature]
9	RAYMOND UDIA UNYANAH	VILLAGE HEAD IKOT ETEKONG	[signature]
10	Paul Danson Ekpofiong	Village Head, ODORO INYANG	[signature]
11	Eteidung Sylwester A. Inyang	Village Head Ikot Oyoro	[signature]
12	Chief Joseph Tombo	D.V.H EKIM Town	14-7-2011
13	Chief Okon Udo Ekpo	Ndon	[signature]
14	Eteidung Moses Udosen Ukpong	Village Head, Ik Isighe	[signature]
15	Eteidung Samuel Jer. Ekpo	Village head Ikot. Odong	[signature]
16	ETEIDUNG/Hon Bassey I. Ekong	Village Head Ikot Umo Ekong	[signature]
17	ETEIDUNG Clement Sunday Ufot (JP)	Village Head Ikot Obio Itong	[signature]
18	ETEIDUNG AKPAN Nelson Ekpo	Village head Ikot Enin	[signature]
19	Chief Ufot Ino Akpan	Ikot ETTI	[signature]
20	Eteidung Udo Ekiko	Village head, Ik. Obio Ekpong	[signature]
21	Peter Raymond Obot	Ikot Enin	[signature]
22	Kaine Edike	PHCN	[signature]
23	Madugba, Echeh	PHCN	[signature]
24	Koofreh Ekong	PHCN Consultant	[signature]
25	Aniefiok J. Isang	"	[signature]
26	K. Chukwume	PHCN	[signature]
27	M.O. Jibril	PHCN	[signature]

PHCN CONSULTATION MEETING WITH ONIONG CLAN ON NATIONAL INTEGRATED POWER PLANT TRANSMISSION LINE

ATTENDANCE LIST

ROUP NAME: .... DATE: 14-7-2011

/N	NAMES	ADDRESS	PHONE NO.
1	HRH Akwaedidem (Dr) A. U. Ukpa JP, FCE	P/Ruler, ONNA LGA Clan Head, Onioing Clan	
2.	Etidung Inyang J. Idiokakpan	Ikot Ebekpo	
3.	Etidung E. D. Nwa	Ikot Eko Ibon	
4	Etidung Udo Tom Akpan	Ikot Udo	
5	Etidung Maxwell Ekpoudia	Ikot Ebiere	
6	Etidung (Barr) S. Efik	Ikot Abasi	
7	Etidung Udo S. Akpan	Ikot Anang	
8	Etidung A. U. Udoken	Ikot Ndudot	
9.	Etidung B. B. Usoro	Okom	
10	Isang, A. J.	PHCN	
11	M. O. Jibril	PHCN	
12	Koofreh Ekong	PHCN	
13	Kaine Edike	PHCN	
14	Udo Smith	PHCN	
15	KAINE EDIKE	PHCN	

ONNA TRC MEMBERS / VILLAGE HEADS IN ATTENDANCE

DATE: 13-7-2011

1	HE Akwaaedidem (Dr) A. U. Ukpa JP, FCE	Paramount Ruler		[signature]
2	HH Etebom Akpan Enoh ~~Akpan~~	Nung Ndem Ik. Ndna Inyan		[signature]
3	Eteidung Ezekiel S. Ezekiel	Edem Idim Ibiet		[signature]
4	Eteidung Samuel W. Achiakpan	Afaha Ulom		[signature]
5	Eteidung B. B. Usoro	Okom		[signature]
6	Eteidung E. D. Nwa	Ik. Eko Ibon		[signature]
7	Eteidung Maxwell Ekpondia	Ikot Ebiere		[signature]
8	Eteidung A. U. Udosen	Ikot Ndudot		[signature]
9	Eteidung Inyang J. Idiokakpan	Ikot Ebekpo		[signature]
10	Eteidung Udo Tom Akpan	Ikot Udo		[signature]
11	Eteidung Okon B. Usung	Ikot Ebidang		[signature]
12	Eteidung Sunday W. Udo	Afaha Atai		[signature]
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PHCN JV TRANSMISSION LINE QIT-EKET-IKOT ABASI

ATTENDANCE FOR MEETING HELD WITH IKPA-IBEKWE CLAN

OF IKOT-ABASI LGA. 13-07-11 5:30PM

S/N	NAME	DESIGNATION	SIGN
1.	Jibril M.O.	PHCN	[signature]
2.	Madugba, Benson	Dzrent	[signature]
3.	Koofreh Ekong	PHCN Consultant	[signature]
4	Isang, A.J.	" " "	[signature]
5	Ekwueme F.K.	PHCN	
6	Eteidung Inuaessiett Ubeng	Village Head Ikot Aba	[signature]
7	Etebung Akpan A.U. Umo	Uta Ewa	[signature]
8	Chief U.W. Akpanowo	Ikot Obong	[signature]
9.	Elder Oku Akpan Udo	Clan Council	
10	Chief (Pastor) L.H. Udoessien	Ikot Essien	[signature]
11	SYLVESTER IKPONG	Ikot Essien	[signature]
12	Nkereuwem Sunday Udoma	Ikot Abasi	[signature]
13	Past. Victor Kendon Inan	Ikot Abasi	[signature]
14	Emmanuel Etukafie	Ikpeitan village	[signature]
15	Akama Ukandeng Udo	Ikot Akpanata village	[signature]
16	Augustus Emmanuel Ekwong	Ikot Aba village	Emmanuel Ekong
17	Uduak Udo Tom	Chairman Ik Etetuk Village	[signature]
18	Boster Ntayat	Clan Exco/Ik. Abasi	Ntayat
19	Saturday Ekponenyen	Youth president Ikpa Ibekwe clan	[signature]
20	Akpan Kofi Udoka	Chairman Ik. Akpanata V.	[signature]
21	Felix monday Akpan	Uta Ewa	[signature]
22	Karie Edike	PHCN	[signature]

PHCN JV TRANSMISSION LINE OIT-EKET-IKOT ABASI
ATTENDANCE FOR MEETING WITH AFAHA-EKET CLAN COUNCIL
08-07-11

S/N	NAME	DESIGNATION	SIGN
1.	HRH Obong Nathaniel James E Oduenyie	Traditional Father P/M TRC	
2	Chief M.D. Uwem	T.R.C member Eket 07063911871	
3	Isong Isong	V/H Afaha Atai	Isong Isong
4	Emmanuel Robert-Edohowkeh	Ebana	
5	Chief (Dr) A. S. Okomo	Consultant Surgeon TRINITY CLINIC, EKET	08025525949
6	Chief Paul Akpan Tom	Afaha Odoro Enen	
7	Prince Benhur J. Oduenyie	Secretary Atibe V/council Afaha Eket	08025325145
8	NOI Enodien Udia (Rt).	Chairman Ataindan village 08085620446	
9	Chief E J. Ekanem		
10	Chief Joe Edoho	Ekpene Village Village Head 08025132867	
11	EMMAN. S-SAKEY Youth President		
12	JOHN ENOCH CSD	Youth Chairman 08026692749	
13			
13	M.O-JIBMC	PHCN	
14	F.R. Ekwueme		
15	Anefiok J. Isong	PHCN Consultant	
16	Koofreh Ekong	PHCN Consultant	
17	Julius Ojeyemi	PHCN Consultant	
18	Kaine Edike	PHCN Consultant	
19	Ekaete Martyrs		

PHCN 3V TRANSMISSION LINE QIT - EKET - IKOT - ABASI

ATTENDANCE FOR MEETING WITH PARAMOUNT RULER OF EKET AND CLAN HEADS - TRADITIONAL COUNCIL, 05-07-11

S/N	NAME	DESIGNATION	SIGN
1.	HH Obong NJE Oduoeyai	Presiding Member, Eket TRC	[signature]
2.	Chief Monday D. Uwem	Village Head, Idung Offiong	[signature]
3.	✓ Usoro S. Usoro	Village Head, Ikot Ebok	Usoro
4	✓ Akpabio Ekpoton Inyang	Village Head, Ikot Obioro	[signature]
5.	✓ Sunday A. Otu	Village Head, Ikot Udoma	[signature]
6.	Prince Ndaeyo Inuaeyen	Secretary, Eket TRC	[signature]
7.	Kanie Edike	consultant PHCN	[signature]
8	Kootreh Ekong	Consultant PHCN	[signature]
9.	Amiefiok J. Isang	Consultant PHCN	[signature]
10	Madupoo Ifeanyi	✓ ✓	[signature]
11	M. O. Jibril	PHCN	[signature]
12	F. R. Chwueme	PHCN	[signature]

PHCN IV TRANSMISSION ...

ATTENDANCE FOR MEETING WITH PARAMOUNT RULER OF IKOT ABASI AND CLAN HEADS — TRADITIONAL COUNCIL, 04-07-11

S/N	NAME	DESIGNATION	SIGN
1.	H.R.M. Edidem U.J. Ntuk Obom	Paramount Ruler - Ikot Abasi	
2.	H.H. (Engr.) C. I. Udia	Clan Head - Ikpa Nung Asang	
3.	Eteidung Eniema O. Esiet	Village Head, Edidue, Edem Aya	
4.	Alcpan Akpan Uwa Unio	Village Head, Uta Ewa, Ikpa Ibekwe	
5.	Ufot Nda	Village Head, Ikot Akan, Ukpum Ete	
6.	Ikpe F. Akpan	Secretary - TRC	[signature]
7.	Kaine Edike	Consultant Fugro	[signature]
8	Koofreh Ekong	Counsultan	[signature]
9	Amofiok J. Isang	Consultant	[signature]
10	Mrs I.B.A. Ruskin	PHCN	[signature]
11	M.O. Jibril	PHCN	[signature]
12	F.K. Ekwueme	PHCN	[signature]

ATTENDANCE FOR MEETING WITH PARAMOUNT RULER OF MKPAT-ENIN AND CLAN HEADS — 04-07-11
2:30pm

S/N	NAME	DESIGNATION	SIGN
1	HRH Aupan Aupan Ekpena	07031297963 Clan Head Ikpa Ikono	
2. ✓	HRH P. N. I. Udoh	08031848650 Clan Head Ikpa Ibom	
3. ✓	HRH Archibong Umanah	08164012335 Clan Head elect Ukpum Minya	
4.	Anthony Ukpe	Secr TRC 08028174573	
5.	Kaine Edike	Consultant Fugro	
6	M. O. Jibril	PHCN	
7.	F. K. Ekwueme	PHCN	
8	Koofreh Ekong	PHCN Consultant	
9	Isong, A. J.	Consultant	

PHCN
Power Holding Company Of Nigeria Plc

Name of Village ......IKOT UKPONG...... Date 13/12/2011

....

Attendance:

S/No	Name	Designation	Signature
1.	Etejoung UFOT BROWN	Village Head	UBrown ~~0803...~~ 00
2.	Prince James Ufot	Member	[illegible]
3.	U. T. MKPAN	member	U. T. MKPAN
4.	JAMES UFOT Udokemo	member	[illegible]
5.	MR Friday Willie	Member.	[illegible]
6.	INI Udo BROWN	youth Head	[illegible]
7.	Mr FRIDAY H. Udoffe	Member	Udoffe
8.	Eld Gabriel G. Akpan	Family Head	[illegible]
9.	Ufot Willie Ekanem	member	[illegible]
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....UDO MBON............ Date 12/12/2011

....

Attendance:

S/No	Name	Designation	Signature
1.	HON. PENIEL UDONTAH	CHAIRMAN	[signature] 08027961668
2.	Oscar Juddy Akpan	V. Chairman	[signature]
3.	CLEMENT FYNEFACE UDOETE	TREASURER	[signature]
4.	Udo J. Nkanang	Secretary	[signature]
5.	Chief Bassey Ibia	member	[signature]
6.	Albert Sunday Akpan	member	[signature]
7.	Richard Evanson Udeu	Member	[signature]
8.	Christopher J. Udoette	—	[signature]
9.	IDARA ALFRED DAVISS	youth president	[signature] 08061664921
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ... IDUNG IMOSE VILLAGE ... Date 12/12/2011

Attendance:

S/No	Name	Designation	Signature	PH NO
1.	CHIEF, BISHOP ÷	CHIEF		
2.	F. M. AKPADIAHA	VILLAGE HEAD	07030617821-	080842387 37
3.	CHIEF AKPAN, B, ORUK	FAMILY HEAD		
4.	CHIEF, FRANCIS IMAT	FAMILY HEAD		
5.	CHIEF, SAMUEL NSIEN	FAMILY HEAD		
6.	CHIEF, SUNDAY IMOSE	FAMILY HEAD		
7.	CHIEF, OKON, B. AKPEIMAH	FAMILY HEAD		
8.	CHIEF, ALBERT ETTI	FAMILY HEAD		
9.	MR JOSHUA SAMUEL	MEMBER		
10.	VICTOR ETTI IMAI	YOUTHS PRESIDENT		080250 94728
11.	EZIEKEL GILBERT	V. P. (YOUTHS)		
12.	GODWIN JOSHUA	PRO (YOUTH)		
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: OBOM VILLAGE Date: 10/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	HRM Edidem U.J. Ntuk Obom	Paramount Ruler	[signature]
2.	Udo Peter Akpan-Umoeseit	C/V Council	[signature]
3.	Sir Ubong Udom	Sec.-Village Obom Council	[signature]
4.	Udo Matthew Akpan	Member	[signature]
5.	Moses Okon Udom	Member	[signature]
6.	Chief Justus A. Ntuk	Member (Advisory)	[signature]
7.	Elder Nathaniel Eshiet	V.C. Village Council	[signature]
8.	Akpan Douglas Inoh	Advisory Member	[signature]
9.	George Udoing	Member	[signature]
10.	Elder Akpan S. Idiong	Member	[signature]
11.	~~Elder Udo M. Akpan~~	~~Asst. Secretary~~	
12.	Patrick Umoetuk	P.R.O	[signature]
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: IDUNG ADIAKOD Date: 10/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF (DR.) ADIAKOT STEPHEN OKOMO	VILLAGE HEAD	[signature]
2.	ELDER FRIDAY STEPHEN OKOMO	VILLAGE COUNCILLOR	[signature]
3.	OKON BROWNSON UKO	CHAIRMAN V/C.	BUKO
4.	SAMUEL MONDAY ATTAH	YOUTH PRESIDENT	[signature]
5.	CHRISTOPHER MICHAEL DAN	VIC YOUTH PRESIDENT	[signature]
6.	Obongawan Deaconess Dorothy Okomo	Head of the women	[signature]
7.	MACAULAY WARDIE EDUOK	Member Village	[signature]
8.	Eld. Itiat K. Itiat	Family head	[signature]
9.	MR OKON JOHNNY ESOP	Counselor	Johnny
10.	Deac. [illegible] Johnny Esop	Family Head	[signature]
11.	Chief Sunday Jeremiah Udo Inyang		S. J. Udo
12.	Anthony Nathaniel Edinam	For Family Head	[signature]
13.	Edoho Friday Nathaniel	Member	Eddo.
14.	Elder Emmanuel Wilson Uyoh	member	[signature]
15.	Ime Wilson Uyoh	Village Councellor	[signature]
16.	VICTOR IKPONG ITIAT	WELFAR	[signature]
17.	Oliver Michael Dan	Member	[signature]
18.	Emmanuel Elijah	P.R.O	[signature]
19.	SAMUEL JOE EDINAM	SECRETARY	[signature]
20.	Michael Friday Nathanel	Member Village	[signature]
21.	Umem Monday Attah,	Youth,	[signature]
22.	GODWIN OKON INYANG	Youth A/S SEC.	Inyang
23.	GODWIN UDO JIMMY-	youth	[signature]
24.	FRIDAY SAMBO	youth	[signature]
25.	Micheal Ben ITIAT	youth.	[signature]
26.	Ubong Adiakot Okomo	HR	[signature]
27.	DANIEL SAMBO OKOMO	mill	youth
28.	AKANINYENE BASSEY	HA	
29.	IDUNGESIT FRANCIS	Sport	

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Power Holding Company Of Nigeria Plc

Name of Village ......IKOT ETETUK...... Date 7/12/2011

Udouak Tom
08065114328

Attendance:

S/No	Name	Designation	Signature
1.	Mr Udouak Udo Tom	Ik, Etetuk	08065114328
2.	Chief Ufot Otan Okoko	Ik, Etetuk	
3.	Chief Ufot Michael	Ik, Etetuk	Ufot Obo
4.	Chief Akpan Williamson	Ik, Etetuk	
5.	Bassey Udokpon	Ik, Etetuk	
6.	~~Esang~~	~~Ik, Etetuk~~	
7.	Johnson Udowoho Ekpo	Ik, Etetuk	
8.	Monday Akpan Sam	Ik, Etetuk	
9.	Idongesit Enyinabasi William	Ik, Etetuk	
10.	Saturday Rufus Ekpenyong	Ik, Etetuk	
11.	Engr. (Ubong) U.P. UDOKPOH	IKOT ETETUK	
12.	Matthew Marcus Udo	IKOT ETEUK	
13.	Emmanuel Genesis	Ikot Etetuk	
14.	Akpan Udowo Ekpo	IKOT ETETUK	
15.	~~UBONG AKPAN~~	~~NEPA~~	
16.	Ubong Akpan	Ikot Etetuk	
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Power Holding Company Of Nigeria Plc

Name of Village ......IKOT ESSIEN...... Date...7/12/2011...

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Attendance:

S/No	Name	Designation	Signature
1.	Elder Ime Akpan Nathaniel	V/C Chairman	[signature]
2.	Elder Samuel Etgong	member	[signature]
3.	Mr Monday A. Inoh	Secretary	[signature]
4.	Elder Etawere Jimmy	V. Chairman	[signature]
5.	Elder Ufot Abraham	Tresurery	[signature]
6.	Mr Mfon Abraham	members	[signature]
7.	Chief Ikpaisong Abraham	member	[signature] Village Head
8.	Prince Clement U. Akpan	Family Head	[signature]
9.	Chief Akpan Jombo	Town Crier	A. Jombo
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: IKOT AKPANATA Date: 7/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Elder A.A. Usoro	Village Head	08081379944
2.	Chief Akpan Nsedu	Village chairman	A I B. N
3.	Chief Charle Ayara	Family Head	C A Ayara
4.	Chief Udo Jacob Usoro	Umonte family	U J
5.	Chief Aniekan Udoessien	Akpadiaha family	A. J.
6.	Chief Etukudo Hart	Inue Akam family	EuHart
7.	Chief A.I. Nkanang	Council Member	[illegible]
8.	Hon. Augustine Ukpong	Council Member	[illegible]
9.	Friday Udo Akpanette	Council Secretary	Akpanette
10.	Ubong Charle (Pastor)	Council Member	[illegible]
11.	Samuel Daniel Essiet	Council Member	Essiet
12.	Ufot Jeremiah	Council Member	[illegible]
13.	Sunday Udofia	Youth Secretary	S. U.
14.	Ini Akpan Ufot	Treasurer	[illegible]
15.	Eyo Ufot James	Youth President	E.U.J - 07039766125
16.	Hon. Nsikan Usoro	Council member	N Usoro
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Name of Village IKOT AMASI Date 7/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Etidung Akpan Monday Okubre	Village Head	
2.	Etebong F. Ukofria	Chairman	08028198581 08189100059
3.	Udo Bruce Ukoeicong	Vice Chairman	
4.	Paul Isaac Udodung	Secretary	
5.	Prince Imo Jackson	Treasurer	
6.	Chief Wilson Ekpro	Auditor	
7.	Joba Archibong Ekere	Provost	
8.	IFIOK AKPAN NYONG	Fin. Sec.	
9.	INI EKERE	Ex Officio	
10.	ESSIEN ISAAC	Ex Officio	
11.	Akpan Sam Ikowoh	Compound head	A. S. Ikwoho
12.	Imedu Nanso Ukpa	youth president	08032653580
13.	Ukoekong Aniefiok Samuel	Youth A. Secretary	
14.	Elder E. S. Uko (JP)	Ex-officio	
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Power Holding Company Of Nigeria Plc

Name of Village: URUA ESSIEN ETUK Date: 6/12/2011

08056783923

Attendance:

S/No	Name	Designation	Signature
1.	Archibong L Udo		[signature]
2.	Iniobong Udo Dick		[signature]
3.	Elijah Akpan George		[signature]
4.	Chief Udo Dick		
5.	Henry Akpan George		[signature]
6.	Emman Udo George		[signature]
7.	Mofe Okon Etebom		[signature]
8.	Aniefiok Udo Etebom		[signature]
9.	Hon Udo George		[signature]
10.	Love Lawrence Udo		[signature]
11.	Esien Akpan George		[signature]
12.	Chief Monday Uku		[signature]
13.	Antony Udo George		[signature]
14.	Promise Ebon Akpan		[signature]
15.	Victor Akpan George	08125693729	[signature]
16.	Godwin Akpan George	Member	[signature]
17.	Monday Lawrance		
18.	Joseph Lawrence Udo	08056783923	[signature]
19.	Udo Etebom	member	[signature]
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Name of Village ......Ediono Isoutibe...... Date......6/12/2011......

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Attendance:

08028345900

S/No	Name	Designation	Signature
1.	Chief Akpan Dick Akpan	Village Chairman	[signature]
2.	H Ahua	V. C Village Council	[signature]
3.	Chief Udo Owo Idem	Comp. Head	[signature]
4.	Chief Willie Ufot	Compound Head	[signature]
5.	Mrs Ekaette Udo Sam	Women Leader	[signature]
6.	Mrs Comfort Akpan Usua	Women Leader	[signature]
7.	Chief Udo Ishamel	Community Leader	[signature]
8.	Clement E. Ukco	Council Member	[signature]
9.	Essienubong Essien	Community Leader	[signature]
10.	Udo Monday Ufot	Youth Activist	[signature]
11.	Captain Esin Johnson	Elder Youth	[signature]
12.	Mfon Akpan Etukudo	Vice youth president	[signature]
13.	Comrade Ubong Imeh	Clan Youth Sec.	[signature] 08182260440
14.	Comrade Ubong Essien	Village Youth President	[signature] 08036763962
15.	Mr Emaikpo Ebong	Village Council Sec.	[signature]
16.	Ebong A - Ebong	" " Member	[signature]
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Power Holding Company Of Nigeria Plc

Name of Village ....Okpoto........ Date....6/12/2011....

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Attendance:

S/No	Name	Designation	Signature
1.	Chief Clement R. Udoh	Village Head	[signature] 08062517690
2.	" Udo U. Essien	D/Village Head	[signature] 07031695320
3.	Mr. Akpan Samuel Ukang	Compound Head	[signature]
4.	Rev. Emmanuel P. Oton	Compound Head	[signature] 07062867343
5.	Priest Mfon Udo Usoro	Compound Head	[signature]
6.	Priest John S. Udoekpo	Chl Village Council	J.S.U.
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Power Holding Company Of Nigeria Plc

Name of Village .... IKOT EKANGNE .... Date 6/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief A. J Mbak	Village head	[signature] 07060642388
2.	Compound head Mr. Ibout	Compound ✓	[signature]
3.	✓ M. J. Udoitah	Compound head	[signature]
4.	✓ Ufot mark	Compound ✓	[signature]
5.	✓ P. E. Utuk.	Compound ✓	[signature]
6.	✓ Udo Johnson Mbak	Compound ✓	[signature]
7.	Christiana M. J. Udoitah	woman leader	[signature]
8.	U/Di Amos Udoseo	Concil Chairman	[signature]
9.	Nse Obot Udoita	Secretary	[signature]
10.	Afiaefiok Udo mark	P.R.O	[signature]
11.	Monday E. Udoitah	Stack holder	[signature]
12.	Ekong I. Akpan	stock holders	[signature]
13.	Imoh Udo Mbak	✓ ✓	[signature]
14.	Uwem A. Adulpus	✓ –	[signature]
15.	Uwem I. Udoitah	✓ ✓	[signature]
16.	Comorade Andy Ndah	Claim president	[signature]
17.	Goodwin T. Utuk	steck holders	[signature]
18.	Ubong Udo Mbak	✓ –	[signature]
19.	Emem E. Udoitah	Adaha Ukim V.	[signature]
20.	OTTO M. Inyang	✓ ✓	[signature]
21.	Mrs Udeme U. Amos	Women Sect.	[signature]
22.	Nyakno Ufot Johnson	Tresurer	[signature]
23.	Sunny I. Akpan	Steck holder	[signature]
24.	Pious Obsikan [illegible]	—	[signature]
25.	Friday Danady Johnson	—	[signature]
26.	Mfon Udo Ufot Johnson	—	[signature]
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Power Holding Company Of Nigeria Plc

Name of Village: EKPUK INNANG Date: 3/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief A. R. Umoren	Village Head	[signature] 07038500519
2.	HON. AKpokpan Green Ufot	Council Chairman	[signature] 08023204935
3.	HON EDWOK UKPE	Secretary	[signature] 08024179400
4.	CHIEF A. A. EYEN	COMP/HEAD OWOK IDE	[signature]
5.	CHIEF A. N. ATAHA	" OWOK AKPAN	[signature]
6.	CHIEF K. G. OFFIONG	" OWOK IBANGA	[signature]
7.	ELDER U. J. UKPE	COMMUNITY LEADER	[signature]
8.	EVAG. LUCKY UWAT	YOUTH LEADER	[signature] 08085598877
9.	ELDER EFFIONG MONDAY	DEP. YOUTH LEADER	[signature]
10.	CHIEF PAUL UDOMA	COMM. LEADER	
11.	MR UMOREN R. UMOREN	YOUTH	[signature]
12.	MR OBOT R. UMOREN	"	[signature]
13.	MR OBOT GREEN	"	[signature]
14.	ELDER UDO AKPAMUKPE	COMM. LEADER	[signature]
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Power Holding Company Of Nigeria Plc

Name of Village ABIANAN Date 3/12/2011

Attendance:

V/H No - 09062898238

S/No	Name	Designation	Signature
1.	Chief Nyong Etukafiah	Village Head	[illegible]
2.	Akpan I. Usuah	compound Head	[illegible]
3.	Ini Essienowo		Essienowo
4.	Ossidoe John Essien		[illegible]
5.	Nseobot Akpanidiok		[illegible]
6.	Obo Akpan Umoh	compound Head/Sect.	[illegible]
7.	Monday Fake Ekpa	Village council Chairman	[illegible]
8.	Nsikan Jimmy	Youth President	[illegible] 08027494295
9.	Monday Frank Udok	council member	[illegible]
10.	~~Nelson [illegible]~~		
11.	Chief Nnanso Jimmy	compound Head	[illegible]
12.	~~Udo Frank Etuk~~		
13.	Chief Kenneth Frank Etukette	compound Head	[illegible]
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Power Holding Company Of Nigeria Plc

Name of Village ....ETE.... Date 2/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Etordung Maurice Udom [illegible]	Village Head	[illegible] 08020364296 08169766660
2.	Chf. Akpan Esseneoso	family Head	[illegible]
3.	Chf. Bethel Dickson	family head	[illegible]
4.	Chf. George Willfred	family head	[illegible]
5.	Chf Mfon-so Asuquo	family head	[illegible]
6.	Chf. Cyril Nkanta	— "	[illegible]
7.	Asuquo Inyang	Secretary	[illegible]
8.	Nsikan Ebenezer	Chairman	[illegible]
9.	Anthony Ukpong	Youth leader	[illegible] 08082614172
10.	Chf Bassey Tom.	family head	[illegible]
11.	Chf Akpan Sunday	— —	[illegible]
12.	Ufot Nkanta	member.	[illegible]
13.	Archibong Koffi	family head	[illegible]
14.	Uduak Obong	Youth Secretary	[illegible]
15.	Chf Akpan Harry	family head	[illegible]
16.	Henday Ukpong	— —	[illegible]
17.	Moses George	— —	[illegible]
18.	Emman John	Youth Member	[illegible]
19.	Joshua Thompson	family head.	[illegible]
20.	Udo George	Council Member	[illegible]
21.	Clement Macauley	Youth Member	[illegible]
22.	Esitima Asuquo	Youth "	[illegible]
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Power Holding Company Of Nigeria Plc

Name of Village OBIOKAMA Date 2/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Etaidung Akpan Obot EKPE	VILLAGE HEAD	[signature] 08084233983
2.	Chief Ufot Johnson Ukpe	Family head	
3.	Akpan Sunday Ukpe	Chairman	[signature]
4.	Mr. Ekwere E. Andrew	Secretary	[signature]
5.	Nkuku Uwo Samuel Akpabio	Priest (Chief)	
6.	Usen Samuel Akpan	Comm. leader	[signature]
7.	Ntieno Akpan Obot	Comm. Leader	[signature]
8.	Etuk Akpan		[signature]
9.	Chief Inyang Mark		[signature]
10.	NSefo Udo Akpabio	Councelor	[signature]
11.	Elder Akpan Friday	family	[signature]
12.	IMOH ARCHIBONG MARK	COMM. LEADER	[signature]
13.	NSIKAN FRIDAY UDO	YOUTH PRESIDENT	[signature] 08029217984
14.	EMEDIONG EKPO DICK		[signature]
15.	ISAAC ETIO INYANG		ISAAC
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Power Holding Company Of Nigeria Plc

Name of Village UBENEKE II Date 2/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Eteidung Paul Efuk-ataha	Village Head	[signature] 08124275953
2.	chief Michael Akwaowo	Compound Head	[signature]
3.	chief Udo Obo Akpan	✓ ✓	[signature]
4.	chief Ufot Jim Usen	✓ ✓	U.O.A
5.	chief Godwin Ekong	✓ ✓	[signature]
6.	Chief Usoro David	✓ ✓	[signature]
7.	chief Akpan Toby Ekin	✓ ✓	[signature]
8.	Mr. Mfon Uthang	Village Chairman	[signature] 08188628536
9.	Mr. Sunday Ufot Jim	Youth president	[signature] 08027680030/ 07068924032
10.	Mr. Nsemo A. Isaiah		
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Name of Village UBENEKE I Date 2/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF NSIKAN E. UDOM	VILLAGE HEAD	[signature] 08061330444
2.	CHIEF EDYINMANG E-ETUKAKPAN	CHAIRMAN V/COUNCIL	[signature]
3.	CHIEF JOSAPH H. UBOM	Secretary V/council	[signature]
4.	MADAM EKAETE E-ETUKAKPAN	WOMEN SECRETARY	[signature]
5.	Elder Steven Joseph Akpan	Odudo's family	[signature]
6.	MADAM EMO NSIKAN E. UDOM	MEMBER WOMEN GROUP	[signature]
7.	Etukakpan E Etukakpan	UBENEKE	[signature]
8.	UMO Ebenezer Etukakpan	Member	[signature]
9.	Chief Lawson S. Ndal	member	[signature]
10.	Iboro Lawson S. Nd	member	[signature]
11.	Ufy Umoekan	MEMBER	[signature]
12.	Kingsley Akpan Udoessien	Member.	[signature] 08133592232
13.	Brang Ikemesit Udo Ekpo	Youth President	[signature]
14.	Edo-obong Ufot Bassey	Youth -	[signature]
15.	Uduak Ufot Bassey	Youth -	[signature]
16.	Nsima M. Obob	Treasurer	[signature]
17.	Mercy S. Joseph	Woman Leader	Mercy
18.	Grace I. Udom	Tresurer	[signature]
19.	Ifiong S. Akpan.	Member	[signature]
20.	M. AKPAN AKPAN	✓	[signature]
21.	Udnak Edwin Davies		[signature]
22.	Nsikan Joseph Akpan	member	[signature]
23.	Udofot Michael Udo	✓	[signature]
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Power Holding Company Of Nigeria Plc

Name of Village ESSIEN ETUK Date 2/12/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Akpan Amos Utere	Deputy Chief	
2.	Chief Udosen Ugwo Udosen	compound head	
3.	Chief Okon Jacob Inyangudo	compound head	
4.	Chief Samuel Isaac Udoekpo	Compound Chief	
5.	Mr NSIKAN ELI DAVIES	Council Chairman	
6.	USOKO OBOT NKANG (08025483045)	YOUTH LEADER	
7.	ELDER IDEM UDOUSORO	SECRETARY	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....IKOT EDOR.... Date..26/11/2011..

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Attendance:

S/No	Name	Designation	Signature
1.	HE Akwaedidem (Dr.) A.U. Ukpa	Paramount Ruler/V.H	[signature] 08066768459
2.	Chief Friday Ekaette Umoren	Member, V/Council	[signature]
3.	Chief Akpan Dickson Ekwere	✓	[signature]
4.	Elder Ufot Christian Udo	✓	[signature]
5.	Chief Attat Attat Nkanang	✓	[signature]
6.	Chief Ekanem Friday Ekanem	✓	[signature]
7.	chief Nkeke Edubok Nkeke	Youth President	[signature] 07037935811
8.	chief Ndube Davies	✓	[signature]
9.	chief Brownson Ukpong	✓	[signature]
10.	✓ Ufot Prince Umoh		[signature]
11.	Bishop Maxwel Udo, Essien	M.Essien	[signature]
12.	chief Udo Hezekiah Akpan		[signature]
13.	CHIEF Emmanuel Nsikak	✓	[signature]
14.	Chief Okon Johnny Eshiet	✓	[signature]
15.	Hon Sam Ekaette	✓	[signature]
16.	Mr Billy Udoukpo	✓	[signature]
17.	Dr Umoren W. Umoren	✓	[signature]
18.	Monday Udosaka	✓	[signature]
19.	Akpan Udo Nfiaba	✓	[signature]
20.	Okon Morgan	✓	[signature]
21.	Ekanem Paul	✓	[signature]
22.	Samuel Abraham	✓	[signature]
23.	Chief Udo Tom Akpan	✓	UdTom
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Power Holding Company Of Nigeria Plc

Name of Village IKOT ATA UDO Date 25/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF FRIDAY A. INOKON	C/m village C.	08053089018
2.	ENGR PIUS JOSEPH EKPEOWO	SECTARY	
3.	CHIEF AKPAN TOM UDO	member	
4.	CHIEF EVANSON UDO	member	
5.	MR UDO UDO ANDREW	youth Chrman	
6.	CHIEF UFOT TITUS PHILLIP	member	
7.	MR AKANIYENE OBOT	youth speaker	07034926620
8.	CHIEF AKPAN NELSON EKAMEN	v/c village C.	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village IKOT UMIANG Date 25 |11| 2011

Attendance:

08089043210

S/No	Name	Designation	Signature
1.	chief UFOT SAMPSON UFOT	VILLAGE HEAD	08161265915
2.	✓ UDO ESSIEN UDO	CHAIRMAN	
3.	ELDER EDWIN JACOB EKENE	SECRATARY	
4.	ELDER SAMPSON UFOT	MEMBER	
5.	✓ UDO PETER UFOT	✓	
6.	MR ALBERT WILSON AKPAN	TREASURER	
7.	CHIEF DANNIS DANIEL UFOT	COMPOUND CHIEF	
8.	ELDER FELIX TOM ESSIEN	MEMBER	
9.	MR UFOT JUMBO AKPAN	MESSENGER	U. J. A.
10.	✓ SUNNY OKON UKPONG	MEMBER	
11.	chief YOUNG EKIM	✓	
12.	✓ ROBERT SAMPSON	✓	
13.	MR ENOBONG FELIX	✓	
14.	✓ SAMPSON UFOT UMO	✓	
15.	✓ OBONG AKPAN JACOB	✓	
16.	Comrad ETEBOM AKPAN JACOB	✓	08134410922
17.	chief AKPAN WILLIAMSON	✓	
18.	DANNIS AKPAN DANIEL UFOT	✓	
19.	samuel UDO peter	✓	
20.	Hongesit A. Essien	✓	
21.	Chief A. Willie	✓	
22.	Mester Ofonime Johnson	✓	
23.	chief AKPAN AARON	Compound chief	
24.	sunday Jacob	member	
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Power Holding Company Of Nigeria Plc

Name of Village: IMAN EKA IBOM (I$II) Date: 25 | 11 | 2011

Attendance:

S/No	Name	Designation	Signature
1.	ETEIDUN F. A. UKUT	VILLAGE HEAD	F. A. Ukut
2.	CHIEF A. J. ESU	EKPUK HEAD	A. J. Esu
3.	✓ SAUL UDOSEN	✓ ✓	[illegible]
4.	✓ F. A. Umoetuk	✓ ✓	[illegible]
5.	✓ UDOH D. ENOH	✓ ✓	U D E
6.	✓ UFOT Jimmy UDO	ASST. ✓ ✓	U. J. Udo
7.	✓ OKON MARK UFOT	✓ ✓ ✓	O. U. Ufot
8.	✓ NTIEDO PETERS	✓ ✓ ✓	[illegible]
9.	✓ SATURDAY Willie Inoh	✓ ✓ ✓	S. Gr.
10.	ELDER A. D. ENOH	V/Council Chairman	[illegible] 08105553955
11.	FRIDAY U. IKONO	✓ ✓ SECRETARY	F. U. Ikono 08134187156
12.	SUNDAY JOHNSON EKPO	COUNCIL ✓	[illegible]
13.	UDO SAMBO UDOSEN	✓ MEMBER	U. S. U.
14.	AKPAN UDO UBAK	✓ ✓	[illegible]
15.	IKPE SEMION Udo	MEMBER YOUTH Council	[illegible]
16.	IMOOWO	✓ ✓	✓
17.	ALPHA F. UKUT	✓ ✓	✓
18.	OTOBONG UFOT SAM	✓ ✓	✓
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....IKWA.................................... Date 25 | 11 | 2011

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Attendance:

S/No	Name	Designation	Signature
1.	Chief Akpan Jack Eppe	Village Head	A. J. Eppe
2.	Chief Akpan Udo Obot	Family Head	[illegible]
3.	Aniefiok Mfon Lazarus	V. Council - 08035324138	[illegible]
4.	Ime Frank Isofi	Fr Head.	[illegible]
5.	Chief Akpan Akpan	Utene	[illegible]
6.	Christopher Akpan Jackson	youth president 08066004389	Christo
7.	Chief I. U. Eppo	Family Head	[illegible]
8.	Obot Peter Umoh	V. Yout 08036633777	[illegible]
9.	Chief Akpan John Akan	Family head	[illegible]
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(2) Vice chairman - Ikwa Village Council - 08035324138
(1) Youth president - Ikwa - 08066004389

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Power Holding Company Of Nigeria Plc

Name of Village: IKOT ATAHA Date: 28/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Akpan Akpan Ntia	Village head	08030256265
2.	Chief Udo Jimmy Ntia	Ekpuk head Ika	
3.	Elder Udofot Umo Nkan	Adviser	
4.	Mr Idongesit Udofot Umoh	Youth Leader	08030792594
5.	Mr Ediono Nsima Umoh	Village chairman	
6.	Mr Ubong Nnah Ufot	Youth Exco	
7.	Mr Asuma Jack	Youth Exco	
8.	Mr Aniekan Akpan Jack	Village Secretary	
9.	Mr Udo Akpan Eyen	Town Cryer	
10.	Mr Uwam Udo Jack	Youth Secretary	
11.	Mrs Nse Akpan Ntia	Women leader	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: IKOT AKA Date: 23/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF RICHARD TOBBY	VILLAGE HEAD	R Udoroo
2.	BASSEY BEN UDOWO	FAMILY HEAD	
3.	AKPAN J. ETEKUNG	FAMILY HEAD	
4.	AKPAN ISAAC EKANEM	FAMILY HEAD	
5.	COMRADE SYLVESTER Heymans	YOUTH LEADER	Heymans
6.	MRS ROSELINE A. Emmans	WOMAN LEADER	
7.	MRS ROSELINE R. TOBBY	VILLAGER	
8.	Elder C. J. UDOWO	FAMILY HEAD	
9.	INSPR UFOT HEYMANS		
10.	ELD (HON) INYANG STEPHEN UMOH	Councillor	
11.	Ufot Ekanem	Member	
12.	Moses Emmans Akpan	Member	
13.	CHIEF WISDOM S. EKANEM	SECRETARY	0802224787 52
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Power Holding Company Of Nigeria Plc

Name of Village: IKOT ETTI Date: 23/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF UFOT INYANG AKPAN	IKOT ETTI	[signature]
2.	CHIEF UFOT AKPA UMOEFIOK	IKOT ETTI	[signature]
3.	PRINCE AKPABIO UDO TOM	IKOT ETTI	[signature]
4.	MR. FRIDAY PETER USORO	IKOT ETTI President	[signature] 08062805052
5.	MR. UKPE AKPAN PETER	IKOT ETTI	[signature]
6.	ESSIEN UFOT AKPAN	IKOT ETTI	[signature]
7.	MICHAEL TOMMY USORO	IKOT ETTI	[signature]
8.	UDO OKON MONDAY	IKOT ETTI	[signature]
9.	STEPHEN AKPAN UMOEFIOK	IKOT ETTI	[signature]
10.	ANIEFON MACAULEY OWO	IKOT ETTI	[signature]
11.	SUNDAY MOSES AKPAN	IKOT ETTI	[signature]
12.	DAVID AKPAN JOHNSON	IKOT ETTI	[signature]
13.	SAMUEL AKPAN IDEM	IKOT ETTI	[signature]
14.	NDUEHE AKPAN PETER	IKOT ETTI	[signature]
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village .... IKOT ABA .... Date 23/11/2011

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07037780264

Attendance:

S/No	Name	Designation	Signature
1.	Eteidong M. S. Akpan	Village Head	~~[illegible]~~
2.	Elder Akpan Hanson Itong	Village Secretary	
3.	Chief Ukpe Akpan Etuk[illegible]	Village T. Crier	
4.	chief A. Dick Akpan	Chairman	
5.	Chief Godfred [illegible]. Umoren	Committee	
6.	Ofon Ime Udofot	Youth President	08037076559
7.			08037076359
8.	Udo Ete Akpan		
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Power Holding Company Of Nigeria Plc

Name of Village IKOT EKPANG Date 23/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief/Eld. Eyo George	Village Chairman	[signature] 07088759568
2.	Eld Ime Edward Inoh	Village Secretary	[signature] 08020623794
3.	Chief Udofot Inoh	Member	[signature]
4.	Chief Reuben Peter	Member	[signature]
5.	Chief Sunday Sam Akpabio	Member	[signature]
6.	Eld/Hon Inyang Stephen Umoh	Member	[signature]
7.	Chief Albert Joshua Umoren	Member	[signature]
8.	Chief Ufot Sunday Ekanem	Security	[signature]
9.	Chief Sunday Douglas	P.R.O	[signature]
10.	Chief Watson Rufus Akpan	Treasurer	[signature]
11.	Mr Nnamso Emmanuel	Youth president	Nnam; 08134455831
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Power Holding Company Of Nigeria Plc

Name of Village: IKOT EKONG Date: 22/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	Eteidung Raymond Udia	Village head	
2.	Bishop Cletus Udo Udia	village assist. Sect	
3.	chief Imoh Jones Ikpe	~~Family Head~~ Council	
4.	Nkuku Donatus Ukana	Obong Nkuku	
5.	chief Alphonsus Ukana Udo	Family Head	
6.	chief Sunday Lyip Eshiet	Family Head	
7.	chief (Rev.) Akpan monday	Family Head	
8.	chief Udo Sunday Udo	Family Head	
9.	chief Mfaha Idem Etuk	Family Head	
10.	chief Sunday Ukana Udo	Family Head	
11.	chief Gabriel Akpan	Family Head	
12.	chief Isaac Tom Akpan	Family Head	
13.	chief Ekot Joshua Ekot	Family Head	
14.	chief Basil Akpan Obong	Family Head	
15.	chief Ukana Ikpe Nyong	Family Head	
16.	chief Francis Idem Umana	Family Head	
17.	Comrade Felix Ukana	Youth President	
18.	chief Sunday Akpan Uko	Family Head	S A UKO
19.	Mr Udo Mkpa Obot	Messenger	
20.	Obong Mkparawa Udo Itak Ukim	Obong Mkparawa	
21.	Kingsley Benedict Akpan	PHCN Represent.	
22.	Engineer Daniel Mkpa	PHCN Represent.	
23.	Boniface J James	Youth Member	
24.	Mr. Rowland Udoma Isang	Youth member	
25.	Mkparawa Thompson Udo Ino	Youth Vice Leader	
26.	Efiong Udia	youth member	
27.	ETEIDUNG / Hon B. I. Ekong	Village Head Ikot Ekong	
28.	OBONGANWAN ALICE RAYMOND	OBONGANWAN	
29.	MADAM SARAH UDIA	Woman leader	
30	Madam Nkosi Ebong	Women Wing	
31	Prince Julius Akpanobong (Ikpe)	Council Sect.	
32	Okon Browson		

PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....Etuim........ Date..22/11/2011..

