ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA[1]) OF THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

(DRAFT REPORT)

SUBMITTED TO

THE FEDERAL MINISTRY OF ENVIRONMENT

OCTOBER 2020

[1] It is noted that the Nigerian legislation refers to EIA and not ESIA. However, if references are made to the FMEnv procedure, acronym EIA is used while the acronym ESIA is used if references are made to the proposed project's broader approach.

DRAFT ESIA REPORT

OF

THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

PREPARED BY

BLUEDOT ASSOCIATES LTD / ENVIRONMENTAL ACCORD LTD

ON BEHALF OF

WIOCC NIGERIA LIMITED / ALCATEL SUBMARINE NETWORKS

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Meaning
μPa	Micropascal
ALARP	As Low As Reasonably Practicable
Amp	Ampere
ANZECC	Australian and New Zealand Environment and Conservation Council
AoI	Area of Influence
ASN	Alcatel Submarine Networks
BAT	Best Available Techniques
Bluedot	Bluedot Associates Limited
BMH	Beach Manhole
BOD	Biochemical Oxygen Demand
BP	Bank Procedures
BPEO	Best Practicable Environmental Option
BU	Branching Unit
BWM	Ballast Water and Sediments
C&D	Construction and Demolition
CAP	Chapter
CBD	Convention on Biological Diversity
CCME	Canadian Council of Ministers of the Environment
Cd	Cadmium
CIA	Central Intelligence Agency
CISQG	Canadian Interim Marine Sediment Quality Guidelines
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLS	Cable Landing Station
CMFRI	Central Marine Fisheries Research Institute
CMS	Convention on Migratory Species of Wild Animals
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
COLREG	Convention on the International Regulations for Preventing Collisions at Sea
CPTs	Cone Penetration Tests
Cr	Chromium
CSBI	Cross Sector Biodiversity Initiative

Acronym/Abbreviation	Meaning
CSR	Corporate Social Responsibility
cT	Tropical Continental
Cu	Copper
CZ	Contiguous Zone
DA	Double Armoured
dB	Decibel
DC	Direct Current
DCD	Development Control Department
DEE	Department of Environment and Energy
DO	Dissolved Oxygen
E&S	Environmental and Social
e.g.	For Example
EEZ	Exclusive Economic Zone
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMF	Electric Magnetic Effects
ERM	Environmental Resources Managers
ESAs	Environmentally Sensitive Areas
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
etc	Etcetera
FGD	Focus Group Discussion
FMEnv	Federal Ministry of Environment
g/m^2	Gram per square meter
GCLME	Guinea Current Large Marine Ecosystem
GHG	Greenhouse Gas
GISP	Global Invasive Species Programme
GUC	Guinea Under Current
HC	Hydrocarbons
HDI	Human Development Index
HIV	Human Immunodeficiency Virus
HP	Horsepower
HPS	High Pressure Sodium
HSE	Health, Safety and Environment
HW	High Water
Hz	Hertz
ICCT	International Council of Clean Transportation
ICPC	International Cable Protection Committee
IEE	Initial Environmental Evaluation

Acronym/Abbreviation	Meaning
IFAW	International Fund for Animal Welfare
IFC	International Finance Corporation
IHR	International Health Regulations
ILO	International Labour Organisation
IMO	International Maritime Organization
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Organisation for Standardisation
ISPs	Internet Service Providers
ITCZ	Inter-Tropical Convergence Zone
ITD	Inter-Tropical Discontinuity
ITU	International Telecommunication Union
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
KII	Key Informant Interview
km	Kilometre
kV	Kilovolt
LAMATA	Lagos Metropolitan Area Transport Authority
LASEPA	Lagos State Environmental Protection Agency
LAWMA	Lagos State Waste Management Authority
LCDA	Local Council Development Area
LED	Light Emitting Diode
LFN	Laws of the Federation of Nigeria
LGA	Local Government Area
LNSC	Lagos Neigbhourhood Safety Corps
LPS	Low Pressure Sodium
LW	Low Water
LWP	Light Weight Protected
m	Meter
MH	Mitigation Hierarchy
mm	Millimetre
MMOs	Marine Mammal Observers
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
mT	Tropical Maritime
MW	Megawatt
NAAQS	Nigerian Ambient Air Quality Standards

Acronym/Abbreviation	Meaning
NBS	National Bureau of Statistics
NCC	Nigerian Communications Commission
NCDC	Nigeria Center for Disease Control
NDHS	Nigeria Demographic and Health Survey
NECC	North Equatorial Counter Current
NESREA	National Environmental Standards and Regulations Enforcement Agency
NIMASA	Nigerian Maritime Administration and Safety Agency
NiMet	Nigerian Meteorological Agency
NIOMR	Nigerian Institute for Oceanography and Marine Research
NITOA	Nigerian Trawler Owners' Association
Nm	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Association
NOx	Oxides of Nitrogen
NPA	Nigerian Ports Authority
NPC	National Population Commission
NPF	Nigeria Police Force
ODK	Open Data Kit
OGB	Ocean Ground Bed
OHS	Occupational Health and Safety
OP	Operational Policy
OPL	Oil Prospecting License
OPRC	Oil Pollution Preparedness, Response and Co-operation
OSH	Occupational Safety and Health
Pb	Lead
PELs	Probable Effect Levels
PFE	Power Feed Equipment
PLB	Post Lay Burial
PLGR	Pre-Lay Grapnel Run
PLI	Post Lay Inspection
PLIB	Post Lay Inspection and Burial
PM	Particulate Matter
PPE	Personal Protective Equipment
PRIB	Post Repair Inspection Burial
PTS	Permanent Auditory Threshold Shift

Acronym/Abbreviation	Meaning
RC	Route Clearance
RCP	Regulatory Compliance Plan
ROV	Remotely Operated Vehicle
RPL	Ring Protection Link
SA	Single Armoured
SBP	Sub Bottom Profiler
SEL	Sound Exposure Level
SELcum	Cumulative Sound Exposure Level
SMPEP	Shipboard Marine Pollution Emergency Plan
SO_2	Sulphur Dioxide
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Sulphur Oxides
SPLrms	Root Mean Square Sound Pressure Level
SSS	Side Scan Sonar
TELs	Threshold Effect Levels
ToR	Terms of Reference
TSP	Total Suspended Particulate
TSS	Temporary Auditory Threshold Shift
TW	Territorial Waters
UNCLOS	United Nations Convention on the Law of the Sea
UNDESA	United Nations Department for Economic and Social Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
WACS	West Africa Cable System
WAPC	West African Pipeline Company
WHO	World Health Organisation
WIOCC	WIOCC Nigeria Limited
WMP	Waste Management Plan
Zn	Zinc

LIST OF ESIA PREPARERS

Name and Qualification	Role
Bluedot Associates Limited	
Neil Cousins	Marine Biodiversity Specialist; Report writing
EnvAccord	
Ibrahim Salau (*M.Sc. Chemical Engineering*)	ESIA Project Director
Atanda Olaogun (*M.Sc. Environmental Chemistry*)	ESIA Project Manager/ Report writing
Chukwuka Oshiokpu (*M.Sc. Environmental Management*)	GIS/Mapping Specialist
Abiola Bolarinwa (*B.Sc. Demography and Social Statistics*)	Field Data Gathering (Socio-economics)
Rhoda Omotosho (*B.Sc. Demography and Social Statistics*)	Gender Specialist
Odewo Oluwadamilare (*M.Sc. Botany)*	Terrestrial Ecologist (Flora Specialist)
Albright Olaitan (*M.Sc. Environmental Toxicology and Pollution Management*)	Report writing

EXECUTIVE SUMMARY

1.0 INTRODUCTION

The following presents a summary of the Environmental and Social Impact Assessment (ESIA) that has been completed for the Nigerian branch of an international submarine cable named EQUIANO ("the Project").

The project proponent WIOCC, intends to install the Equiano Cable System, to link Nigeria with key international telecommunications hubs in Southern Africa and Europe. As the designated Landing Partner of the Equiano Cable System in Nigeria, WIOCC is to secure local permits to land the Equiano Cable System in Lagos.

The EQUIANO cable system will span from Sesimbra (Portugal) to Melkbosstrand (South Africa). The system will deliver ultra-broadband capacity and faster access to consumers and businesses. The entire EQUIANO cable system will comprise a main trunk of approximately 15,000 km in length. This report is concerned only with the consideration of impacts associated with the portion of the cable branch that lies within the Nigerian Exclusive Economic Zone (EEZ).

Alcatel Submarine Networks (ASN) has been appointed as the supplier and installer of the Equiano Cable System connecting Africa and Europe. The system is to be installed in phases. The first phase ("Baseline System") will entail the installation of cable landings at, but not limited to:

- Portugal: Lisbon (Sesimbra).
- Nigeria: Lagos.
- St Helena: Rupert's Bay.
- South Africa: Melkbosstrand.

There is a legislative requirement to undertake an EIA[2] for the Project based on the provisions of the Nigeria EIA Act No 86 of 1992 (now codified as the EIA Act CAP E12 Law of the Federation of Nigeria, 2004). In light of this, an ESIA of the Project has been undertaken by Bluedot Associates Limited (Bluedot) and Environmental Accord Limited (EnvAccord), on behalf of the Project proponent.

The scope of this ESIA relates to the marine system components of the submarine cable from the limit of the Nigerian EEZ. This includes the construction of the BU, fibre optic cable and repeaters, System Earth and beach manhole (BMH). The landing is located at Elegushi beach in Lekki, Lagos. The associated terrestrial

[2] It is noted that the Nigerian legislation refers to EIA and not ESIA. However, if references are made to the FMEnv procedure, acronym EIA is used while the acronym ESIA is used if references are made to the proposed project's broader approach.

system components of the Project will be covered under a separate ESIA study. This includes a new Cable Landing Station (CLS), connecting cables seaward of the BMH to the CLS, and connecting of cables to the existing terrestrial backhaul system (the cable network).

The overall objective of this ESIA is to proactively identify and evaluate the potential environmental and social (E&S) impacts of the Project; and to put in place appropriate mitigation measures and management actions to address the identified impacts.

The applicable legal and administrative framework to the Project include, amongst others:

- EIA Act Cap E12 LFN 2004.
- National Policy on the Environment, 1989 (revised in 1999 and 2017).
- EIA Sectoral Guidelines for Telecommunications Sector, 2013.
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, S.I.15 of 1991.
- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, S.I.9 of 1991.
- National Environmental (Coastal and Marine Area Protection) Regulations, 2011.
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010.
- Nigerian Communications Commission Act, 2003.
- Lagos State Environmental Management and Protection Law 2017.
- Relevant international conventions and protocols to which Nigeria is a signatory.

2.0 PROJECT JUSTIFICATION

Need for the Project

The purpose of the Project is to install a fibre optical submarine cable to provide additional telecommunications capacity to Nigerian users as well as providing high-speed connectivity to the global network.

Project Benefits

The benefits of the Project include, amongst others, the following:

- Access to substantial international bandwidth which would improve the quality of service for international voice, internet and other data services, and ensure the increased availability of such services.

- Increased competition, which may lead to cheaper access to international internet services and voice and data services.
- Contribution to the realisation of the National Telecommunications Policy objectives which include providing affordable and high quality voice and data services.
- Creation of direct and indirect employment opportunities.
- Improved educational opportunities through increase in access to information and education resources.
- Development of a regional sense of community through greater equality of information sharing across geographical regions and across groups in society.
- Economic benefits from the enhanced opportunities for new and small enterprises that may have previously been excluded from technologies by high costs.
- Macro-economic benefits of the potential expansion of technology-reliant industries, such as information technology services and software development businesses.
- Revenue generation to the government, for example, through taxes.

Value of the Project

The envisaged cost of the Nigerian portion of the overall EQUIANO cable project is around USD 5 million. In addition, the Project has local and national economic values in terms of employment opportunities for various categories of Nigerian professionals, skilled and semi-skilled craftsmen, and business opportunities.

Envisaged Sustainability of the Project

Technical Sustainability: The design and installation of the Project is managed by ASN and its consultants, according to pre-established standards and procedures. ASN is a leading company in submarine communication networks with more than 600,000 km of submarine networks cable installed till date with more than 220 fibre optic systems delivered in the last 26 years.

Environmental Sustainability: The cable routing aims to minimise environmental impact; and to maximise cable protection and reliability. A comprehensive cable route study was undertaken to determine a preferred route with the lowest environmental impact and highest resource efficiency in comparison to alternative routes. In particular, the routing has sought to avoid legally protected and internationally recognised areas and other features of ecological and socio-economic interest that may have high sensitivity to Project impacts. In addition, in water depths of <1000 m the cable will be buried, which reduces the potential for cable deterioration, especially on the more dynamic continental shelf area.

Undertaking installation at normal low vessel speeds will also greatly minimise the potential for ship strikes on marine wildlife. The cable installation techniques that are used also seek to minimise environmental disturbance and promote natural restoration during or after cessation of construction activities. The cable design will also ensure that entanglement is not a risk for marine wildlife.

Economic Sustainability: There is increased demand for the telecommunication services that would be provided by the Project, which will support the economic sustainability of the Project.

Social Sustainability: A detailed stakeholder consultation process has been implemented throughout the ESIA process to assist in ensuring that all relevant stakeholders, including the potentially Affected Community, have had the opportunity to provide input into the Project planning process. This has also assisted in laying a good foundation for building relationships with the stakeholders. In water depths of <1000m the cable will be buried to avoid potential cable snagging due to fisheries operations, i.e., for bottom trawling activities. Also, the cable will route through a 'no anchorage and fishing zone' in the water depths of <100 m.