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Attendance:

S/No	Name	Designation	Signature
1.	HRH Etoobom P.N.J. Udoh	V. Head	[signature] 08031848650
2.	Chief Joseph Jumbo (DVH)	Deputy V. Head	[signature]
3.	✓ Lawrence P. Udofia	Secretary	[signature]
4.	✓ James Brown	Family Head	[signature]
5.	✓ Akpan Sampson	Family Head	[signature]
6.	✓ Sunday Umoh	Principal Mem.	[signature]
7.	✓ Maurice Akpan Udotai	Treasurer	[signature]
8.	✓ Nkanga Okpo	Principal M	[signature]
9.	✓ Monday Sampson	P.R.O	[signature]
10.	✓ Malachy George	Principal Mem	[signature] 07038420459
11.	✓ Udo Eno Essien	Youth President	[signature]
12.	✓ Patrick Udo Umoren	~~[illegible]~~	[signature]
13.	✓ Chief Udo Akpan Eno	Principal M	[signature]
14.	✓ Pius Udosen	Principal M	[signature]
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Power Holding Company Of Nigeria Plc

Name of Village: Ikot Obio Ndoho Date: 22/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Anthony Ukpong	Chairman V/Council	[signature] 08160385414
2.	✓ Umoren Evanson	Secretary	Umoren Evanson [signature]
3.	✓ Alex D. Ikpim	Ass. Secr.	[signature]
4.	✓ Inyang Friday Ekanem	member ✓	[signature]
5.	Elder Christopher Max Akpan	✓ ✓	[signature]
6.	Mr Udo S. Ukpong	✓ ✓	[signature]
7.	Elder ISAAC Ubek	youth Leader	[signature] 08038765863
8.	Hon Akwaowo Nelson Amauwa	member V/C	[signature]
9.	Chief Paulinus T. Udo	✓ ✓	[signature]
10.	✓ Slessor J. Akpo	✓ ✓	[signature]
11.	✓ Dominic Edmond	✓ ✓	[signature]
12.	✓ David John	✓ ✓	[signature]
13.	Etidung Pius Udosen	Village Head	Not around
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Power Holding Company Of Nigeria Plc

Name of Village .... IKOT OYORO .... Date 22/11/2011

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Attendance:

S/No	Name	Designation	Signature
1.	Etiidung Sylvester A. INYANG	Village Head	08066669177
2.	Chief George E. Eduat	Family head	
3.	Chief Samuel Ekpo	-do-	Samuel
4.	Chief Donald S. Ukoette	Councillor	
5.	Chief Akpan Matthew Ndah	-do-	
6.	Chief Micheal Essiet	-do-	
7.	MR C. S. Akpan	Village Secretary	CSA for P
8.	MR CHRIS A. Ndah	Youth President	08066191399
9.	MR OKON UDO THOMAS	Youth	
10.	MR INI Akpan Jacob	Youth	
11.	MR TONY EKPO	Youth	
12.	MR Solomon Sylvester INyang	Youth	
13.	MR IBORO Akpan THOMAS	Youth Secretary	
14.	MR OWOABASI Udo George	Youth	
15.	madam Ekanem Udoebreubong	WOMEN PRESIDENT	CSA for
16.	madam ENO Sylvester INyang	Woman	Enoh
17.	UBONG UFOT UDO THOMAS	Youth.	
18.	MR Sylvanus AKPAN BEJAMIN	Youth	
19.	ENO Maurice Uko	Youth.	
20.	Godwin Udo Ekpo	Youth	G Ekpo
21.	Cletus A. Inyang	Youth	
22.	MONDAY Akpan Ekong	Youth	MAEkong
23.	MISS ImaoBong Udo THOMAS	Youth Woman leader	
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Power Holding Company Of Nigeria Plc

Name of Village: Ikot Akpaden Date: 22/11/2011.

Attendance:

Village No 08068224849

S/No	Name	Designation	Signature
1.	Akh Mfon Essien	V/Head	
2.	Chief M. U. Uko	Vice V/Head	0803581652
3.	Pro Elder Umoh Peter Umoh	PRO	080354574
4.	James S. Ekim	Secretary	0803214114
5.	Young W. Essien		
6.	Elder (Mrs) Comfort Umoh	member	
7.	Mrs Janet Ekim	member	
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Power Holding Company Of Nigeria Plc

Name of Village IKOT EKPENIN Date 22/11/2011

Attendance:

S/No	Name	Designation	Signature	
1.	CHIEF AKPAN NELSON EKPO	VILLAGE HEAD	Akon	08033262992
2.	CHIEF PETER RAMOND OBOT	DEPUTY VILLAGE HEAD	[illegible]	08063139236
3.	Emmanuel Akpan Udonna	SECRETARY	[illegible]	08188396446
4.	MR DONATUS D. AKPAN	YOUTH PRESIDENT	[illegible]	
5.	Chief Friday Udo Usen	Members	[illegible]	
6.	Chief Akpan Pius Nnah		[illegible]	
7.	Chief Okon Akpan Nelson		[illegible]	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....IKOT EKO IBON.......... Date...19-11-2011

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Attendance:

S/No	Name	Designation	Signature
1.	Efelding E.D. Nwah	VHH	[illegible] 08034403401
2.	Chief Inyang Moses Inyang	Secretary	[illegible]
3.	Deputy Prince Elijah Ikpe	Dep. Secretary	[illegible]
4.	Evg. Jameson Joseph	Treasurer	[illegible]
5.	Friday Macaulay Luke	Youth Leader	[illegible] 08162400141
6.	Obonganwa Eno E.D. Nwah	W. Leader	[illegible]
7.	Chief. Monday Noah	Councillor	[illegible]
8.	" Akpan Warri Obot	Town Cryer	[illegible]
9.	" Ufot Ufot Nwah	Councillor	[illegible]
10.	" Ikpong Daniel	"	[illegible]
11.	" Ps B. Bassey Utoh	"	[illegible]
12.	Mr Friday Christopher	"	[illegible] 0806816[illegible]
13.	~~Chief Akpan F. Uko~~	"	Absent
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Power Holding Company Of Nigeria Plc

Name of Village NDON Date 19-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Okon Udoekpo	NDON VILLAGE	O.U.U.
2.	Chief Emmanuel Danson Akpan	✓	[illegible]
3.	Chief Akpan Thompson Udoh	✓	A. T. Udoh
4.	Chief Akpan Sam Eko	✓	[illegible]
5.	Chief Smart Ekpo Nki	✓	[illegible]
6.	✓ Akpan Jack Essien	✓	A. J. Essien
7.	✓ Peter Godwin Udobia	✓ ✓	[illegible]
8.	✓ Decency Okonko		[illegible]
9.	✓ Friday Oton Etukudo		F. Oton
10.	✓ Akpan Tompeter Ufot		A. T. Ufot
11.	Jonathan A. Jonathan	✓	[illegible]
12.	Itok Akpan Usen	✓	[illegible]
13.	Jacob Akpan Bassey	—	[illegible]
14.	NSIMA Okon Udo	✓	[illegible]
15.	Bassey U. Udo Umeh	✓	[illegible]
16.	Prince Monday Jim Ukokaly	✓	[illegible]
17.	Samuel Jackson	✓	[illegible]
18.	Akpan Robinson Obot	✓	Akpan
19.	Ezekiel Ezekiel Usen	✓	[illegible]
20.	Umoren Okon Udo	—	[illegible]
21.	Ituen Efiong Okonko	✓	
22.	Emmanuel Thomas	✓	[illegible]
23.	Isaiah Nkpe Umoren	✓	[illegible]
24.	Essien Jackson	✓	
25.	Jonah Udo Abraham	✓	
26.	Akpan Ufot Simpson	✓	[illegible]
27.	Ekwere Ekwere Etuko	✓	
28.	Nathan Sunday Efefiong	✓	
29.	Udo Udo Abraham	✓	

Augustine Ukoma Youth President 07~~068327165~~

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Power Holding Company Of Nigeria Plc

Name of Village IBOTIO Date 19-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	Etidong Joseph Ufot Inah	Village Head	[signature]
2.	Chief Edim Jack Edim	Village Chairman	[signature]
3.	Chief Macaulay J. Essien	Village Secretary	MEssien
4.	Chief Jackson Aaron	member	Akpan
5.	Chief Joseph Koko Bassey	member	Bassey
6.	Chief Monday Benjamin Akpan	member	[signature]
7.	Mr Joe John Ekwere	Member	Joek
8.	Chief David Udo	member	DUdo
9.	Chief Jonath Udoessien	member	[signature]
10.	Hon Elijah Nsop	✓	[signature]
11.	Chief Nelson Usoere	✓	[signature]
12.	Chief Ufot Tom	✓	Ufot
13.	✓ Ikpe Akpan Udo		[signature]
14.	Mr Unwana Okpon	Youth President	[signature] 07039462664
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ...IKOT AKPATEK............ Date...18-11-2011.........

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Attendance:

S/No	Name	Designation	Signature
1.	ETEIDUNG: OKON IDEM MBOSO	VILLAGE HEAD	ETEIDUNG OKON IDEM MBOSOH RTD
2.	CHIEF: UDO AKPAN OBOT	FAMILY HEAD	
3.	✓ : AKPAN THOMPSON ESSIEN	FAMILY HEAD	
4.	✓ : EKOT AKPAN UDO	D. V. HEAD	
5.	✓ : UDO JIMMY AKPAN	FAMILY HEAD	
6.	✓ : EKPOH AKPAN UDO	FAMILY HEAD	
7.	✓ : EBONG JOHNSON EKPA	FAMILY HEAD	
8.	✓ : AKPAN NYA IDEM	FAMILY HEAD	
9.	✓ : CHARLIE CHARLIE EKUKUDO	FAMILY HEAD	
10.	MR: MONDAY SAMPSON IDEM	VILLAGE SECT.	
11.	BARR. NTIENSE MBOSOH	FAMILY HEAD CONCERN CITIZEN	08037083089
12.	MR. BASSEY EFFIONG OKPUDOR	✓	
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Name of Village: IKOT EBEKPO Date: 18-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	Chief Inyang James	Village Head	08037525979
2.	Chief Akpan Marcus	Dep. Village Head	Marcus
3.	Chief Ikpe Joe Ekanem		
4.	Chief U. U. Akpan	Land Adviser	
5.	~~Chief U. U. AKP~~		07064789886
6.	Chief U. U. Oton	~~Land~~ Adviser	
7.	Chief A. A. Stukumo	Land Adviser	
8.	Elder A. B. Ekanam	Adviser/Elder	
9.	Chief Collins Nathan	Family Head	
10.	Chief Ezekiel Ekpa	Family Rep.	
11.	Chief A. U. Utak	Elder	A U UTAK
12.	Chief/Inspt. A.E. Ekanem	Elder	
13.	Chief U. R. Ikokpu	Counsellor	U. R.
14.	Chief Udo Daniel	Counsellor	
15.	Mr Nelson Ekanem	Youth Solicitor	08033262817
16.	Mr Friday Ekpa	Youth Leader	08036689461
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ..... IKOT ANANG ..... Date 18-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	ETIDUNG UDO SAMPSON	~~08068287963~~	08068287963
2.	EYO EYO ETUKETE		
3.	PRINCE A.U. BASSEY		
4.	AKPAN BASSEY		
5.	FRIDAY JACKSON		FJ
6.	AKPAN GEORGE		A G.
7.	UDO DAVIS		Udo.
8.	NSE SAMPSON		
9.	SUNDAY BENSON		SB
10.	AKPAN BOB.		
11.	AKPAN FRANK		
12.	FRIDAY ETUKUDO EKPO		
13.	AKPAN PAUL		AP
14.	AKPAN MARKSON		AM
15.	JOANIE UDO AKPADAK		
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village IKOT EBIDANG Date 18-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF USEN OKON BEN	VILLAGE HEAD	08022617817
2.	APOSTLE UFOT PHENSON	PRESIDENT ADC	08034266328
3.	CHIEF AKPAN AKPAN ETUK	FAMILY HEAD	
4.	CHIEF USUA CHARLIE ITUEN	FAMILY HEAD	
5.	CHIEF EFIOK AKPAN EBONG	" "	
6.	CHIEF UDO SUNDAY INYANG	" "	
7.	CHIEF UFOT SUNDAY INIBESSIEN	" "	U.S.
8.	CHIEF UDO UDO BEN	" "	
9.	CHIEF AKPAN AKPAN JOHNSON	" "	Johnson
10.	CHIEF TIM AKPAN SUNDAY	" "	
11.	CHIEF OKON ROBSON UDOH	" "	O.R.Udoh
12.	CHIEF NYOH UFOT ABASI	" "	
13.	CHIEF UDOH ROBSON UDOEKWERE	" "	
14.	REX AKPAN UKO	VICE PRESIDENT ADC	
15.	UFOT AKPAN JOSEPH	TOWN CRIER	
16.	CHIEF FRIDAY SUNDAY UDONSEK		
17.	MR SAM UDOH SAM	Y - President	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: MKPA ETO Date: 18-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	Etteidung A. A. Inyang	Village Head	[illegible] 07061086976
2.	Hon. Donald Bob	Deputy V/H	[illegible]
3.	Chief Ekpeyo Danson	Councelor	Ekpeyo
4.	Chief Sunday Frank	"	[illegible]
5.	Chief Udofot Ben Utah	"	[illegible]
6.	Elder Etim Bob	"	Elder E-Bob
7.	Clever Lucky Ben	Youth Leader	[illegible] 08134243465
8.	Chief Ekpe Jacob	Family Head	
9.	Chief Akpan Jonah	Family Head	
10.	Sunday Harrison	P.R.O	[illegible]
11.	Akpan Etim Bob	Village Secretary	[illegible]
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village EDE - EBUK Date 17 - NOV - 2011

Attendance:

Youth members

S/No	Name	Designation	Signature
3 1.	Jimmy Okon Ikpong	V. President youth	[signature] 08022074950 ~~0802207499~~
3 2.	Ime Akpan Jimmy	Youth member	[signature]
3 3.	GODWIN ETIM WILLIE	✓ ✓	[signature]
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village EDE - EBUK Date 17-11-2011

Attendance:

S/No	Name	Designation	Signature
1.	Assam M. Assam	CHAIRMAN	[signature] 08090770836
2.	David Willie Etuk	SECRETARY	[signature]
3.	Chief Simon Udo Etuk	Village chief	[signature]
4.	Chief Kenedy Ben	Village Chief	[signature]
5.	Chief, Udo Samuel	✓ ✓	[signature]
6.	Chife Friday Phonson	✓ ✓	[signature]
7.	Chife Mondae E.	✓ ✓	[signature]
8.	DEACON ETIM WILLIE	✓ ✓	[signature]
9.	MR SAMUEL EDEM		[signature]
10.	MR AKPAN MATHEW		A.M.A
11.	MR OKON JIMMIE		O.J.E.
12.	DEACON AKPA WILLSON		[signature]
13.	Etti Okon Sunday		Asimor
14.	EMMANUEL MARK AKPAN		[signature]
15.	Eyakeno Ben Edemidepon		[signature]
16.	Afiedo Ukpong Daniel		[signature]
17.	Ubong Udoetuk Peter		[signature]
18.	FELIX MONDAE	YOUTH LEADER	[signature]
19.	VICTOR SUNDAE C.		[signature]
20.	Joseph Akpan Mathew	Youth Secretary (AS)	[signature]
21.	Friday Emmanuel Edeke	Leader	[signature]
22.	Emmanuel Ezekiel Willie	Youth member	[signature]
23.	Sameuel Akpan Amos	✓	[signature]
24.	UBONG Samuel JOHONI	✓	[signature]
25.	Afen Eno Amos	✓	[signature]
26.	GODWIN ETUKUDO	✓	[signature]
27.	JOSEPH BEN EDOHO	✓	[signature]
28.	DAVID AKPAN AMOS	✓	D.A.A.
29.	UBONG SAMUEL EDEM	✓	[signature]

PHCN
Power Holding Company Of Nigeria Plc

Name of Village ....Ekpene........ Date..17-11-2011

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Attendance:

S/No	Name 08023264289	Designation	Signature
1.	Chief Enim J. Ekanem	Village Head	
2.	Dcn. A. T. Odungide	Chairman V. Council	
3.	Eld N. S. Imuk	member	
4.	Edem R. Edem		
5.	ELDER ETUK T. ETUK	MEMBER of COUNCIL	
6.	Akaninah H. Ekott	P.R.O	
7.	JOHN D Eshiet	Treasurer	
8.	Imo Udo-Akagha	Community Member	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ...NDITIA............ Date...17-11-2011...

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Attendance:

S/No	Name	Designation	Signature
1.	CHIEF ADIAMBUK A. EBITU	VILLAGE HEAD	08080361338
2.	ELDER IKPE THOMPSON EDOHO	CHAIRMAN	Thompson 08089280662
3.	MR VICTOR NSE TUDOR	SECRETARY	07040800145
4.	MR AKANIMO S. EBITU	MEMBER	08098277370
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: ATAI NDON Date: 17/11/2011

Attendance:

S/No	Name	Designation	Signature
1.	CHIEF FRIDAY AKPAUMO	CHAIRMAN(VC)	98085620 440
2.	MKPO ENODIEN UDIA	V. CHAIRMAN	
3.	INIOBONG ETUK WILLIE	SECRETARY	
4.	CHIEF ITA HANSON	TREASURER	
5.	CHIEF ESHIET GEORGE	FAMILY HEAD	
6.	~~OKON JOHN ABAKASANGA~~	~~MEMBER~~	
7.	SUNDAY ROBERT	✓	
8.	CHIEF NTUK-A-NTUK	✓	
9.	JOSEPH EKPA NTUK	MESSENGER	
10.	AKANIMO EMMANUEL	MEMBER	08097822385
11.	JOSHUA MATHEW	YOUTH	
12.	Edoho John ABAKASANGA	REP. OLUNCHIEF FAMILY	
13.	EDOHO ABASUBONG	MEMBER	
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village ATIBE Date 17/11/2011

Attendance: H R M Edidem N I E. Odueyie Village Head - Atibe, paramount Ruler - Eket.

S/No	Name	Designation	Signature
1.	Prince U. F. Akpan	Chairman	[signature]
2.	Benhur Odueyie	Secretary	[signature] 08025325143
3.	Mr Umo E. Ekpe	Treasurer	[signature]
4.	Chief A. A. Echikere	Member	[signature]
5.	Mr. Tom Wilson		[signature]
6.	Mr. John Enoch Udo	Youth Leader	[signature]
7.	Emmanuel Wilson Udo	Assistant	[signature] 08064161169
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PHCN
Power Holding Company Of Nigeria Plc

Name of Village: IKOT AKPAN OKOP Date: 16-11-2011.

MKpat-ENIN L.G.A.

Attendance:

S/No	Name	Designation	Signature
1.	ETIDUNG OBOT AKPAN THOMPSON	VILLAGE HEAD	[signature] 08026075211
2.	CHIEF EKNERE JUMBO INOH	SECRETARY	[signature]
3.	SAMUEL UDO AKPAN	CHAIR, VILLAGE COUNCIL	[signature]
4.	CHIEF AKPAN MARKSON UDOKA	ASST. SECRETARY	[signature]
5.	CHIEF SUNDAY WILLIAM UKPE	MEMBER	[signature]
6.	CHIEF WILLIE UDO	TREASURER	[signature]
7.	CHIEF FRIDAY JAMESON SAM	MEMBER	[signature] 08058333735
8.	SUNDAY NDARAKE EKPO	YOUTH CHAIRMAN	[signature]
9.	MONDAY DOUGLAS EKPO	CHIEF SECURITY	[signature]
10.	MADAM BESSIE JONATHAN	Women Leader	BJS.
11.	EKAETE SUNDAY WILLIAM	Women Secretary	ESJ-W
12.	SUNDAY BASSEY JOHN	MEMBER	S. B. J
13.	EZEKIEL SAMBO JUMBO	Vice Youth Leader.	[signature]
14.	AMEFLOK ISAAC SAMBO	Vice Women Leader.	
15.	GIDEON JOSIAH SAM	MEMBER	GJ.
16.	PETER SYLVANUS ESHIET.	MEMBER	PS.
17.	EKPO UDO IMUK	MEMBER	[signature]
18.	AKPAN NAPOLEON	MEMBER	[signature]
19.	MADAM MARY SAMUEL EDEM	MEMBER	MSU
20.	MFON OBOT AKPAN	MEMBER	MOA
21.	ANTHONY EKPO AKPABIO	MEMBER	[signature]
22.	OBONG KUFRE UDO AKPAN	"	[signature]
23.	MR ARMSTRONG UDO UKPE	"	[signature]
24.	UDEME UDO AKPAN	"	08158240429
25.	SATURDAY RUFUS THOMPSON	"	[signature]
26.	ISAAC SAMBO.	"	[signature]
27.	MBORO EKPO UDOIMUK	"	[signature]
28.	IME OKOKOBIOKO	"	[signature]
29.	Felix Kofi.	"	Felix.

ATTENDANCE OF EBANA VILLAGE 16/11/17

S/N	Name	Signature
1	Chief E. Eshiett	Eshiett 080236802[illegible] 66
2	Inspr. Nsien Samuel Nsien	[illegible] 08084319985
3	Isaac Ndumbuk	[illegible]
4	Samuel Nelson okon	08084319676 [illegible]
5	MICHAEL OKON ESHIET YOUTH	07083734793 [illegible]
6	ESHIET S. ESHIET	08037964727 Eshiet
7.	Sunday T. Eshiet	08086783313 Sunday Eshiet
8	Okon Udo Eshiet	08038433366
9	IMOH Peter	08085613857
10	Victor Sunday Edukeo	08022819281

ATTENDANCE RSII URUA VILLAGE 16/11/11

S/N	Name	Signature
1	Chief Wilson Etop Itok	
2	Dr Okon Udo Umoetuk 08027787726	
3	Chief Columbus Daniel Okpokpo	
4	" Elliet John ~~Elliet~~ ETOP	
5	MR Anietie Ukoh- 07057996687	
6	Chief Akpan Daniel SECTARY 07080176768	
7	" Emos Samuel Isukette	
8	" ~~Okon~~ Okporonum Bassey	
9	" Ekang Johnson Ekang	
10	" Ukon Isukette	
11	" Julius John Imaikop	J. J Imaikop
12	" Samuel Sim Ukoh	
13	MR Godwin Felix	
14	MR Abraham Ernest Sambo	
15	Engr Imaikop Ekpe Peter	
16	Chief Umoetuk Ben	
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Ikot Nsung Community 15/11/11

Attendance

1) Chief Archibong James Akpe [signature]
2) Chief Sunday Imoseh Udo [signature]
3) Chief Elijah Sunday Awak [signature]
4) Ebenge Friday Henry [signature] Sect. 08083359540
5) Chief Okon Friday Ukot [signature]
6) Chief Bassey Worrie Ete [signature] Bassey Ete
7) Chief Thompson Equere [signature]
8) Bassey Friday Imaikop [signature]
9) Chief Bassey Willie [signature]
10) Mr Martin Bassey Friday M.B.F
11) David Nyoho Harrison. D.N.H.
12) Chief Ete John Ete.
13) Benjamin Bassey Udo [signature]
14) Mrs Grace Elijah [signature]
15) Mrs Cicilia Dominic [signature]
16) Mrs Arit Archibong [signature]
17) Mrs Emen Okon Mbat [signature]
18) Mrs Udeme Sunday Imoseh Udeme
19) Mrs Adiaha Monday [signature]
20) Nkoyoh Eyo [signature]
21) Mrs Adiaha Thompson [signature]
22) Chief

EDIDA EDO Village (Esit Ekop). 25/11/11

Attendance

1. Chief Johnson Assam Etidem – Village Head Edida
2. Lawrence Sunday Etukudoh – Youth President
3. Sunday Daniel Ekot. Secretary
4. Godwin Michael Hanson: P.R.O
5. Okon Monday Simon
6. Monday Akpakpa Ekong
7. Godwin Sampson Etto

15/11/11

S/N	ATTENDANCE IN AKPAMBIAT-EDO VILLAGE	Remark
1	Chief Akpan Abraham Ibok	
2	Chief Okon Tom Ekwene	
3	Chief Joshua William Edemidiong	
4	Aniefiok Okon Tom	
5	Godwin Okon Tom	
6	David Ekwere Peter	
7	~~Edikis~~ Isaiah Philip Iniese	
8	Friday Akpe Isang	
9	Monday Alfred Ben	
10	Ps Moses Solomon	
11	Okon Bassey Ntuen	
12	Ezekiel Alfred Ben	
13	Wilson ~~Ato~~ Iyang	

COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ..IKOT ABASI VILLAGE 46
LOCAL GOVERNMENT AREA:...IKOT ABASI
DATE:...16 NOV. 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Akpan Monday Okubre	M	Village Head	
2	ETEBOM FRANK UKOFIA	M	CHAIRMAN	
3	UDO BRUCE UKOEKONG	M	Vice chairman	
4	PAUL ISAAC UDODUNG	M	SECT.	
5	IMEDU NNAMSO UKPA	M	YOUTH PRESIDENT	
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COMMUNITY CONSULTATION

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NAME OF COMMUNITY/VILLAGE ..IKOT AKPAN ATA..

LOCAL GOVERNMENT AREA:..IKOT ABASI..

DATE:..16TH NOV 2011..

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Anefiok Akpan Nsoro	M	Village Head	[illegible]
2	Chief Akpan Benson Nsedu	✓	Village Chairman	A.B.N
3	Friday Udo Akpanette	✓	Village Secretary	Akpanette
4	Eyo Ufot James	✓	Youth Leader	
5	Mrs Obot Udo Exodus	✓	Women Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ...IKOT ESSIEN........... 464
LOCAL GOVERNMENT AREA:...IKOT ABASI...........
DATE:...16 NOV 2011.............

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung Ikpatsong Abraham			
2	Elder Ufot Akpan Nathaniel		Chairman Village Council	[illegible]
3	Mr. Ekwere Jimmy Udoh		Vic. Chairman Village Council	[illegible]
4	Elder Ufot Abraham Akpan		Treasurer	[illegible]
5	MR CLEMENT UDO AKPAN		FAMILY H	[illegible]
6	Mr Samuel Ekong			
7	MR UKO G. SAM		YOUTH L.	
8	MFON UDO AKPAN		WOMEN L	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ..IKOT ETETUK.......... 43

LOCAL GOVERNMENT AREA:....IKOT ABASI..........

DATE:...16 NOV. 2011..........

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Uduak Udo Tom	m	Chairman	[illegible]
2	Ufot Michael Idopika	m	Ass-Chairman	
3	Saturday Rufus	M	Secretary	
4	Ebong Udo Genesis	m	Youth presid	
5	Udo Akpan Brown	m	Ass. Presida	
6	Rose Nsese Udokpon	female	Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......ABASI UTE............ 49
LOCAL GOVERNMENT AREA:......IKOT ABASI..........
DATE:......16 NOV 2011..........

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Elder Chief Monday Eyo Usoro	M	Chairman	
2	Chief Uyai Mark Idem Udo	M	~~Act~~ Village head	
3	Mr. Aniefiok A. Abasiute	M	Secretary	
4	Pastor Isaing Udo Utere	M	Youth president	
5	Madam Alice Akpan Udom	F	Woman Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......ABIARAN...... 41
LOCAL GOVERNMENT AREA:......IKOT ABASI......
DATE:......16 NOV. 2011......

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	ETEIDUNG NYONG ETUKAFFIA	MALE	VILLAGE HEAD	
2	ELDER MONDAY FACE EKPA	MALE	CHAIRMAN	
3	MENDI AKPAN GAULLEY	MALE	SECRETARY	
4	ENOBONG EKWERE	MALE	VICE CHAIRMAN	
5	NSIKAN JIMMY UFOT	MALE	YOUTH LEADER	
6	COMFORT USEN EKONG	FEMALE	WOMAN/LEADER	[signature]
7	EKWERE A. EKWERE	MALE	EX-OFFICIO	[signature]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ..Odiono Isoutibe.. 40
LOCAL GOVERNMENT AREA:..Ikot Abasi..
DATE:....16 NOV 2011....

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	AKPAN DICK AKPAN	Male	Chairman V/C	[signature]
2	Evangelist Emmakop Ebong	✓	Secretary	[signature]
3	Chief AKPAN DAVIES AKPAN	✓	V/Chairman	Davies
4	Chief Uso Owoidem	✓	Treasurer	Owodim
5	Madam Grace AKPAN USO	female	Women leader	[signature]
6	Ukong AKPAN ESSIEN	Male	youth Leader	[signature]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....Urua Essien Etuk.... 89
LOCAL GOVERNMENT AREA:....MKPAT ABASI....
DATE:....16 Nov 2011....

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Akpan Afiah	Male	Deputy Village Head	
2	Udo Okon	✓	Youth Leader	
3	Mrs Alice Monday Ukut	Female	W/Leader	
4	Ufot Okon	Male	Secretary	
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COMMUNITY CONSULTATION

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NAME OF COMMUNITY/VILLAGE ......OKPOTO..........................

LOCAL GOVERNMENT AREA:...IKOT ABASI.............................

DATE:.......16 NOV 2011..............................

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung Clement R. Udo	Male	Village Head	
2	John Sunday Udo	✓	Chairman	
3	Eteyen Udo Sunday	✓	Youth Leader	
4	Obongawan E. Udokpo	Female	Woman Leader	
5	Udo Ukang Essien	Male	Secratary	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....ADAHA UKIM.................. 37
LOCAL GOVERNMENT AREA:....IKOT ABASI..........................
DATE:.......16 NOV 2011...............

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Udo Wilson	Male	V. Head	[illegible]
2	Michael Johnny	Male	Council C.	[illegible]
3	Nsikan Reuben Ekpo	✓	Youth Pr.	[illegible]
4	Kingsly Johny Thompson	✓	Sect.	[illegible]
5	Chief Okon Sonnest	✓	Comp. Head	[illegible]
6	Hannah Okon Ufot	Female	Women L.	UFC
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ...IKOT ETENGHE............ 36
LOCAL GOVERNMENT AREA:....IKOT ABASI..............
DATE:.......16 NOV 2011..............

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Akpan Johnson	Male	Village Head	[signature]
2	Mr Etiese U. Stong	Male	Chairman	[signature]
3	Mr Udo J. Akpan	Male	Sect.	[signature]
4	Mrs Endo A. J. Mbak	female	Women Leader	[signature]
5	Pius Davis Akpan	Male	Youth L.	[signature]
6	Chief Udo Moses Ada	Male	Comp. Head	[signature]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE: EKPUK INANG
LOCAL GOVERNMENT AREA: IKOT ABASI
DATE: 16 NOV. 2011

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COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung A. R. Umoren	M	Village Head	
2	Etiomo A. Umoren	M	Village Head Representative	Etiomo
3	Elder Udo Green	M	VC chairman	
4	Mr. Kenneth Offion	M	Sect V/C	
5	Mrs. Unwa Udowo	F	Woman leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....ESSIEN ETUK....
LOCAL GOVERNMENT AREA:....IKOT ABASI....
DATE:....16 NOV 2011....

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung C.M. IDEMUDO	Male	Village	[signature]
2	Nsikan Eli Davies	✓	Chairman	
3	Nsikan Obot Nkang	✓	Youth leader	
4	Akpan Nyaha	✓	Secretary	
5	~~Mrs Alice Monday~~ Uku	✓	~~Woman leader~~	
6	Adiaha Akpan Isong	Woman leader		
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COMMUNITY CONSULTATION

35

NAME OF COMMUNITY/VILLAGE ....IKOT AKA..........
LOCAL GOVERNMENT AREA:....MKPAT ENIN..........
DATE:.....15 NOV 2011..........

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Richard Tobby Udom	M	Village Head Elect	
2	MR. Wisdom Sunday Ekanem	M	Secr	
3	Chief Anthony Isaac Ekanem	M	Family Head	
4	✓ Akpan Emans	M	✓	
5	✓ A. J. Etukong	M	✓	
6	Elder Christopher J. Udom	M	✓	
7	Mr Udoey Titus Ekanem	M	Youth Leader	
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COMMUNITY CONSULTATION

3$\cancel{2}$

NAME OF COMMUNITY/VILLAGE: IKOT EKPANG

LOCAL GOVERNMENT AREA: MKPAT ENIN

DATE: 15 NOV 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Edo Akpan Williamson		Village Head	Dep. Edh
2	UWA OKOKO AKPAIKot		villiay dep	
3	DME Edward InoH		secretry	
4	Ndamso willson udo		youth chairm	
5	Elder EYOH Judge		Speaker	[illegible]
6	Ruben peter Ekpoh		Fin. chair	[illegible]
7	Catherine James		Woman Leader	
8	chief - S.S. AkpAbio		Councillor	[illegible] 15/11/2011
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3 1

COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ONIOK EDO

LOCAL GOVERNMENT AREA: ESIT EKET

DATE: 15-11-2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Elder Abia Johny Abia	M	President of the Community	[illegible]
2	Elder Okon Thompson Etokhet	M	Secretary V/council	
3	Michael Davis Inim	M	Youth leader	
4	Adiaha Evans Equere	F	Women leader	
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COMMUNITY CONSULTATION

30

NAME OF COMMUNITY/VILLAGE ...EDIDA EDO...
LOCAL GOVERNMENT AREA:...ESIT EKET...
DATE:...15TH NOV 2011...

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Johnson Assam Eledem	m	Village Head	
2	Mr. Sunday Daniel Ikot	m	V/c Sect	
3	Mr Friday Sunday Etukudo	m	Youth Leader	
4	Mrs Grace Bassey Ekpo	F	Woman Leader	
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COMMUNITY CONSULTATION

29

NAME OF COMMUNITY/VILLAGE ...AKPAMBIET EDO...
LOCAL GOVERNMENT AREA:...ESIT EKET...
DATE:...15TH NOV. 2011...

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Akpan A. Ibok	Male	V/Head	
2	Chief Okon Tom Ekwere	,,	V/Head	
3	Chief Joshua W. Edemidiong	,,	V/Head	
4	Elder Monday Alfred Ben	,,	F/Head	
5	Elder Friday Akpan Isang	,,	F/Head	
6	Godwin Okon Tom	,,	Youth Leader	
7	Pastor Moses Solomon	,,		
8	Ubong Okon Tom	,,	Youth Member	
9	David Akpan Peter	,,	✓	
10	Ezekiel Alfred Ben	,,	✓	
11	Mrs Helen Akpan Akpan	F	Women Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE: IKOT AKPAN OKOP 28
LOCAL GOVERNMENT AREA: MKPAT ~~ABAK~~ ENIN
DATE: 15 NOV 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	ETE IDUN OBOT AKPAN	M	VILLAGE H.	
2	CHIEF AKPAN UDOAKA	M	Asst. Sc.	
3	CHIEF EKWERE JOMBO	M	VILLAGE Sc.	
4	MR. SATURDAY RUFUS	M	YOUTH P.	
5	Mr. Akpabio Napoleon Etuk	M	Youth member	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......ETE VILLAGE.......... 27

LOCAL GOVERNMENT AREA:.....IKOT ABASI..........

DATE:......14 NOV 2011..........

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung Maurice Udo-Mbat	M	Village Head	Mbat
2	Mr. Nsikan Ebenezar Uko	M	Chairman	
3	Mr Asuquo Inyang Etukakpan	M	Secretary	
4	Mr Anthony Monday Moses	M	Youth president	
5	Mrs. Ekaete N. Ebenezar	F	Women Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....UBENEKE II.............
LOCAL GOVERNMENT AREA:....IKOT ABASI..............
DATE:....14 NOV. 2011............

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung Paul Etukataha	M	Village Head	
2	chief Mfon Akpan Utiang	M	Chairman	
3	Mr. Nsemo Akpan Essiet	M	Secretary	
4	Mr. Sunday Udo Jim	M	Youth President	
5	Mrs Mercy Clement Idemudo	F	Woman Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....UBGNEKE 1........
LOCAL GOVERNMENT AREA:....IKOT ABASI........
DATE:....14 NOV 2011........

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Nsikan Etuk Udom	M	Village Head	
2	Chief Enyinnkang Etukudyan	M	Chairman	
3	Chief Jonah Hankenson Udom	M	Secretary	[illegible]
4	Evang. Ekemini Udo Ekpo	M	Youth Leader	
5	Mrs Comfort Emem Job	F	Women Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......OBIOKAMA......

LOCAL GOVERNMENT AREA:..IKOT ABASI......

DATE:.....14 NOV 2011.......

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	ETEIDUNG A. O. EKPE	M	VILLAGE HEAD	[signature]
2	Akpan Sunday Udo	M	Village Chairman	
3	Ekwerre Andrew	M	Village Sect.	
4	Madam Unwa Inyang Etuk Akpan	F	Woman Leader	
5	Mrs Mary A. O. Ekpe	F	Asst Woman Leader	
6	Nsikan Friday	M	Youth Leader	
7	Nseyo Akpabio	M	Asst. Youth Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE: IMAN EKABOM I & II

LOCAL GOVERNMENT AREA: IKOT ABASI

DATE: 14 NOV. 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Friday Atat	m	Villagehead	[signature]
2	Chief Udo Dick Eno	"	f/Head	for U
3	" S. I. Udosen	"	"	[signature]
4	" Akpan Joseph Esu	"	"	[signature]
5	" James Etuk Ubak	"	"	[signature]
6	" F. A. UmoEtuk	"	"	[signature]
7	" Akpan Dick	"	Ch. Village Council	[signature]
8	" Ufot Jimmy	"	"	Ufot Jim
9	" Akpan Udo Ubak	"	Member	[signature]
10	" Ufot Sam	"	"	[signature]
11	" Ufot John Ufot	"	"	[signature]
12	Mr. Udo Samuel	"		[signature]
13	" Udo Sambo	"		[signature]
14	" Akai ~~Simon~~ Etuk Udo	"		A. E. Udo
15	" Udo Atat	"		[signature]
16	" Ime Henshaw	"		IH.UJO
17	" Ikpe S. Udo	"		[signature]
18	" Idongesit S. Udo	"		[signature]
19	" Anthony Godwin	"		[signature]

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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE IKOT UMIANG OKON
LOCAL GOVERNMENT AREA: IKOT ABASI
DATE: 14 NOV 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief. Ufot Sampson Ufot	Male	Village Head.	[signature]
2	Chief. Udo Essien Udoh	M	Council Chairman	
3	Elder. Edwin Jacob Ekene	M	Secretary	[signature]
4	Comrade. NSeobong Wilson	M	Assist Secretary	[signature]
5	Comrade. Etebom Akpan Jacob	M	Vice Youth Chairman	[signature]
6	MR. Idongesit Akpan Essien	M		[signature]
7	Madam. Alice Udo Jack	Female	Women Leader	[signature]
8	MRS. NSe Enobong Ndah	F	Secretary	NNdoh
9	MR. Akpan Tom Udo	M		[signature]
10	MR. Uduak Akpan Ezekiel	M		[signature]
11	MR. Otto Ufot Sampson	M		[signature]
12	Chief. A. W. Essien	M	Adviser	[signature]
13	Engr. Sampson Ufot	M	Vc Chairman	[signature]
14	MRS. Cathrine Friday A. Udo	F		[signature]
15	MR. Akpan Etuk Umoekwere	M		[signature]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....IKOT AIAHA....
LOCAL GOVERNMENT AREA:....IKOT ABASI....
DATE:....14/11/2011....

2

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung Akpan A. Ntia	M	Village Head	[illegible]
2	Mr. Ediomo Umoh	M	Chairman	
3	Mr. Idongesit Umoh	M	Youth-Chairman	
4	" Aniekan A. Jack	M	Secretary	
5	Madam, Akpan Jack	F	Women Leader	
6	Mr. Udo Nnah Ufot	M	Y/Sect.	
7	Mr. Udo Jim Ntia	M	Ekpuk Head	
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COMMUNITY CONSULTATION

20

NAME OF COMMUNITY/VILLAGE ....IKWA....................................

LOCAL GOVERNMENT AREA:...IKOT ABASI...................................

DATE:....14/11/2011.........................

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief AKPAN JACK EKPE	M	Village Head	A. J. Ekpe
2	Chief Akpan Daniel Udo Ekpo	M	Chairman V/Council	
3	Christopher Jackson Iquoho	M	Youth Leader	
4	Anwanwa Udo Ekpo	F.	Women Leader	
5	Akpan Sunday Ekerete	M.	Secretary V/Council	
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COMMUNITY CONSULTATION

#9

NAME OF COMMUNITY/VILLAGE ...IKOT ABA...

LOCAL GOVERNMENT AREA:...MKPAT ENIN...

DATE:...14 NOV. 2011...

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Etidong M. S. Akpan		V/Head	[illegible]
2	Elder Akpan Hanson Itong		Secretary	[illegible]
3	Deputy V/H. Chief E. Nkantan		Deputy V/H	
4	Afon Ime Udofot Udo		Youth L.	
5	Anthony Dick Akpan		Chairman	[illegible]
6	Cici Titus Udoma		W/Leader	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE: IKOT OBIO NDOHO
LOCAL GOVERNMENT AREA: MKPAT ENIN
DATE: 14 — 11 — 2011

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Anthony Ukpong	male	V/C Chairman	[signature]
2	Chief Umoren Evanson	✓	V/C Secratary	[signature]
3	Elder C. Mex	✓	members	[signature]
4	Chief Inyang Friday Ekam	✓	✓	[signature]
5	Noah Eberete Emmanson	✓		[signature]
6	Isaac Ubak.	✓	Youth President	
7	Ugwa Gilbert Aomannman	female	W/ Leader	
8	Akwa Owo Amaunam	male		
9	Hon Ini Borown	✓		
10	Chief Pius Udosen	✓	Village Head	
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE: IKOT EKONG GROUP OF VILLAGES
LOCAL GOVERNMENT AREA: MKPAT ENIN
DATE: 12-11-2011

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COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung(wo) Raymond Udia (Rtd)	M	Village Head	[signature]
2	Chief (Hon) Bassey I. Ekong	M	Ikot Umo Ekong Village Head Elect	[signature]
3	Chief Paul D. Ekpoffiong	M	Odoroinyang Village Head Elect	[signature]
4	Chief Insoh Jones Ikpe	M	Reps. Ikpe Nnah	[signature]
5	Chief Alfonsus Ukana Udo	M	Reps. Udoinyangofia	[signature]
6	Chief Basil Benson Akpanobong	M	Reps. Adiaisese	[signature]
7	Chief Sunday Iyip Esiet	M	Reps. Esiet Ikot [illegible]	[signature]
8	Chief Mfagha Idem Etuk	M	Reps Ekong Nkan	[signature]
9	Bishop Cletus Udo Udia	M	member	[signature]
10	Chief Ukana Nyong Ikpe	M	member	[signature]
11	Rev. Chief Akpan Monday Udo	M	Reps Ekpantuk	[signature]
12	Pst Ishmail Akpan	M	Members	[signature]
13	Udo Mkpa Obot	M	Town Crier	[signature]
14	Prince Julius Akpanobong	M	Secretary	[signature]
15	Chief Jackson Udo Ekadong	M	family Head	Jackson
16	Chief Jashua Ekot E.	M	family Head	[signature]
17	Chief Francis Nna Idem	M	family Head	F. Idem
18	Chief Gabriel Peter Akpan	M	family Head	G. Akpan
19	Chief Sunday Ukana	M	family Head	[signature]

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: IKOT EDOR

LOCAL GOVT. AREA: ONNA LGA

DATE: 31st OCT. 2011

S/N	NAME	POSITION	SIGNATURE
1	HIS EMINENCE		
	AKINA EDIDEM (DR)		
	AKPABIO UDO UKPA		
	JP/FCE OKUK IBOM		
	IBIBIO III PARAMOUNT		A. Ukpa
	RULER ONNA LGA		
2	Moses Akpan Andrew	Cordinator	[signature]

COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......NDON......
LOCAL GOVERNMENT AREA:...MKPAT ENIN......
DATE:......12-11-2011......

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Ch. O. U. Ekpo	M	V. Head	O. U. Ekpo
2	Ch. Eko Sam Eko	M	F. Head	Eko
3	Ch. A. Thompson	M	F. Head	[illegible]
4	Ch. Peter G. Udobia	M	F. Head	[illegible]
5	" Akpan Robinson Otosi	M	" "	Akotot
6	Chief Emmanuel Danson Akpan	M	Family Head	[illegible]
7	Ch. Akpan Thompeter	M	F. Head	A. T. Peter
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ......Ibotio......

LOCAL GOVERNMENT AREA:......Mkpat Enin......

DATE:......12-11-2011......

14

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	ETEIDUNG J. U IMOH	M	VILLAGE HEAD	[signature]
2	EDEM JACK EDEM		VILLAGE CHIEF	
3	M. J. ESSIEN		SECRETARY	
4	IMOH JOSEPH UFOT		Family HEAD	Imoh J. Ufot
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....EKIM.................................. 13

LOCAL GOVERNMENT AREA:....MKPAT ENIN.................................

DATE:........12 NOV. 2011....................

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	HH Obong P. N. J. Udoh	M	C/Head	[illegible]
2	Chief (Hon) A. J. Usen	M	V/Head (elect) Ikwen Ikpe	[illegible]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ..IKOT OYORO.......... 12
LOCAL GOVERNMENT AREA:...MKPAT ENIN.........
DATE:.....12 NOV 2011.....

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Etteidung Sylvester Inyang		Village head	[illegible]
2	CYRIL S. AKPAN	m	Village Secretary	[illegible]
3	Chief Donald S. Ukoette	m	Council member	[illegible]
4	Akpan N. Ndah	m	council member	[illegible]
5	CRETUS A. INYANG	M	MEMBER IN COUNCIL	[illegible]
6	CHRISTOPHER A. NDAH	m	YOUTH LEADER	[illegible]
7	SOLOMON SYLVESTER INYANG	m	Youth	[illegible]
8	PAUL AKPAN INYANG	m	Youth	[illegible]
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COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ...IKOT ENIN...
LOCAL GOVERNMENT AREA:...MKPAT ENIN...
DATE:...12 NOV. 2011...

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Eteidung AKPAN NELSON EKPO	M	Village Head	AKpan
2	Mr Emmanuel A. Udoma	M	Sect	
3	Mr Pius Akpan Nnah	M	Chairman	
4	Mrs Clara Davis Usen	F	Woman Leader	
5	Mr Donatus Donald Akpan	M	Youth Leader	
6	Mrs Molly Okon Akpan	F	Comm Member	[signature]
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ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: AFAHA EKET

LOCAL GOVT. AREA: EKET

DATE: 18 – 10 – 2011

S/N	NAME	POSITION	SIGNATURE
1	HRM ~~ENIDEM~~ N.J. E. ODUENYIE JP, Ansf	PARAMOUNT RULER	
2	CHIEF ETINYANG J. UDOFA JP	VILLAGE HEAD/ ADMIN SECRETARY	
3	CHIEF ENIM J. EKANEM	VILLAGE HEAD EKPENE AFAHA EKET	
4	CHIEF/ENGR JOE MARK EDOHO	VILLAGE HEAD ATAINIDON AFAHA EKET	
5	CHIEF ADIAMBUK EBITU	VILLAGE HEAD NDITIA	
6	EMMANUEL SUNDAY SAKI	YOUTH LEADER ATAINIDON AFAHA EKET	
7	STANLEY CHARLIE UDOKA	YOUTH LEADER EKPENE AFAHA EKET	
8	EMMANUEL UDOH WILSON	YOUTH LEADER ATIBE AFAHA EKET	
9	OBONGAWAN MFON SUNNY UKUT	WOMAN LEADER	
10	OBONGAWAN IME PATRICK EDOHO	WOMAN LEADER	
11	EUNICE EMMANUEL EKPO	L.G.A ~~REP~~	

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: IKOT EKO IBON 9

LOCAL GOVT. AREA: ONNA

DATE: 18TH OCT. 2011

S/N	NAME	POSITION	SIGNATURE
1	Eteidung (Hon.) Emem Daniel Nwa II	Village Head	[signature]
2.	Mr. Inyang Moses Inyang	Council Sect	
3.	Akpan Isaiah Udo	Youth leader	
4.	Obongawan Eno Emem Daniel	Woman Leader	[signature]
5.	chief Akpan Friday	Family Head	
6.	✓ Ufot Noah	✓ ✓	
7.	✓ Monday Noah	✓ ✓	
8.	✓ Hezekiah Ebito	✓ ✓	
9.	✓ Akpan Charity Union	✓ ✓	
10.	✓ J. M. Essien (JP)	✓ ✓	
11.	Chief Akpan Warrie Udo	Town Crier	[signature]
12	chief Innocent J. Josiah	Family Head	

ATTENDANCE DURING COMMUNITY CONSULTATION

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NAME OF COMMUNITY: MKPA ETO

LOCAL GOVT. AREA: ONNA

DATE: 18TH OCT. 2011

S/N	NAME	POSITION	SIGNATURE
1	Eteidung Akpan A. Inyang	Village Hd.	[illegible]
2	Elder Etim Bob Essien	Deputy V/Hd	EL EB Essien
3	Mr. Udo Inyang Akpan	V/councillor	[illegible]
4	Obonganwan Esther Inyang	Women Leader	
5	Hon Chief Donald Bob	Family Hd	
6	Ekpo Jacob Akpan	✓ ✓	
7	Akpan Jonah Akpan	✓ ✓	
8	Eleven Lucky Bon	Youth Leader	

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ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: IKOT ANDANG

LOCAL GOVT. AREA: ORUNA

DATE: 18TH OCT 2011

S/N	NAME	POSITION	SIGNATURE
1	ETIDUNG UDO Sampson	Village head	[signature]
2	Eyo Ejo Etuk Eli	V/C Sect	[signature]
3	Akpan George.	V/C member	[signature]
4	Friday JACKSON	F/Head	
5	Akam Joseph Udo	Youth Leader	
6	Akpan Maxson	Family Head	
7	Akpan Frank	✓	
8	Akpan Charie Solomon	✓	
9	Udo Essien Bully	✓	
10	Akpan Paul	F/Head	
11	Sunday Benson	✓	
12	AKpan BoB	V/C member	
13	Udo Davis	✓	
14	Akpan Udo Bassey	✓	
15	Friday Udo Ekpo	✓	
16	Akpan Bassey	✓	
17.	Nse Sampson Umoh.	✓	
18.	Grace Udo Sampson	Women Leader	
19	Elder Godwin E. Eyo	[signature]	
20	Monday Udo Sampson	[signature]	
21	King Udo Sampson	—	
22	Monday Akpan Willie	—	[signature]
22	Ime Udo Sampson	—	[signature]
23	William Bassey Udo		[signature]
24	Mummy OBOT		
24	Akpan Eyot Akpabio		
23	Nse A. Etie Peter		
24	Asuo Akpam Edim		

6

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: IKOT EBIDANG

LOCAL GOVT. AREA: ONNA

DATE: 18TH OCT. 2011

S/N	NAME	POSITION	SIGNATURE
1	EGEDUNG, OKON BEN	V/Head	
2	PRINCE, USEN OKON BEN	V/Rep V/Head	[illegible]
3	BISHOP, REX A. UKO	A.D.C/VICE [illegible]	[illegible]
4	MARIA OKON BEN	Princess	
5	APOST. UFOT A. PHENSON	C/Advisory Comm.	
6	CHIEF, EFIOK A. EBONG	Family Head	[illegible]
7	CHIEF, UFOT S. INOESSEN	✓ ✓	
8	CHIEF, AKPAN, A. JOHNSON	✓ ✓	
9	CHIEF, TIM AKPAN SUNDAY	✓ ✓	
10	CHIEF, UDO SMITH AKPAN	✓ ✓	
11	CHIEF, UDO S. INYANG	✓ ✓	
12	CHIEF, UDO UDO BEN	F/Head	
13	CHIEF, UDO R. UDOEKWERE	✓	
14	CHIEF, NYONG UFOT EKAM	✓	
15	CHIEF, USUA CHARLE ITUEN	✓	
16	CHIEF, UDO SAMUEL UFOT	✓	
17	CHIEF, AKPAN A. ETUK	F/Head	
18	CHIEF FRIDAY S. UDOINSEK	F/Head	
19	CHIEF, OKON ROBSON	F/Head	
20	GLORY ITA BEN	Woman Leader	
21	PRINCE, IMOH IMOH AKPAN	Youth Vice President	
22	MARGARET IMOH AKPAN	Woman Leader	
23	PRINCE, VICTOR UMANAH	Youth Rep	

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: IKOT AKPATEK

LOCAL GOVT. AREA: ONNA

DATE: 18/10/11

S/N	NAME	POSITION	SIGNATURE
1	ETEIDUNG: OKON IDEM MBOSOH	V/HEAD	
2	CHIEF: UDO AKPAN OBOT	F/HEAD	
3	Mr. Monday Sampson Idem	V/SECRETARY	Sampson
4	Mr. Akpan Robert Ituen	Akpan	Akpan
5	Mr. Ernest Udo Ndem	Y/President	
6	Chief: Akpan Thomson Essien	F/head	
7	✓ Ekpo Akpan Udo Ituen	F/head	
8	✓ Ekpo Solomon Ekpo	F/head	
9	✓ Ebong Johnson Ekpah	F/head	
10	✓ Charlie Charlie	F/head	
11	✓ Udo Jimmy Akpan Udo	F/head	
12	Udo Nda Ufot	F/head	
13	Akpan Nya Idem	F/head	
14	Madam: Eno Okon Idem	W/Leader	[illegible]
15	Chief: Akpan Warrie Ufot	S/ass. Seck	

4

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: EBANNA

LOCAL GOVT. AREA: EKET

DATE: 17 – 10 – 2011

S/N	NAME	POSITION	SIGNATURE
1	CHIEF EMMANUEL ESHIETT (3)	VILLAGE HEAD	ESEshiet
2	INSPR. NSIEN SAMUEL NSIEN (Rtd)	V/C. CHAIRMAN	[illegible]
3	Mr. EKANIM JAMES Odoro	Secretary	
(4)	Hanson Thomas Eshiet	Youth Leader	
(5)	Rose William	women Leader	
(6)	Mr. Emmanuel Ndembuk		
(7)	Mr. Monday Henry		
(8)	Mr. Monday Tommy Nsien		
(9)	Mr. Peter Okon		

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: EDE OBUK

LOCAL GOVT. AREA: EKET

DATE: 17 – 10 – 2011

S/N	NAME	POSITION	SIGNATURE
1	Chief Simon Udo Etuk	Family Head	[illegible]
2	Assam M. Assam	Chairman	[illegible]
3	Deacon Etim N. Etuk	Chairman NIPP	[illegible]
4	Eyakeno Ben Edemikpong	Adviser	E.Ben
5.	David Wilfie Etuk	Secretary	[illegible]
6.	Deacon Etakero Jimmy	Youth President	
7.	Grace Jimmy Assam	Woman Leader	
8.	Chief Udo Samuel Assam	Family Head	
9	Chief Kennedy Ben Edoha	✓ ✓	
10	Chief Friday Phonson Akpan	✓ ✓	
11	Chief Monday Elijah Akpan	✓ ✓	
12	Chief Etti Wilson Mbre	✓ ✓	
13.	Chief Samuel Jimmy Edem	✓ ✓	
14.	Chief Okon Sunday Imose	✓ ✓	
15	Chief Benjamin Udo	✓ ✓	
16.	Chief Sunday Phonson	✓ ✓	
17.	Chief Udo Nelson Udo	✓ ✓	
18.	Chief Barrister E.J. Etukudo	✓ ✓	
19	Chief Barrister N.B. Edemukpong	✓ ✓	
20	Chief Assam Jimmy Assam	✓ ✓	
21	Chief Elder Udo Sam	✓ ✓	

ATTENDANCE DURING COMMUNITY CONSULTATION

NAME OF COMMUNITY: ESIT URUA

LOCAL GOVT. AREA: EKET

DATE: 17-10-2011

S/N	NAME	POSITION	SIGNATURE
1	CHIEF WILSON ETOP ITOK	V/H	N Etop
2	AKPAN DANIEL UMOETUK	REP. FAMILY/H Nung Umoetuk	[signature]
3	Chief Ekang Johnson Ekang	V/C Sect.	
4	Anietie Uko	Y/Preside	
5	Roseline Bukette Daniel	Women leader	
6	Columbus Daniel Okpokpok	V/C C/man	
7	Chief Barney Eka	F/Head.	
8	Chief Marshall Tobby Inyang	F/Head	
9	Chief Friday Peter Bassey	" "	
10	Chief Amos Samuel Bukette	F/H.	
11	Michael Willson Etop.		[signature]
12	Victor Willson Etop.		WVE

COMMUNITY CONSULTATION

NAME OF COMMUNITY/VILLAGE ....MKPANAK....

LOCAL GOVERNMENT AREA:.......IBENO......

DATE:......10 – 08 – 2011....

COMMUNITY REPRESENTATIVE(S)

S/N	NAME	SEX	POSITION	SIGNATURE
1	Chief Edmund. N. Okon	mel	Chairman	[illegible]
2	" Ben Akpanyong	"	Member	BEN
3	Chief Nyong William	"	Member	[illegible]
4	" Ahoa Udoh Akwa	"	"	[illegible]
5	" Rt. Hon. NKPOUTO ESSIEN	"	Member	[illegible]
6	" Enyina EHE	"	"	[illegible]
7	Chief M. E. Idioh			[illegible]
8	CHIEF ASUAUO OKON	"	MEMBER	[illegible]
9	Daniel Effiong	M	Youth leader	
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

APPENDIX 4.6

SOCIO-ECONOMIC SURVEY TOOLS

APPENDIX 1

QIT – IKOT ABASI PHCN TL PROJECT

SOCIO –ECONOMIC/ HEALTH IMPACT ASSESSMENT STUDY

IN-DEPTH INTERVIEW SCHEDULE FOR KEY INFORMANTS

– LOCAL STAKEHOLDERS

QUESTIONNAIRE NO _________________
NAME OF COMMUNITY: ___________________ L.G.A _____________________
DATE OF INTERVIEW: ____________NAME OF INTERVIEWER: _____________

1. a) Household Information

Position	House Hold size W/C/D	Sex (M/F)	Age	Marital status	Highest Educational Standard Obtained	Occupation	Ethnicity	Other skills/trades	No. of years living in the area	Migrants Present (P) Absent (A)	If (A) Where are they?	Why are they there?

***W/C/D = No. of wives, Children, Other Dependants**

2. Community Information

(a) Composition of the community: How would you describe this community in terms of the proportion of the population by sex, age, religion, social status, migrant status and ethnic background?

Characteristics Proportion **Proportion** **Characteristics**

	none	¼	½	¾	All		none	¼	½	¾	all
Age: Adults						Children/Youth					
Religion: Christian						Muslim					
Indigenes						Migrants					
Status: Better-off						Poor					
Gender: Male						Female					
Majority ethnic Group(________)						Minority ethnic Group					

* Indicate here if there is a proportion of the population that are traditional worshippers.

(b) Name the major traditional gods of your community and shrines locations……………………….

(c) Name the major cultural festivals in your community and period of observance…………………

(d) Name the cultural sites of importance in your community………………………………………

(e) In the last 12 months, has there been any disturbance/destruction to nos. b c,d, above?..............

3. Intra and Inter Ethnic Relations

a) Mention any **recent conflict** within the community! Who were those involved?; what was the **cause** of the conflict and how was it **resolved?**___________________________________

b) Mention any **recent conflict** between members of this community and outsiders! Who were **involved**, what was the cause of the conflict and how was it **resolved?** __________________

4. Economic Scenario

a) Household Income per month

Income sources	Last 12 months	Presently	Reasons for Change
Paid Employment			
Agriculture			
Trade on household provisions			
Trade on fish produce			
Pensions			
Rent of housing/return			
Rent of fishing boats			
Cyclist			
Boat building/repairs			
Boat transportation			
Sales of fishing equipments			
Artisan (carpentry, mason, etc)			
Handicraft (pottery, weaving, tailoring)			
Processing (garri, local gin, fufu, etc)			
Collection of forest products (fruits, vegetables, firewood etc)			
Collection of sea products (periwinkle, crayfish etc)			
Other income sources (specify)			

b) Household Expenditure per Month

Items	Last 12 months	Presently	Reasons for Change
Food			
Clothing			
Fuel			
Education			
Health			
Others (specify)			

c) Household Structure and assets

	Yes	No		Yes	No
House (Block/ corrugated iron, hut etc			Stove		
Fan			Boat		
Generator			Fridge		
Motorcycle					
Bicycle					

d) Household Resources Use

	Yes	No		Yes	No
Fuel wood			Electricity		
Charcoal			Solar Power/Panel		
Kerosene stove			Generator		
Gas Cooker			Medicinal plants and crafts		
Water			Others (specify)		
Stream					
Borehole					
Earthen well/ dug pit					
River					

e) Household Agricultural production

A Crops	B Grown yearly		C Grown last year		D Crop rotation		E Crop yield Good/Mediocre/Poor			Returns last year				Returns compared to previous years		Estimate of Income received if crop sold
										Sold		Bartered				
	Y	N	Y	N	Y	N	G	M	P	Y	N	Y	N	Better	Worse	
Maize																
Cassava																
Pumkin																
Others (Specify)																

f) List 2 most important income-generating activities in this community ___________________ ____ ______

g) How much do you save monthly? ______ No savings; ___less than ₦ 1,000; __________ less than ₦ 5,000________ less than ₦ 10,000 _______ more than ₦10,000________

h) Have there been any changes in items (**f) and (g)** in the last two months?__________

Specify____

h) Have you ever received any loan/ credit for your business expansion? _______ Specify ____

5. Infrastructure /Health

a) Which of the following types of houses is common in this community (Enumerator to note)?: mud and wattle thatch; _____ mud and wattle zinc; _____Earth block/Thatch; ______Earth Block/Zinc; ____ Cement Block/Zinc; ______Cement Block/Asbestos; _________Timber Wall/Thatch; ___________ Timber Wall/Zinc; ____

b) From which of the following sources is your water supply? Rain, ____ River____ Stored run-off; _______ pipe borne; _______ borehole; __________ well etc, _______

c) How is water from each of these sources treated before use?_________

d) How is solid waste disposed off?: Burning; _______ Burying; _____ Dumping; _____Throwing in running/stagnant water______________

e) How is human waste disposed off? Pit latrine; ___ defecation into water channels _____ defecation into surrounding bushes; _____ pail systems; ____ pit toilet; _________ VIP-ventilate latrines: ____ Any other (specify) ___________________

f) What are the common diseases and pests found in this community (especially in the last 3 months)______________________________________

g) Specify any form of disease or pest that is found only in this community and not in neighboring ones. ___________________________

h) Why are the above diseases common in your locality? ______________

i) What has been done by the village or Govt. to reduce the presence of above mentioned diseases and pests? ______________________________

i) Where do people suffering from various disease normally go for cure?:

Churches ____Native doctors ___Dispensary/Health centre/Hospital:__

6. **Standard Of Living**

a) What category of people are more common in your community? _____________ Landlords;______________ _tenants _________________

b) Do you consider most dwelling houses adequate in size for each household?

Yes; ____ No. ________

c) What proportion of houses/households you have visited/known would you consider as having modern facilities/conveniences (e.g. cars, TV. Fan, motorcycle etc): none; ______

¼; _____½;______¾; ______ all ______

d) What fraction of your income (e.g. ½; 1/3 ; ¾ etc.) do you spend on the following?

Food;_____ clothing; _______ education;______ health care;_____ housing _____

transportation; _____ etc (specify) ________

e) What proportion of this community would you consider to be poor (e.g. ½; 1/3; etc)___________________

f) What do you think are the reasons for poverty in this community?____

g) What do you think is the proportion of functionally educated (can read and write) people in this community (e.g. ½; ¼ etc) _______________

h) What would you say is the proportion of jobless people in this community? (e.g. ½; ¾ etc)____

i) Which of the following 3 groups have the highest proportion of jobless people in this community? The uneducated; ____the partially educated (Primary and Secondary education);______the well educated (more than secondary education)__________________

j) List 3 frequently eaten food items in order of importance (1)______(2)_______(3)______

7. **Community Organization/ Assistance**

a) List the common groups and organizations found in this community._______________

b) Which are the 2 most important groups? ______________________________

c) Mention any project that has been undertaken by any of the mentioned groups in the community

d) Has the government or any other organization embarked on activity to help reduce environmental problems in your community? Yes; _______ No;_____________

e) If yes what type of development programmes; Which organization; and what has been the impact?____

9 Community Perceptions

a) How far from human habitation are any PHCN installations in your community?____

b) Did they come to your community to discuss with you what they were planning to do?____

c) Do PHCN officials ever come to discuss their activities with your community? Yes, regularly; __________ Yes, occasionally; ________ no, not at all ________ if yes, what do they discuss? ____

d) Do they ever discuss your problem with you or consult you before they site their installations?
____

f) How would you characterize the relationship between the PHCN and your community? Very good; _______ fair; ____ poor;______ hostile; ___what is the reason for the "chosen" relationship? _______________________________________

g) Has any of your communal lands been taken over by the PHCN? Yes; ____No; ______ If yes, what proportion of your land has taken over? Over ½; _____ ¼ - ½; _____
over ¼; _____ a very small size; ____

h) Have there been cases of electricity related problems in this community? Yes; ___ No;______ I don't know;_______

i) If Yes, give details about the latest problem _________________________-
____

Thank you for your assistance and God bless you!

APPENDIX 2

QIT – IKOT ABASI PHCN TL PROJECT

SOCIO –ECONOMIC/ HEALTH IMPACT ASSESSMENT STUDY

FOCUS/ GENERAL GROUP DISCUSSION GUIDE

Name of Community__________________ LGA:_____________________
Type of Group:____________ Male:___________ Female:_____________

List of Participants (b/w 8 – 10)

1	2
3.	4.
5.	6.
7.	8
9.	10.

Name of Moderator __________Name of Note taker _________Date_________

A. Community Characteristics

1. Composition of the community: How would you describe this community in terms of the proportion of the population by sex, age, religion, social status, migrant status and ethnic background? (use the table to record responses.)

Characteristics Proportion Characteristics Proportion

	none	¼	½	¾	All		none	¼	½	¾	all
Age: Adults						Children/Youth					
Religion: Christian						Muslim					
Indigenes						Migrants					
Status: Better-off						Poor					
Gender: Male						Female					
Majority ethnic Group(_______)						Minority ethnic Group					

Record the consensus of opinion not the responses of one person.
* Indicate here if there is a proportion of the population that are traditional worshippers.

2. How would you rate the level of infrastructural development in this community?
High __________ average _________ very low ___________

Use the table below to indicate the type of facilities available and their condition:

Type of facility	Tick if present	Tick if functioning	Condition: Good/ poor	Any plan to Improve.
Access road				
Public transportation				
Local market				
Primary school				
Secondary school				
Dispensary/maternity				
Electricity				
Stable water supply				
Others:				

Record the consensus of opinion not the responses of one person.
* Indicate here if there is any plan by community or outside agency to improve the facility.

4. List the common social groups in this community:

5. A). How is the general health status of people in this community? Good;________ Just fair; ________ poor ________
   B) What are the common diseases affecting people here?
   C) Are there any reasons for particular health problems here?.

6. A). How would you characterize this community in terms of cooperation and harmony? Do people work together or are there cases of fighting between social groups within the community? What are the likely causes of such conflict, if they occur?
   B). In the case of conflict between groups within the community, how are such problems resolved?
   D) Have there been any recent cases of conflict with groups outside the community? Yes; ___ No; _____ if yes, what were the causes?
   E). How have such conflicts with outside groups been resolved?

B. Livelihood Activities of Local Population

7. Which of the following activities are practiced in this community? Indicate if women, men or both are engaged in each activity. Also indicate if each activity is declining or not

Activity	Gender M/F/B*	Tick if activity is threatened or declining	If threatened, give reasons
Crop farming			
Trading			
Livestock rearing			
Civil servant			
Fishing			
Hunting			
Gathering non-timber forest products			
Processing produce			
Marketing Produce			

Blacksmith, carpenter			
Crafts			
Selling food, snacks			
Hired labourer: Agricultural or oil company			
Other:			

* M = Males only engage in this activity; F = females only; B = both males and females engage in this activity.

8.A) Over the last 1 -5 years, have there been any changes in these activities?
Yes, improved; ___ Yes, declined; ___ No change ____

B) Which activities have improved?
Which has remained the same?

C) Why has there been a change, if any?

9. List the major crops grown here:

10. List the common fish breeds and other river/swamp produce harvested in your waters?

C. Community Perceptions

11. How far from human habitation are PHCN installations in your community?____

12. Do PHCN officials ever come to discuss their activities with your community? Yes, regularly; __________ Yes, occasionally; ________ no, not at all ________ if yes, what do they discuss? ____

13. Do they ever discuss your problem with you or consult you before they site their installations? ____

14. How would you characterize the relationship between the PHCN and your community? Very good; _______ fair; ____ poor;______ hostile; ___what is the reason for the "chosen" relationship? _______________________________________

15. Have there been cases of electricity related problems in this community? Yes; ___ No;______ I don't know;_______

37. If yes, give details about the latest problem.
…………………………………………………

38. Has the Government/NGO/Company embarked on any activity to try to reduce the environmental problems in your locality? Specify__________________________

43. What are the advantages and disadvantages of the PHCN in your community?____
_

44. Overall, do you think the activities of the PHCN have had?
Good effect; _____________ No. effect; _______Bad effect;_____________

45. What should be done to help the people of this area?

Thank you for your assistance. God bless you.

APPENDIX 3

Checklist on Infrastructural Facilities

Name of Settlement/ Community: ……………………………………………….

1. Water Supply:

Type of Supply	Available in Community (Yes/No)	Used by what proportion of population	Used for which purposes: drinking/washing/bathing	Any development projects/ plans to improve water supply?
Private borehole				
Public borehole				
Private wells				
Public wells				
Creek or Stream				
Rain water				
Others				

*Everyone, more than ½; less than ½; very few; no one

2. Electricity:

Source of Supply	Available in Community (Yes/No)	Used by what proportion of population	Regularity	Usual voltage: Good/ poor	Any development projects/ plans to improve electricity?
Public electricity from PHCN					
Community Generator					
Private Generators					
Others					

*Most of time, occasionally, very seldom, etc

3. Educational Facilities:

Type of Educational Facility	Availability in community. (Yes/ No)	No. of Rooms	Condition of School	Any development projects/ plans to improve electricity?	If none, where is nearest school
Primary School					
Secondary School					
Tertiary institution					
Others					

4. Health Facility

Type of Health Facility	Availability in community. (Yes/ No)	No./ type of Medical staff	No. of beds	Any development projects/ plans to improve Health facility?	If none, where is nearest Health facility
Primary Health Care					
Hospital					
Patent Chemist					
Others					

b) What type of Traditional health care is available? …………………………………

5. Transportation

Type of Transportation	Availability in community. (Yes/ No)	proportion of population using	Dependability of service	Frequency of Service	Remarks: Describe the most common routes /destination
Truck/ lorry					
Bus /Car					
Speed boat / ferry					
Canoe					
Motorcycle					
Bicycle					
Others					

6. Markets

Type of Market	Availability in community. (Yes/ No)	Approximate no. of Sellers	Buyers from where? Locality/ Other Village/ Cities	Frequency of Market: daily or how many days interval	Types of products sold- only locally produced or wide range of goods
Local Village square/ no permanent stalls					
Open stall market					
Permanent Lock- up stalls					

7. Other facilities

Type of Facility	Availability in community. (Yes/ No)	Number of Staff	Any project or plans to improve?	If none, where is nearest facility?
Police station or Police Post				
Bank (Name: ……..)				
Post Office				

Town Hall				
Others …………				

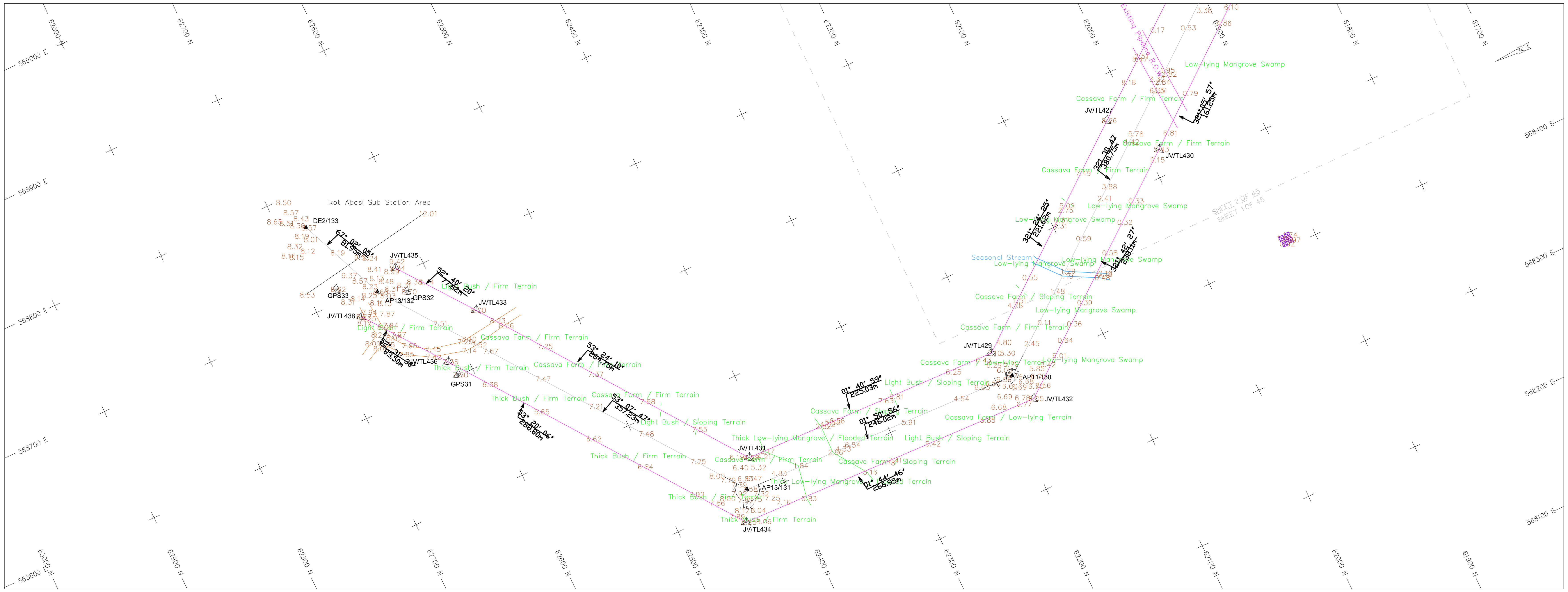
8. Religious Facilities

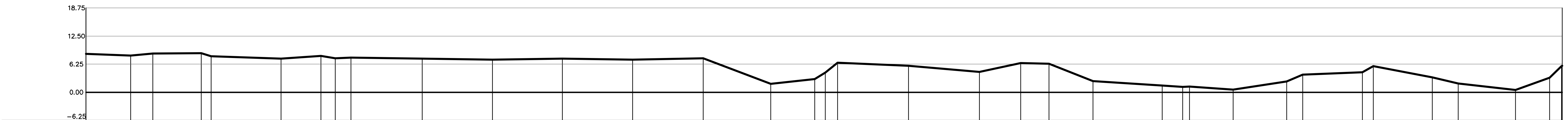
Type of Facility	Found in Community (Yes/ No)	Number of Churches/ Mosques/ Shrines and Names
Churches		
Mosques		
Shrines		

APPENDIX 5.1

TOPOGRAPHICAL SURVEY CHARTS

PLAN





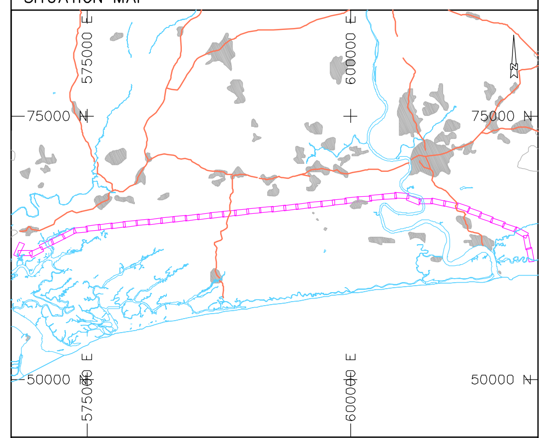
TOWER NUMBER	DE2/133, AP13/132, AP13/131, AP11/130
GROUND ELEVATION (m)	6.57, 8.19, 8.62, 8.66, 8.03, 7.51, 8.10, 7.52, 7.67, 7.47, 7.21, 7.48, 7.25, 7.58, 1.84, 2.96, 4.33, 6.54, 5.91, 4.54, 6.50, 6.34, 2.45, 1.48, 1.19, 1.29, 0.59, 2.41, 3.88, 4.42, 5.78, 3.31, 1.95, 0.53, 3.26, 5.83
PARTIAL HORZ. DIST. (m)	31.89, 7.20, 49.59, 11.12, 50.72, 49.88, 49.93, 49.93, 48.09, 31.33, 7.50, 8.66, 50.47, 50.51, 29.42, 31.24, 49.42, 31.06, 38.05, 11.44, 42.48, 7.72, 40.54, 24.31, 8.50
CUMMULATIVE DISTANCE (m)	0.00, 81.95, 439.18, 685.20
VEGETATION	Light Bush, Thick Bush, Thick Low-lying Mangrove, Cassava Farm, Cassava Farm
SOIL TYPE	Firm Terrain, Firm Terrain, Flooded Terrain, Low-lying Terrain, Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centreline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM	: Minna
ELLIPSOID	: Clarke 1880 RGS
Semi major axis	: 6378249.145m
Inverse flattening	: 293.465
PROJECTION	: NTM Mid Belt
Central Meridian (CM)	: 008 30' 00' East
Latitude of Origin	: 04 00' 00' North
False Easting	: 670553.984m
False Northing	: 0m
Scale factor at CM	: 0.99975
DATUM TRANSFORMATION	: WGS84 to Minna
Source	: MPN
	: dX = 94.031m, dY = 83.317m, dZ = -116.708m
	: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec
VERTICAL DATUM	:

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED

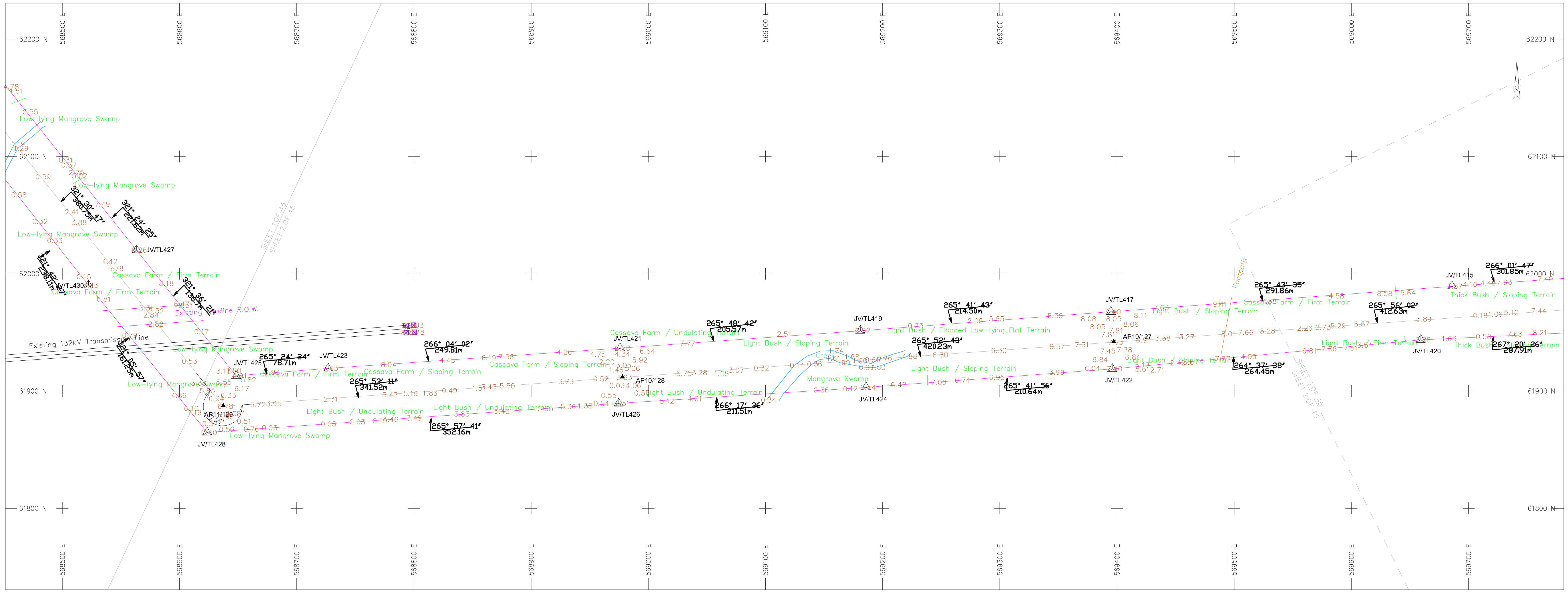
FUGRO NIGERIA LIMITED

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 1 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP01

PLAN

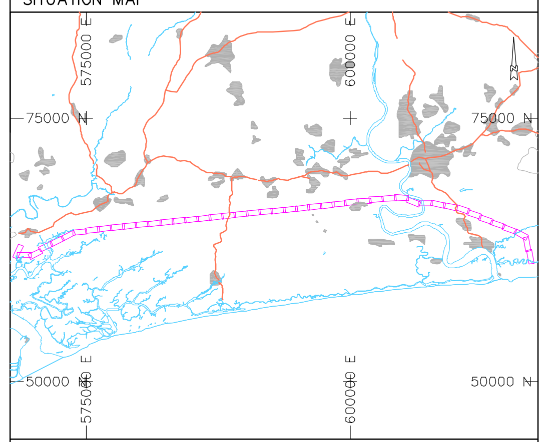


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

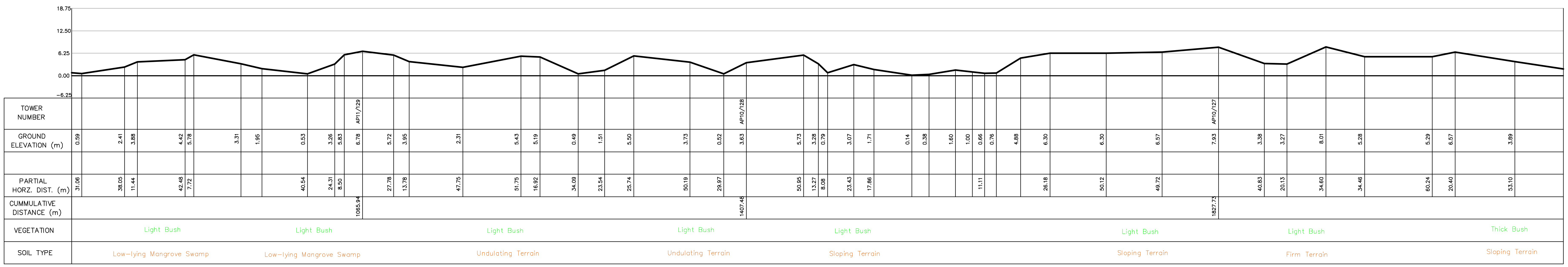
GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :



SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

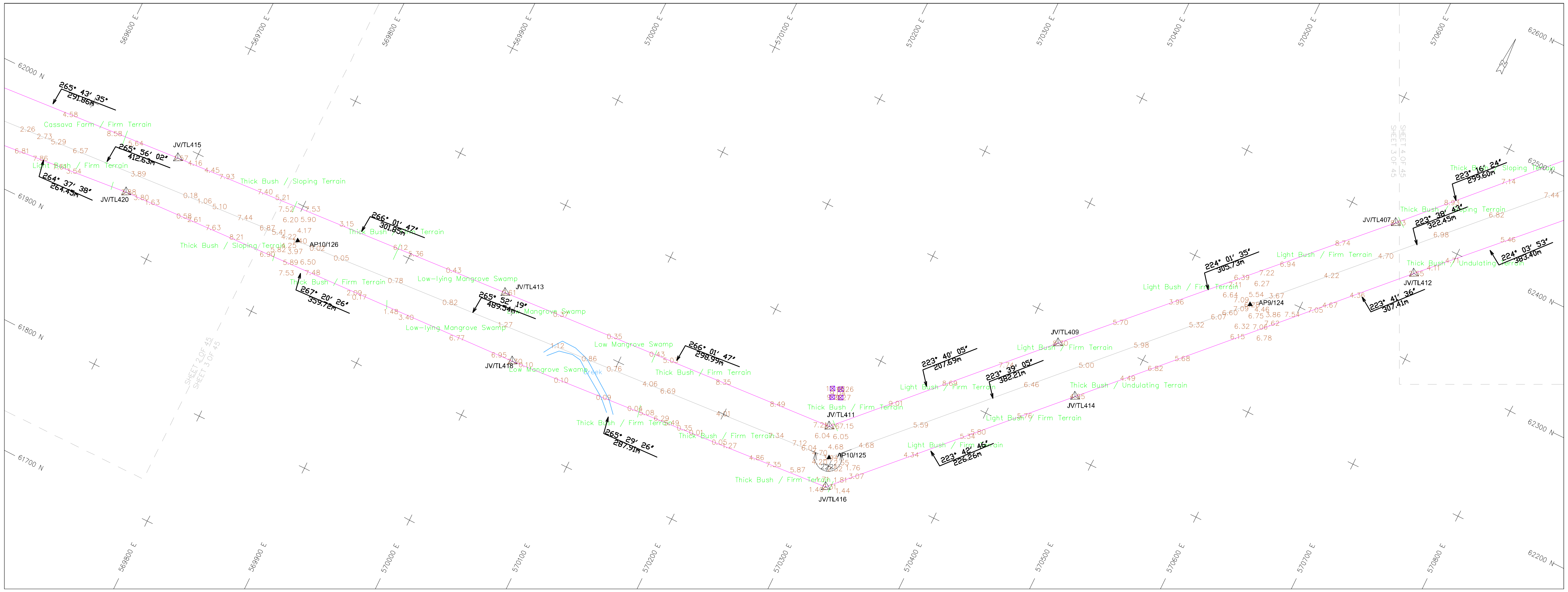
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 2 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP02

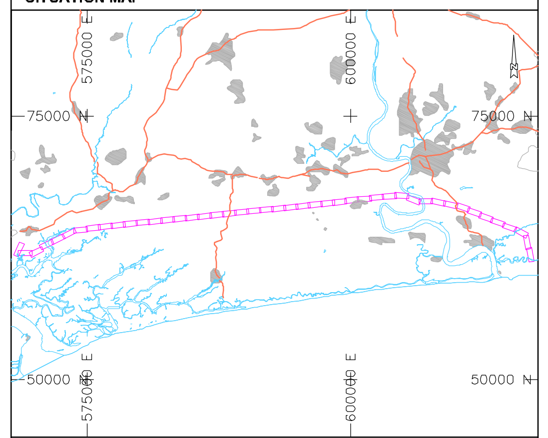
PLAN

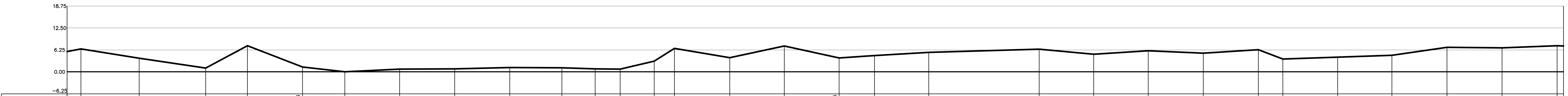


LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP





TOWER NUMBER					AP10/126												AP10/125							AP9/124						
GROUND ELEVATION (m)	6.57	3.89	1.06	7.44	1.40	0.05	0.78	0.82	1.27	1.12	0.86	0.76	3.03	6.69	4.01	7.34	3.94	4.68	5.59	6.46	5.00	5.98	5.32	6.28	3.67	4.22	4.70	6.98	6.82	7.44
PARTIAL HORZ. DIST. (m)	20.40	53.10	60.81	37.91		38.74	49.93	50.25	50.12			22.95	30.96	18.49	50.45	49.82		32.32	49.38	100.64	49.68	49.86	50.22		22.51	50.01	49.28	50.32	50.24	50.18
CUMMULATIVE DISTANCE (m)					2240.4												2729.96							3112.17						
VEGETATION				Thick Bush					Thick Bush							Thick Bush				Light Bush						Thick Bush				
SOIL TYPE				Firm Terrain					Low Mangrove Swamp							Firm Terrain				Firm Terrain						Undulating Terrain				

SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

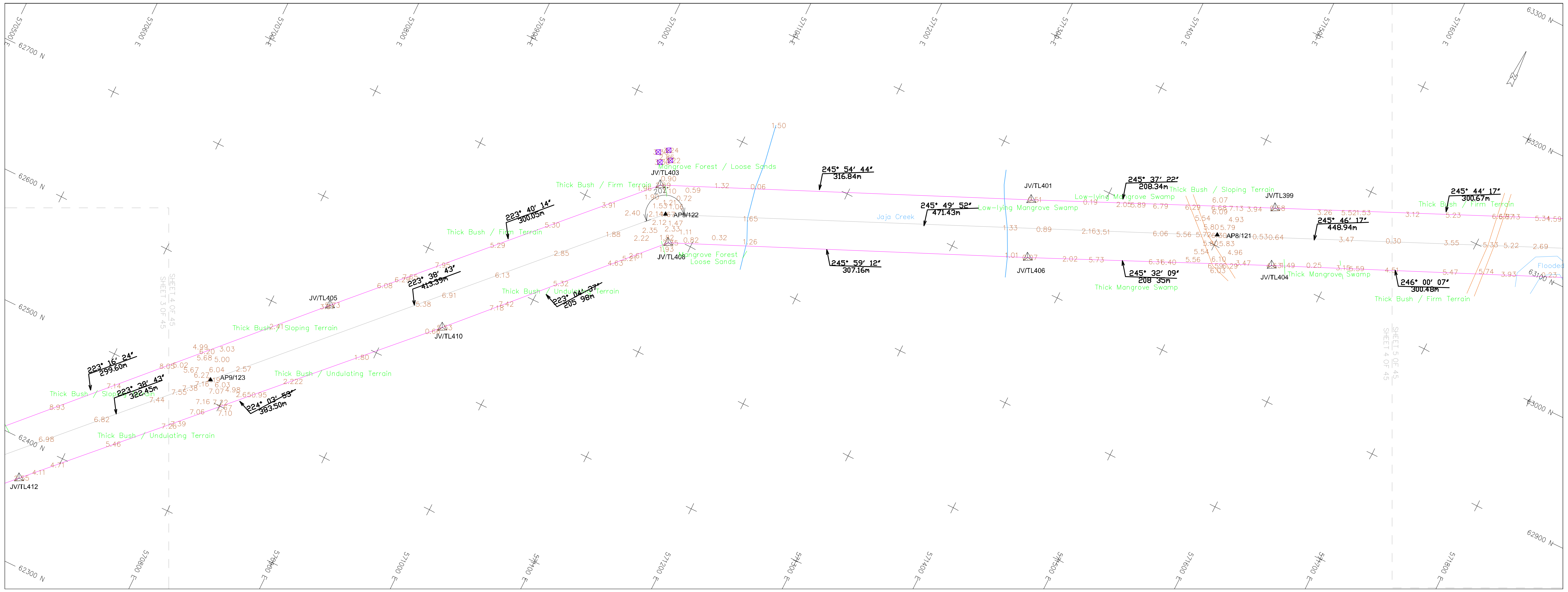
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 3 of 45

Author : FNL	Encl.	Date :	January 2012
Checked : Kalu, U Ajike		Report :	
Approved : Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP03

PLAN



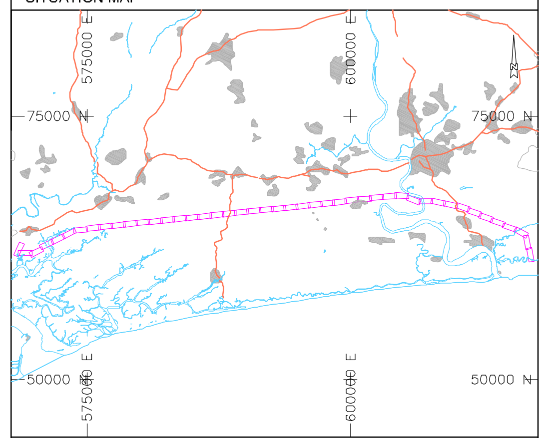
TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)	VEGETATION	SOIL TYPE
	6.98	50.32		Thick Bush	Undulating Terrain
	6.82	50.24			
	7.44	50.18			
AP9/123	7.19		3434.62		
	2.57	28.64		Thick Bush	Firm Terrain
	5.38	162.92			
	6.91	22.22			
	6.13	49.09		Thick Bush	Firm Terrain
	2.85	54.29			
	1.74	46.38			
AP9/22	1.67		3848.05		
	1.65		3918.87		
	1.33		4140.65		
	0.89	29.34		Thick Bush	Sloping Terrain
	3.51	48.52			
	6.06	50.02			
	5.56	19.86			
	5.72				
	5.84				
AP8/121	6.30		4319.55		
	4.05	25.15		Thick Bush	Firm Terrain
	0.64	24.03			
	3.47	59.67			
	0.30	40.25			
	3.55	49.38			
	5.33				
	5.34				
	5.22	12.06			