Project Alternatives

In accordance with the EIA Act CAP E12 LFN, 2004, an EIA should consider alternative technically and economically feasible alternatives for carrying out a project, including an assessment of the environmental effects of alternatives. The Project has therefore considered:

- Technological alternatives.
- Marine route alignment alternatives.
- Landing site alternatives.

In addition, the development options for the Project which included no-project option, delayed option and go-ahead option were analysed.

As a result of the review of alternatives an overall preferred option for the Project has been identified.

3.0 PROJECT DESCRIPTION

The Nigerian branch of the EQUIANO cable system will extend from the connection to the trunk and pass through the country's EEZ and the Territorial Waters to a landing site at Elegushi beach where it will be connected to a proposed Beach Manhole (BMH) that will be located around 140 m behind the beach. The cable meets the boundary of the EEZ at a point with a direct linear distance of about 452 km from the landing site. The preferred landing site is located on Elegushi beach, near Yemi Adetayo Street, Elegushi, Lekki, Lagos.

The marine system components of the Project involve the installation of a fibre optic subsea cable that is designed to minimise environmental impact. The design of the cable routing has ensured that important sensitive receptors have been avoided as far as possible.

Repeaters will be installed along the length of the cable and are used to extend the reach of optical communications links by overcoming loss due to attenuation of the optical fibre. Each repeater is powered via an electrical current that is fed into the submarine cable system from the shore-based terminal station. The cable includes a copper conductor to transfer the electrical current.

The Project will include the development of a System Earth or Ocean Ground Bed (OGB), which will likely be located within the plot assigned for the construction of the CLS, as has been acquired by WIOCC. This land is Plot 99 and Plot 100 within the Maiyegun Tourism and Recreational Zone, Lekki Phase II, Lagos. This Project will also include the construction of a BMH, which is the structure where the subsea portion of the cable is connected to the terrestrial system components. The BMH will again be located inside the boundary fence of land acquired by WIOCC for the CLS.

Planning and pre-installation studies, including a route survey have already been undertaken to inform the initial design of the cable route. Such activities therefore fall outside the scope of the ESIA.

The construction phase will include Route Clearance (RC), Pre-Lay Grapnel Run (PLGR) and cable installation. The RC and PLGR will be undertaken immediately prior to cable installation. In water depths of >1000 m the cable will be laid on to the seabed. In water depths of 1000 m to 15 m the cable will be installed through plough burial where it is needed and possible. In inshore shallower waters, the cable will be buried through hand-held jetting techniques. Onshore, the cable will be trenched. Articulated pipe will protect the cable in water depths of less than nominally 8 m. Excavation will be required to form the BMH and the OGB. The hatch of the BMH will sit flush with ground level. The OGB will be entirely subsurface once constructed. The footprint of impacts for all activities are small and installation techniques allows for restoration through re-filling of disturbed areas. The construction phase will be completed in a matter of days for each activity.

The operation phase will lead to minimal activity, unless cable repair is required, which will lead to localised activities where maintenance is needed.

The EQUIANO system has a shelf life of about 25 years. Options for decommissioning of the system at the end of the Project's lifetime include retirement in place, or removal and salvage. The subsea portion of the cable is likely to largely be retired in place, as is current global industry practice for minimal environmental and social disruption.

4.0 DESCRIPTION OF THE ENVIRONMENT

The ESIA has considered the baseline conditions with respect to receptors that may be affected by the Project. This has included desktop studies using secondary information and some focused surveys for biophysical and socio-economic conditions. Study boundaries have been defined on a receptor basis with consideration of the Area of Influence (AoI) of the Project and also broader seascape level understanding to determine the wider ecological value that may be associated with activities.

A brief description of the Project environment is provided below.

Physical Environment

Climate and Meteorology

Regional climate: The regional climate in the Gulf of Guinea is influenced by two air masses resulting into two distinct wet and dry seasons in Nigeria.

Local climate: The climate of Lagos State is tropical savannah with alternating wet and dry seasons. The wet season period is usually between April and October, while the dry season is experienced between November and March. Based on the long-term climatic data (1991 - 2018) of the Project area obtained from the Nigerian Meteorological Agency (NiMet), the average annual rainfall in the cable landing area is about 1,970.64 mm. The overall annual average daily temperature is approximately 26^{o}C. The area is characterised by high relative humidity as a result of prevailing Tropical Maritime (TM) air mass blowing the environment all year round. An average of 91.25 % and 73.75 % are recorded at 10:00 hrs and 16:00 hrs local time. The average monthly wind speeds range between 2 m/s and 5 m/s; however, wind speeds are highest during the July-August period and lowest during the October-January.

Air Quality and Noise

A review of wet and dry season data of air monitoring studies conducted in the Project's AoI showed that the concentration of major air pollutants of concern (carbon monoxide (CO), oxides of nitrogen (NO_x), oxides of sulphur (SO_x), and particulate matter) are below the FMEnv maximum permissible limits. In addition, the noise levels were below the World Bank maximum limit of 70 dB(A), as well as FMEnv limit of 90 dB(A).

Hydrogeology and Soils

The landing site is characterised by sandy beach. A Geotechnical investigation (GI) has been completed within the CLS site. The results of the GI indicated that soils predominantly comprise sand and the groundwater level is between 1.4-17 m below ground level. No rock outcrops are apparent in this area with exception of artificial groynes. The cable route survey identified outcropping rock in the inshore survey area of the cable route to water depths of around 7 m. However, they reported that this appeared to be potentially artificial dumped material that is part of erosion control efforts.

Oceanography

The offshore waters of Nigeria are dominated by the Guinea Current, which transports water eastward roughly along the 3° N latitude along the western coast of Africa. The marine environment of the eastern Gulf of Guinea can be characterised as highly stratified with a thin surface layer of Tropical Surface Water overlying cooler high-salinity subtropical water, or South Atlantic Central Water. During the cable survey operation, the observed wave heights varied from 0.2 m to 1.2 m. A swell of up to 1.8 m was observed during deep and shallow water operations of the proposed route. The average tidal range in the Project's AoI is about 1 m, and ranges about 0.5 m during neap tides and 1.5 m during spring tides.

Coastal Geomorphology

The Lagos coastline is located on the Barrier-Lagoon complex which lies between Badagry and Ajumo, east of Lekki town and extends for about 200 km. The beaches are erosive in nature. However, as part of the measures to mitigate coastal erosion, the Nigerian government, in 2014, began a process of building beach protection groynes, working from west (Victoria Island) to east along the coast. A total of 19 groynes had been built as of early January 2019.

Bathymetry and Seabed Type

The cable route survey revealed that from the edge of the continental shelf, the bathymetry drops more steeply; and this area comprises the continental slope. The continental slope begins at a water depth of around 100 m along the cable route. The continental slope ends to meet the abyssal plan at around 52 km offshore at water depths of around 1900 m. From here the bathymetry falls to a maximum depth of approximately 4400 m at the BU GNQ, which is outside of the EEZ.

The seabed along the cable route primarily comprises soft sediments.

Marine Water and Sediment Quality

Marine water quality: desktop reviews of marine water studies in the Project AoI were compared to the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value guidelines. The pH of marine water samples in the Project AoI ranged from 7.54 to 7.68 in the dry season, and 7.71 to 8.83 in the wet season indicating that the water is slightly alkaline. The data also showed that the turbidity of the water samples was higher in the wet season than in the dry season. In addition, the concentration of heavy metals such as (Pb), Zinc (Zn), Cadmium (Cd), Copper (Cu), and Chromium (Cr) was higher in the dry season. This indicates that there are anthropogenic inputs in the marine water.

Sediment quality: samples from studies conducted within the Project AoI were compared to the Canadian Interim Marine Sediment Quality Guidelines (CISQG), as well as the ANZECC Sediment Quality Guidelines. The pH of sediment samples collected within the Project AoI ranged from 7.32 to 7.65 in the dry season. Heavy metals analysed in the sediments were generally below the CISQGs threshold effect levels and probable effect levels, as well as the ANZECC interim marine sediment quality guidelines. However, the concentration of Nickel during the wet season exceeded the threshold effect level and the interim marine sediment quality guidelines low trigger value.

Biological Environment

Based on review of relevant data related to the Study area, there are no coastal or marine legally protected or internationally recognised areas within the AoI of project activities and also within the broader interconnected seascape area.

Terrestrial biodiversity: the majority of the land cover in the AoI comprises bare sand interspersed with areas for concrete drainage structures, commercial and residential buildings and piles of scrap and waste materials. Based on the field assessment and information from desktop review of relevant documents, the habitats of the coastal area in the AoI has low to very low ecological value.

Marine biodiversity: information from desktop review, site visits, and rapid sea turtle walkover survey have been used to identify intertidal and subtidal species that may be present in the marine environment within the AoI of the cable route. This review has determined that there are various marine ecological receptors that may be affected by Project activities, including features of conservation interest that are afforded some protection through legal instruments and multilateral agreements. This includes features that are listed as Endangered or Critically Endangered species; and also, migratory and congregatory species. However, as noted above, the design for cable routing and installation has ensured that the potential for impacts are limited. In addition, no legally protected or internationally recognised areas would be influenced by the Project.

Socio-economic Environment

Stakeholder engagement: A scoping workshop for the ESIA study was held on October 29, 2019 at May Hill Hotel in Lekki, Lagos. The workshop had the following stakeholders in attendance:

- Federal Ministry of Environment
- Lagos State Ministry of the Environment and Water Resources
- Lagos State Environmental Protection Agency
- Nigerian Maritime Administration and Safety Agency
- Nigerian Institute for Oceanography and Marine Research
- Nigerian Ports Authority
- Nigerian Conservation Foundation
- Eti-Osa Local Government
- High Chiefs from Ikate-Elegushi Community
- Women leader and representatives from Ikate-Elegushi Community
- Fishermen from Ikate-Elegushi Community
- Youth leader and representative from Ikate-Elegushi community
- Representatives of WIOCC
- Representatives of Elegushi Beach Management

The consultations served to provide stakeholders with information about the Project and to gather information important to the ESIA. The objective was to identify any key concerns or high-level issues that the stakeholders had at the early stage. The responses from the identified stakeholders (including regulators and potentially affected community) showed general acceptance of the Project.

Socio-economic characteristics of the marine environment: A summary of socioeconomic conditions of the nearshore section of the cable route from the point of duct connection at Elegushi beach seaward to the limit of the EEZ is provided below.

- Fishing and anchoring: During the technical survey of the cable route conducted in September 2019, no indication of fishing activities in the deep water area but many small fishing boats and fishing gear nearshore. The cable route design has sought to avoid important nearshore fishing and anchorage zones.
- Ports (marine traffic): very low to no traffic was observed during the survey along the cable route. Some moderate traffic was observed closer to Lagos due to the anchorage area about 7 nautical mile (Nm) west of the route. Based on site visits, cable route survey and review of relevant literature, the subtidal area across the cable route is not within the designated shipping channels or anchorage areas and is not used for water sports vessels.
- Oil and gas concession and exploration: the cable route crosses 14 oil concession block boundaries, including 3 licenced blocks that have companies with interests; and there are no known or planned oil and gas projects in the region.
- Dumping, dredging, and reclamation; There are no known dumping sites of chemical or spoilage known in the vicinity of the cable route.
- Cables and pipelines: the cable route crosses 9 out-of-service and 8 in-service cables (3 in-service cables and 4 out-of-service cables in the shallow water section while 5 in-service cables and 5 out-of-service cables were crossed in the deep water section.
- Coastal shipwrecks: During the cable route survey, one wreck was identified in the inshore survey area and a potential one in the shallow survey area. The cable route design has also avoided any cultural heritage sites.
- Military practice areas/restricted zones: The findings from the cable route survey indicate that no military practice areas were crossed by the submarine cable route.

<u>Socio-economic characteristics of the terrestrial environment</u>: Ikate-Elegushi community was identified as the host community within the AoI of the cable landing site. The socio-economic characteristics of the community, based on information gathered through key informant interviews, household surveys and direct observations, indicate that all the community is a built-up urban community. The socio-economic survey was conducted from May 27th to June 1st, 2020 and was witnessed by an FMEnv representative.

Ikate-Elegushi community has an established traditional administrative structure under the control of Oba Ikate-Elegushi and his council of high chiefs and Baales.

The community has an economically active population, with thriving large and medium scale businesses that provide employment. The level of infrastructure development within the community is relatively high, and there is access to electricity from the national grid, water supply (mostly private owned), good roads and telecommunication records. Based on survey data, literacy level in the community is high as most respondents had at least primary and secondary school education. The housing structures in the community were mostly in nucleated (clustered) settlement patterns, and most of them were fenced. Ikate Primary Healthcare Centre was identified as the primary health care provider in the community. Common health issues reported in the community include diabetes, malaria, respiratory diseases, typhoid, high blood pressure. The women of Ikate-Elegushi community are economically active, have some level of formal education, and contribute to the welfare of their families. Women are well involved in community decision-making and they have freedom of association.

Some small businesses activities were observed in the immediate surroundings of the cable landing site at the beach, which include manufacture of cement block, sand dredging, and sales of food items. However, Elegushi beach and the coastline are mostly used for recreational purposes. The nearshore areas of the cable landing site are not used as fishing grounds.

5.0 POTENTIAL AND ASSOCIATED IMPACTS

An impact assessment for Project activities has been completed. In addition, consideration has been given to associated impacts from activities that will be undertaken for construction of terrestrial system components. Cumulative impacts have also been assessed. Planned and unplanned Project impacts have been considered separately.