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED

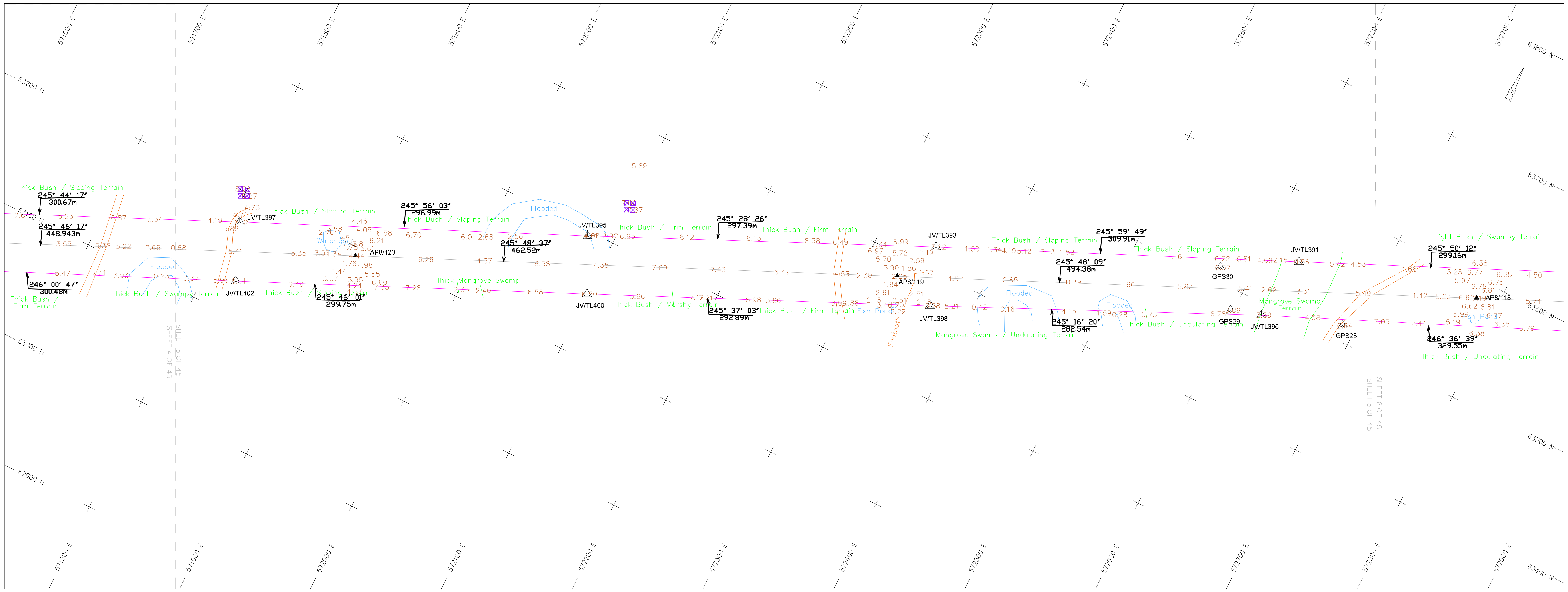
FUGRO NIGERIA LIMITED

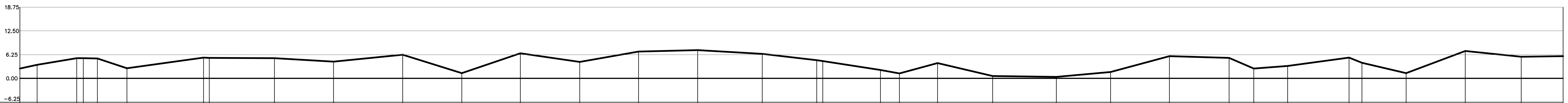
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 4 of 45

Author :	FNL	Encl.	Date : January 2012
Checked :	Kalu, U Ajike		Report :
Approved :	Ukhebo, A John		Drwg Ref : FNL-ILF-DWG-PP04

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	3.55	49.38	
	5.33		
	5.34		
	5.22	12.06	
	2.69	24.94	
	5.48		
	5.41		
	5.35	54.84	
AP8/120	4.44		4768.50
	6.26	58.41	
	1.37	50.03	
	6.58	49.44	
	4.35	50.38	
	7.09	49.70	
	7.43	50.08	
	6.49	54.55	
	4.80	46.00	
	4.53	5.13	
AP8/119	2.25		5231.03
	1.31		
	4.02	32.39	
	0.65	46.46	
	0.39	54.00	
	1.66	45.62	
	5.83	49.74	
	5.41	50.48	
	2.62	20.88	
	3.31	28.68	
	5.49		
	4.15		
	1.42	37.41	
AP8/118	7.19		5725.43
	5.74	47.29	

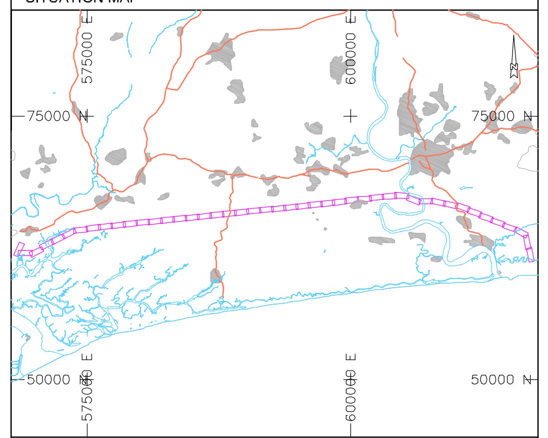
VEGETATION	SOIL TYPE
Thick Bush	Sloping Terrain
Thick Bush	Sloping Terrain
Thick Mangrove Swamp	Swampy Terrain
Thick Bush	Marshy Terrain
Thick Bush	Sloping Terrain
Thick Bush	Undulating Terrain
Thick Bush	Undulating Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

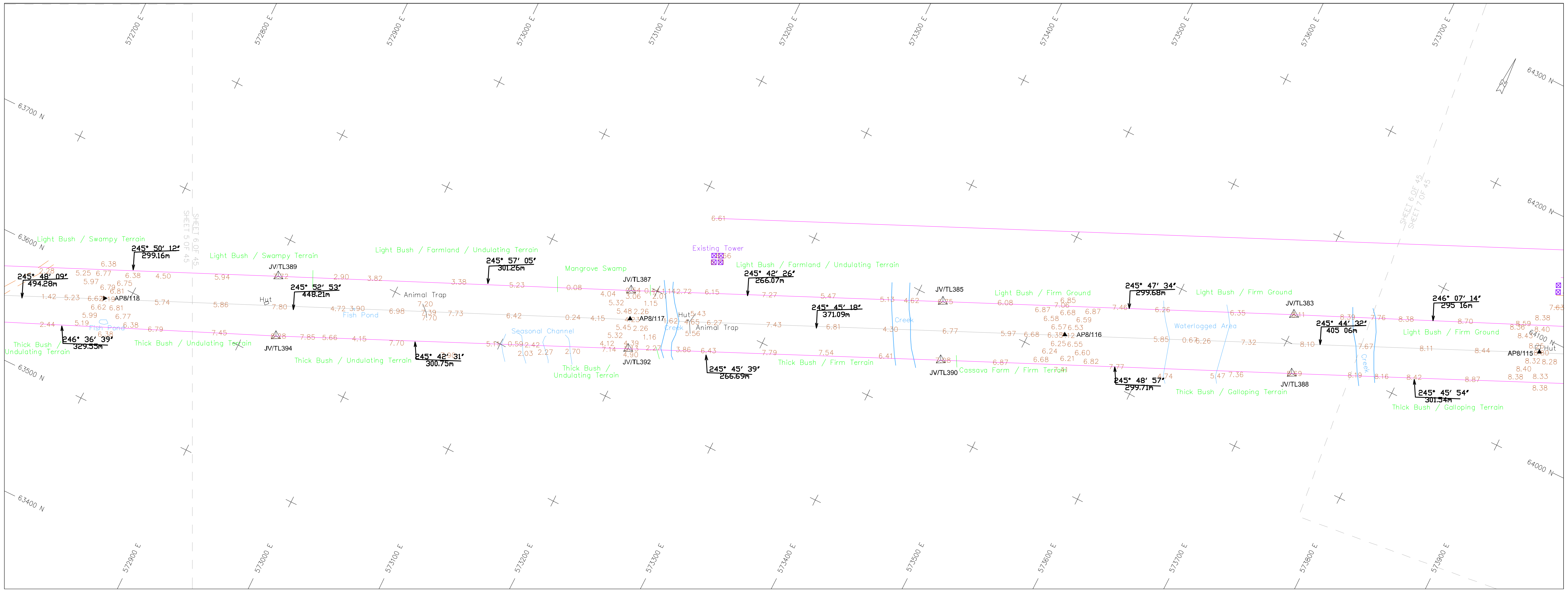
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

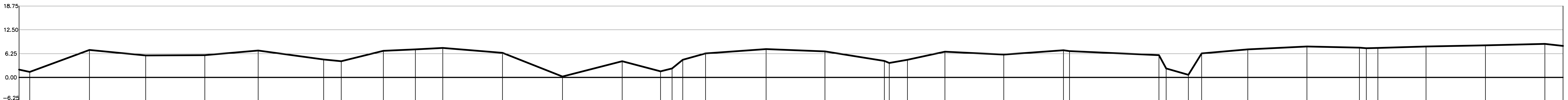
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 5 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP05

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	1.42	37.41	
AP8/118	7.19		5725.43
	5.74	47.29	
	5.86	49.79	
	7.03	44.94	
	4.72	55.17	
	4.22		
	6.98	35.49	
	7.39		
	7.73	23.03	
	6.42	50.09	
	0.24	50.44	
AP8/117	4.23		6173.65
	1.62		
	2.33		
	4.65		
	6.27	19.17	
	7.43	50.81	
	6.81	49.64	
	4.30	49.98	
	3.76		
	4.59		
	6.77	31.60	
	5.97	49.64	
AP8/116	7.12	5.22	6544.75
	6.87		
	5.85	75.25	
	2.36		
	0.67		
	6.26		
	7.32	38.90	
	8.10	49.61	
	7.84	5.81	
	7.67		
	7.74		
	8.11	40.49	
	8.44	49.92	
AP8/115	8.80		6949.81

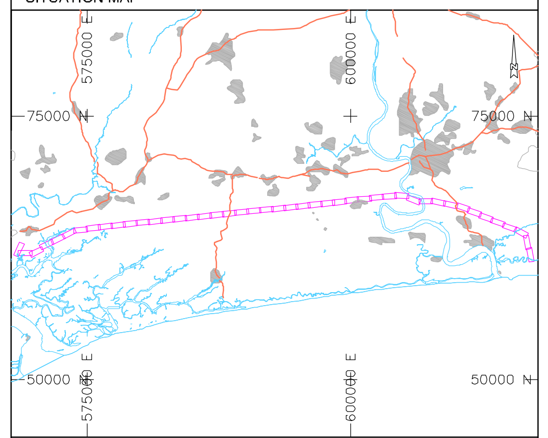
VEGETATION	SOIL TYPE
Thick Bush	Undulating Terrain
Thick Bush	Undulating Terrain
Thick Bush	Firm Terrain
Thick Bush	Firm Terrain
Light Bush	Firm Ground
Thick Bush	Galloping Terrain
Thick Bush	Galloping Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED

Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

FUGRO NIGERIA LIMITED

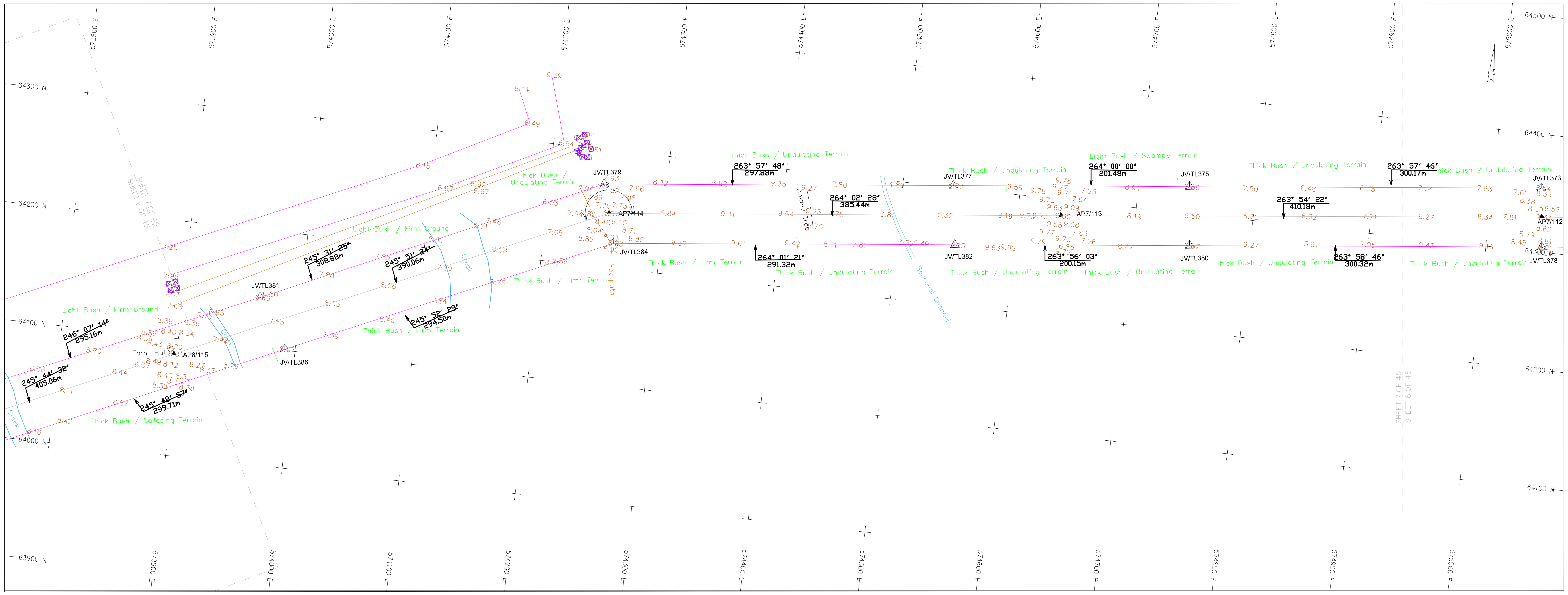
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

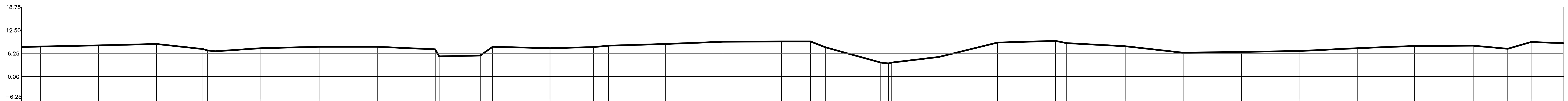
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 6 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref FNL-ILF-DWG-PP06

PLAN





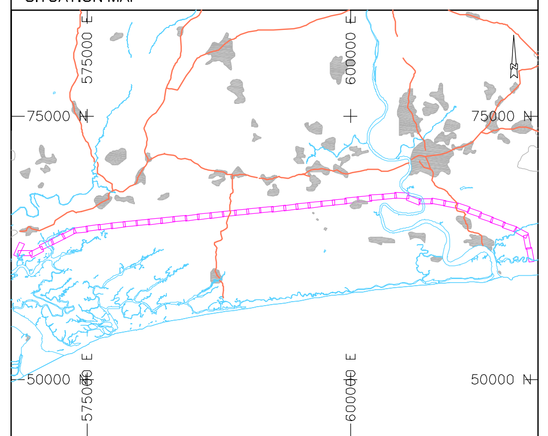
TOWER NUMBER			AP8/115													AP7/114											AP7/113										AP7/112
GROUND ELEVATION (m)	8.11	8.44	8.80	7.42	7.06	6.82	7.65	8.03	8.08	7.39	5.50	5.69	8.08	7.65	7.96	8.37	8.84	9.41	9.54	9.48	7.94	3.81	3.56	3.82	5.32	9.19	9.65	9.03	8.19	6.50	6.72	6.92	7.71	8.27	8.34	7.55	9.33
PARTIAL HORZ. DIST. (m)	40.49	49.92		40.05			39.58	50.18	50.27	49.96			10.55	49.66			48.85	49.80	50.49		13.04	47.62			40.78	50.54		9.64	50.55	50.02	50.08	49.78	50.36	49.38	50.46	29.96	
CUMMULATIVE DISTANCE (m)			6949.81													7339.87											7725.31										8135.49
VEGETATION	Thick Bush					Thick Bush							Thick Bush						Thick Bush						Thick Bush						Thick Bush				Thick Bush		
SOIL TYPE	Galloping Terrain					Firm Terrain							Firm Terrain						Undulating Terrain						Undulating Terrain						Undulating Terrain				Undulating Terrain		

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on

	Easting (m)	Northing (m)	Elevation (m)
QIT 1	615897.120	60047.060	4.370
QIT 2	616158.390	60039.700	4.600
QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

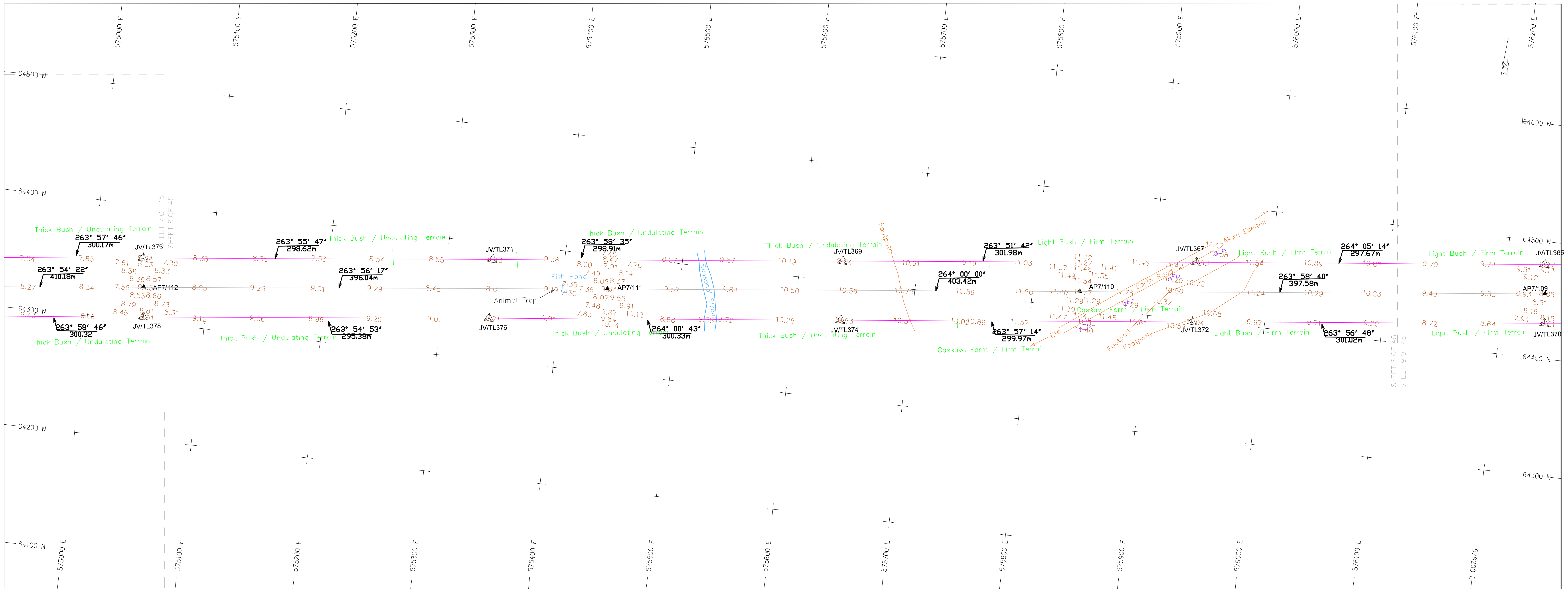
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

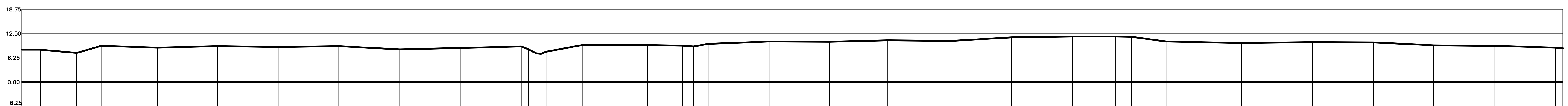
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 7 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP07

PLAN





TOWER NUMBER			AP7/112											AP7/111											AP7/110									AP7/109
GROUND ELEVATION (m)	8.34	7.55	9.33	8.85	9.23	9.01	9.29	8.45	8.81	9.19	8.45	7.44	7.30	7.60	9.54	9.57	9.40	9.21	9.84	10.50	10.39	10.75	10.59	11.50	11.77	11.76	11.65	10.50	10.13	10.29	10.23	9.49	9.33	8.85

PARTIAL HORZ. DIST. (m)
50.46, 29.96, 46.32, 49.51, 50.42, 49.37, 50.31, 50.11, 49.86, 3.97, 53.50, 11.98, 50.18, 49.65, 52.10, 49.80, 62.09, 58.55, 49.83, 49.94, 50.04

CUMMULATIVE DISTANCE (m)	8135.49	8531.53	8934.95	9332.54

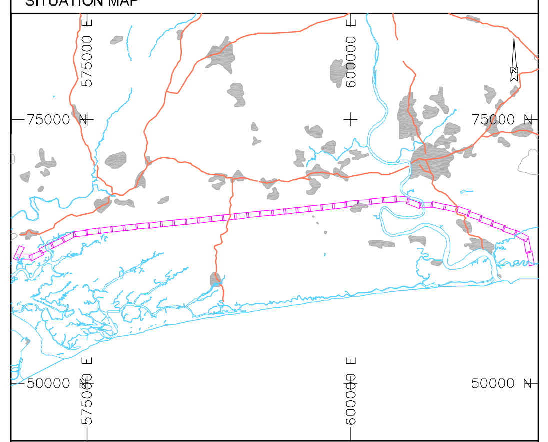
VEGETATION	Thick Bush	Thick Bush	Thick Bush	Thick Bush	Cassava Farm	Light Bush	Light Bush
SOIL TYPE	Undulating Terrain	Undulating Terrain	Undulating Terrain	Undulating Terrain	Firm Terrain	Firm Terrain	Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

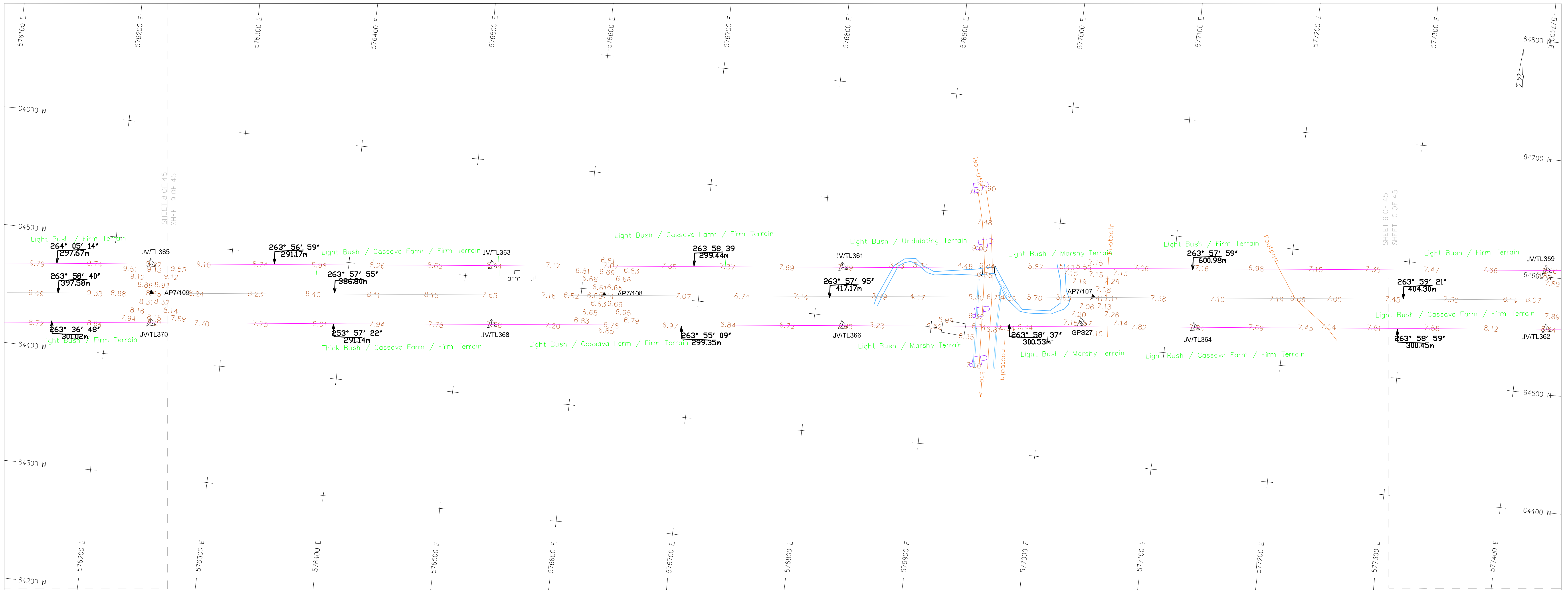
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 8 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP08

PLAN

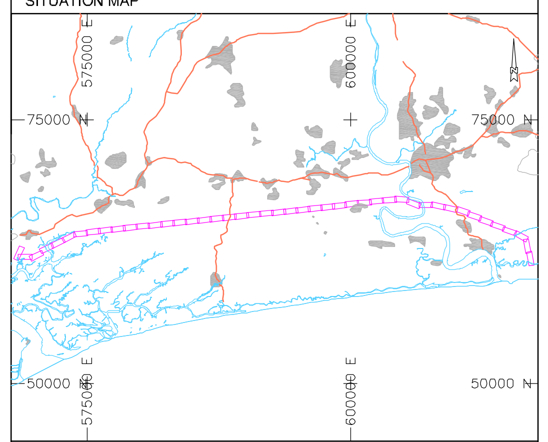


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

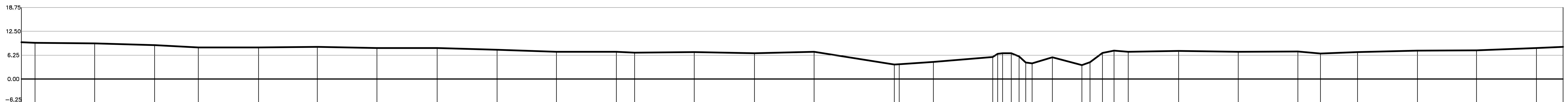
GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :



TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	9.49	49.94	
	9.33	50.04	
AP7/109	8.85		9332.54
	8.24	36.58	
	8.23	50.33	
	8.40	49.47	
	8.11	49.93	
	8.15	50.42	
	7.65	50.28	
	7.16	49.64	
AP7/108	7.14		9719.35
	6.90	15.37	
	7.07	50.05	
	6.74	50.36	
	7.14	49.94	
	3.79		
	3.86		
	4.47	28.54	
	5.80	49.91	
	6.56		
	6.76		
	6.77	7.34	
	5.90		
	4.35		
	4.08		
	5.70	17.13	
	3.65		
	4.38		
	6.80	10.28	
AP7/107	7.41		10136.51
	7.11		
	7.38	42.05	
	7.10	50.01	
	7.19	50.09	
	6.66		
	7.05	31.15	
	7.45	50.18	
	7.50	49.58	
	8.14	50.10	

VEGETATION	SOIL TYPE
Light Bush	Firm Terrain
Thick Bush / Cassava Farm	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain
Light Bush	Marshy Terrain
Light Bush	Marshy Terrain
Light Bush / Cassava Farm	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

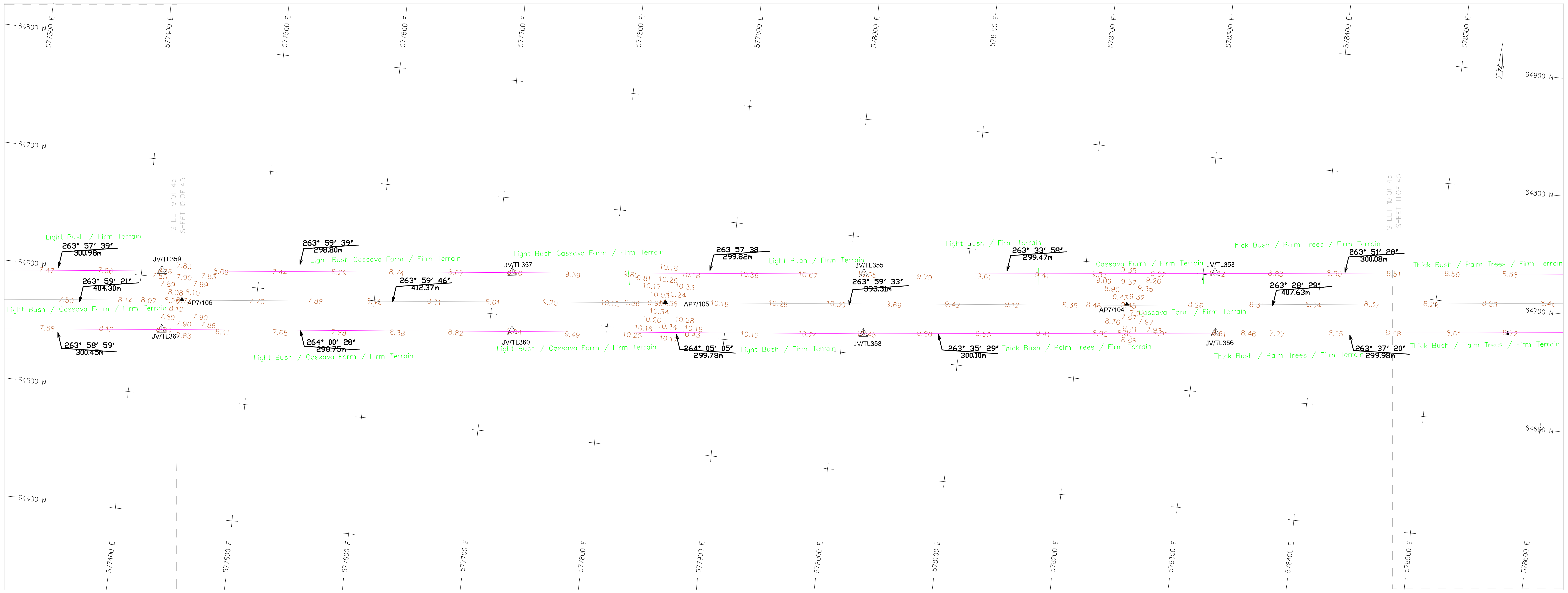
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

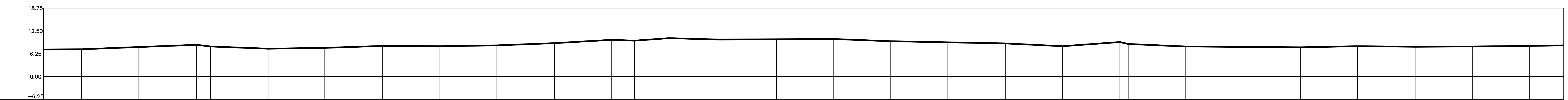
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 9 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP09

PLAN





TOWER NUMBER			AP7/106										AP7/105	
GROUND ELEVATION (m)	7.50	8.14	8.73	8.30	7.70	7.88	8.42	8.31	8.61	9.20	10.12	9.86	10.56	10.18
PARTIAL HORZ. DIST. (m)	49.58	50.10		12.22	50.12	49.70	50.32	49.98	49.88	50.17	50.00	19.89		43.55
CUMMULATIVE DISTANCE (m)			10540.81										10953.18	

TOWER NUMBER							AP7/104							
GROUND ELEVATION (m)	10.28	10.30	9.69	9.42	9.12	8.35	9.45	8.98	8.26	8.04	8.37	8.22	8.25	8.46
PARTIAL HORZ. DIST. (m)	50.36	49.35	49.79	50.18	50.24	49.96		7.14	49.76	149.34	49.64	50.45	50.00	49.97
CUMMULATIVE DISTANCE (m)							11346.70							

VEGETATION: Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush — Cassava Farm — Thick Bush / Palm Trees — Thick Bush / Palm Trees

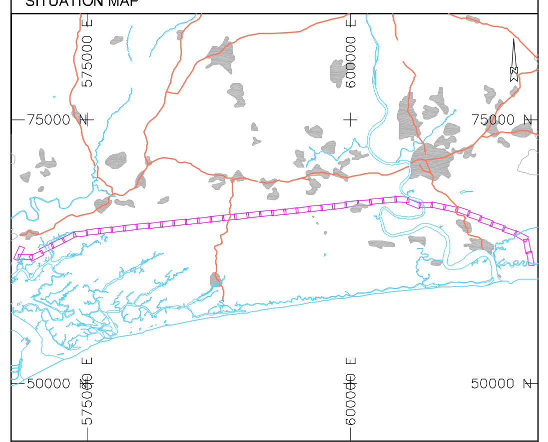
SOIL TYPE: Firm Terrain — Firm Terrain — Firm Terrain — Firm Terrain — Firm Terrain — Firm Terrain — Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF CONSULTING ENGINEERS

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

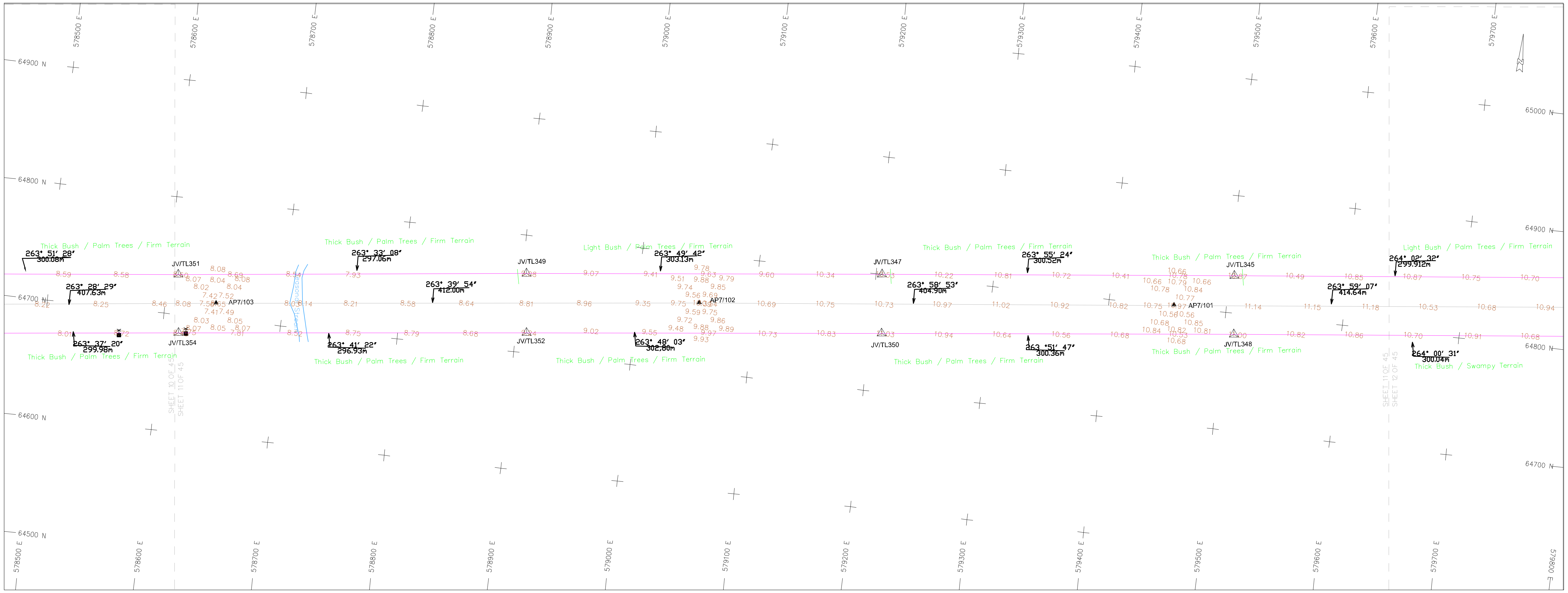
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

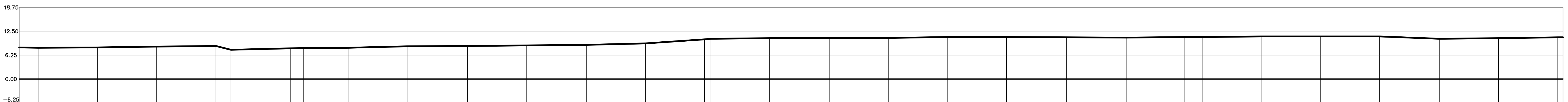
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 10 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP10

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	8.22	50.45	
	8.25	50.00	
	8.46	49.97	
AP7/103	8.65		11754.33
	7.64	12.52	
	8.03	50.63	
	8.14	10.90	
	8.21	38.01	
	8.58	49.85	
	8.64	50.11	
	8.81	49.91	
	8.96	50.31	
	9.35	50.06	
AP7/102	10.39		12166.34
	10.54	5.38	
	10.69	49.50	
	10.75	50.24	
	10.73	50.13	
	10.97	49.66	
	11.02	49.65	
	10.92	50.64	
	10.82	50.14	
AP7/101	10.97		12571.24
	11.03	14.68	
	11.14	49.52	
	11.15	50.31	
	11.18	49.73	
	10.53	50.29	
	10.68	49.85	
	10.94	50.20	

VEGETATION: Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush

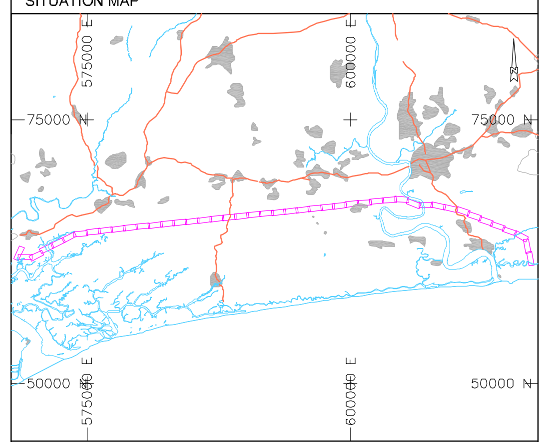
SOIL TYPE: Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Swampy Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

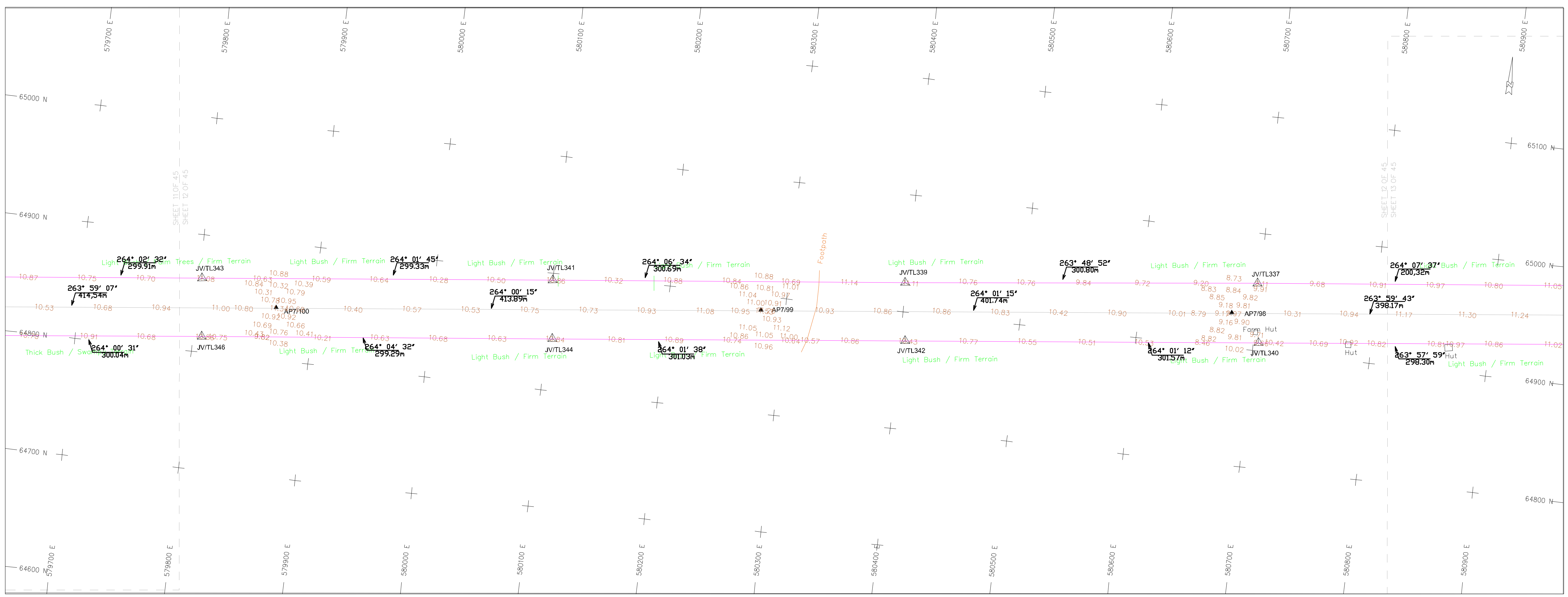
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

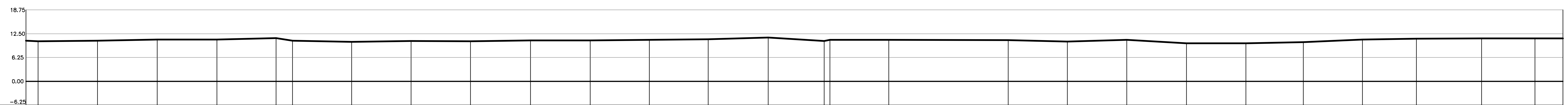
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 11 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP11

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	10.53	50.29	
	10.68	49.85	
	10.94	50.20	
	11.00	50.22	
AP7/100	11.34		12985.88
	10.68	13.95	
	10.40	49.67	
	10.57	49.99	
	10.53	50.04	
	10.75	50.44	
	10.73	50.12	
	10.93	49.64	
	11.08	49.65	
AP7/99	11.53		13399.77
	10.57 10.93	4.96	
	10.86	49.46	
	10.83	100.48	
	10.42	49.72	
	10.90	50.04	
	10.01	50.17	
AP7/98	9.97		13801.59
	10.31	48.46	
	10.94	49.55	
	11.17	45.37	
	11.30	54.89	
	11.24	44.84	

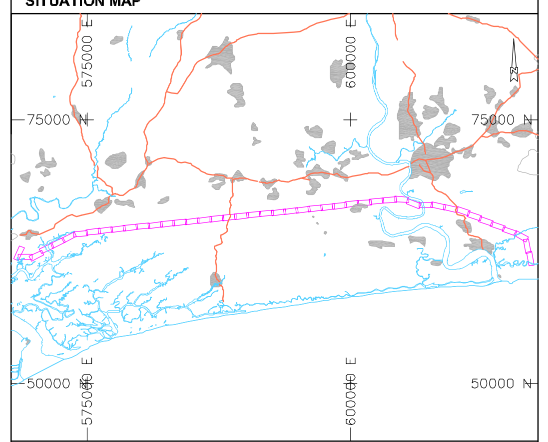
VEGETATION	SOIL TYPE
Thick Bush	Swampy Terrain
Light Bush	Firm Terrain
Light Bush	Firm Terrain
Light Bush	Firm Terrain
Light Bush	Firm Terrain
Light Bush	Firm Terrain
Light Bush	Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

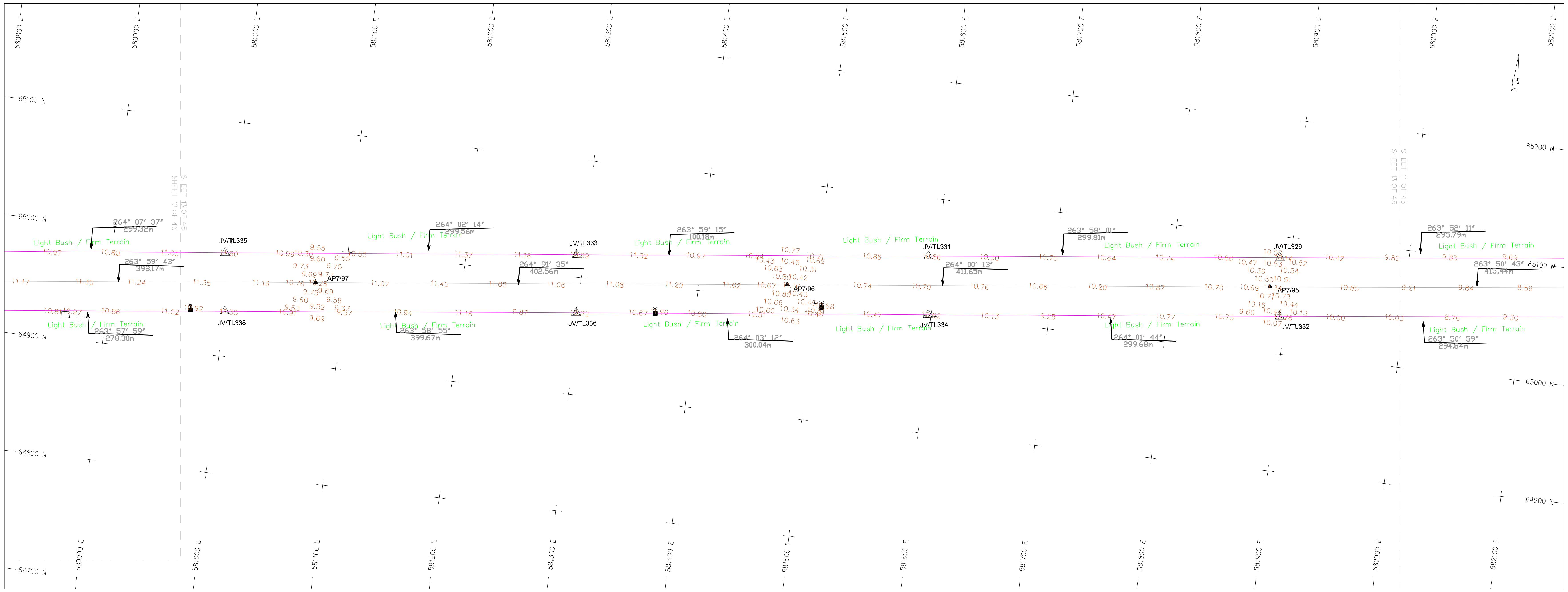
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