Following the scoping phase, a range of impacts on receptors were scoped out either due to the absence of baseline features that may be affected by the Project features or expected negligible impacts. This included the scoping out of impacts on legally protected and internationally recognised areas, coastal processes, cultural heritage, seagrass beds, nearshore coral reefs and mangroves; and impacts that may relate to the potential entanglement of marine wildlife.

The impact assessment methodology has followed international best practice approaches to determine significance.

As already noted, the cable route design work has taken into account areas of potentially high value and sensitivity so that these can be inherently avoided. In addition, the techniques used for cable installation seek to minimise impacts on the environment. There is also a need to implement the requirements of relevant legislation that address emissions to the environment, such as MARPOL 73/78 and the BWM Convention. The Project has therefore included considerable inherent mitigation, which is an important approach to reduce impacts as far as possible in line with the best practice adoption of the Mitigation Hierarchy. Where inherent mitigation is relevant it has been included in the assessment of pre-mitigation effects.

Impacts were considered for construction and operation phases. Impacts associated with decommissioning were not, however, considered as the expected approach is to leave the cable *in situ* at the end of its design life.

The assessment of planned impacts prior to the implementation of additional mitigation measures has largely determined impacts to be of negligible to minor significance. However, a small number of impacts of moderate significance were identified (relating to disturbance to sea turtle nesting habitats, underwater sound generation, risks to Occupational Health and Safety). Such impacts have been reduced through the adoption of additional mitigation measures; and are of minor residual significance once implemented.

The likelihood and consequence of impacts from unplanned events have also been considered. The assessment has determined that these are generally of low risk and minor consequence.

The assessment of associated and cumulative situation has also determined that the Project would lead to impacts of negligible to minor significance.

6.0 MITIGATION MEASURES

As already stated, the assessment of impacts has considered the implementation of inherent mitigation. However, additional mitigation measures were proposed to reduce impacts as far as practicable.

The approach to the identification of additional mitigation measures followed the adopted of the Mitigation Hierarchy (MH) – avoid, minimise, restore and offset. Additional mitigation has only been proposed when residual impacts of note remain. Therefore, minimisation measures are proposed when avoidance is not sufficient to address impacts. Restoration is only proposed when avoidance and minimisation are not adequate to address impacts and where restoration is possible. As these measures would satisfactorily mitigate impacts to a minor or negligible level, no offsets have been proposed.

Mitigation has been proposed for both planned and unplanned events. Such mitigation will inherently address both associated and cumulative impacts. A range of measures have been identified for the construction phase that will require implementation as part of the Project. Such mitigation is also relevant to the operation phase relating to any cable maintenance activities that may take place.

The adoption of the additional mitigation measures has led to residual impacts being determined as negligible or minor significance for all receptors; with the majority of impacts being of negligible significance.

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

An ESMP has been developed to set out an approach for the implementation of the environmental and social mitigation measures that have been identified during the ESIA process. The main purpose of the ESMP is to ensure that those recommended additional mitigation measures are translated into practical management actions, which can be adequately resourced and integrated into the Project phases. It therefore includes a commitment's register for both the construction and operation phases. The ESMP establishes objectives, responsibilities and procedures for the implementation of mitigation measures; and also establishes a principle for adopting adaptive management as appropriate.

8.0 REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

As already stated, there are no plans to withdraw the cable once in situ. Current global industry practice is to retire cables in place at the end of the Project's lifetime. No impacts are therefore predicted to occur. However, at the time of cable retirement, options and any requirements for a decommissioning plan shall be reviewed, considering relevant legal requirements and industry practices at that time.

9.0 CONCLUSIONS AND RECOMMENDATIONS

It has been determined that the Project will have not have any significant impacts on the biophysical environment or socio-economic conditions. The key recommendation is that the mitigation measures detailed in this ESIA Report are implemented during the construction and operation phases.

ACKNOWLEDGEMENT

WIOCC/ASN will like to thank the ESIA Consultants – Bluedot Associates Ltd and Environmental Accord Limited for their commitment to the success of the study. We also thank the Federal Ministry of Environment and other stakeholders for their valuable contributions to the ESIA study.

CHAPTER ONE:

INTRODUCTION

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1.1 Background Information

This report provides the results of an Environmental and Social Impact Assessment (ESIA) that has been completed for the Nigeria branch of an international submarine cable system named EQUIANO. The EQUIANO cable system is a proposed fibre optic telecommunications submarine cable that will span from Sesimbra (Portugal) to Melkbosstrand (South Africa) with branching units (BUs) to various countries (including Nigeria). It seeks to deliver ultra-broadband capacity and faster access to consumers and businesses.

The entire EQUIANO cable system will comprise a main trunk of approximately 15,000 km in length. Figure 1.1 shows the main route of the overall EQUIANO cable and also identifies the BU connection to Nigeria. This report is only concerned with the consideration of impacts associated with the portion of the branched cable that lies within the Nigerian Exclusive Economic Zone (EEZ).

The Nigerian segment of the proposed EQUIANO cable will extend from the BU (that is beyond the EEZ – see Figures 1.2 and 1.4) to the proposed Beach Manhole (BMH) that would be located adjacent Elegushi beach in Lekki, Lagos. The direct straight linear distance to the boundary of the EEZ is about 452 km from the landing point.

Once the cable has been installed, it will be operated by WIOCC Nigeria Limited (WIOCC) who are the "Project Proponent". Alcatel Submarine Networks (ASN) have been contracted to design, supply and install the marine components of the cable system.

The overall Project will comprise:

- Marine system components: BU, fibre optic cable and repeaters, System Earth, ducts for connection to the BMH and the BMH; and
- Terrestrial system components: a new Cable Landing Station (CLS), connecting cables seaward of the BMH to the CLS, and connecting of cables to the existing terrestrial backhaul system (the cable network).

The scope of this ESIA relates to the marine system components of the submarine cable from the limit of the EEZ to the BMH only. The associated terrestrial system components of the Project will be covered under a separate ESIA study and additional permitting as part of a different scope of work being led by WIOCC. The separation of permitting in this way is the same as the previously permitted West Africa Cable System (WACS) (MTN Nigeria, 2011).