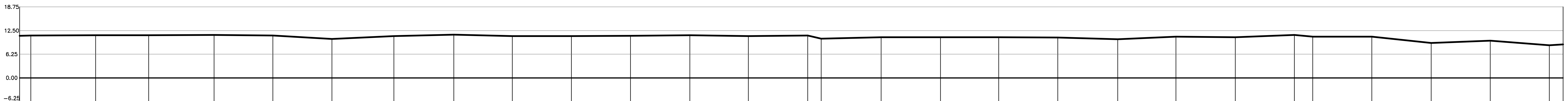
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 12 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP12

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.17	45.37	
	11.30	54.89	
	11.24	44.84	
	11.35	55.25	
	11.16	49.84	
AP7/97	10.28		14200.68
	11.07	52.27	
	11.45	50.80	
	11.05	49.56	
	11.06	49.82	
	11.08	50.10	
	11.29	50.31	
	11.02	49.43	
AP7/96	11.16		14603.24
	10.38	11.25	
	10.74	50.83	
	10.70	50.06	
	10.76	49.42	
	10.66	49.93	
	10.20	50.63	
	10.87	49.26	
	10.70	50.17	
AP7/95	11.34		15014.89
	10.89	15.60	
	10.85	49.89	
	9.21	50.16	
	9.84	50.04	
	8.59	50.00	

VEGETATION: Light Bush

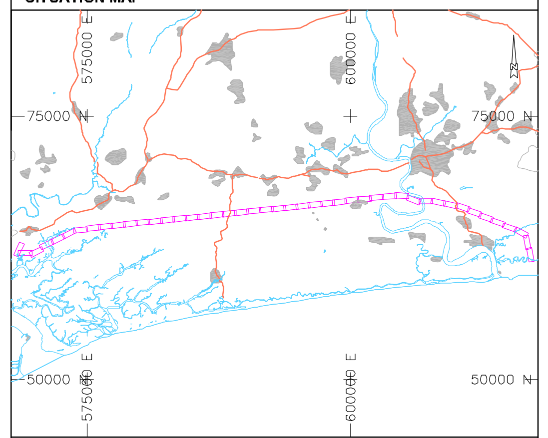
SOIL TYPE: Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

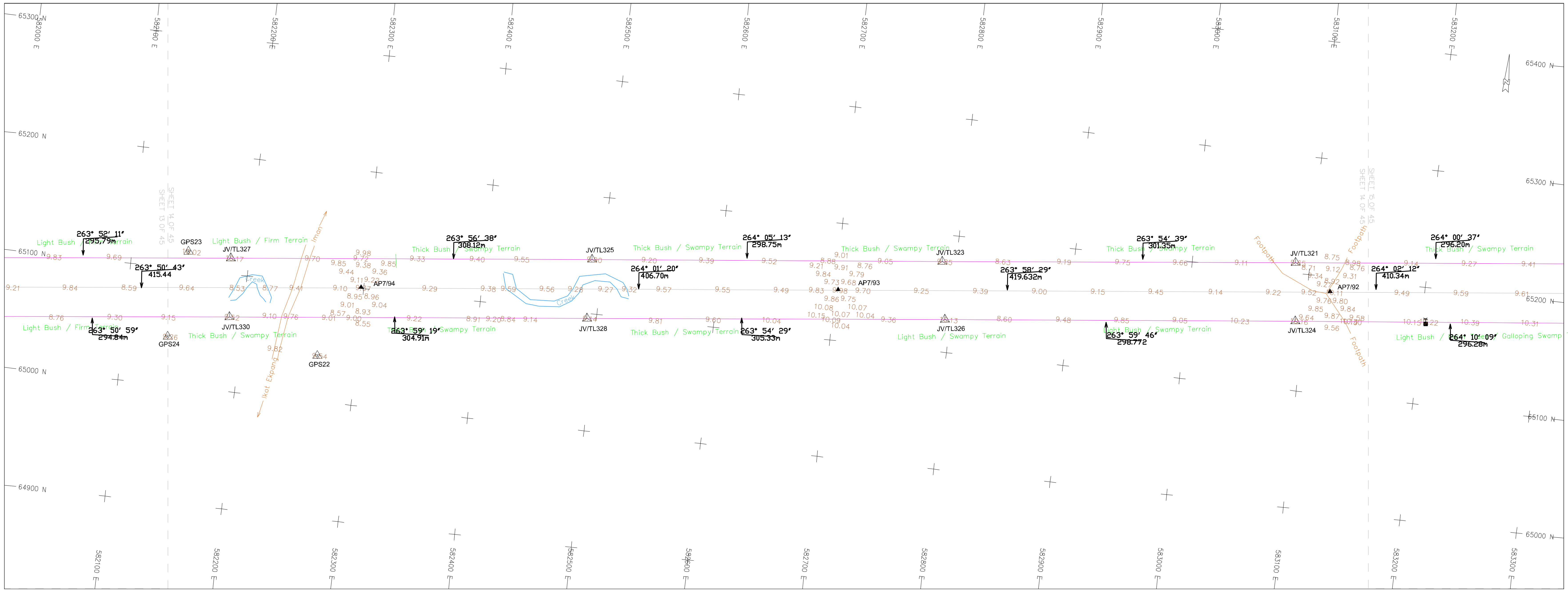
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

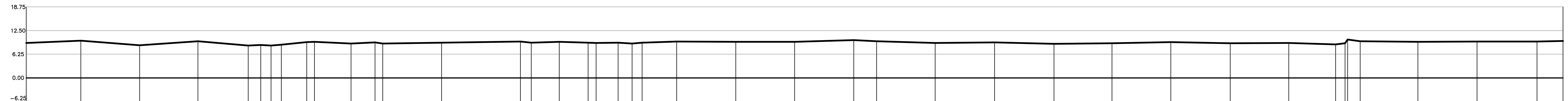
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 13 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP13

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	9.84	50.04	
	8.59	50.00	
	9.64	49.43	
	8.53		
	8.67		
	8.51		
	8.77		
	9.41		
	9.55	6.68	
	9.10	31.09	
AP7/94	9.37		15430.33
	9.09	6.60	
	9.29	50.02	
	9.59		
	9.31		
	9.56	23.91	
	9.28		
	9.22		
	9.27	18.83	
	9.07		
	9.32		
	9.57	29.33	
	9.55	50.15	
	9.49	50.02	
AP7/93	9.98		15837.03
	9.70	19.52	
	9.25	49.76	
	9.39	50.41	
	9.00	50.45	
	9.15	49.19	
	9.45	50.11	
	9.14	50.51	
	9.22	49.57	
	8.86		
	9.12		
AP7/92	10.11		16256.66
	9.70	10.50	
	9.49	49.17	
	9.59	50.28	
	9.61	50.86	

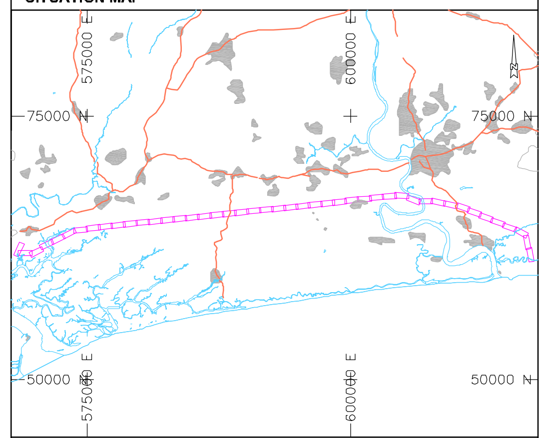
VEGETATION	SOIL TYPE
Thick Bush	Swampy Terrain
Thick Bush	Swampy Terrain
Light Bush	Swampy Terrain
Light Bush	Swampy Terrain
Light Bush	Swampy Terrain
Light Bush / Palm Trees	Galloping Swamp Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED

Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

FUGRO NIGERIA LIMITED

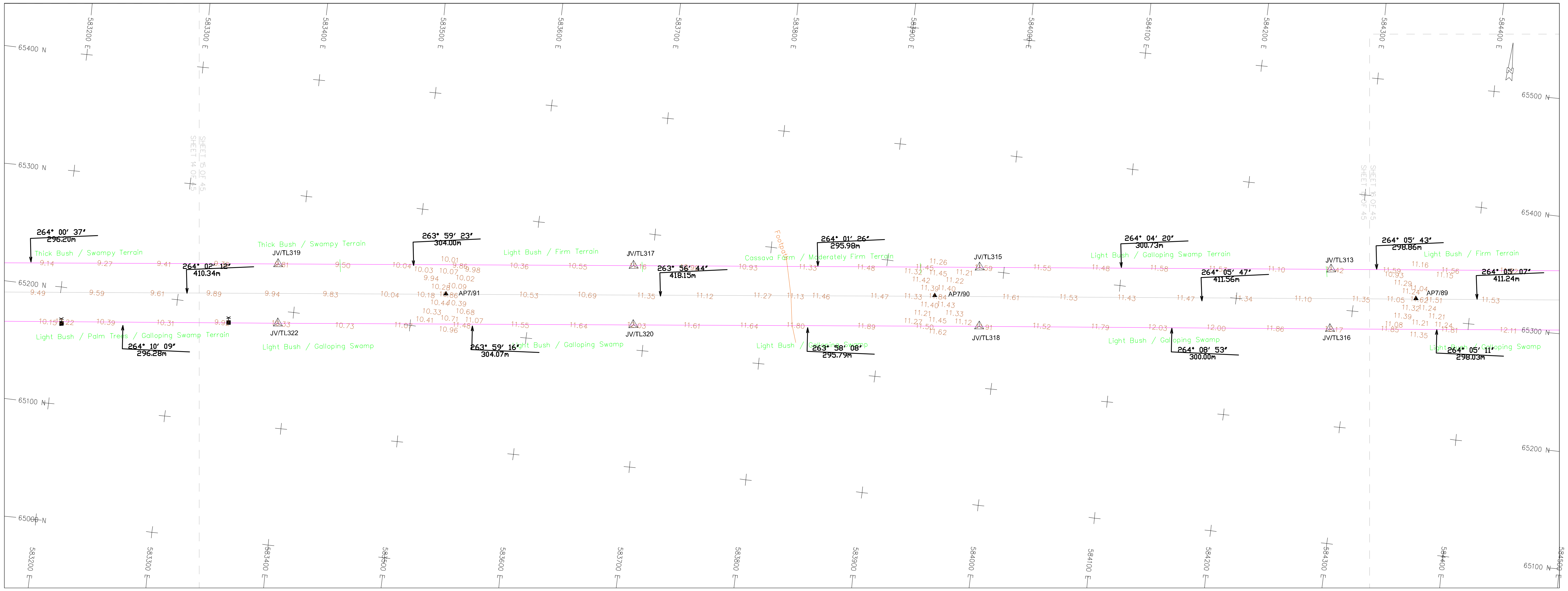
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

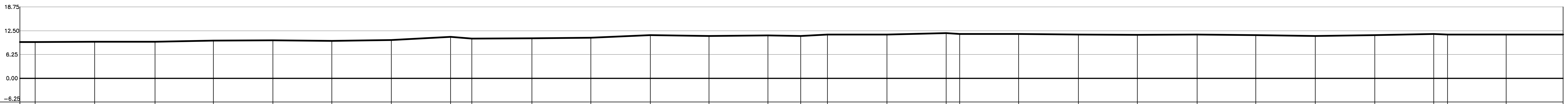
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 14 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP14

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	9.49	49.17	
	9.59	50.28	
	9.61	50.86	
	9.89	49.38	
	9.94	50.20	
	9.83	49.62	
	10.04	50.40	
AP7/91	10.86		16667.00
	10.42	17.90	
	10.53	50.79	
	10.69	49.71	
	11.35	50.13	
	11.12	49.57	
	11.27	49.84	
	11.13		
	11.46	22.60	
	11.47	50.06	
AP7/90	11.84		17085.15
	11.67	11.44	
	11.61	49.82	
	11.53	50.35	
	11.43	49.90	
	11.47	50.40	
	11.34	49.62	
	11.10	50.22	
	11.35	50.12	
AP7/89	11.62		17496.71
	11.51	11.62	
	11.53	49.50	

VEGETATION: Light Bush / Palm Trees — Galloping Swamp — Light Bush — Light Bush — Light Bush — Light Bush

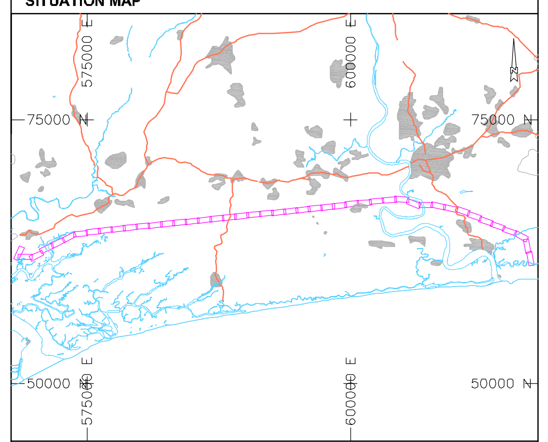
SOIL TYPE: Galloping Swamp Terrain — Galloping Swamp — Galloping Swamp — Galloping Swamp — Galloping Swamp — Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centreline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

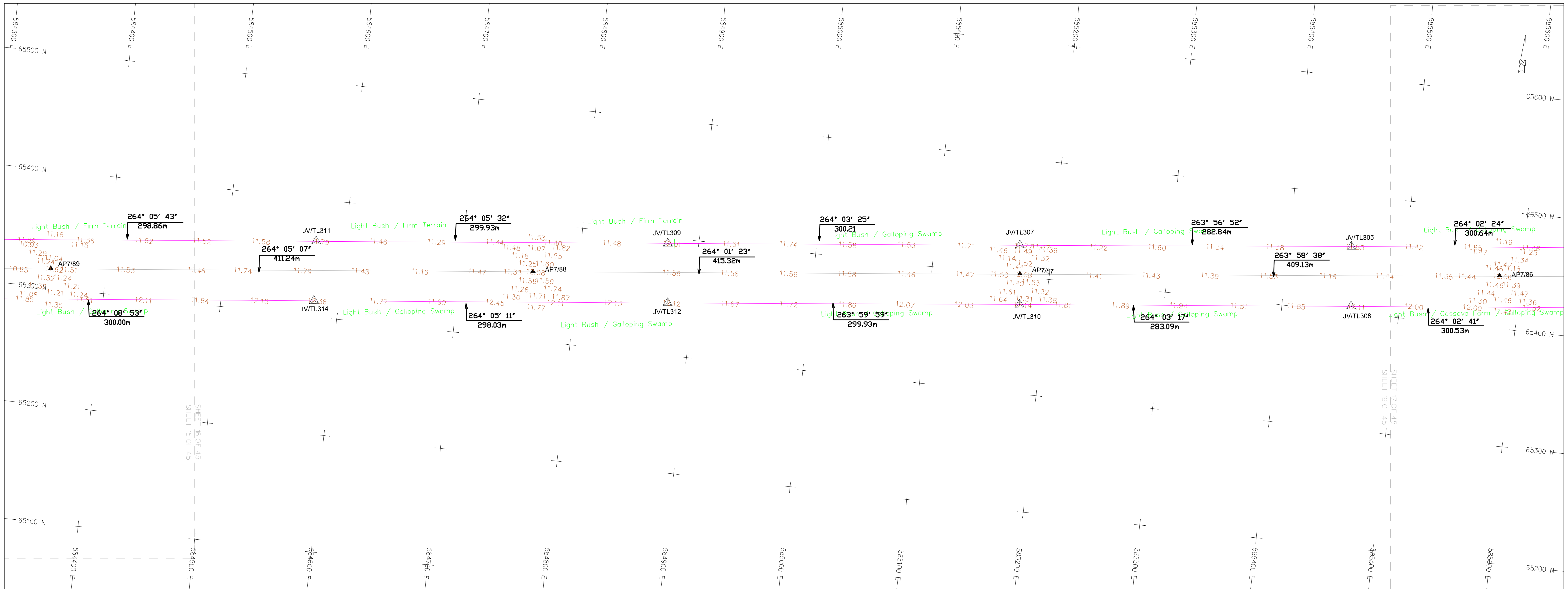
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 15 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref :FNL-ILF-DWG-PP15

PLAN

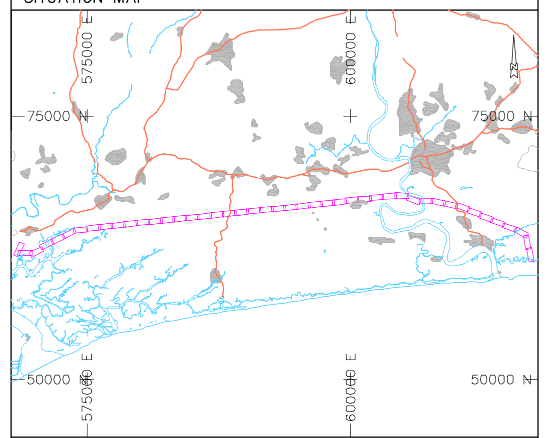


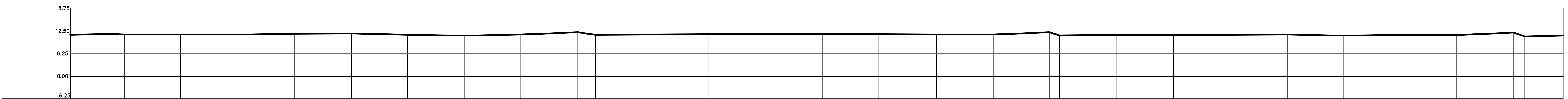
PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
AP7/89	11.62		17496.71
	11.51	11.62	
	11.53	49.50	
	11.46	60.32	
	11.74	39.76	
	11.79	50.49	
	11.43	49.54	
	11.16	50.14	
	11.47	49.59	
AP7/88	12.08		17907.95
	11.45	15.34	
	11.56	99.92	
	11.56	49.65	
	11.56	50.17	
	11.58	50.08	
	11.46	50.63	
	11.47	49.95	
AP7/87	12.08		18323.27
	11.24	8.86	
	11.41	50.49	
	11.43	49.96	
	11.39	49.80	
	11.53	50.45	
	11.16	49.65	
	11.44	49.67	
	11.35	49.93	
AP7/86	12.06		18732.40
	11.00	9.62	

VEGETATION: Light Bush | Light Bush | Light Bush | Light Bush | Light Bush | Light Bush | Light Bush / Cassava Farm

SOIL TYPE: Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp Terrain

SURVEY DATA

Survey based on	Easting (m)	Northing (m)	Elevation (m)
QIT 1	615897.120	60047.060	4.370
QIT 2	616158.390	60039.700	4.600
QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
CONSULTING ENGINEERS
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

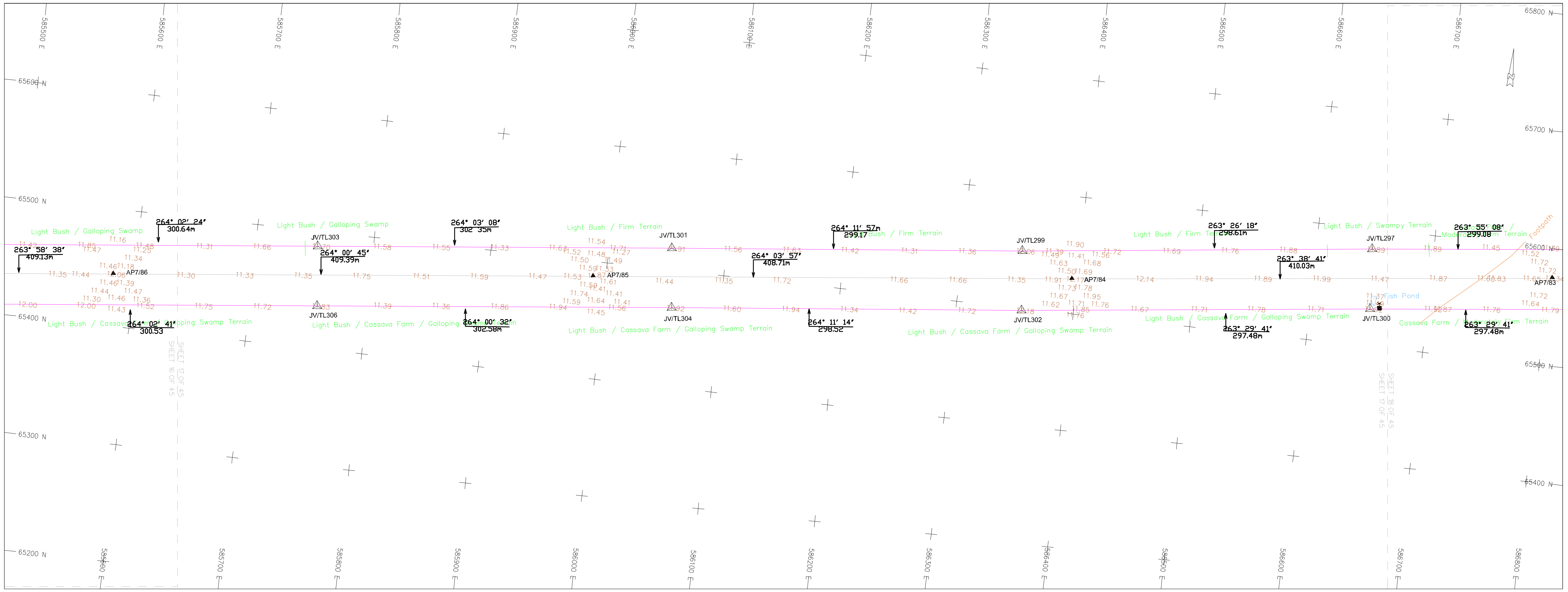
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

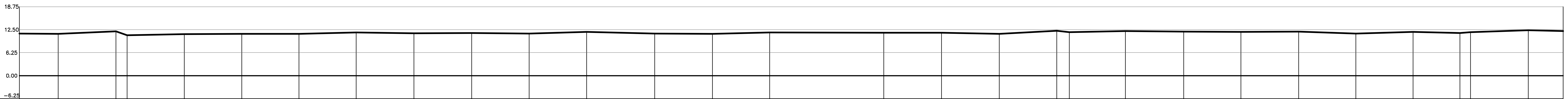
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 16 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP16

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.35	49.93	
AP7/86	12.06		18732.40
	11.00	9.62	
	11.30	49.74	
	11.33	49.94	
	11.35	49.90	
	11.75	49.80	
	11.51	50.04	
	11.59	50.38	
	11.47	49.98	
AP7/85	11.87		19141.79
	11.44	58.99	
	11.35	50.25	
	11.72	49.78	
	11.66	99.34	
	11.66	50.19	
	11.35	50.12	
AP7/84	12.17		19550.50
	11.85	10.83	
	12.14	48.97	
	11.94	50.63	
	11.89	49.76	
	11.99	50.12	
	11.47	49.77	
	11.87	49.78	
	11.60		
	11.83	9.25	
AP7/83	12.34		19960.53

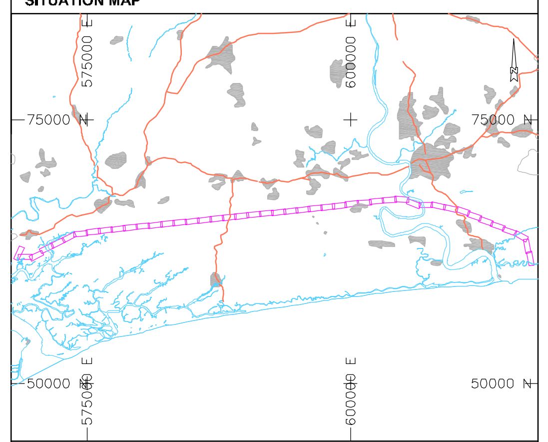
VEGETATION: Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush / Cassava Farm — Light Bush / Cassava Farm — Cassava Farm

SOIL TYPE: Galloping Swamp Terrain — Galloping Swamp Terrain — Galloping Swamp Terrain — Galloping Swamp Terrain — Galloping Swamp Terrain — Galloping Swamp Terrain — Moderately Firm Terrain

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

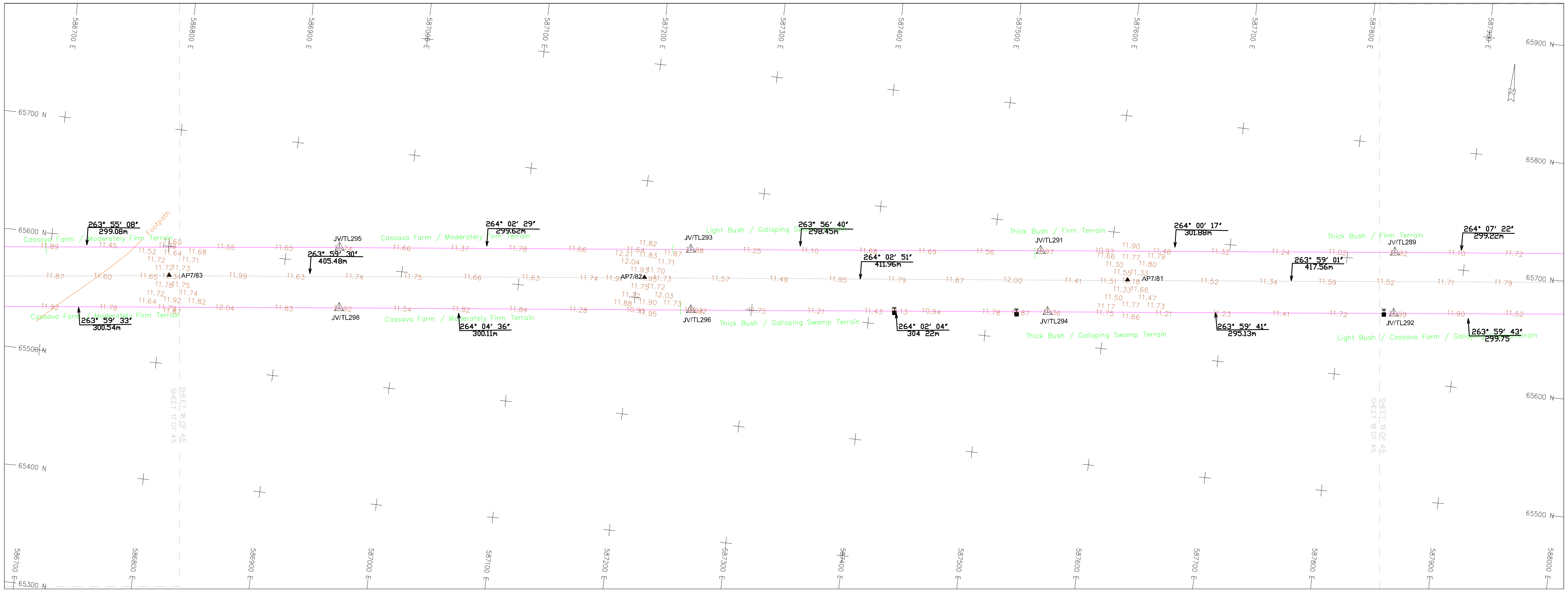
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

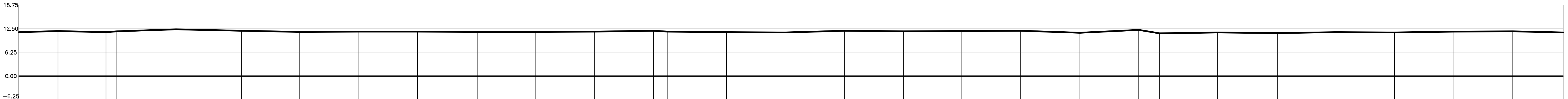
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 17 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref :FNL-ILF-DWG-PP17

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.87	49.78	
	11.60		
	11.83	9.25	
AP7/83	12.34		19960.53
	11.99	55.75	
	11.63	49.32	
	11.74	50.30	
	11.75	49.77	
	11.66	50.75	
	11.63	49.61	
	11.74	49.91	
AP7/82	11.95		20366.01
	11.73	12.28	
	11.57	49.69	
	11.49	49.80	
	11.95	50.31	
	11.79	50.23	
	11.87	49.46	
	12.00	50.02	
	11.41	50.18	
AP7/81	12.18		20777.97
	11.27	17.90	
	11.52	49.24	
	11.34	50.58	
	11.59	49.88	
	11.52	49.69	
	11.71	50.29	
	11.79	50.00	

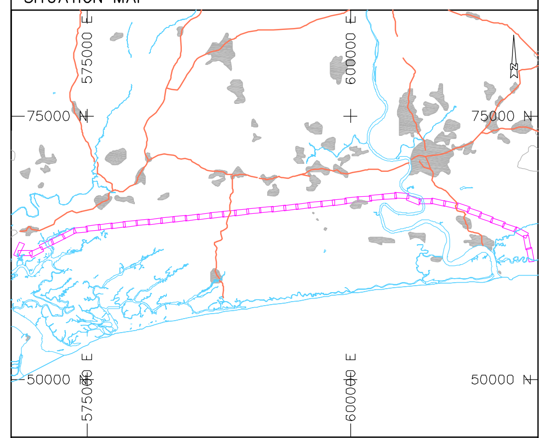
VEGETATION	SOIL TYPE
Cassava Farm	Moderately Firm Terrain
Cassava Farm	Moderately Firm Terrain
Thick Bush	Galloping Swamp Terrain
Thick Bush	Galloping Swamp Terrain
Light Bush / Cassava Farm	Galloping SwampTerrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

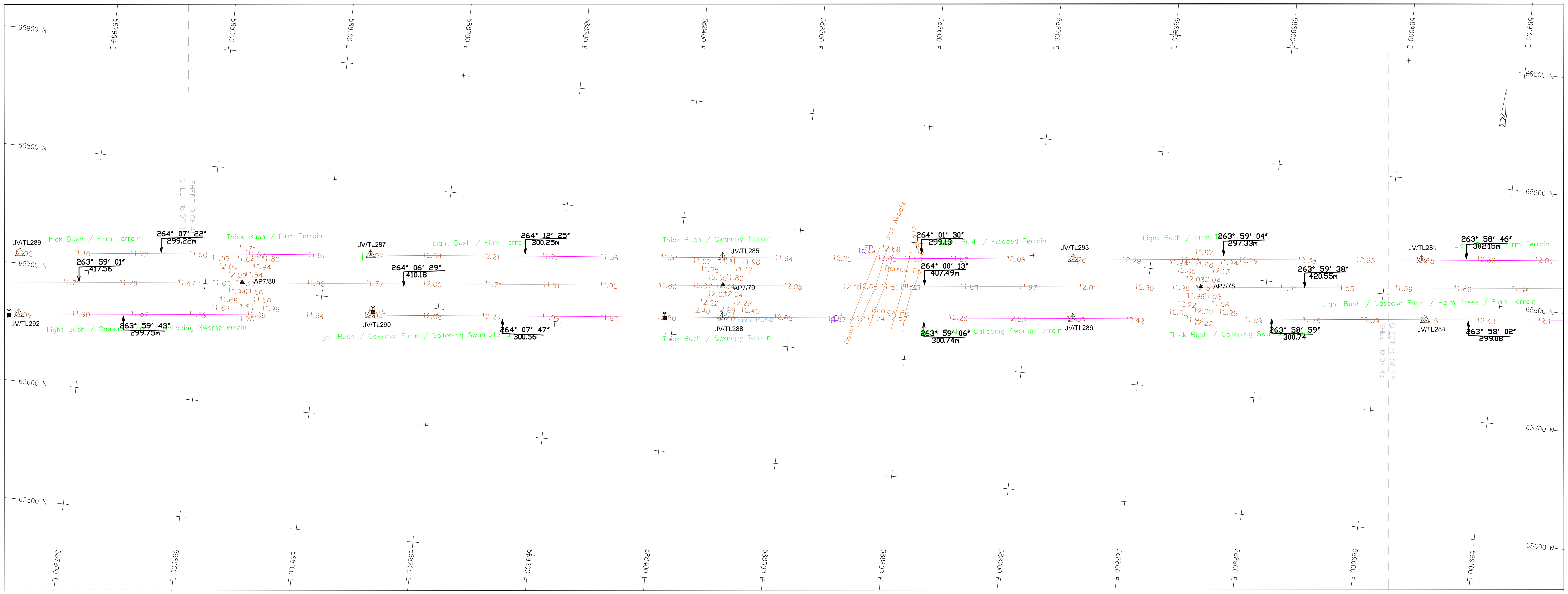
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

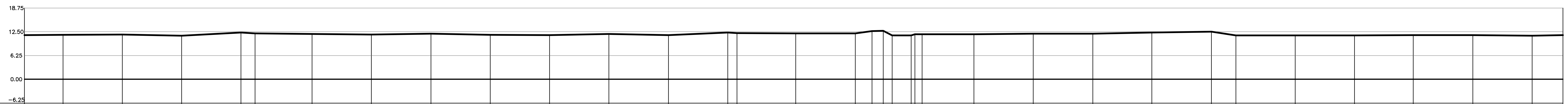
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 18 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP18

PLAN





TOWER NUMBER				AP7/80									AP7/79														AP7/78						
GROUND ELEVATION (m)	11.71	11.79	11.47	12.30	12.10	11.92	11.77	12.00	11.71	11.61	11.92	11.60	12.34	12.14	12.05	12.10	12.65	12.79	11.51	11.51	11.85	11.88	11.85	11.97	12.01	12.30	12.51	11.57	11.51	11.55	11.59	11.66	11.44

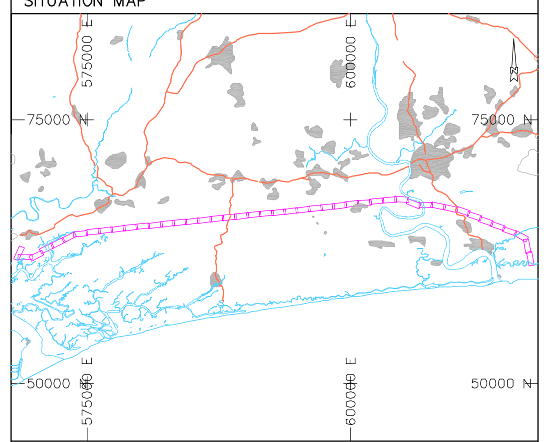
PARTIAL HORZ. DIST. (m)	50.29, 50.00, 49.84, 11.88, 48.00, 49.98, 50.05, 50.19, 49.93, 49.84, 50.40, 7.67, 49.67, 50.09, 3.36, 43.63, 50.02, 50.26, 49.61, 20.73, 50.05, 49.79, 49.54, 50.38, 49.97
CUMMULATIVE DISTANCE (m)	21195.53, 21605.71, 22013.20
VEGETATION	Light Bush / Cassava Farm; Light Bush / Cassava Farm; Thick Bush; Light Bush; Thick Bush; Light Bush / Cassava Farm / Palm Trees
SOIL TYPE	Galloping SwampTerrain; Galloping SwampTerrain; Swampy Terrain; Galloping Swamp Terrain; Galloping Swamp Terrain; Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

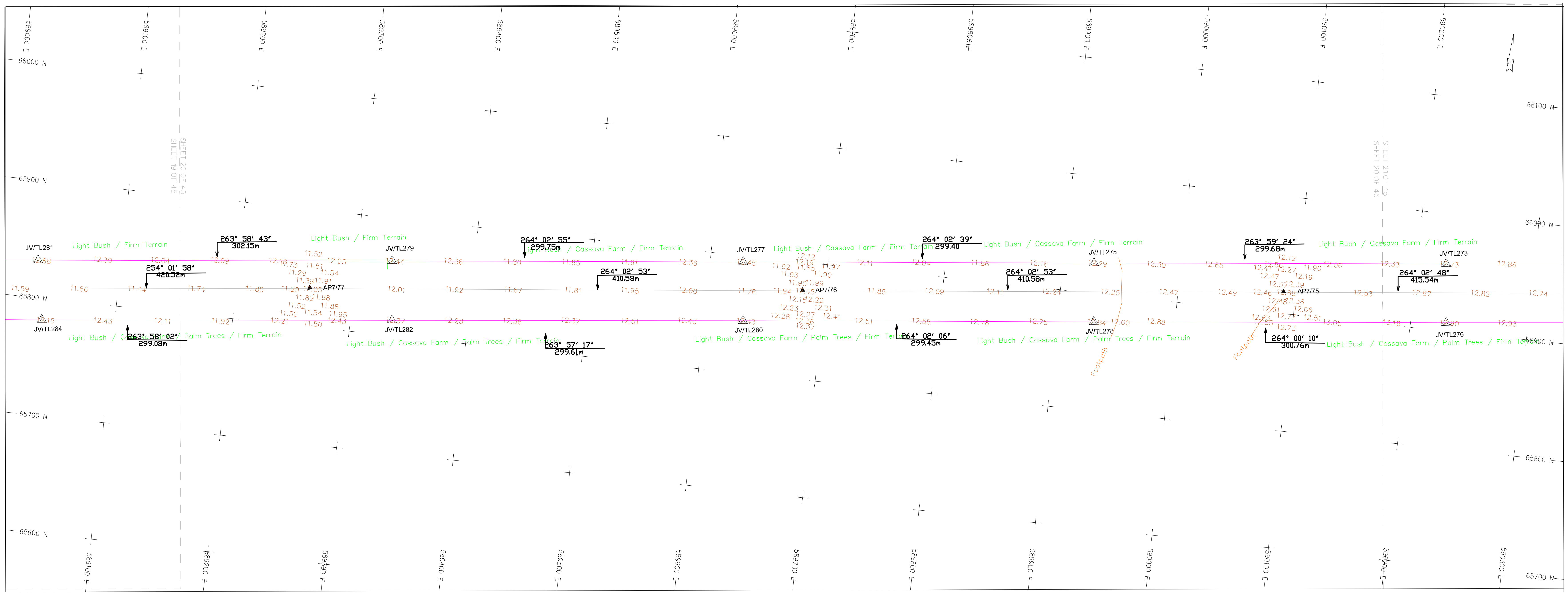
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

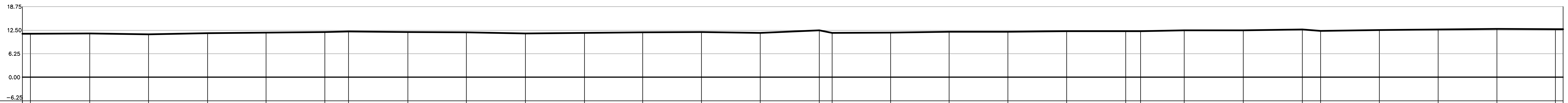
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 19 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP19

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)	
	11.59	49.54		
	11.66	50.38		
	11.44	49.97		
	11.74	50.39		
	11.85	49.62		
AP7/77	12.05		22433.75	
	12.14	20.11		
	12.01	50.39		
	11.92	49.87		
	11.67	50.25		
	11.81	50.11		
	11.95	49.54		
	12.00	50.00		
	11.76	49.88		
AP7/76	12.45		22854.27	
	11.79	10.84		
	11.85	49.67		
	12.09	49.81		
	12.11	49.98		
	12.24	49.95		
	12.25	50.12		
	12.24			
	12.47	37.30		
	12.49	50.09		
AP7/75	12.68		23264.85	
	12.29	15.61		
	12.53	49.94		
	12.67	50.03		
	12.82	50.06		
	12.74	49.74		

VEGETATION: Light Bush / Cassava Farm / Palm Trees

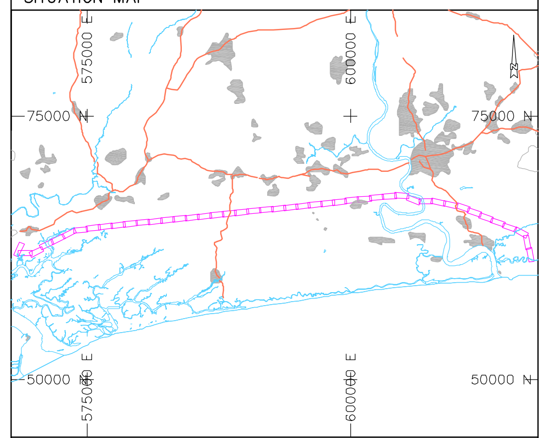
SOIL TYPE: Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

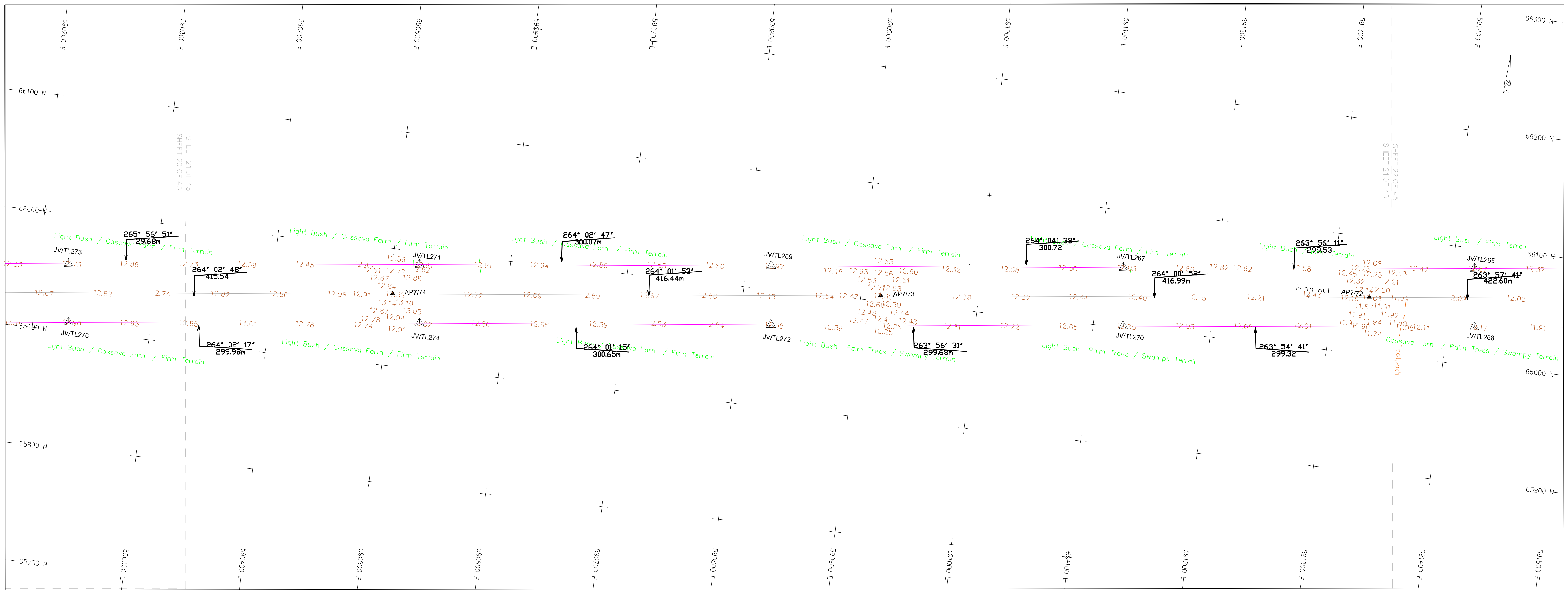
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

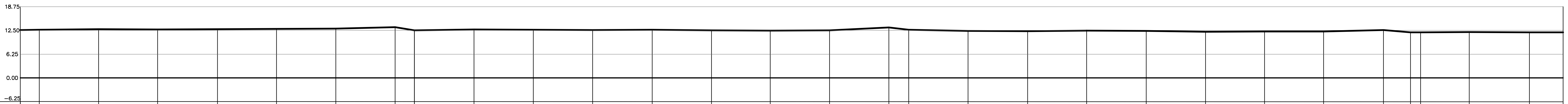
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 20 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP20

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	12.67	50.03	
	12.82	50.06	
	12.74	49.74	
	12.82	50.58	
	12.86	49.64	
	12.96	50.06	
AP7/74	13.32		23680.39
	12.53	[illegible]	
	12.72	50.22	
	12.69	50.17	
	12.59	49.84	
	12.67	50.28	
	12.50	49.92	
	12.45	49.68	
	12.54	49.95	
AP7/73	13.30	49.79	
	12.66	16.89	
	12.38	49.92	
	12.27	50.19	
	12.44	49.72	
	12.40	50.24	
	12.15	50.09	
	12.21	49.64	
	12.25	49.88	
AP7/72	12.63		24513.81
	11.99	22.81	
	11.95		
	12.09	40.87	
	12.02	50.76	

VEGETATION: Light Bush / Cassava Farm; Light Bush / Cassava Farm; Light Bush / Palm Trees; Light Bush / Palm Trees; Light Bush

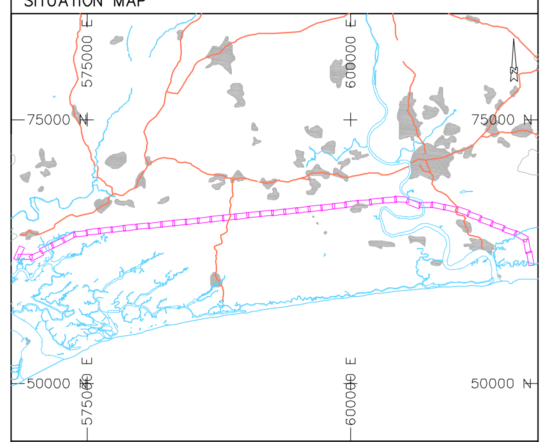
SOIL TYPE: Firm Terrain; Firm Terrain; Swampy Terrain; Swampy Terrain; Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
CONSULTING ENGINEERS
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