Figure 1.1: Route overview of the overall EQUIANO submarine cable indicating connection to Nigeria (Source: Adapted from ASN RPL, 2019)

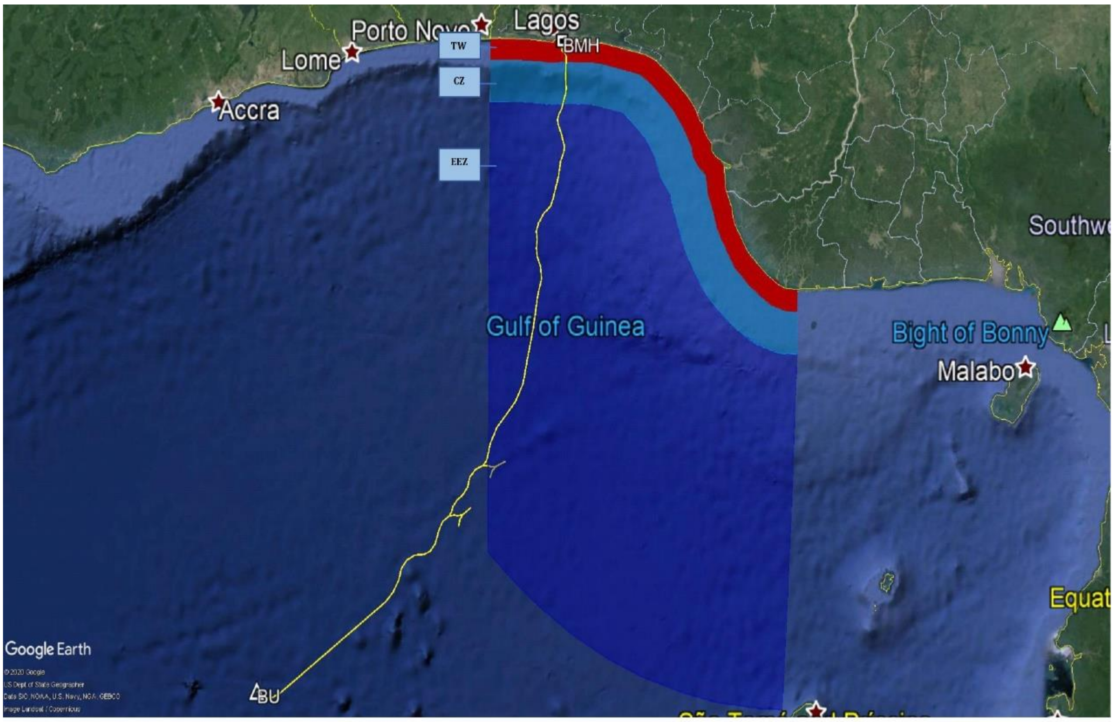

Figure 1.2: Proposed EQUIANO Nigeria submarine cable route from BU (BU NGA) to the proposed BMH in Lagos (Source: Adapted from Google Map, 2020)

There is a legislative requirement to undertake an EIA[3] for the proposed Nigerian branch of the EQUIANO cable system ("the Project") based on the provisions of the Nigeria EIA Act No 86 of 1992 (now codified as the EIA Act CAP E12 Law of the Federation of Nigeria, 2004). In light of this, an ESIA of the Project has been undertaken by Bluedot Associates Limited (Bluedot) and Environmental Accord Limited (EnvAccord), on behalf of the Project proponent.

1.2 Project Proponent

For the cable system, each branch has a 'landing party' who are responsible for acquiring permits for landing the cable and also for connections to a wider network. In Nigeria, the landing party is WIOCC; and they therefore comprise the Project proponent for the permitting of the marine cable components and landing in Nigeria.

WIOCC is a leading supplier of resilient, end-to-end managed, wholesale connectivity solutions into, out of and within Africa. WIOCC operates exclusively

[3] It is noted that the Nigerian legislation refers to EIA and not ESIA. However, if references are made to the FMEnv procedure, acronym EIA is used while the acronym ESIA is used if references are made to the proposed project's broader approach.

as a wholesaler, providing capacity to international and African telecommunication companies, content providers and internet service providers within and out of Africa. They offer connectivity to over 500 locations across 30 African countries – utilising more than 55,000 km of terrestrial fibre and 40,000 km of submarine fibre-optic cable. WIOCC's international network reach currently extends to 100 cities in 29 countries in Europe and more than 700 cities in 70 countries globally.

WIOCC's registered office in Nigeria is located at 3b, Bosun Adekoya Street, Lekki Phase 1, Lekki, Lagos.

1.3 Objectives of the ESIA Study

The overall objective of this ESIA study is to proactively identify and evaluate the potential environmental and social (E&S) impacts of the Project; and to put in place appropriate mitigation measures and management actions to address the identified impacts.

The specific objectives of the ESIA study are to:

- Provide the detail description of the proposed Project.
- Establish the existing state of the environmental and socio-economic conditions and to identify any sensitive components.
- Consult with relevant stakeholders including regulatory authorities, interested parties and the potentially affected community (in the area of influence of the cable landing site); and obtain their inputs at an early stage in the ESIA process.
- Identify and assess the potential environmental and socio-economic impacts of the Project; including potential, associated and cumulative impacts.
- Recommend appropriate mitigation measures (adopting the Mitigation Hierarchy) to address the identified impacts of the Project.
- Develop an appropriate Environmental and Social Management Plan (ESMP) for the Project throughout its life cycle.
- Prepare a detailed report presenting clear and concise information on the findings of the ESIA.

1.4 Scope of the ESIA

In delivery of the ESIA, the following activities have been completed:

- Review of applicable national and international laws, regulations, agreements and industry codes;
- Scoping and advanced stakeholder engagement;
- Literature review of relevant information pertaining to the Study Area;
- Consideration of Project alternatives;
- Description of all actions/activities that will be carried out in the course of the proposed Project;
- Baseline data gathering through review of secondary data and direct socio-economic survey;
- Identification and evaluation of potential impacts of the Project;
- Recommendation of appropriate mitigation measures, including the development of an ESMP;
- Preparation and disclosure of ESIA report.

1.5 ESIA Terms of Reference

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

1.6 ESIA Process

This ESIA study has been conducted in line with the Nigerian (FMEnv) EIA Procedural Guidelines, as well as, ensuring consideration of relevant best practice international standards and guidelines. The FMEnv EIA process is summarised in Figure 1.3.

The ESIA study involved a number of key activities carried out in a stepwise manner. These included: scoping, literature review, baseline data gathering, stakeholder engagement, impact identification and evaluation, development of mitigation measures and ESMP, and report writing. Each of these activities is explained in detail in the subsequent Chapters of this report.

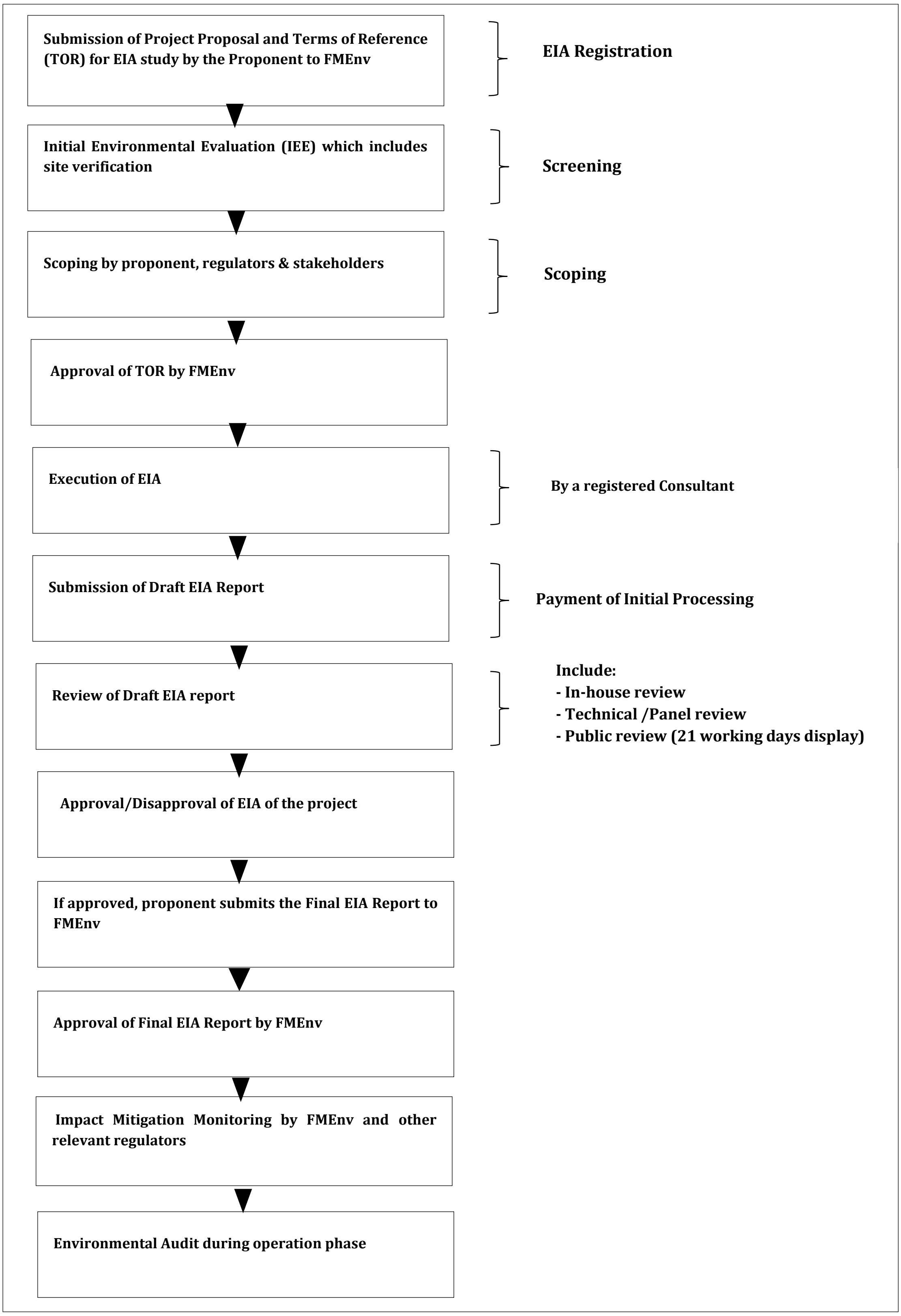

Figure 1.3: Overview of Nigeria EIA Process (Source: Adapted from FMEnv, 2014)

1.7 Legal and Administrative Framework

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

1.7.1 National Policy, Guidelines and Regulations

1.7.1.1 Federal Ministry of Environment (FMEnv)

FMEnv is the primary authority for the regulation and enforcement of environmental laws in Nigeria. The Act establishing the Ministry places on it the responsibilities of ensuring that all development and industrial activity, operations and emissions are within the limits prescribed in the national guidelines and standards; and that they comply with relevant regulations for environmental pollution management in Nigeria as may be released by the Ministry.

In furtherance of its mandate, the FMEnv has developed laws / guidelines on various sectors of the national economy. The specific policies, acts, guidelines enforced by FMEnv that apply to the proposed Project are summarised in the following paragraphs:

- *National Policy on the Environment*

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

- *EIA Act CAP E12 LFN, 2004*

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

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

Act. FMEnv have confirmed at the scoping stage that the magnitude, nature and location of the proposed Project therefore requires an EIA study.

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

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

- *National Environmental Impact Assessment Procedural and Sectoral Guidelines*

In response to the promulgation of the EIA Act, the FMEnv developed National EIA Procedural Guidelines and set of guidelines on various sectors of the National economy, including the EIA Guidelines for Telecommunications Sector. The Telecommunications Sector EIA guidelines, which is applicable to the proposed Project, has been developed by the FMEnv to assist project proponents in conducting detailed environmental and social assessment with regard to telecommunications projects in Nigeria.

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

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

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

This statutory instrument regulates the collection, treatment and disposal of solid and hazardous wastes from municipal and industrial sources; and gives the comprehensive list of chemicals and chemical waste by toxicity categories. The Project proponent is required by this regulation to practice waste segregation and engage the services of a Government-approved waste management agent for proper waste disposal throughout the life cycle of the Project.

1.7.1.2 National Environmental Standards and Regulations Enforcement Agency (NESREA)

NESREA was established in 2007 by the Federal Government of Nigeria as a parastatal of the FMEnv. The Agency is charged with the responsibility of enforcing all environmental laws, guidelines, policies, standards and regulations in Nigeria, specifically during the operation phase of development projects. The NESREA regulations applicable to the proposed Project are summarised as follows:

- *National Environmental (Sanitation and Wastes Control) Regulations, 2009, S.I.35*

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

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

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

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

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

- *National Environmental (Ozone Layer Protection) Regulations, 2009, S.I.32*

The provisions of this regulation seek to prohibit the importation, manufacture, sale and the use of ozone-depleting substances.

- *National Environmental (Electrical/Electronic Sector) Regulations, 2011, S.I.23*

The main purpose of this regulation is to ensure that best practices are applied and maintained in the operation of electrical and electronic equipment in order to safeguard the Nigerian environment against pollution hazards.

- *National Environmental (Protection of Endangered Species in International Trade) Regulations, 2011*

The major objective of this regulation is to protect species of endangered wildlife from extinction through the prohibition of trade, importation, etc.

- *National Environmental (Air Quality Control) Regulations, 2013*

The objective of this regulation is to ensure the control of air pollutants that may affect the ambient environment.

❖ *National Environmental (Soil Erosion and Flood Control) Regulations 2011, S.I.12*

The overall objective of this regulation is to regulate all earthing-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.

❖ *National Environmental (Coastal and Marine Area Protection) Regulations, 2011*

The purpose of this regulation is to ensure the protection of the coastal and marine environment for sustainable development.

❖ *National Environmental (Standards for Telecommunications and Broadcast Facilities) Regulations, 2011*

The main objective of this regulation is to protect the environment and human health, ensure safety and general welfare, eliminate or minimize public and private losses due to activities of the telecommunications and broadcast industry.