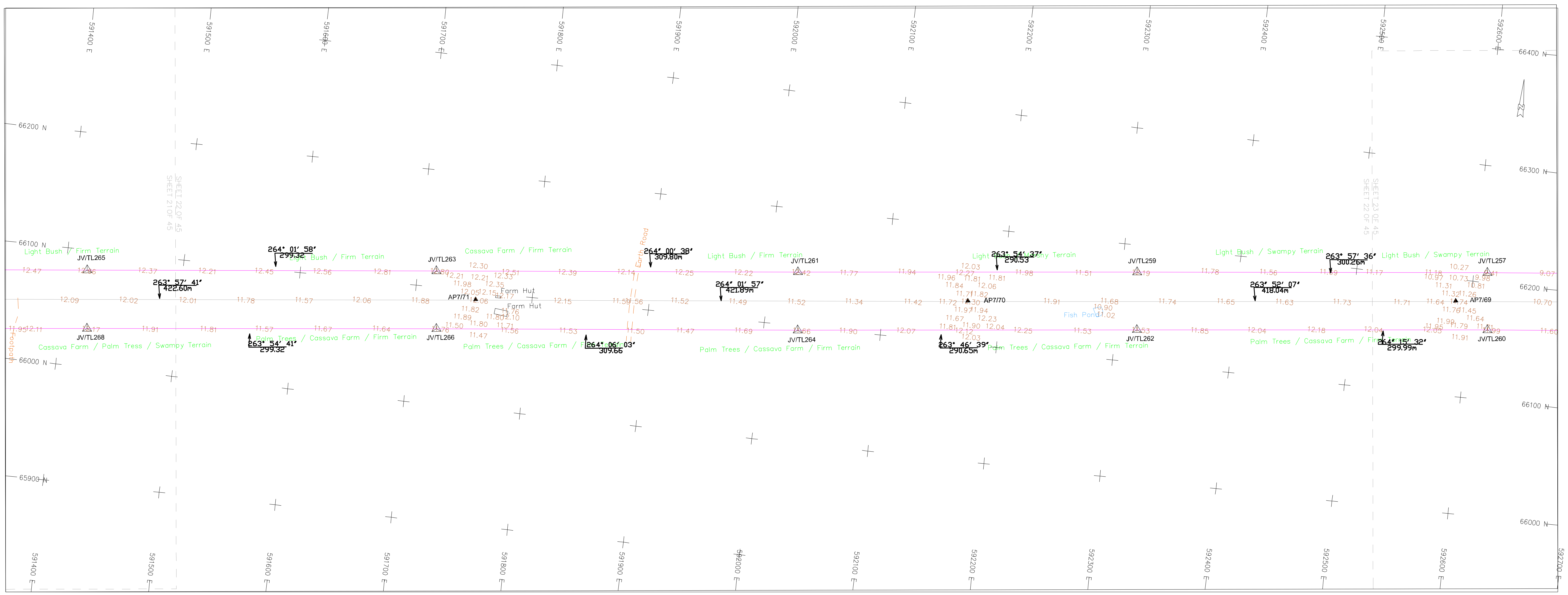
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

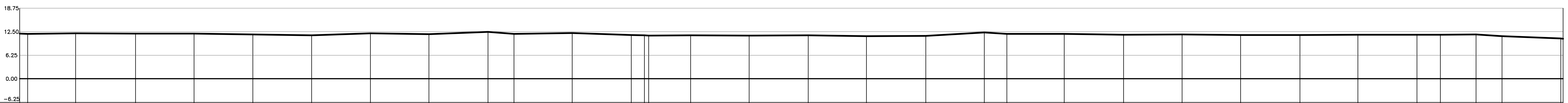
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 21 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP21

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.95		21077.73
	12.09	40.87	
	12.02	50.76	
	12.01	49.82	
	11.78	50.02	
	11.57	49.84	
	12.06	50.08	
	11.88	49.85	
AP7/71	12.43		24936.41
	11.94	22.11	
	12.15	49.51	
	11.59	50.34	
	11.56		
	11.40		
	11.52	35.67	
	11.49	49.74	
	11.52	50.21	
	11.34	49.56	
	11.42	50.44	
AP7/70	12.30		25358.30
	11.96	19.29	
	11.91	48.80	
	11.68	50.34	
	11.74	49.82	
	11.65	49.84	
	11.63	50.26	
	11.73	49.37	
	11.71	50.31	
	11.70	19.88	
AP7/69	11.74		25776.34
	11.30	22.23	
	10.70	49.90	

VEGETATION: Cassava Farm / Palm Trees; Palm Trees / Cassava Farm; Palm Trees / Cassava Farm; Palm Trees / Cassava Farm; Palm Trees / Cassava Farm; Palm Trees / Cassava Farm

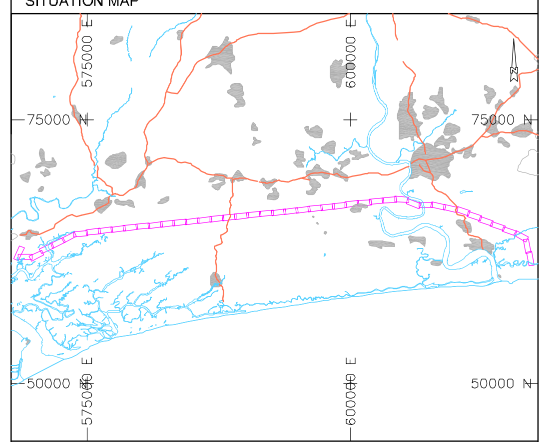
SOIL TYPE: Swampy Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

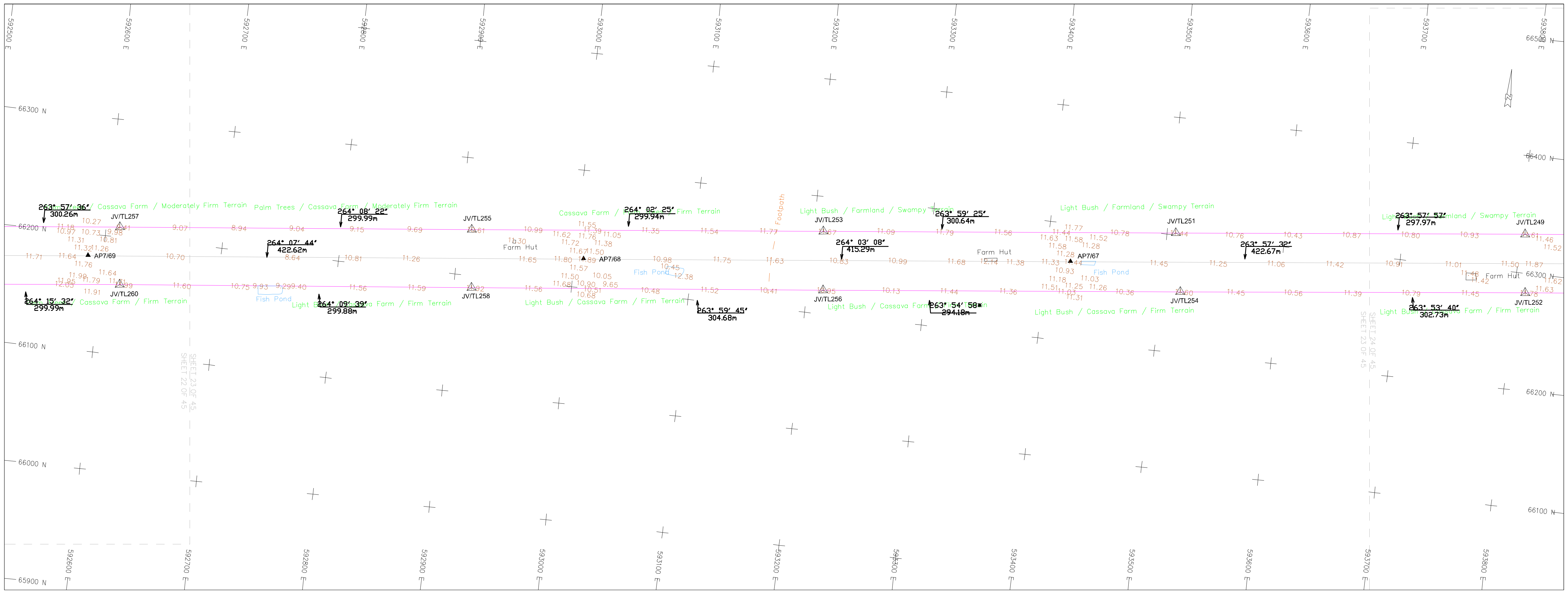
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 22 of 45

Author : FNL	Encl.	Date : January 2012	
Checked : Kalu, U Ajike		Report :	
Approved : Uchebo, A John		Drwg Ref FNL-ILF-DWG-PP22	

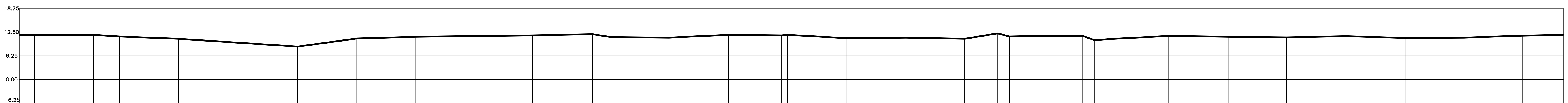
PLAN



TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.71	50.31	
	11.70	19.88	
AP7/69	11.74		25776.34
	11.30	22.23	
	10.70	49.90	
	8.64	100.90	
	10.81	49.95	
	11.26	49.66	
	11.65	99.44	
AP7/68	11.89		26198.96
	11.15	15.65	
	10.98	49.26	
	11.75	50.39	
	11.63 / 11.74	4.81	
	10.83	50.48	
	10.99	50.06	
	10.68	49.62	
	12.14	27.95	
	11.31	10.06	
	11.38	12.29	
AP7/67	11.44		26614.25
	10.29	10.22	
	10.66	11.92	
	11.45	50.66	
	11.25	50.32	
	11.06	49.48	
	11.42	50.27	
	10.91	49.97	
	11.01	50.08	
	11.50	49.25	

VEGETATION: Palm Trees / Cassava Farm; Light Bush / Cassava Farm; Light Bush / Cassava Farm; Light Bush / Cassava Farm

SOIL TYPE: Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain

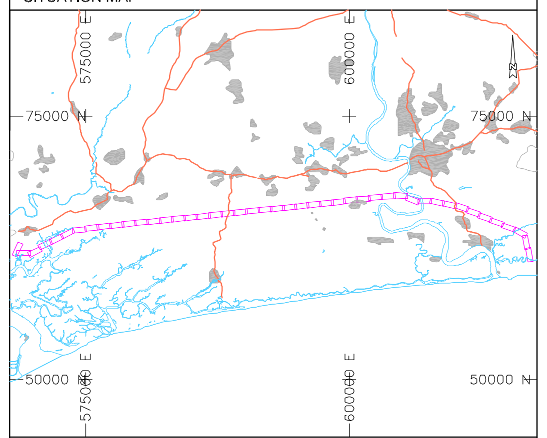


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right—of—Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

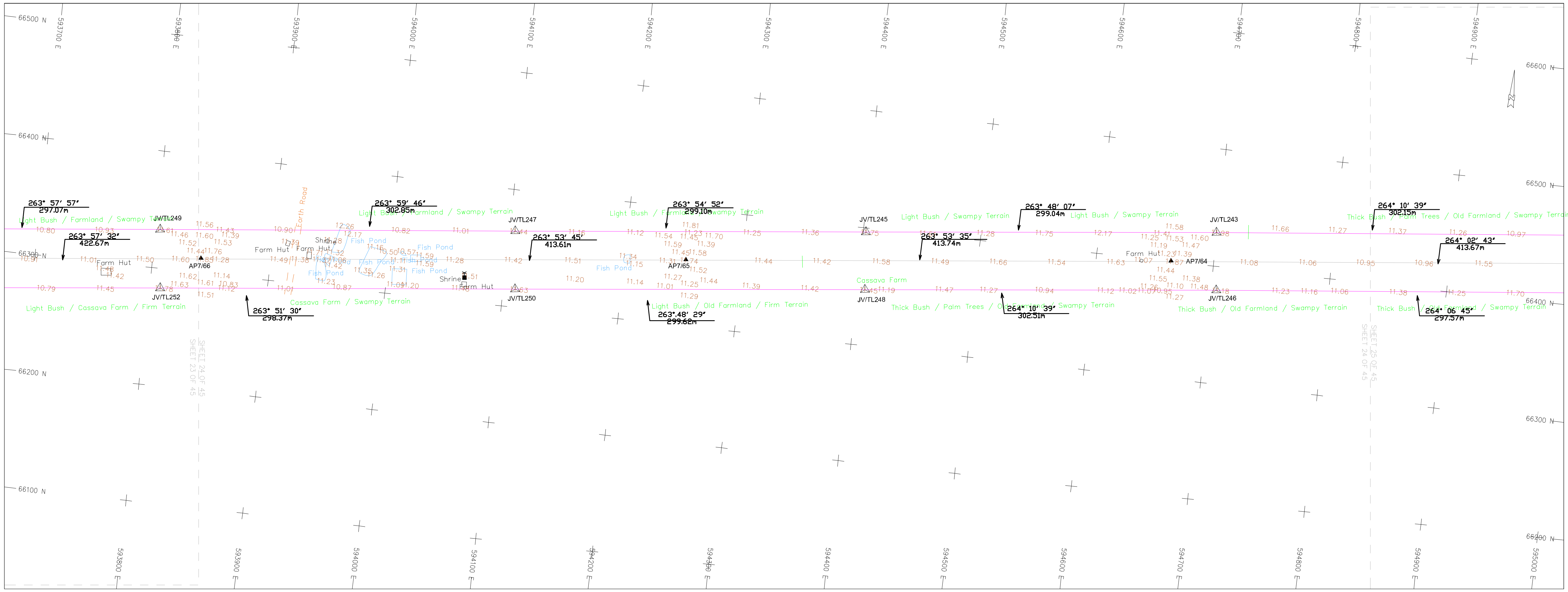
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

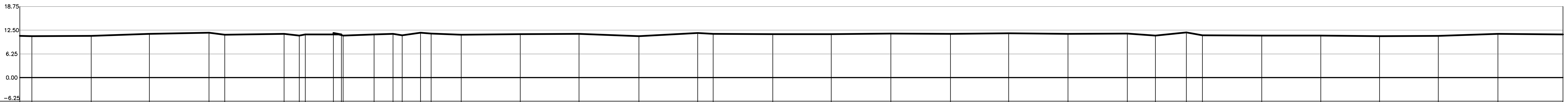
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 23 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP23

PLAN





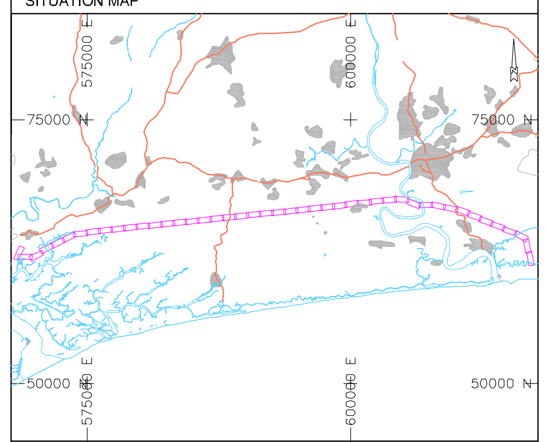
TOWER NUMBER	AP7/66, AP7/65, AP7/64
GROUND ELEVATION (m)	10.91, 11.01, 11.50, 11.85, 11.28, 11.49, 11.05, 11.38, 11.73, 11.88, 11.35, 11.50, 11.11, 11.79, 11.59, 11.28, 11.42, 11.51, 10.90, 11.74, 11.52, 11.44, 11.42, 11.58, 11.49, 11.66, 11.54, 11.63, 11.07, 11.87, 11.14, 11.08, 11.06, 10.95, 10.96, 11.55
PARTIAL HORZ. DIST. (m)	49.97, 50.08, 49.25, 13.46, 50.11, -6.71, 30.44, 7.80, 25.60, 50.09, 49.64, 13.23, 50.43, 49.58, 50.45, 50.30, 49.46, 50.03, 50.21, 13.67, 50.10, 49.97, 49.91, 49.71, 50.44
CUMMULATIVE DISTANCE (m)	27037.00, 23600.92, 27450.58, 27864.33
VEGETATION	Light Bush / Cassava Farm; Light Bush / Old Farmland; Thick Bush / Old Farmland; Thick Bush / Old Farmland
SOIL TYPE	Firm Terrain; Firm Terrain; Swampy Terrain; Swampy Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

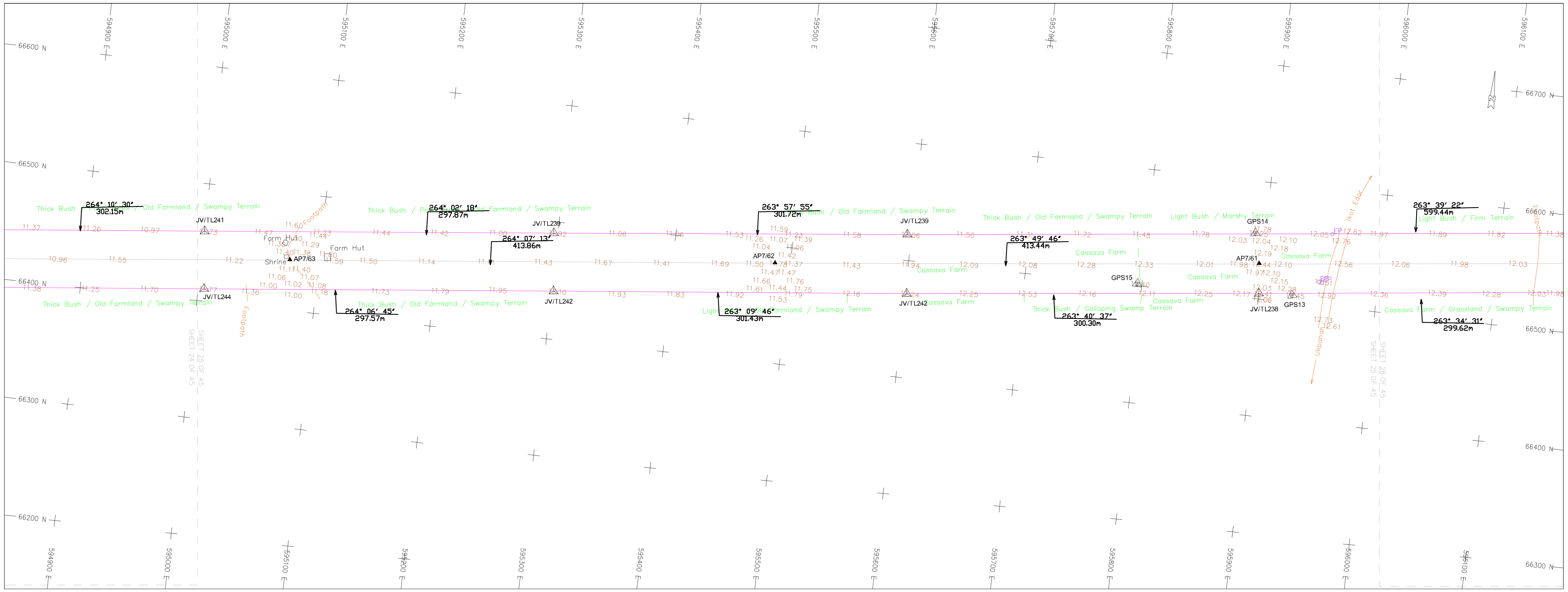
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 24 of 45

Author :	FNL	Encl.	Date : January 2012
Checked :	Kalu, U Ajike		Report :
Approved :	Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP24

PLAN

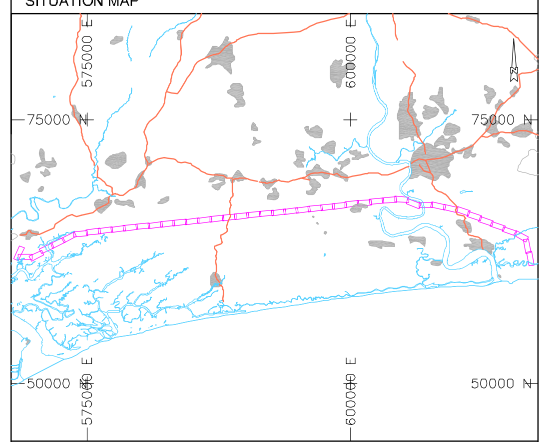


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

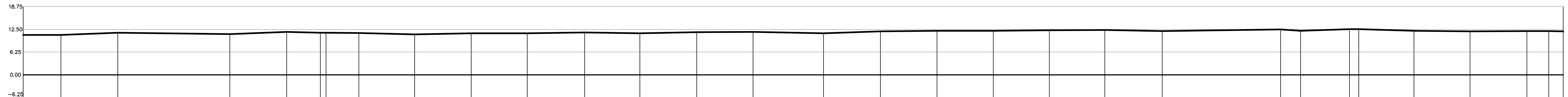
GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :



TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	10.96	49.71	
	11.55	50.44	
	11.22	99.51	
AP7/63	11.79		28278.01
	11.56		
	11.59		
	11.50	29.17	
	11.14	49.33	
	11.41	50.26	
	11.43	49.71	
	11.67	50.91	
	11.41	49.07	
	11.69	50.43	
AP7/62	11.78	49.97	28691.84
	11.43	62.69	
	11.94	50.46	
	12.09	50.13	
	12.08	50.17	
	12.28	49.60	
	12.33	49.30	
	12.01	50.85	
AP7/61	12.44		29105.00
	12.10	17.54	
	12.56		25724.22
	12.56		25724.22
	12.06	48.83	
	11.98	49.81	
	12.03	50.37	
	12.03		25724.22

VEGETATION: Thick Bush / Old Farmland; Thick Bush / Old Farmland; Light Bush / Old Farmland; Cassava Farm; Cassava Farm; Cassava Farm / Grassland

SOIL TYPE: Swampy Terrain; Swampy Terrain; Swampy Terrain; Marshy Terrain; Marshy Terrain; Swampy Terrain

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

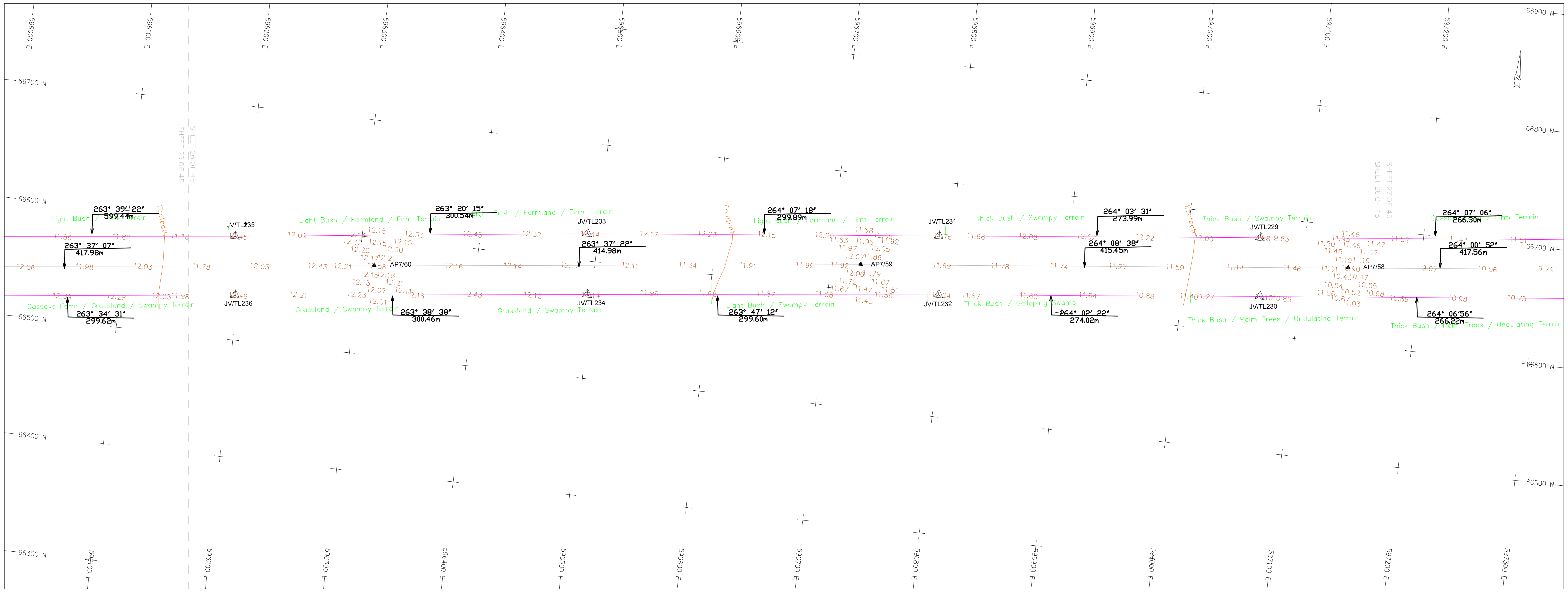
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

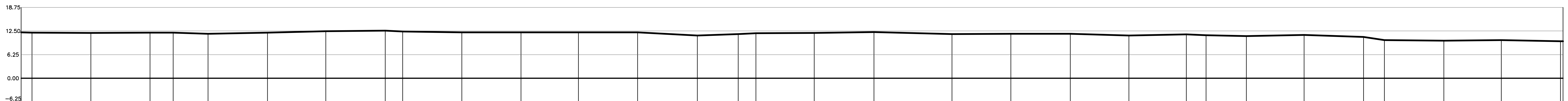
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 25 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP25

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	12.06	48.83	
	11.98	49.81	
	12.03	50.37	
	12.03		
	11.78	29.69	
	12.03	50.37	
	12.43	49.48	
AP7/60	12.58		29522.91
	12.34	14.92	
	12.16	50.23	
	12.14	50.21	
	12.17	48.70	
	12.11	50.22	
	11.34	50.70	
	11.69		
	11.91	15.02	
	11.99	49.49	
AP7/59	12.25		29937.80
	11.69	66.42	
	11.78	49.78	
	11.74	50.57	
	11.27	49.79	
	11.59	48.74	
	11.40		
	11.14	34.19	
	11.46	49.00	
AP7/58	10.90		30353.62
	10.10	17.56	
	9.97	50.43	
	10.06	48.78	
	9.79	50.19	

VEGETATION: Cassava Farm / Grassland; Grassland; Light Bush; Thick Bush; Thick Bush / Palm Trees; Thick Bush / Palm Trees

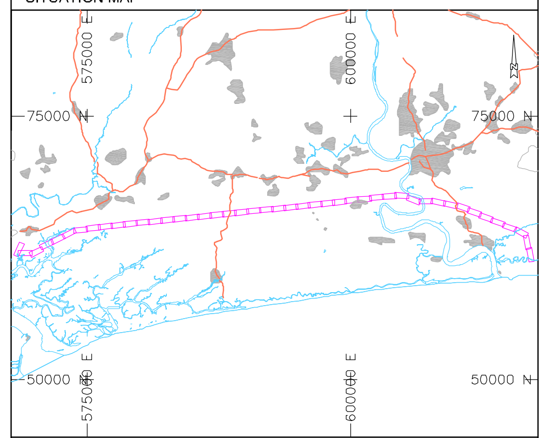
SOIL TYPE: Swampy Terrain; Swampy Terrain; Swampy Terrain; Galloping Swamp; Undulating Terrain; Undulating Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

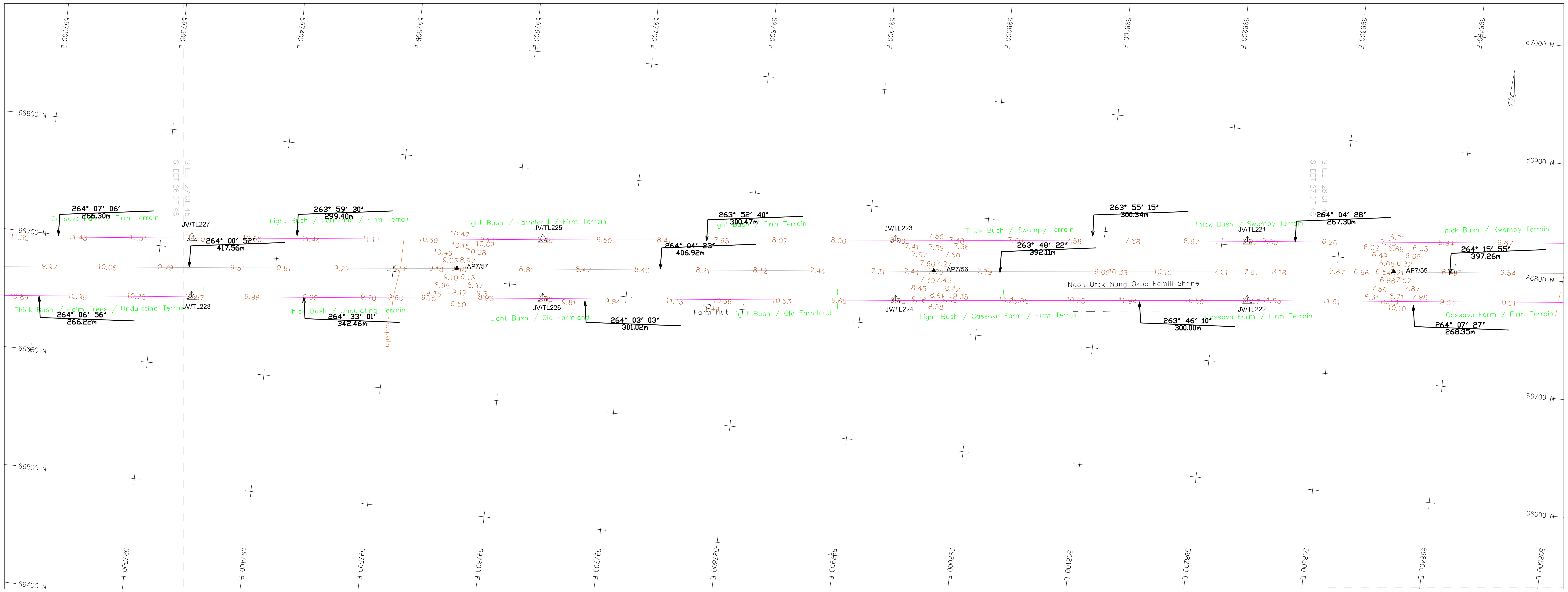
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

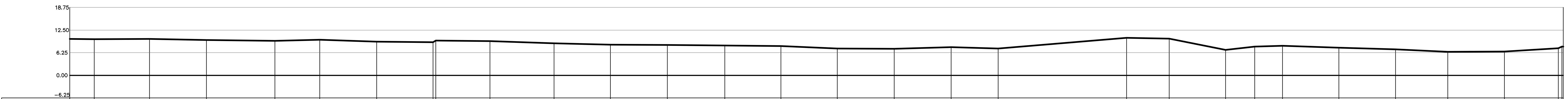
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 26 of 45

Author : FNL	Encl.	Date : January 2012	
Checked : Kalu, U Ajike		Report :	
Approved : Uchebo, A John		Drwg Ref FNL-ILF-DWG-PP26	

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	9.97	50.43	
	10.06	48.78	
	9.79	50.19	
	9.51	60.43	
	9.81	39.75	
	9.27	50.23	
	9.16	49.68	
AP7/57	9.48		30770.95
	8.81	56.48	
	8.47	49.77	
	8.40	50.11	
	8.21	50.71	
	8.12	49.41	
	7.44	49.87	
	7.31	50.10	
AP7/56	7.76		31177.67
	7.39	41.43	
	10.33	113.45	
	10.15	37.65	
	7.01	49.73	
	7.91	25.60	
	8.18	24.51	
	7.67	49.88	
AP7/55	7.21		31569.92
	6.49	46.04	
	6.54	49.96	
	7.47 7.53	47.52	28189.14

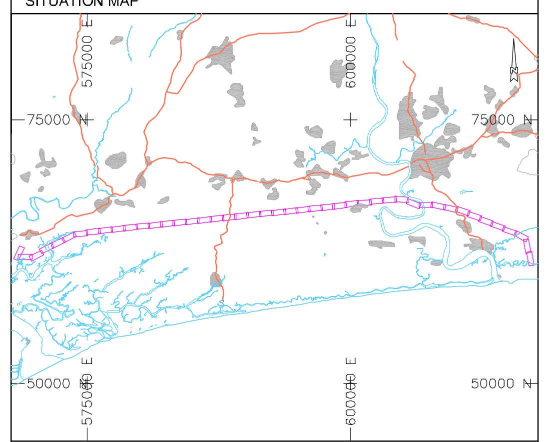
VEGETATION	SOIL TYPE
Thick Bush / Palm Trees	Undulating Terrain
Thick Bush	Undulating Terrain
Light Bush	Old Farmland
Light Bush	Old Farmland
Light Bush / Cassava Farm	Firm Terrain
Cassava Farm	Firm Terrain
Cassava Farm	Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

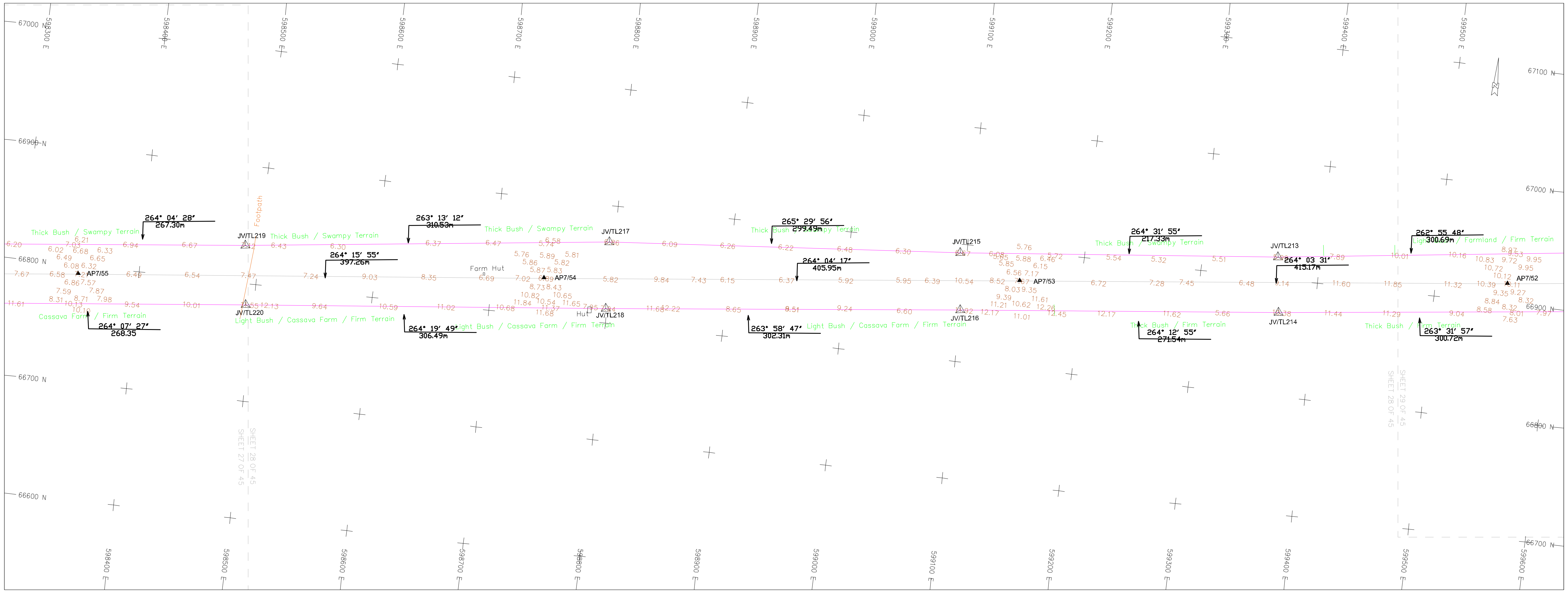
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

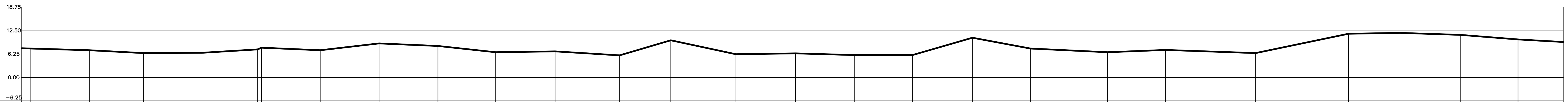
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 27 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP27

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	7.67	49.88	
AP7/55	7.21		31569.92
	6.49	46.04	
	6.54	49.96	
	7.47	47.52	
	7.24	50.07	
	9.03	50.24	
	8.35	50.41	
	6.69	49.08	
AP7/54	6.89		31967.23
	5.82	55.22	
	9.84	43.71	
	6.15	55.41	
	6.37	50.90	
	5.92	50.57	
	5.95	49.29	
	10.54	51.24	
AP7/53	7.67		32373.02
	6.72	65.69	
	7.28	49.42	
	6.48	76.99	
	11.60	79.40	
	11.85	43.97	
	11.32	51.24	
AP7/52	10.11		32788.98

VEGETATION: Cassava Farm; Light Bush / Cassava Farm; Light Bush / Cassava Farm; Light Bush / Cassava Farm; Thick Bush; Thick Bush

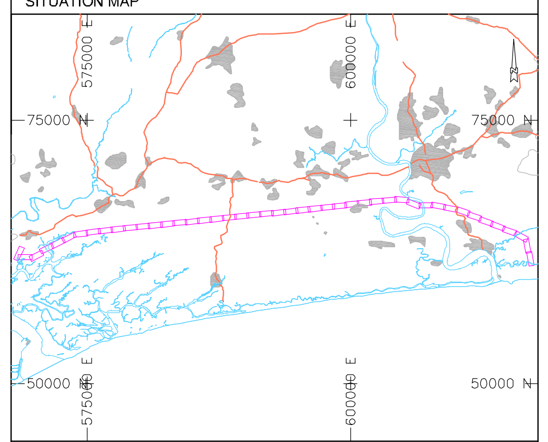
SOIL TYPE: Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain; Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

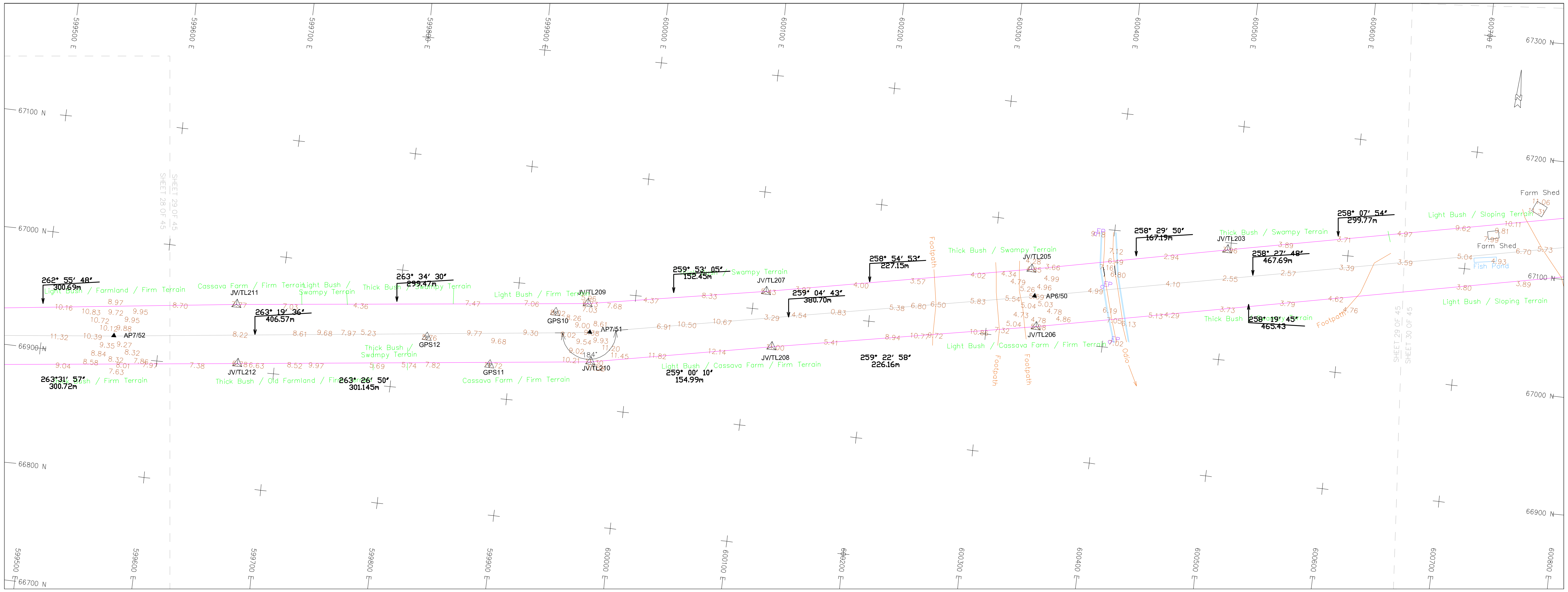
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 28 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref FNL-ILF-DWG-PP28

PLAN



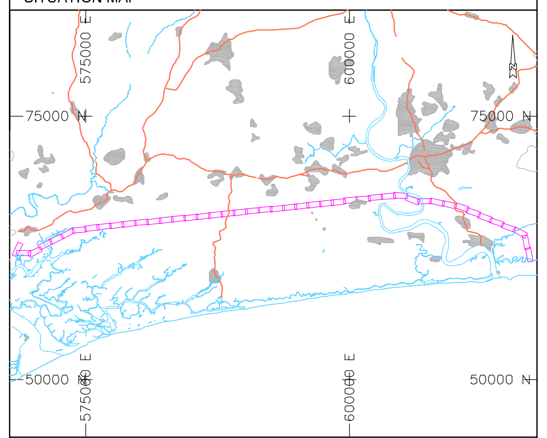
TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	11.32	51.24	
AP7/52	10.11		32788.93
	8.22	106.27	
	8.61	49.82	
	5.23	59.49	
	5.68	52.46	
	9.77	37.90	
	9.30	48.15	
AP7/51	9.38		33194.93
	6.91	60.90	
	10.67	50.29	
	3.29	43.03	
	0.83	57.31	
	5.38	49.93	
	6.50	35.24	
	5.83	33.94	
AP7/50	5.59		33575.57
	4.99	50.63	
	6.20		
	6.13		
	4.10	42.59	
	2.55	49.27	
	2.57	49.80	
	3.39	50.05	
	3.51	24.77	
	3.59	25.15	
	5.04	51.65	
	6.70	49.98	
	5.73		

VEGETATION	SOIL TYPE
Light Bush / Farmland	Firm Terrain
Thick Bush / Old Farmland	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain
Thick Bush	Swampy Terrain
Light Bush	Sloping Terrain

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

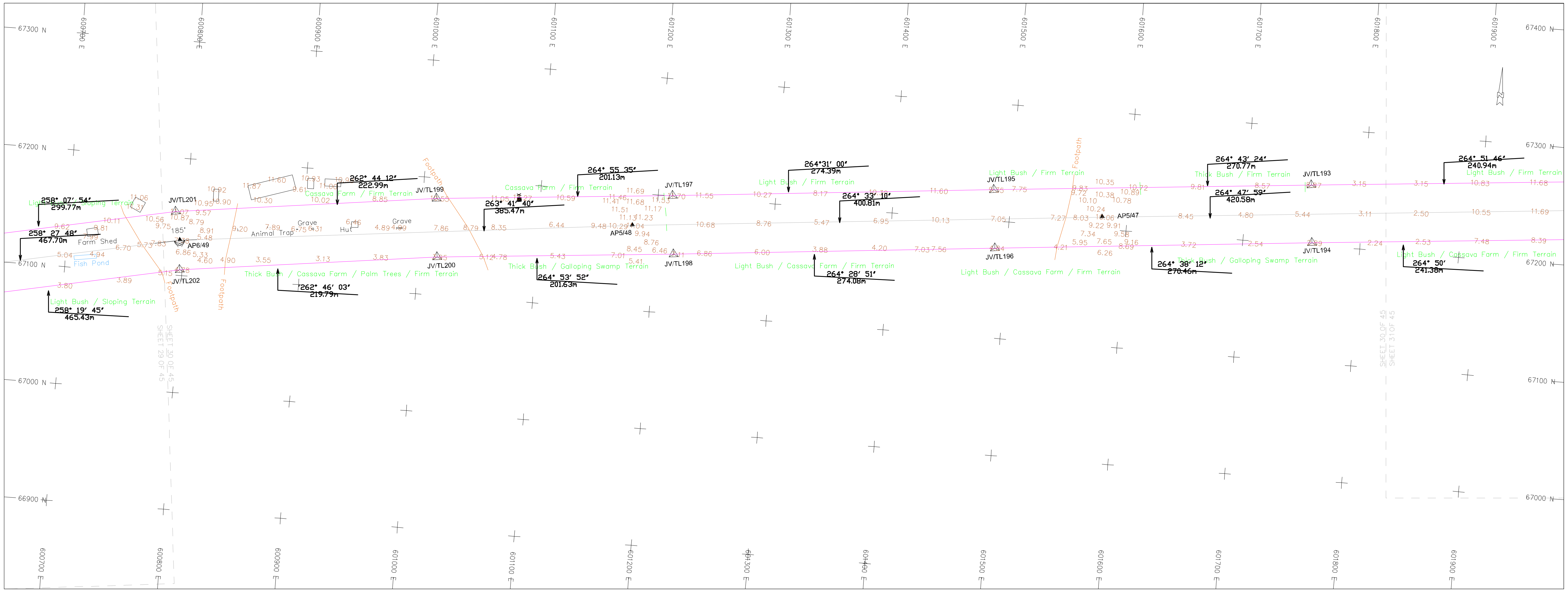
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

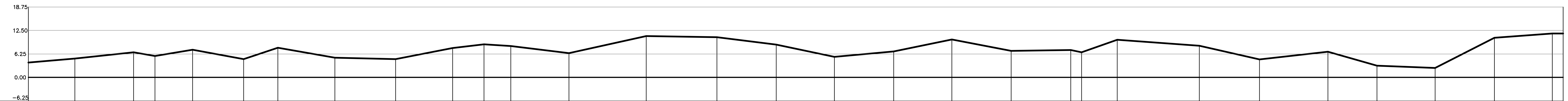
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 29 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP29

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	5.04	51.65	
	6.70	49.98	
	5.73		
AP7/49	7.38		34043.22
	4.90		
	7.91	29.05	
	5.22	48.47	
	4.89	51.68	
	7.86	48.62	
	8.79		
	8.35	22.77	
	6.44	49.44	
AP7/48	11.04		34429.30
	10.68	60.09	
	8.76	50.41	
	5.47	49.57	
	6.95	50.44	
	10.13	49.49	
	7.05	50.48	
	7.27	50.79	
	6.70		
AP7/47	10.06		34830.11
	8.45	69.79	
	4.80	51.23	
	6.88	58.25	
	3.11	41.76	
	2.50	49.32	
	10.55	50.47	
	11.69	49.43	

VEGETATION: Light Bush | Thick Bush / Cassava Farm / Palm Trees | Thick Bush | Light Bush / Cassava Farm | Light Bush / Cassava Farm | Thick Bush | Light Bush / Cassava Farm

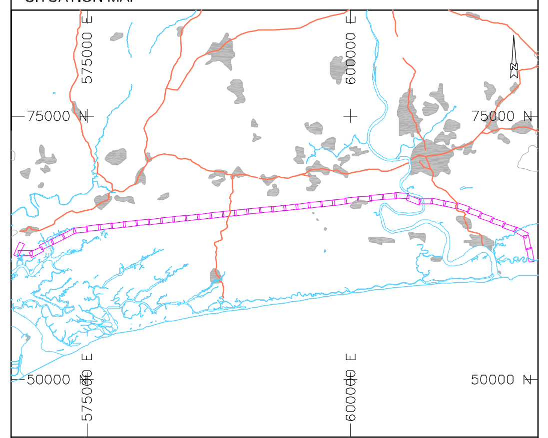
SOIL TYPE: Sloping Terrain | Firm Terrain | Galloping Swamp Terrain | Firm Terrain | Firm Terrain | Galloping Swamp Terrain | Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

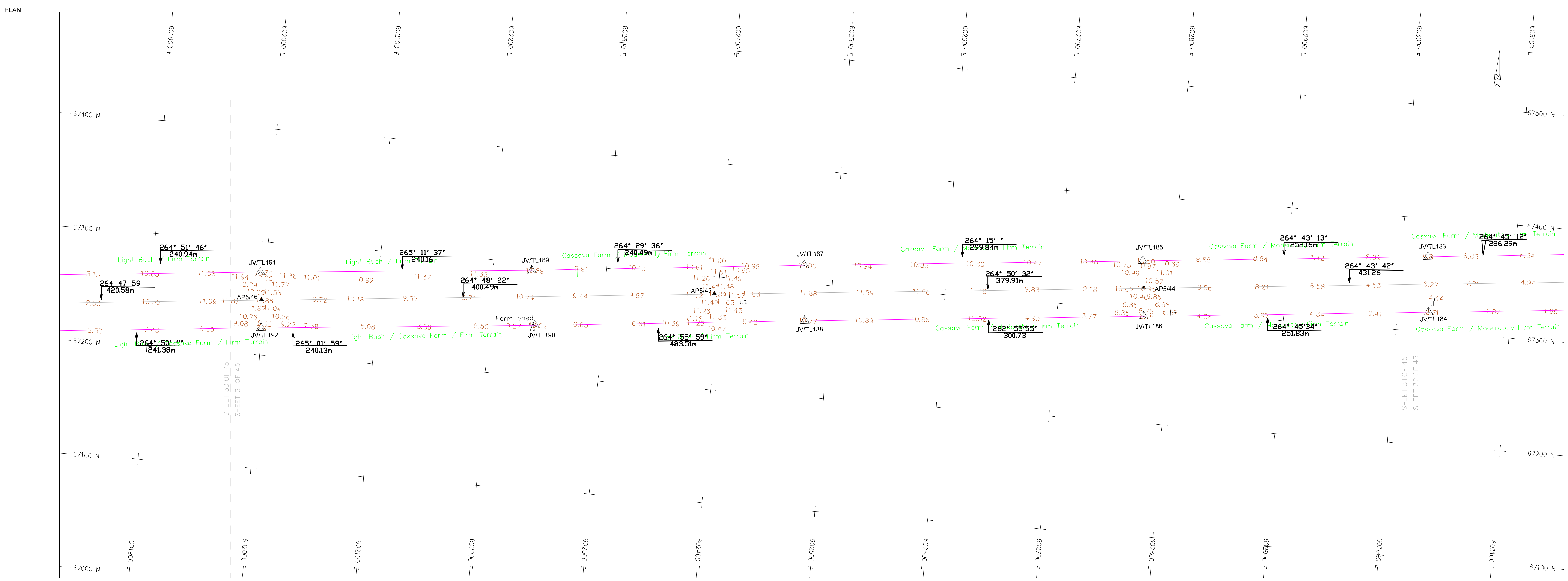
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

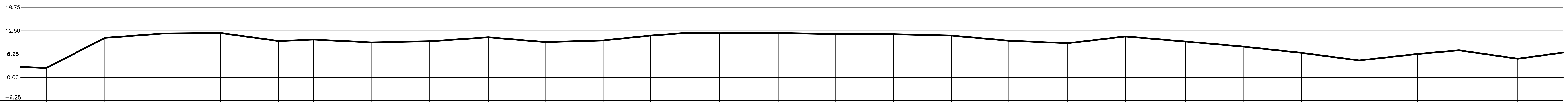
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 30 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP30

PLAN





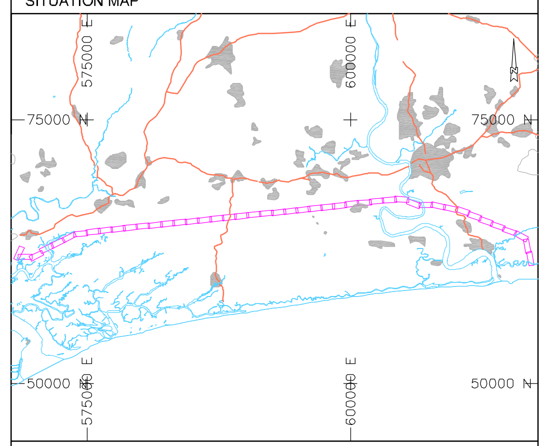
TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	2.50	49.32	
	10.55	50.47	
	11.69	49.43	
AP7/46	11.86		35250.69
	9.72	50.19	
	10.16	30.09	
	9.37	49.73	
	9.71	50.51	
	10.74	50.37	
	9.44	49.69	
	9.87	49.52	
	11.18	40.59	
AP7/45	11.89		35651.18
	11.83	30.00	
	11.88	50.33	
	11.59	49.88	
	11.56	49.82	
	11.19	49.93	
	9.83	49.35	
	9.18	50.77	
AP7/44	10.95		36031.09
	9.56	51.80	
	8.21	49.67	
	6.58	50.29	
	4.53	49.69	
	6.27	50.48	
	7.21	35.80	
	4.94	50.68	

VEGETATION	SOIL TYPE
Light Bush / Cassava Farm	Firm Terrain
Light Bush / Cassava Farm	Firm Terrain
Thick Bush	Firm Terrain
Cassava Farm	Moderately Firm Terrain
Cassava Farm	Moderately Firm Terrain

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on	Easting (m)	Northing (m)	Elevation (m)
QIT 1	615897.120	60047.060	4.370
QIT 2	616158.390	60039.700	4.600
QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

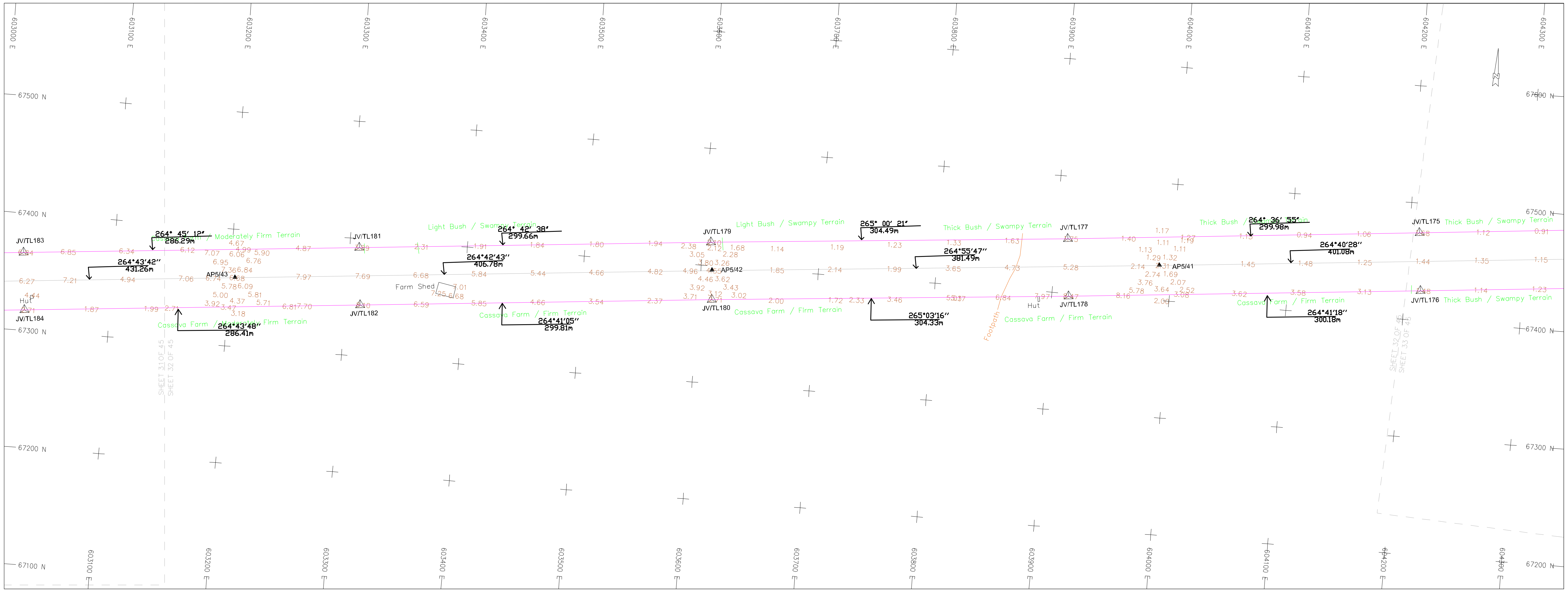
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

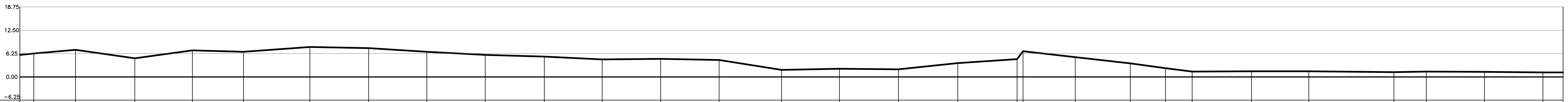
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 31 of 45

Author : FNL	Encl.	Date :	January 2012
Checked : Kalu, U Ajike		Report :	
Approved : Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP31

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	6.27	50.48	
	7.21	35.80	
	4.94	50.68	
	7.06	49.32	
AP7/43	6.68		36462.37
	7.97	56.78	
	7.69	50.15	
	6.68	49.93	
	5.84	49.93	
	5.44	50.39	
	4.66	49.44	
	4.82	50.21	
AP7/42	4.55		36869.15
	1.85	53.37	
	2.14	49.43	
	1.99	50.33	
	3.69	50.89	
	4.73 / 6.84	50.56 / 5.08	
	5.28	44.67	
	3.60	47.06	
AP5/41	2.31		37250.65
	1.43	22.94	
	1.45	50.59	
	1.48	49.18	
	1.25	72.63	
	1.44	27.66	
	1.35	49.86	
	1.15	49.98	

VEGETATION: Cassava Farm | Cassava Farm | Cassava Farm | Cassava Farm | Cassava Farm | Cassava Farm | Thick Bush

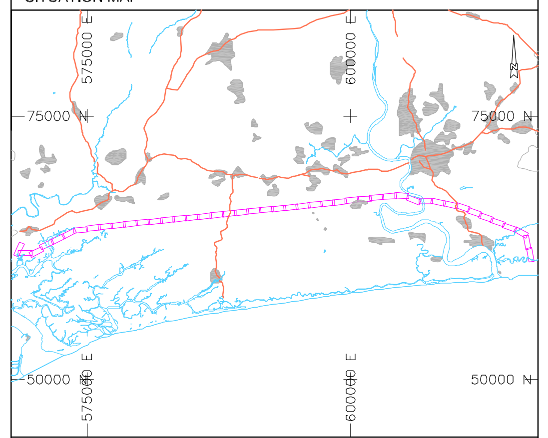
SOIL TYPE: Moderately Firm Terrain | Firm Terrain | Firm Terrain | Firm Terrain | Firm Terrain | Firm Terrain | Thick Bush

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED

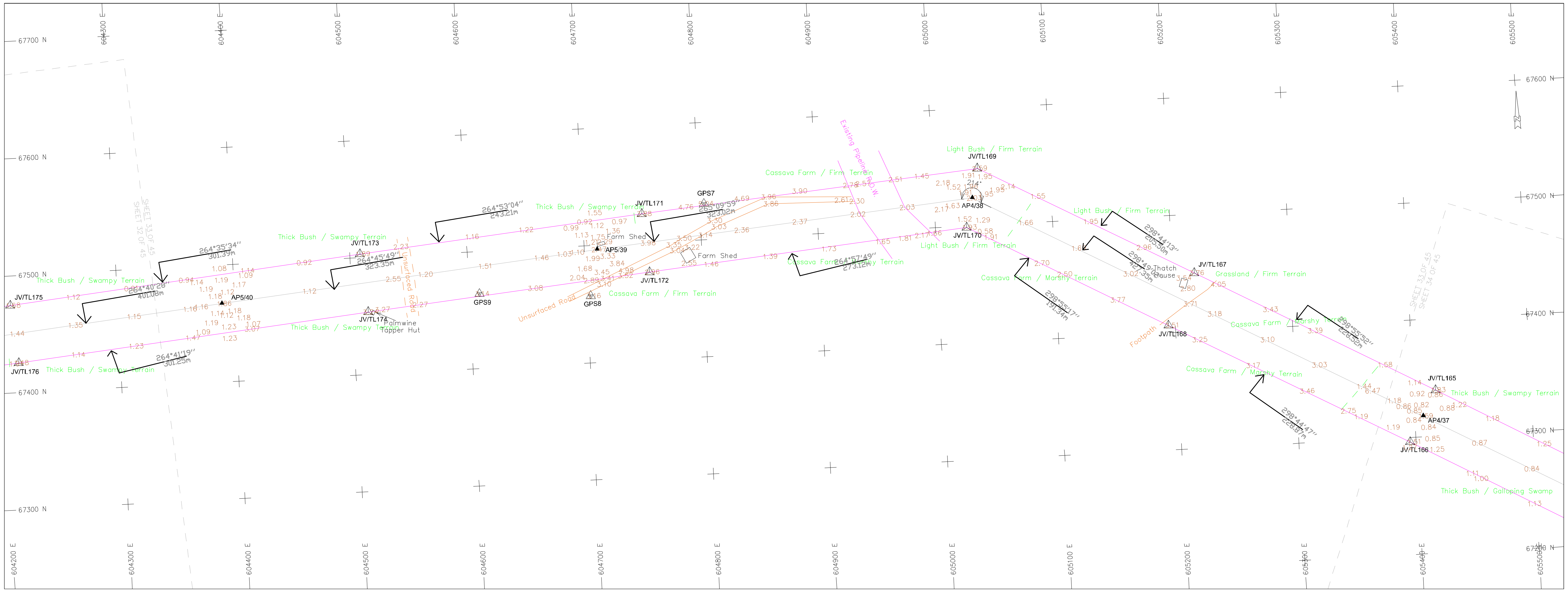
FUGRO NIGERIA LIMITED

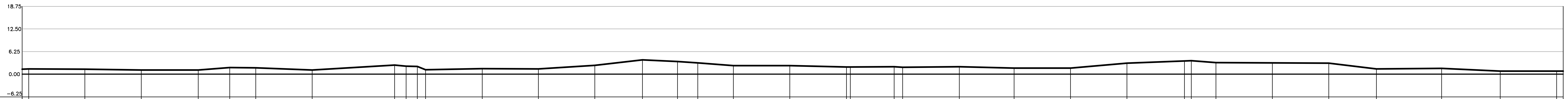
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 32 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U.Ajike		Report :	
Approved :	Uchebo, A.John		Drwg. Ref.	FNL-ILF-DWG-PP32

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	1.44	27.66	
	1.35	49.86	
	1.15	49.98	
	1.12	50.42	
AP5/40	1.86		37651.73
	1.76	23.13	
	1.12	49.80	
	2.55	73.11	
	2.23		
	2.12		
	1.20	7.27	
	1.51	50.36	
	1.46	49.71	
AP5/39	2.47		37975.08
	3.98	42.21	
	3.50		
	3.14		
	2.36	31.50	
	2.37	50.19	
	2.02 / 1.96	50.01	
	2.03		
	1.89	7.54	
AP4/38	2.03		38298.10
	1.66	48.48	
	1.69	50.02	
	3.02	49.97	
	3.69	50.94	
	3.71		
	3.18	21.88	
	3.10	50.09	
	3.03	49.85	
	1.44	42.14	
AP4/37	1.59		38725.45
	0.87	51.89	
	0.84	49.87	

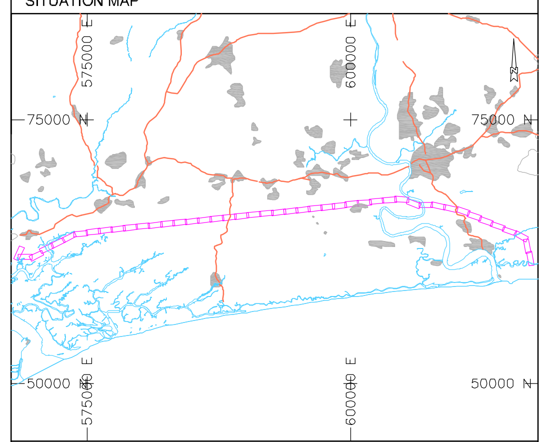
VEGETATION	Thick Bush	Thick Bush	Cassava Farm	Cassava Farm	Light Bush	Cassava Farm	Thick Bush
SOIL TYPE	Swampy Terrain	Swampy Terrain	Firm Terrain	Firm Terrain	Firm Terrain	Marshy Terrain	Swampy Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

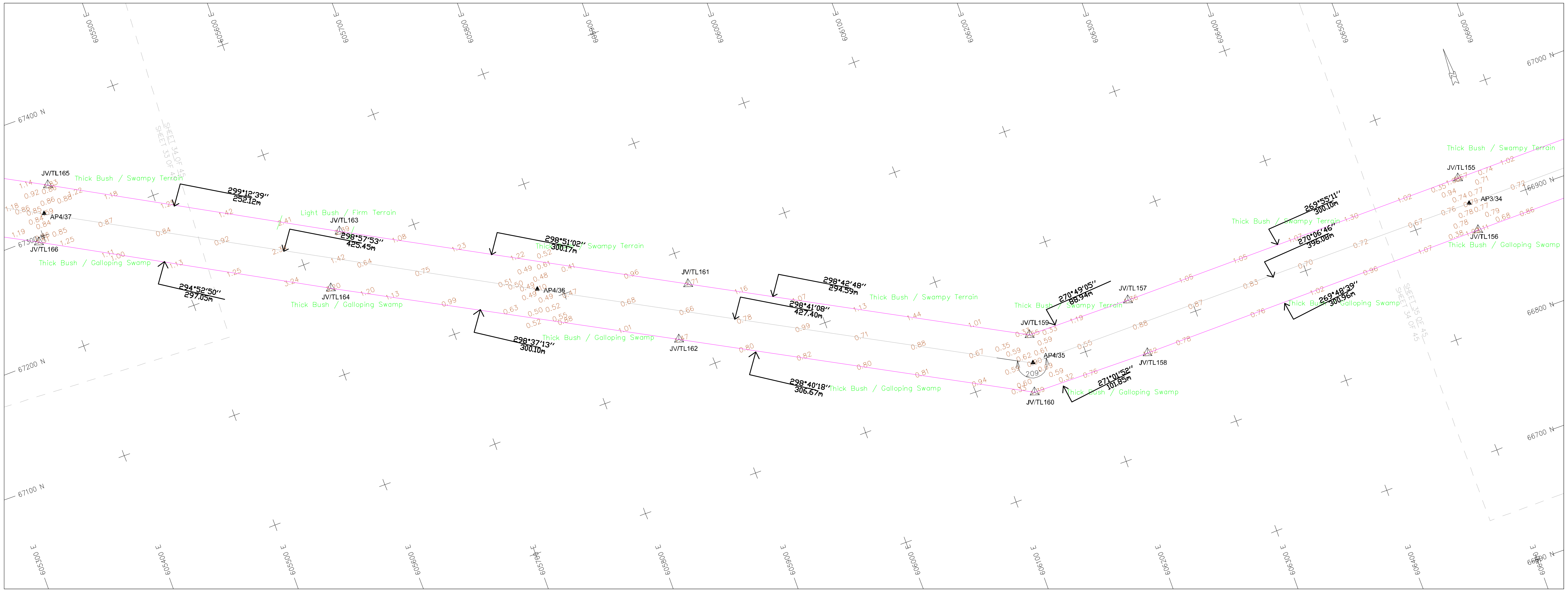
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

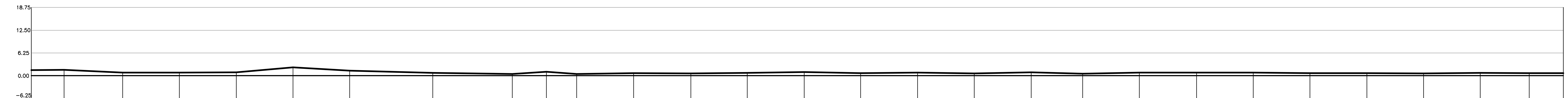
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 33 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref :FNL-ILF-DWG-PP33

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
AP4/37	1.59		38725.45
	0.87	51.89	
	0.84	49.87	
	0.92	50.19	
	2.34	49.96	
	1.42	50.02	
	0.75	73.22	
	0.51	70.29	
AP4/36	1.10		39150.90
	0.47	26.77	
	0.68	50.16	
	0.66	50.42	
	0.78	49.77	
	0.99	50.18	
	0.71	49.82	
	0.88	50.11	
	0.67	50.04	
AP4/35	0.90		39578.30
	0.55	45.41	
	0.88	50.13	
	0.87	50.44	
	0.83	50.01	
	0.70	49.81	
	0.72	50.18	
	0.67	49.98	
AP3/34	0.79		39974.38
	0.72	43.04	

VEGETATION: Thick Bush | Thick Bush | Thick Bush | Thick Bush | Thick Bush | Thick Bush | Thick Bush

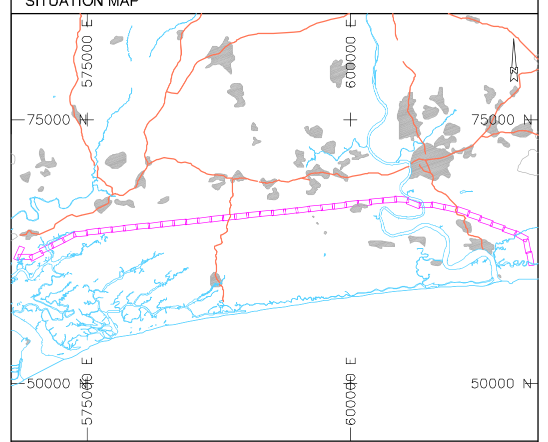
SOIL TYPE: Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp | Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on

	Easting (m)	Northing (m)	Elevation (m)
QIT 1	615897.120	60047.060	4.370
QIT 2	616158.390	60039.700	4.600
QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

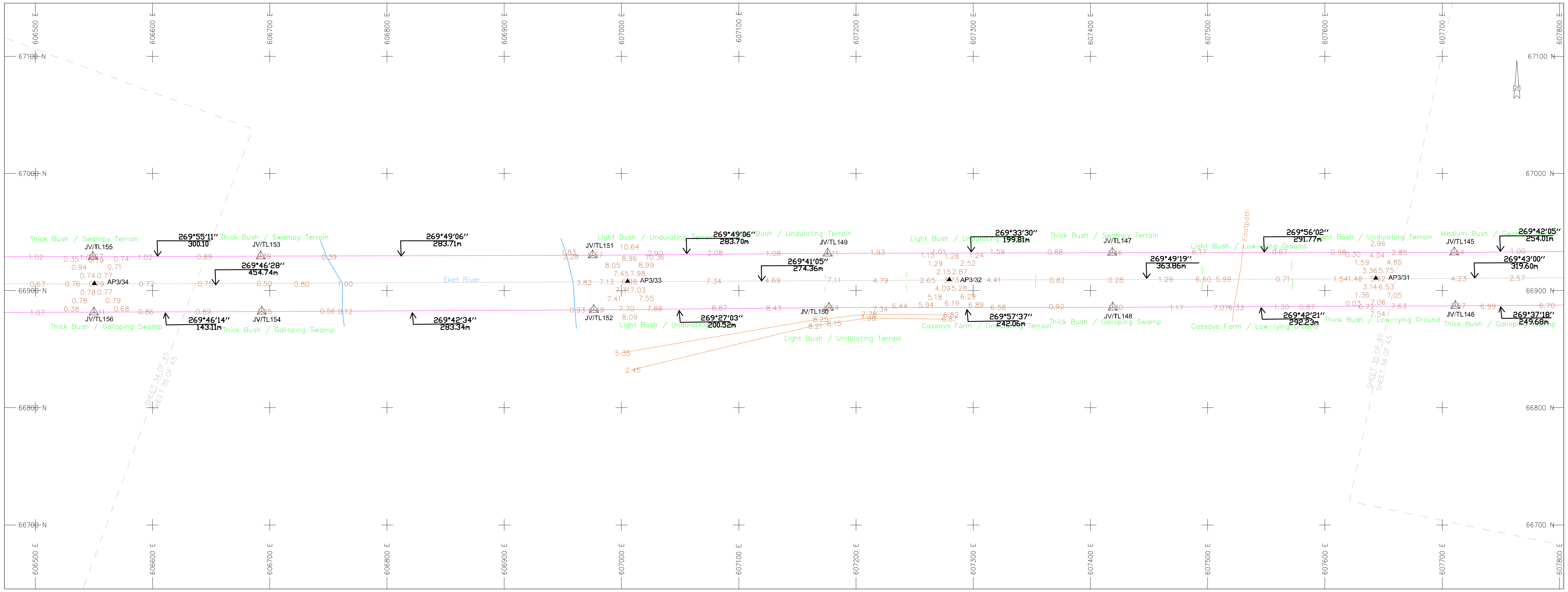
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

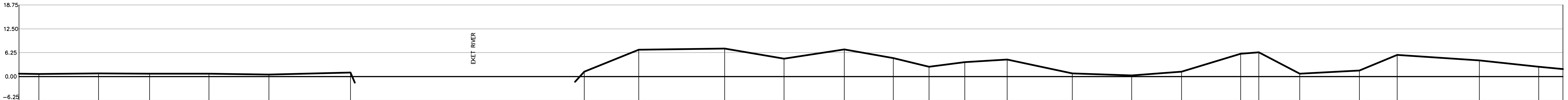
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 34 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP34

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	0.67	49.98	
AP3/34	0.79		39974.38
	0.72	43.04	
	0.75	49.98	
	0.50	50.36	
	1.00		40186.03
	1.26		40383.03
AP3/33	6.98		40429.17
	7.34	72.13	
	4.69	50.15	
	7.11	50.53	
	4.79	41.26	
	2.54	30.03	
AP3/32	3.73		40703.55
	4.41	35.50	
	0.82	55.02	
	0.28	49.99	
	1.29	41.75	
	5.99	49.85	
	6.33		
	0.71	34.54	
	1.54	50.11	
AP3/31	5.62		41087.42
	4.23	69.10	
	2.57	49.91	

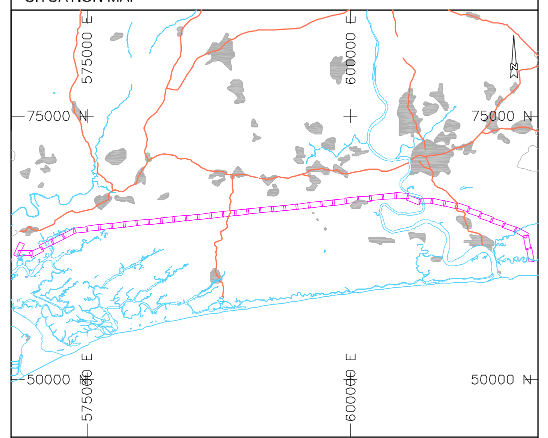
VEGETATION	SOIL TYPE
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Light Bush	Undulating Terrain
Cassava Farm	Undulating Terrain
Thick Bush	Galloping Swamp
Light Bush	Undulating Terrain
Thick Bush	Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

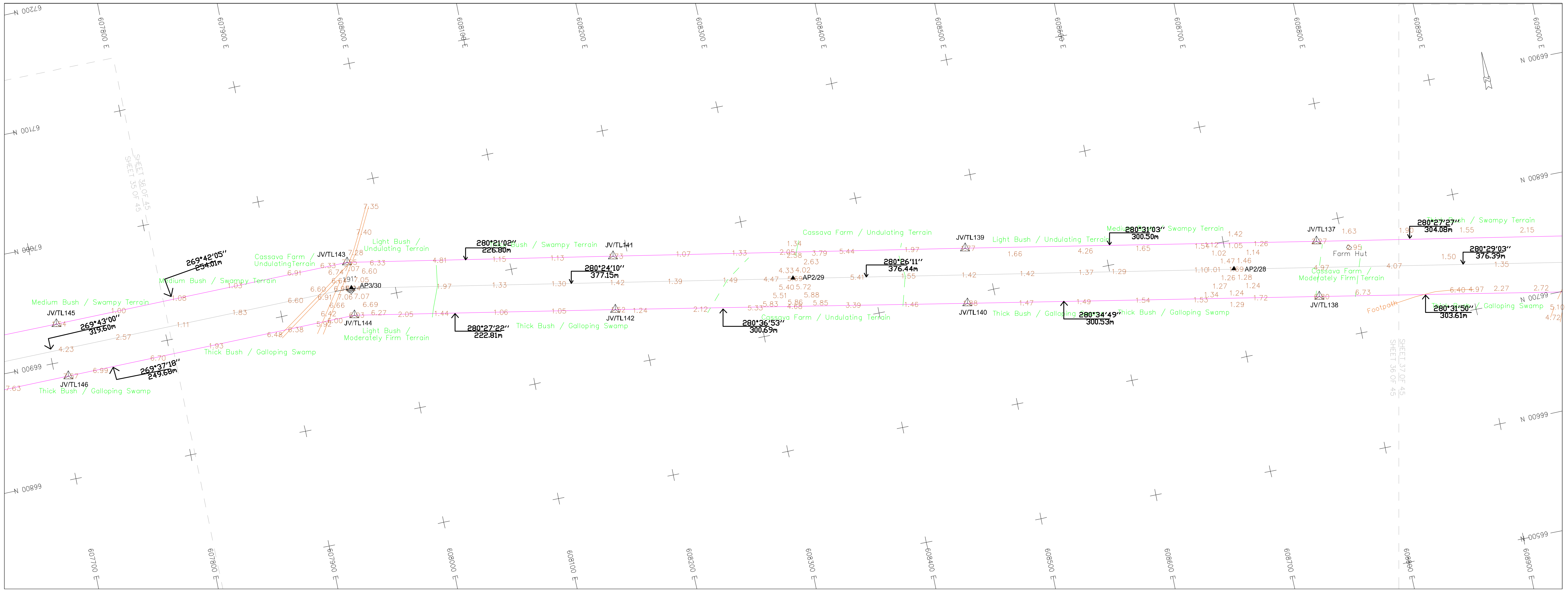
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

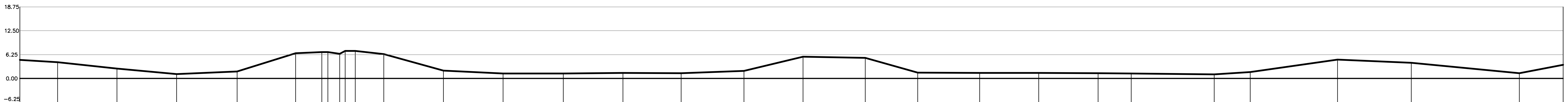
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 35 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref	:FNL-ILF-DWG-PP35

PLAN





TOWER NUMBER										AP3/30								AP2/29							AP2/28			
GROUND ELEVATION (m)	4.23	2.57	1.11	1.83	6.60	6.94	6.91	6.48	7.21	7.24	6.40	2.08	1.33	1.30	1.42	1.39	1.98	5.69	5.41	1.55	1.42	1.42	1.37	1.29	1.10	1.69	4.97	4.07	1.35
PARTIAL HORZ. DIST. (m)	69.10	49.91	50.07	51.04	49.19						24.08	50.16	50.32	50.72	50.03	49.08	52.95		52.39	44.12	52.02	49.72	50.09	27.90	69.92		73.40	62.13	91.08
CUMMULATIVE DISTANCE (m)										41387.03								41764.18								42140.64			

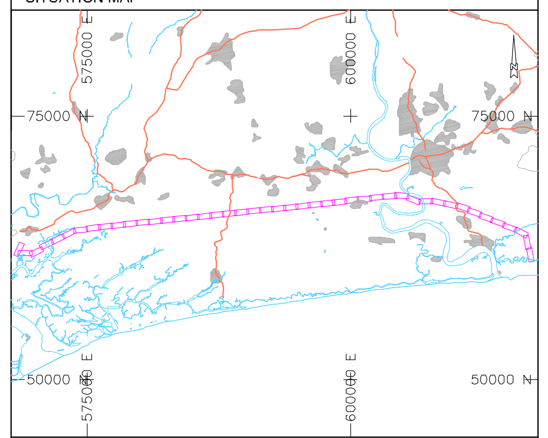
VEGETATION	Thick Bush	Light Bush	Thick Bush	Cassava Farm	Thick Bush	Medium Bush	Thick Bush
SOIL TYPE	Galloping Swamp	Moderately Firm Terrain	Galloping Swamp	Undulating Terrain	Galloping Swamp	Swampy Terrain	Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

		Easting (m)	Northing (m)	Elevation (m)
Survey based on	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF CONSULTING ENGINEERS

ILF ENGINEERS NIGERIA LIMITED

Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

FUGRO NIGERIA LIMITED

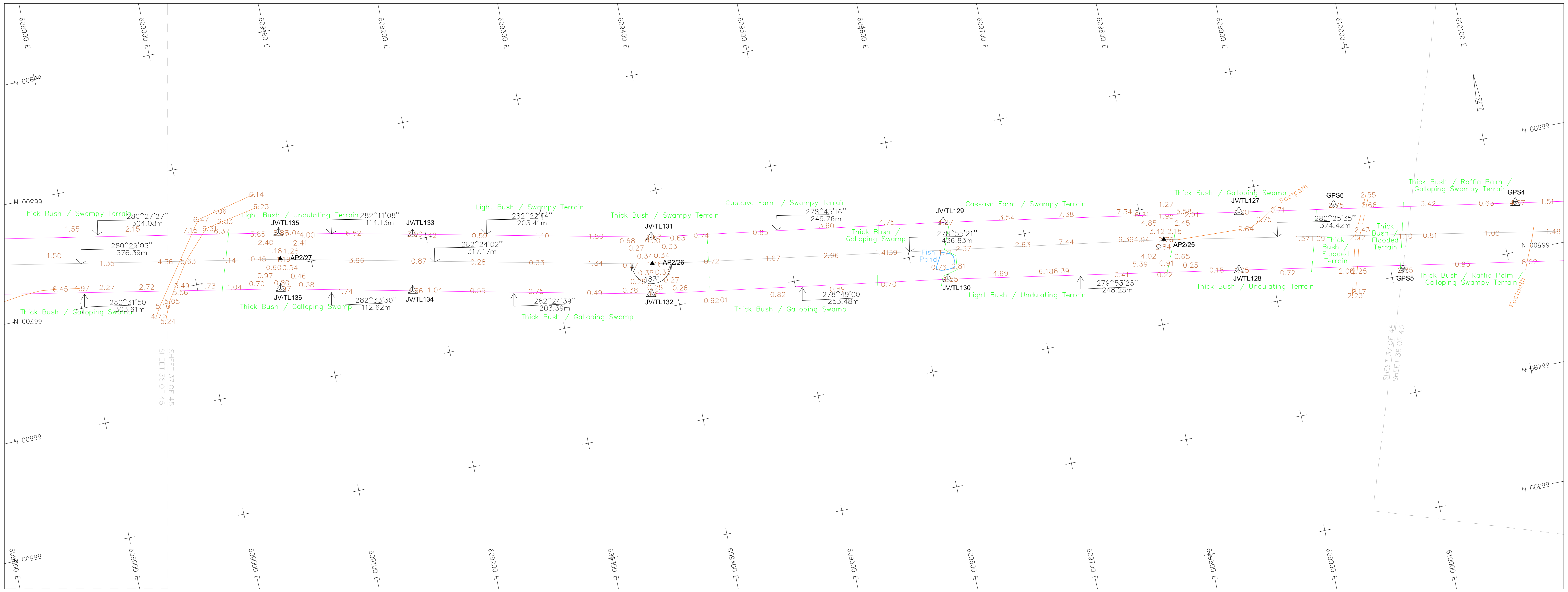
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

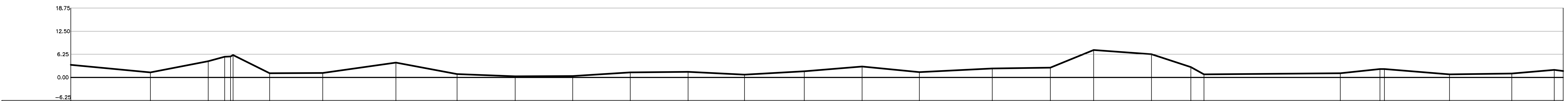
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 36 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP36

PLAN





TOWER NUMBER	AP2/27	AP2/26	AP2/25
CUMMULATIVE DISTANCE (m)	42517.03	42834.20	43271.03

GROUND ELEVATION (m)
1.35, 4.36, 5.61, 6.01, 1.14, 1.19, 3.96, 0.87, 0.28, 0.33, 1.34, 1.46, 0.72, 1.67, 2.96, 1.39, 2.37, 2.63, 7.44, 6.30, 2.76, 0.84, 1.09, 2.22, 2.27, 0.81, 1.00, 2.00

PARTIAL HORZ. DIST. (m)
91.08, 50.18, 2.09, 31.98, 63.47, 53.16, 50.45, 50.05, 49.97, 49.20, 51.91, 50.04, 49.84, 63.25, 50.46, 37.70, 50.10, 118.43, 56.51, 54.13

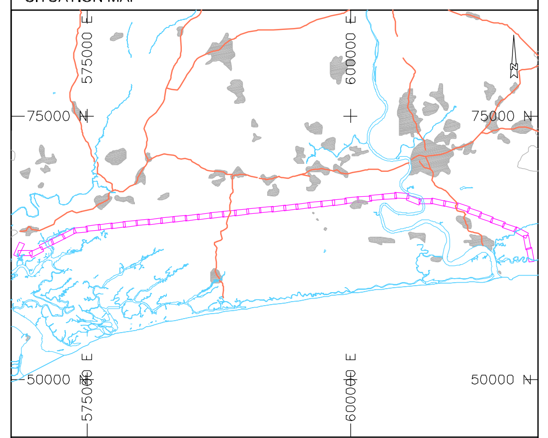
VEGETATION	SOIL TYPE
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Light Bush	Undulating Terrain
Thick Bush	Undulating Terrain
Thick Bush / Raffia Palm	Galloping Swampy Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

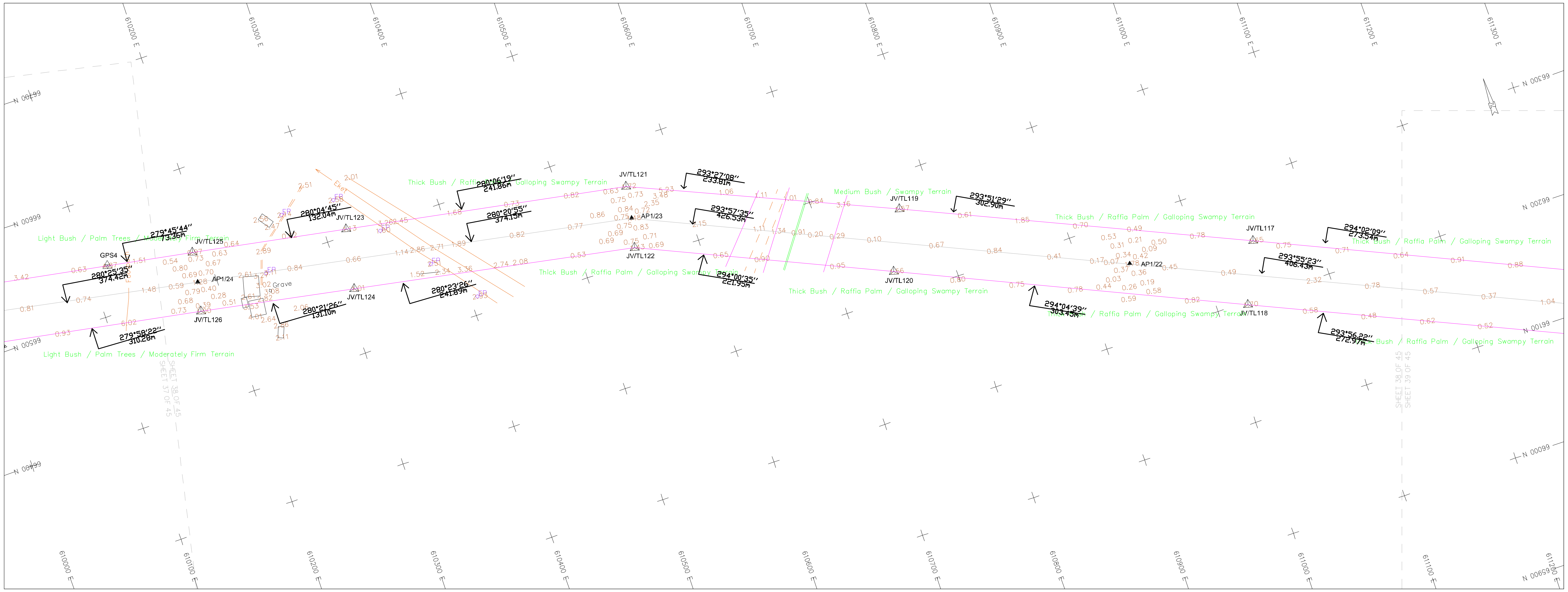
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 37 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP37

PLAN

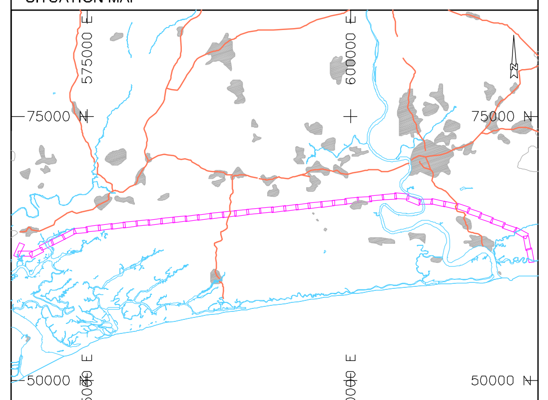


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
CONSULTING ENGINEERS
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

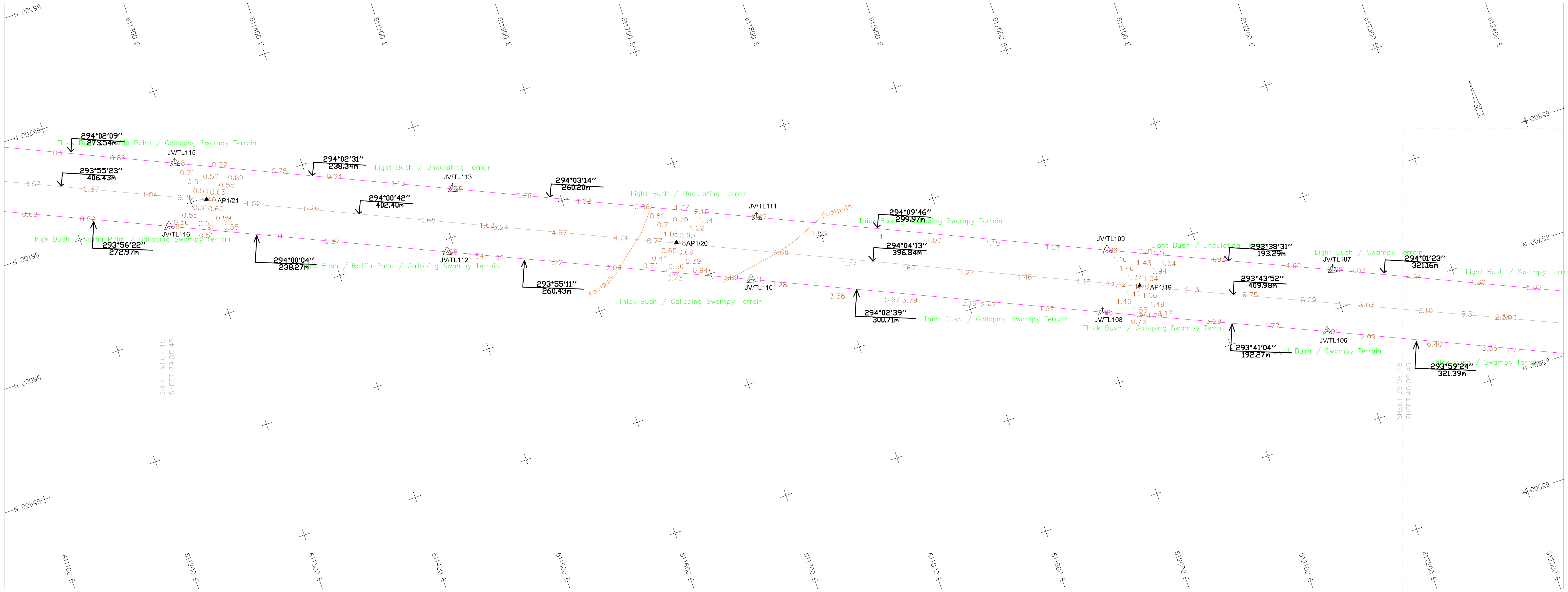
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

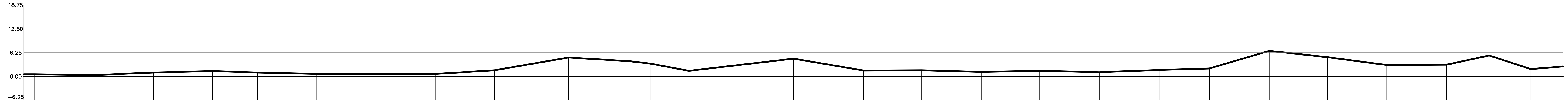
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 38 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP38

PLAN





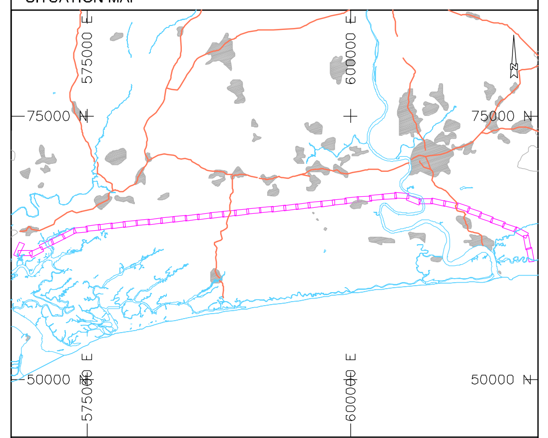
TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	0.57	49.78	
	0.37	50.10	
	1.04	50.14	
AP1/21	1.40		44852.57
	1.02	37.76	
	0.69	50.29	
	0.65	99.97	
	1.62	50.13	
	4.97	62.57	
	4.01	51.73	
	3.37	17.04	
AP1/20	1.48		45254.92
	4.68		
	1.57	59.23	
	1.67	48.96	
	1.22	50.36	
	1.46	49.34	
	1.13	50.26	
AP1/19	1.70		45651.72
	2.13	42.48	
	6.75	50.63	
	5.09	49.41	
	3.03	50.04	
	3.10	50.19	
	5.51	36.02	
	1.93	35.12	

VEGETATION	SOIL TYPE
Thick Bush / Raffia Palm	Galloping Swampy Terrain
Thick Bush / Raffia Palm	Galloping Swampy Terrain
Thick Bush	Galloping Swampy Terrain
Thick Bush	Galloping Swampy Terrain
Thick Bush	Galloping Swampy Terrain
Light Bush	Swampy Terrain
Thick Bush	Swampy Terrain

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

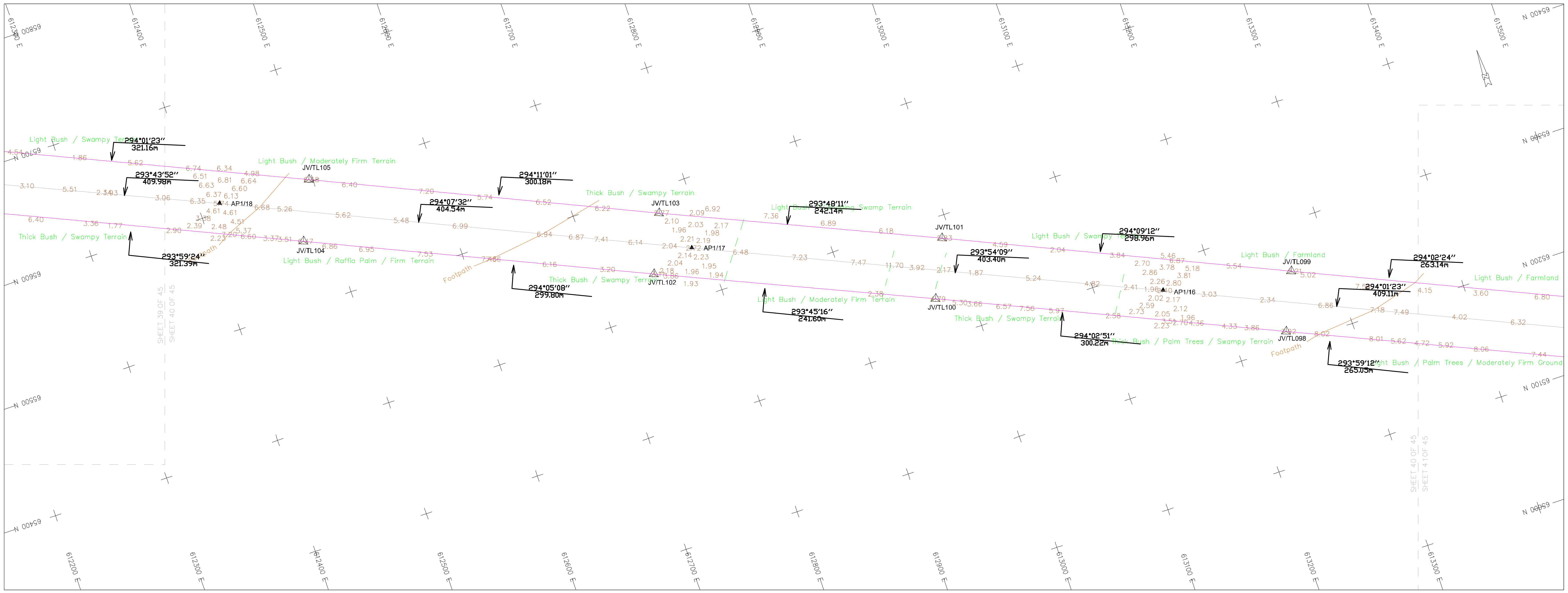
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH–Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 39 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref :FNL–ILF–DWG–PP39

PLAN

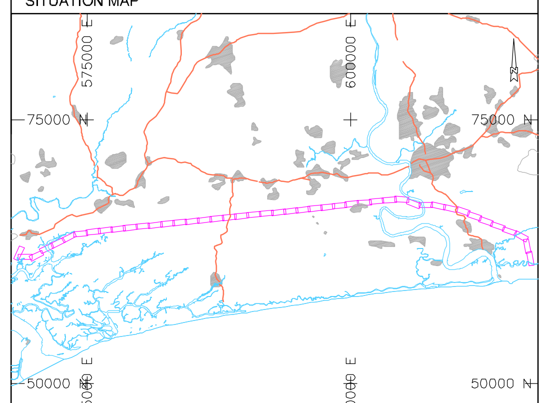


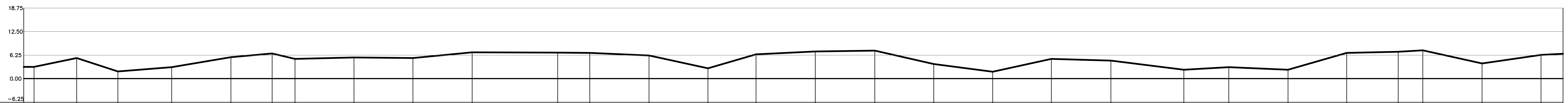
PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	3.10	50.19	
	5.51	36.02	
	1.93	35.12	
	3.06	45.52	
AP1/18	5.74		46061.36
	6.68		
	5.26	19.29	
	5.62	50.07	
	5.48	50.05	
	6.99	50.18	
	6.94		13688.34
	6.87	27.00	
	6.14	50.43	
AP1/17	2.72		46465.82
	6.48	40.73	
	7.23	50.21	
	7.47	50.60	
	3.92	49.82	
	1.87	49.96	
	5.24	49.92	
	4.82	50.37	
AP1/16	2.40		46869.38
	3.03	38.05	
	2.34	50.14	
	6.86	49.71	
	7.18		
	7.49	21.01	
	4.02	50.03	
	6.32	50.07	

VEGETATION: Thick Bush; Light Bush / Raffia Palm; Thick Bush; Light Bush; Thick Bush / Palm Trees; Light Bush / Palm Trees

SOIL TYPE: Swampy Terrain; Firm Terrain; Swampy Terrain; Moderately Firm Terrain; Swampy Terrain; Moderately Firm Ground

SURVEY DATA

		Easting (m)	Northing (m)	Elevation (m)
Survey based on	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right–of–Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

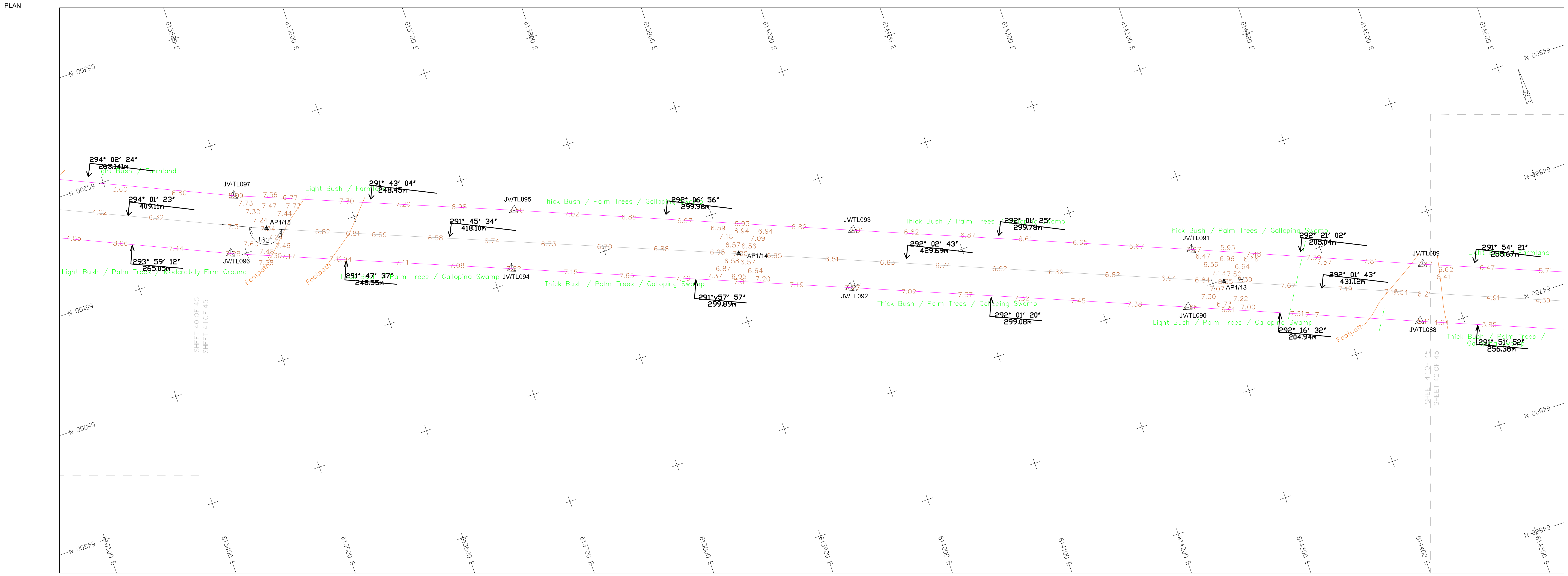
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 40 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP40

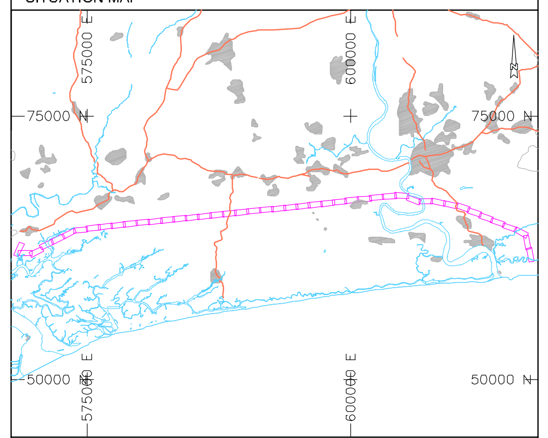
PLAN



LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

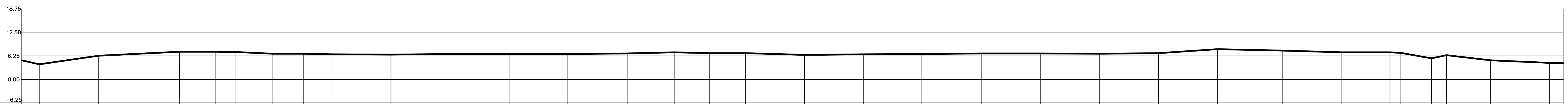
ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION



TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	4.02	50.03	
	6.32	50.07	
	7.31	68.80	
AP1/15	7.34		47271.49
	7.30		
	6.82	31.39	
	6.81		
	6.69	24.17	
	6.58	49.91	
	6.74	50.07	
	6.73	50.00	
	6.70	49.69	
	6.88	50.13	
	7.20	39.93	
AP1/14	7.00		47689.67
	6.95	30.20	
	6.51	50.00	
	6.63	50.09	
	6.74	49.33	
	6.92	50.08	
	6.89	49.90	
	6.82	50.05	
	6.94	50.00	
AP1/13	8.05		48119.36
	7.67	55.33	
	7.19	49.96	
	7.16		
	7.04	9.40	
	5.63	25.90	
	6.41	12.73	
	5.09	37.22	
	4.39	50.02	

VEGETATION	SOIL TYPE
Light Bush / Palm Trees	Moderately Firm Ground
Thick Bush / Palm Trees	Galloping Swamp
Thick Bush / Palm Trees	Galloping Swamp
Thick Bush / Palm Trees	Galloping Swamp
Light Bush / Palm Trees	Galloping Swamp
Thick Bush / Palm Trees	Galloping Swamp

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

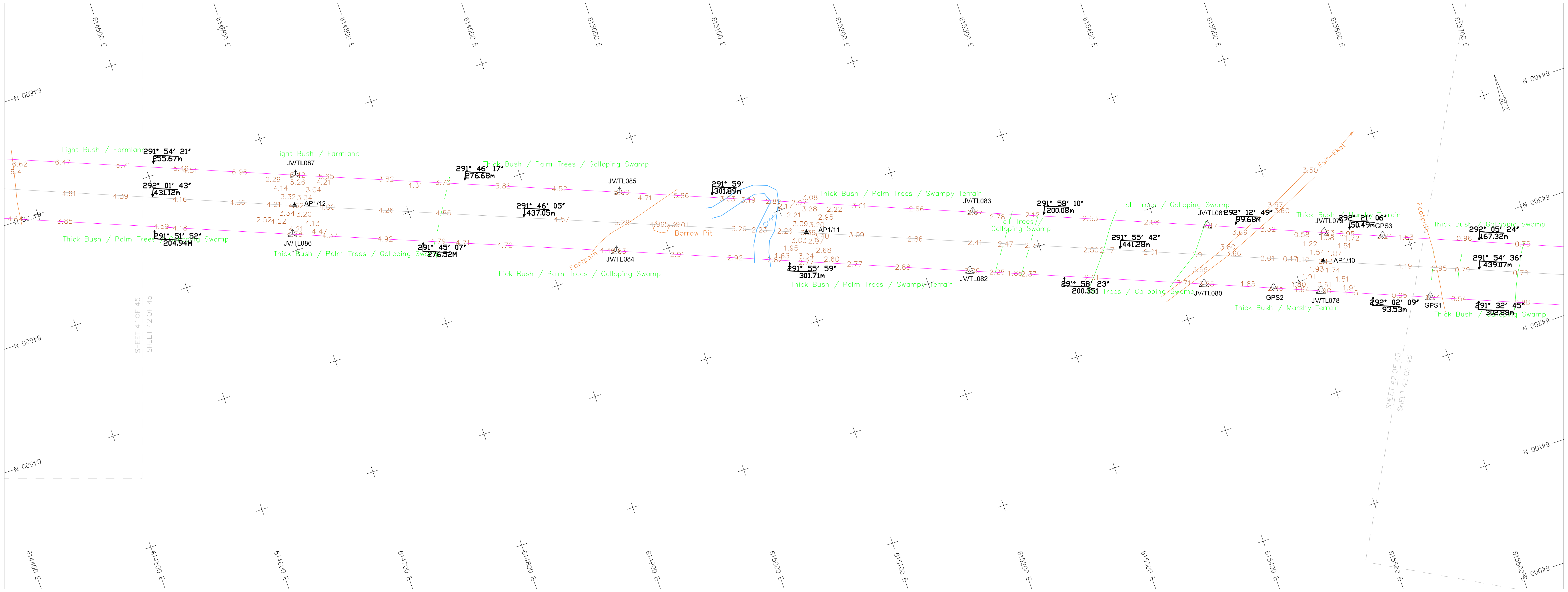
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

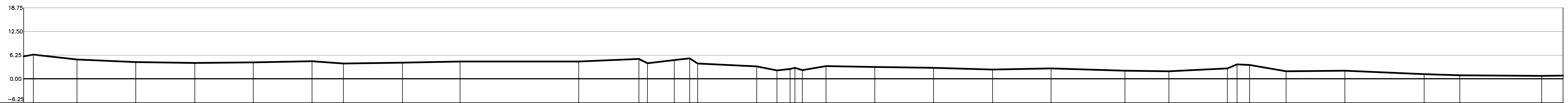
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 41 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP41

PLAN





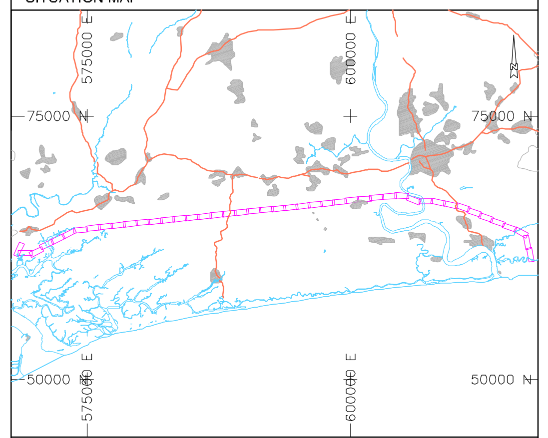
TOWER NUMBER	AP1/12; AP1/11; AP1/10
GROUND ELEVATION (m)	6.41, 5.09, 4.39, 4.16, 4.36, 4.62, 4.00, 4.26, 4.55, 4.57, 5.28, 4.12, 4.96, 5.39, 4.01, 3.29, 2.23, 2.59, 2.86, 2.26, 3.36, 3.09, 2.86, 2.41, 2.77, 2.17, 2.01, 2.72, 3.80, 3.66, 2.01, 2.13, 1.19, 0.95, 0.78
PARTIAL HORZ. DIST. (m)	12.73, 37.22, 50.02, 50.04, 49.91, 26.65, 50.09, 49.19, 100.78, 51.31, 6.91, 50.05, 6.50, 41.44, 49.99, 50.29, 49.84, 62.76, 37.43, 49.75, 31.12, 67.48, 30.31, 69.56
CUMMULATIVE DISTANCE (m)	48550.50; 48987.55; 49429.01
VEGETATION	Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush / Palm Trees; Thick Bush; Thick Bush
SOIL TYPE	Galloping Swamp; Galloping Swamp; Swampy Terrain; Marshy Terrain; Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

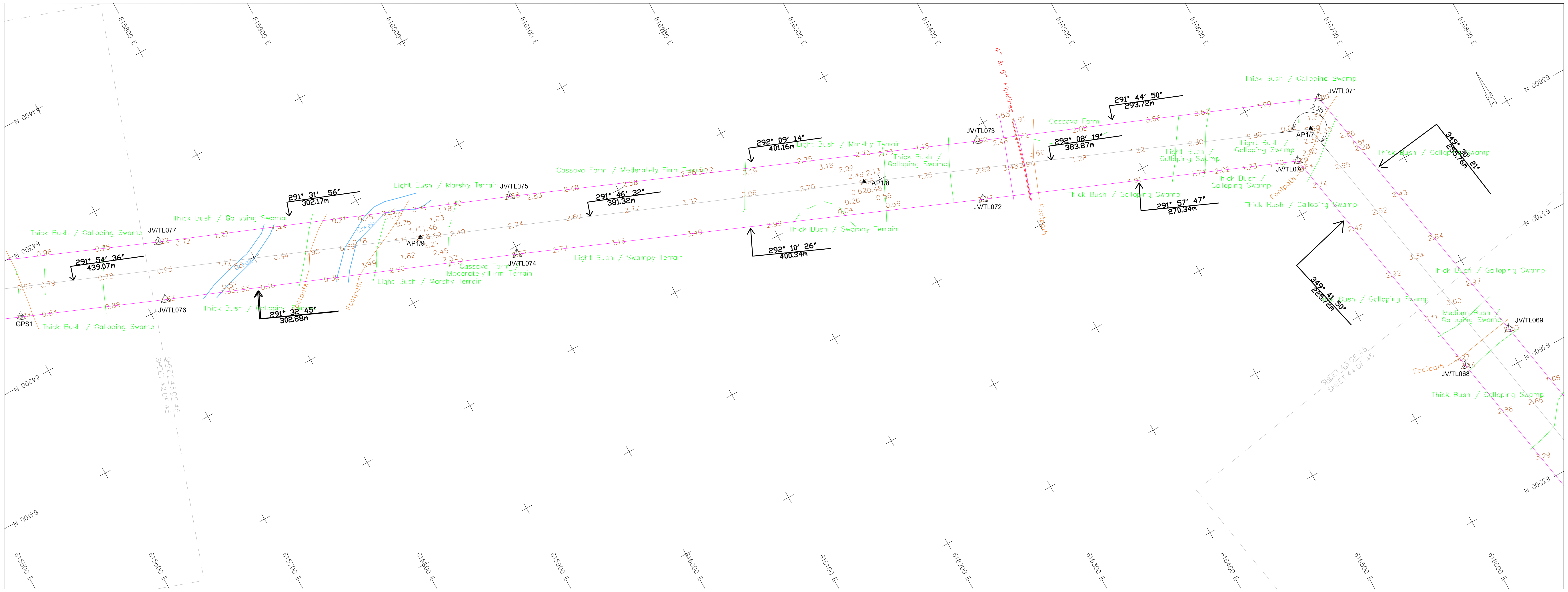
FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

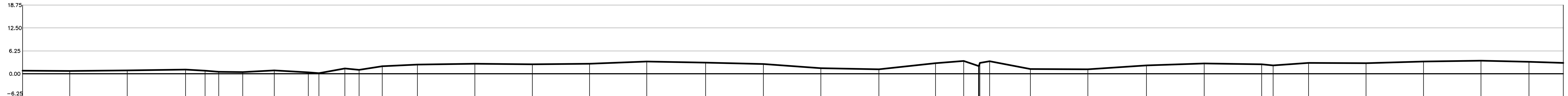
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 42 of 45

Author : FNL	Encl.	Date : January 2012
Checked : Kalu, U Ajike		Report :
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP42

PLAN





TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	0.78	69.56	
	0.95	50.14	
	1.17	50.64	
	0.83	16.88	
	0.57	12.03	
	0.44	20.73	
	0.93	27.59	
	0.39		
	0.18		
	1.49		
	1.11	12.35	
AP1/9	2.10		49868.14
	2.49	30.59	
	2.74	49.97	
	2.60	49.92	
	2.77	49.93	
	3.32	49.54	
	3.06	51.38	
	2.70	50.08	
AP1/8	1.56		50249.49
	1.25	50.67	
	2.89	49.25	
	3.48		
	2.94	0.64	
	3.46		
	1.28	35.51	
	1.22	49.89	
	2.30	51.06	
	2.86	50.19	
AP1/7	2.60		50633.09
	2.32		
	2.95	30.85	
	2.92	50.02	
	3.34	49.89	
	3.60	50.17	
	3.27	41.59	

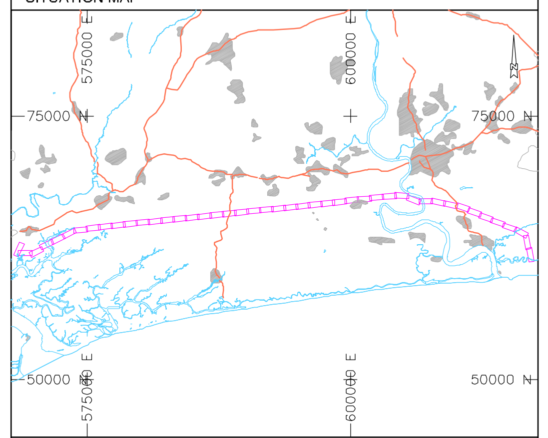
VEGETATION	Thick Bush	Light Bush	Light Bush	Thick Bush	Thick Bush	Light Bush	Thick Bush
SOIL TYPE	Galloping Swamp	Marshy Terrain	Swampy Terrain	Swampy Terrain	Galloping Swamp	Galloping Swamp	Galloping Swamp

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM : Minna

ELLIPSOID : Clarke 1880 RGS
Semi major axis : 6378249.145m
Inverse flattening : 293.465

PROJECTION : NTM Mid Belt
Central Meridian (CM) : 008 30' 00' East
Latitude of Origin : 04 00' 00' North
False Easting : 670553.984m
False Northing : 0m
Scale factor at CM : 0.99975

DATUM TRANSFORMATION : WGS84 to Minna
Source : MPN
: dX = 94.031m, dY = 83.317m, dZ = -116.708m
: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
Block D, Plot 23, Water Corporation, Dideolu Estate, Victoria Island, Lagos

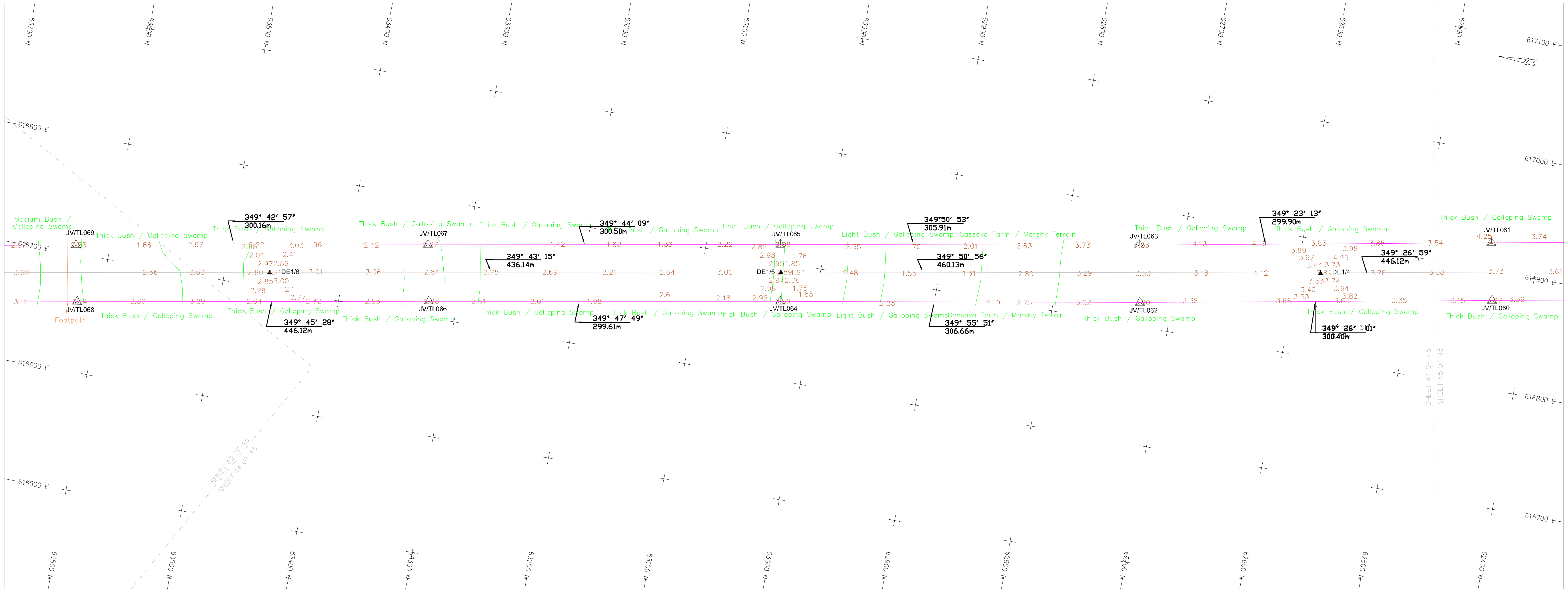
FUGRO NIGERIA LIMITED
91, Odani Road. Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 43 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP43

PLAN

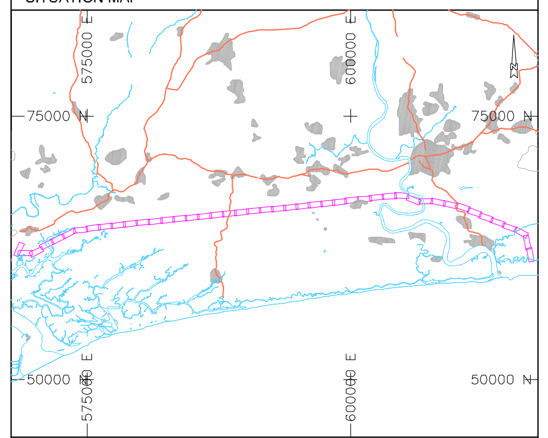


PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
- Edge of Flooded Area / Marshland
- Limit of Clearing / Vegetation Type
- Edge of Pond/ Channel/Other Water Body
- Wire Fence
- Wall Fence
- Product Pipeline

SITUATION MAP



SURVEY DATA

Survey based on		Easting (m)	Northing (m)	Elevation (m)
	QIT 1	615897.120	60047.060	4.370
	QIT 2	616158.390	60039.700	4.600
	QIT 3	616153.970	60375.100	4.810

Right-of-Way Information: Length = 53.269km, Width = 50.00m

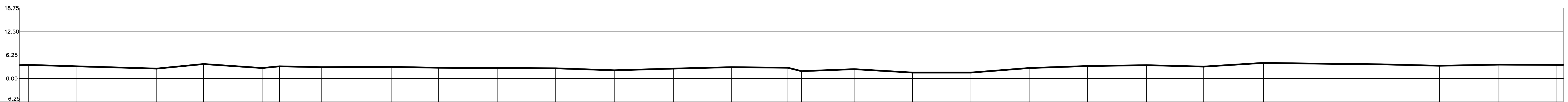
HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM	: Minna
ELLIPSOID	: Clarke 1880 RGS
Semi major axis	: 6378249.145m
Inverse flattening	: 293.465
PROJECTION	: NTM Mid Belt
Central Meridian (CM)	: 008° 30' 00" East
Latitude of Origin	: 04° 00' 00" North
False Easting	: 670553.984m
False Northing	: 0m
Scale factor at CM	: 0.99975
DATUM TRANSFORMATION	: WGS84 to Minna
Source	: MPN
	: dX = 94.031m, dY = 83.317m, dZ = -116.708m
	: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec
VERTICAL DATUM	:

SCALE 1 : 2000

0 — 160m

NIGERIAN MID BELT PROJECTION



TOWER NUMBER	GROUND ELEVATION (m)	PARTIAL HORZ. DIST. (m)	CUMMULATIVE DISTANCE (m)
	3.60	50.17	
	3.27	41.59	
	2.66	68.11	
	3.83	40.21	
	2.80	49.80	
DE1/6	3.21		51038.47
	3.01	35.49	
	3.06	59.86	
	2.84	40.16	
	2.75	50.37	
	2.69	49.96	
	2.21	49.90	
	2.64	50.53	
	3.00	49.35	
DE1/5	2.86		51474.49
	1.94	11.51	
	2.48	44.98	
	1.55	49.67	
	1.61	49.95	
	2.80	49.85	
	3.29	49.77	
	3.53	50.35	
	3.18	48.84	
	4.12	51.07	
DE1/4	3.89		51934.72
	3.76	46.11	
	3.38	50.04	
	3.73	50.58	
	3.61	49.63	

VEGETATION	SOIL TYPE
Medium Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Light Bush	Galloping Swamp
Cassava Form	Marshy Terrain
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp
Thick Bush	Galloping Swamp

ILF ENGINEERS NIGERIA LIMITED

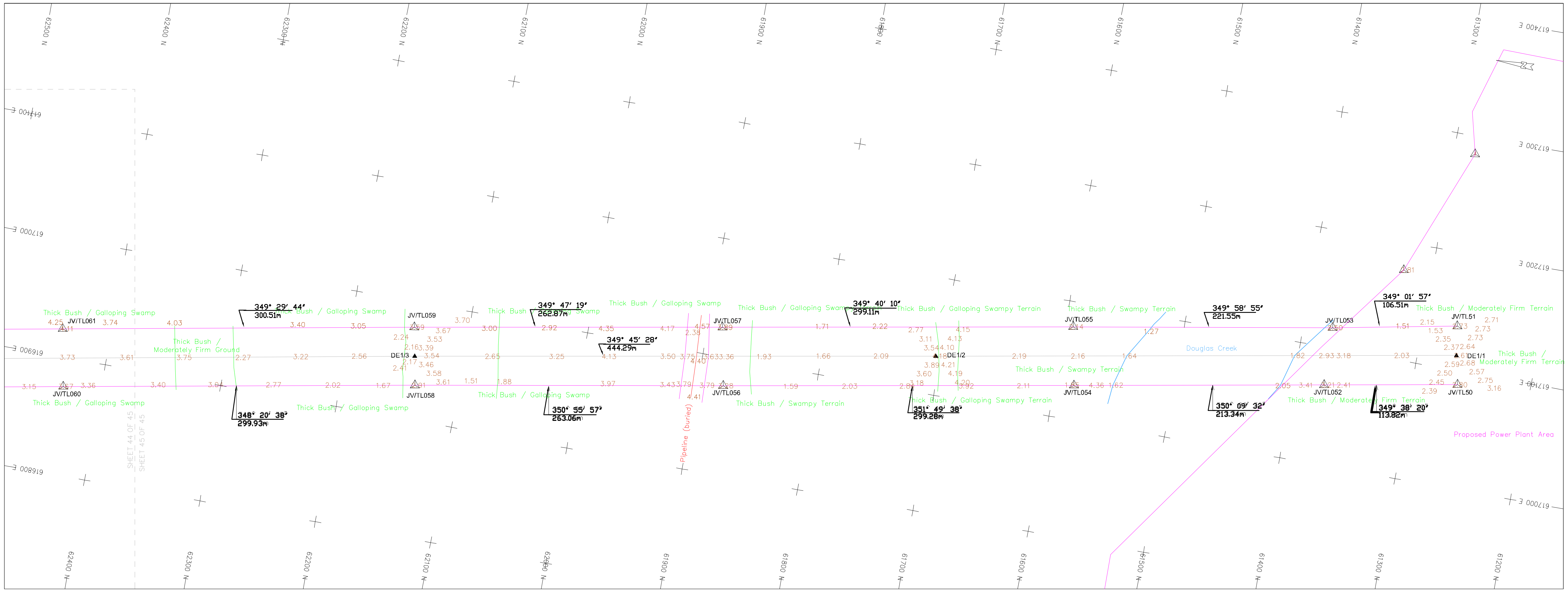
FUGRO NIGERIA LIMITED

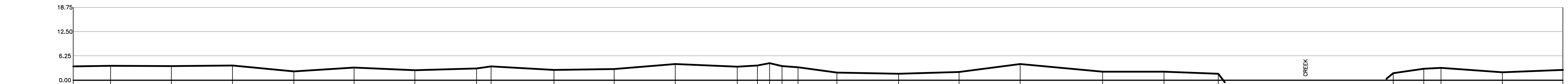
ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 44 of 45

Author :	FNL	Encl.	Date :	January 2012
Checked :	Kalu, U Ajike		Report :	
Approved :	Uchebo, A John		Drwg Ref :	FNL-ILF-DWG-PP44

PLAN





TOWER NUMBER	DE1/3 · DE1/2 · DE1/1
GROUND ELEVATION (m)	3.73, 3.61, 3.75, 2.27, 3.22, 2.56, 3.05, 3.54, 2.65, 2.87, 4.13, 3.50, 3.75, 4.40, 3.63, 3.36, 1.93, 1.66, 2.09, 4.18, 2.19, 2.16, 1.64, 1.82, 2.93, 3.18, 2.03, 2.61
PARTIAL HORZ. DIST. (m)	50.58, 49.63, 50.03, 50.23, 49.30, 49.73, 11.80, 51.54, 49.26, 49.86, 50.70, 13.11, 31.75, 50.44, 49.70, 67.57, 50.10, 25.02, 14.16, 50.13
CUMMULATIVE DISTANCE (m)	52380.83, 52825.44, 52987.55, 53130.60, 53269.59
VEGETATION	Thick Bush, Thick Bush, Thick Bush, Thick Bush, Thick Bush, Thick Bush, Thick Bush
SOIL TYPE	Galloping Swamp, Moderately Firm Ground, Galloping Swamp, Galloping Swamp, Galloping Swampy Terrain, Swampy Terrain, Moderately Firm Terrain

PLAN

LEGEND

- Building
- Other Structure
- Building - Under Construction
- R.O.W. Boundary
- Route Centerline
- Edge of Road
- Edge of Creek / Channel
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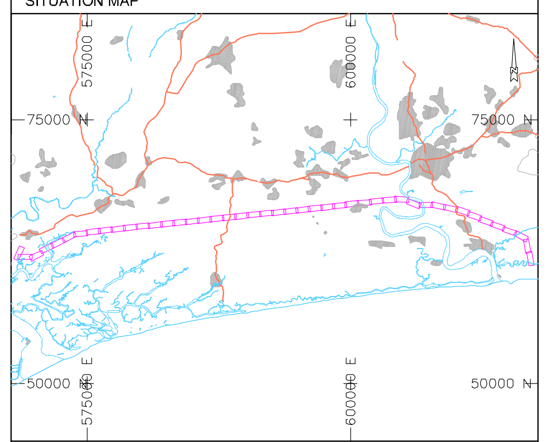
SITUATION MAP



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: rX = 0.00 sec, rY = 0.00 sec, rZ = 0.00sec

VERTICAL DATUM :

SCALE 1 : 2000
0 — 160m
NIGERIAN MID BELT PROJECTION

ILF ENGINEERS NIGERIA LIMITED
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FUGRO NIGERIA LIMITED
91, Odani Road, Off PH-Eleme Expressway, Elelenwo
Port Harcourt, Nigeria

ROUTE TOPOGRAPHICAL SURVEY OF PROPOSED TRANSMISSION LINE ROUTE QUA IBOE POWER PROJECT AKWA IBOM STATE, NIGERIA

Chart 45 of 45

Author : FNL	Encl.	Date : January 2012	
Checked : Kalu, U Ajike		Report :	
Approved : Uchebo, A John		Drwg Ref : FNL-ILF-DWG-PP45	

APPENDIX 5.2
SUMMARY OF CONTENT OF COMMUNITY RELATIONS AND ENGAGEMENT PLAN

Appendix 5.2
Summary of Content of Community Relation and Engagement Plan
(to be Developed and Implemented by the EPC)

The community Relations and Engagement Plan is a procedure that guides the relations with all project affected communities to ensure fairness and transparency in the processes of consultation and engagement, to improve community relations, to reduce risks of unresolved issue and over commitment in the course of consultations, and to prevent project associated adverse impacts on the cultural values of the areas. The key aspects that will be covered by the project Community Relations and Engagement Plan include the following;

- Procedures that will ensure early and well defined engagement of the different communities, the various groups, and individuals who are affected by the project
- Strategies for ensuring that all affected groups participate in consultations and that all concerns are duly documented and addressed
- Identification of acceptable communication tools and approaches to educate community members and stakeholders on project activities, potential impacts, schedules, and progresses
- Engagement strategies for workers and contractors from the different communities to ensure fairness and prevent conflicts
- Conflicts management strategies for issues that arise in the course of project activities such as community agitations over employment, contracting, compensations, land disputes, wrong stakeholder identification, leadership tussles, etc. The plan will Reference the RAP and approved grievance procedure
- Identification of sensitive local cultures, traditions, lifestyles, and issues that have the potential to cause problems in the course of project works and provide effective management strategies
- Strategies for sustaining consultations throughout the life span of the project, among others.

APPENDIX 6

INTEGRATED DISEASE SURVEILLANCE AND RESPONSE DATA (IDSR) FOR STUDIED LGAS ABD AKWA IBOM STATE

APPENDIX 6a - 2010 (JAN. - DEC.) INTEGRATED DISEASE SURVEILLANCE AND RESPONSE (IDSR) DATA FOR STUDIED LGAs AND AKWA IBOM STATE

SN	LGA	1. CSM	2. Cholera	3. Diarrhoea (Watery without blood)	4. Diarrhoea (with blood)	5. Dracunculiasis (Guinea Worm Disease)	6. Hepatitis B	7. New AIDS cases	8. Lassa fever (Viral hemorrhagic fever)	9. Leprosy	10. Lymphatic Filariasis	11a) Malaria	11b) Malaria (severe)	11c) Malaria (Pregnant Women)	12. Measles	13. Pertussis	14. Plague	15. Pneumonia	16. Poliomyelitis/AFP	17a. STDs (Vaginal Discharge)	17b. STDs (Genital Ulcer)	17c. STDs (Urethral Discharge)	17d. STDs (Others)	18. Neonatal Tetanus	19. Tuberculosis	20. Onchocerciasis	21. Yellow Fever	22. HPAI (Bird Flu)	23. Malnutrition	24. Typhoid Fever	25. Diabetes Millitus	26. High Blood Pressure
1	Eket	0	69	327	33	0	116	565	0	0	422	2814	201	223	3	0	4	45	4	6	0	0	1	10	51	0	0	0	NA	NA	NA	NA
2	Esit Eket	0	0	52	5	0	1	55	0	0	0	727	117	35	7	1	0	40	10	8	1	1	1	1	9	0	0	0	NA	NA	NA	NA
3	Ibeno	0	0	181	2	0	0	23	0	0	32	1472	2	196	2	0	0	110	2	5	0	0	4	0	8	0	3	0	NA	NA	NA	NA
4	Ikot Abasi	0	0	83	12	0	2	260	0	0	1	2840	8	659	63	0	0	32	3	11	0	0	24	2	37	0	0	0	NA	NA	NA	NA
5	Mkpat Enin	0	0	70	5	0	0	2	0	0	0	5844	0	77	4	0	0	8	2	0	1	0	0	0	27	0	0	0	NA	NA	NA	NA
6	Onna	0	0	28	7	0	1	76	0	0	0	1975	28	449	5	0	0	21	10	5	2	0	1	0	15	0	0	0	NA	NA	NA	NA
State Total		1	81	5456	2425	56	331	6164	20	25	483	61230	3786	14298	300	39	4	2302	412	22	116	176	47	1392	36	8	8	1	NA	NA	NA	NA

Source: Epidemiology Unit, Akwa Ibom State Ministry of Health, Uyo. (2011)

APPENDIX 6b - 2011 (JAN. - MAY) INTEGRATED DISEASE SURVEILLANCE AND RESPONSE (IDSR) DATA FOR STUDIED LGAs AND AKWA IBOM STATE

SN	LGA	1. CSM	2. Cholera	3. Diarrhoea (Watery without blood)	4. Diarrhoea (with blood)	5. Dracunculiasis (Guinea Worm Disease)	6. Hepatitis B	7. New AIDS cases	8. Lassa fever (Viral hemorrhagic fever)	9. Leprosy	10. Lymphatic Filariasis	11a) Malaria	11b) Malaria (severe)	11c) Malaria (Pregnant Women)	12. Measles	13. Pertussis	14. Plague	15. Pneumonia	16. Poliomyelitis/AFP	17a. STDs (Vaginal Discharge)	17b. STDs (Genital Ulcer)	17c. STDs (Urethral Discharge)	17d. STDs (Others)	18. Neonatal Tetanus	19. Tuberculosis	20. Onchocerciasis	21. Yellow Fever	22. HPAI (Bird Flu)	23. Malnutrition	24. Typhoid Fever	25. Diabetes Millitus	26. High Blood Pressure
1	Eket	0	0	77	10	0	0	157	0	0	0	1459	0	103	0	0	0	17	3	1	0	0	8	0	52	0	0	0	7	22	38	150
2	Esit Eket	0	0	12	4	0	0	33	0	0	0	302	0	26	3	0	0	4	0	6	0	0	0	0	2	0	0	0	8	1	5	34
3	Ibeno	0	0	58	4	0	0	0	0	0	0	537	0	92	8	0	0	34	1	0	0	0	2	0	0	0	0	0	6	11	0	3
4	Ikot Abasi	0	0	12	7	0	0	70	0	0	0	316	0	117	0	0	0	8	4	0	0	0	0	0	12	0	0	0	0	1	0	5
5	Mkpat Enin	0	0	18	2	0	0	0	0	0	1	182	0	35	212	1	0	5	0	0	0	0	1	0	0	0	0	0	3	5	0	3
6	Onna	0	0	19	3	0	0	63	0	0	0	714	0	321	3	3	0	10	0	0	0	0	0	0	9	0	0	0	14	0	25	24
State Total		0	2	1360	592	0	69	2295	0	3	79	24840	952	8146	491	42	0	693	46	171	18	35	66	19	538	15	2	4	408	1120	547	1640

Source: Epidemiology Unit, Akwa Ibom State Ministry of Health, Uyo. (2011)