1.7.1.3 Nigerian Communications Commission (NCC) Act, 2003

In broad terms, the proposed Project would be classified as a telecommunications project, and as such, Nigeria policy and legislation on telecommunications apply. NCC is the national regulatory authority for the telecommunications industry in Nigeria. The broad function of the NCC, based on Act No. 19 of 2003, is to facilitate private sector participation in telecommunications service delivery and to co-ordinate and regulate the activities of the operators to ensure consistency in availability of service delivery and fair pricing. Other functions of the Commission include:

- Promote the implementation of the national policy on telecommunications;
- Encourage local and foreign investments in the Nigerian communications industry and also encourage participation of Nigerians in ownership, control and management of communications companies and organisations;
- Protect the rights and interest of service providers and consumers within Nigeria; and
- Ensure an efficient management including planning, coordination, allocation, assignment, registration, monitoring, and use of scarce national resources in the communication sub-sector, including but not limited to frequency spectrum, numbers and electronic addresses, and also promote

and safeguard national interests, safety and security in the use of the said scarce national resources.

1.7.1.4 National Policy on Telecommunications, 2000

The overriding objective of this Policy is to achieve the modernisation and rapid expansion of the telecommunications network and services in order to enhance national economic and social development and integrate Nigeria internally as well as into the global telecommunications environment.

The EQUIANO Nigeria Submarine Cable Project will facilitate the achievement of the objectives of the National Telecommunication Policy. In particular, the following objectives of the National Telecommunication Policy are key to the proposed Project.

- Implement network development projects which shall ensure that the country meets and exceeds the International Telecommunication Union (ITU) recommended minimum teledensity of 1 telephone to 100 inhabitants;
- Promote widespread access to advanced communications technologies and services in particular the internet and related capabilities; and
- Develop and enhance indigenous capacity in telecommunications technology.

Other objectives of the policy, include, amongst others:

- Participate effectively in international telecommunications activities in order to promote telecommunications development in Nigeria, meet the country's international obligations and derive maximum benefit from international co-operations in these areas;
- Review and update telecommunications laws in order to bring all telecommunications operators under the regulatory control of the NCC; and
- Encourage the development of an information super-highway that will enable Nigerians enjoy the benefits of globalisation and convergence.

1.7.1.5 Nigerian Maritime Administration and Safety Agency (NIMASA) Act, 2007

NIMASA's focal areas include effective Maritime Safety Administration, Maritime Labour Regulation, Marine Pollution Prevention and Control, Search and Rescue, Cabotage enforcement, Shipping Development and Ship Registration, Training and Certification of Seafarers, and Maritime Capacity construction. The functions of the Agency include:

- Pursue the development of shipping and regulate matters relating to merchant shipping and seafarers;
- Administering the registration and licensing of ships;
- Regulate and administer the certification of seafarers;
- Regulate the safety of shipping as regard the construction of ships and navigation;
- Provide directions and ensure compliance with vessel security measures;
- Carry out air and coastal surveillances;
- Control and prevent maritime pollution;
- Enforce and administer the provisions of the Cabotage Act, 2003;
- Receive and remove wrecks; and
- Provide National Maritime Search, Rescue Services and Maritime Security.

1.7.1.6 Nigerian Ports Authority (NPA) Act, 1999

NPA is a federal government agency that governs and operates the ports of Nigeria. NPA was established in 1955 by the Port Act CAP 155 LFN as a corporate body with perpetual succession. The successor law is the NPA Act No 38 of 1999. The Authority has the responsibility for providing safe and navigable channel for common user areas. Under Section 7 of the NPA Act No. 38 of 1999, the functions of the Authority in summary are to:

- Provide and operate port facilities and services;
- Maintain, improve and regulate the use of the ports;
- Ensure efficient management of port operations; and
- Control pollution arising from oil or any other from ships using the port limits or their approaches.

1.7.1.7 Nigeria Hydrological Services Agency Act, 2010

The Nigeria Hydrological Services Agency (Establishment) Act, 2010 stipulates that the Agency shall, where it is required, prescribe the hydrological requirements for all sectoral activities including environmental and water way transportation, natural disaster and relief management issues.

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

The Harmful Waste (Special Criminal Provisions) Act CAP H1 LFN, 2004 prohibits and declares unlawful all activities relating to the purchase, sale, importation, transit, transportation, deposit, storage of harmful wastes. Appropriate penalties for contravention are prescribed.

1.7.1.9 Criminal Code Act CAP 38 LFN, 2004

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, 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.

1.7.1.10 Urban and Regional Planning, Act, 1992

The Act 88 of 1992 established a Development Control Department (DCD) charged with the responsibility for matters relating to development control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdiction.

1.7.1.11 Endangered Species (Control of International Trade and Traffic) Amendment Act, 2016

This Act amended the Endangered Species (Control of International Trade and Traffic) Act CAP LFN (2004). The Act provides for the conservation and management of Nigeria’s wildlife and the protection of some of her species in danger of extinction as a result of overexploitation or habitat change as required under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migratory Species of Wild Animals (CMS) and the Convention on Biological Diversity (CBD) to which Nigeria is a signatory. The Act prohibits hunting and trading in wildlife (wild animals and plants), as well as, the regulation of their trade. It also provides a list of animals and plants to which international trade is prohibited except in exceptional circumstances.

1.7.1.12 Water Resources Act CAP W2 LFN, 2004

This Act is aimed at promoting the optimum planning, development and use of the Nigeria's water resources; ensuring the co-ordination of activities that are likely to influence the quality, quantity; distribution, use and management of water; and ensuring the application of appropriate standards and techniques for the investigation, use, control, protection, and management of water resources.

1.7.1.13 Sea Fisheries Act, 1992

This Act provides for the control, regulation and protection of sea fisheries in the territorial waters of Nigeria.

1.7.1.14 Land Use Act CAP L5 LFN, 2004

The Land Use Act was promulgated on March 29, 1978 and it vested all urban land within a state in the Governor of the state, and all non-urban land in the local governments in which they are found. The terrestrial system components (e.g. CLS and related infrastructure) of the Project will be sited within approximately 4 ha of land acquired by WIOCC adjacent Elegushi beach in Lekki, Lagos, through outright purchase. The Title Deed for the acquired land has been obtained from the Lagos State Government. As noted, the terrestrial system components of the Project are outside of the scope of this ESIA.

1.7.1.15 Labour Act CAP L1 LFN, 2004

The Labour Act (2004) is the primary law protecting the employment rights of individual workers. The Labour Act covers protection of wages, contracts, employment terms and conditions, and recruitment. It also classifies workers and special worker types.

1.7.1.16 National Policy on Occupational Safety and Health, 2016

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

1.7.1.17 National Health Act, 2014

This Act requires that development projects should be executed under guidelines that protect the environment and safeguard the public health.

1.7.2 State Laws on Environmental Protection

1.7.2.1 Lagos State Ministry of Environment and Water Resources

The Lagos State Ministry of the Environment and Water Resources is responsible for the protection and management of the environment in Lagos State. The authority administers the various laws of Lagos State on environmental protection. It collaborates, consults and cooperates to the maximum extent practicable with any Federal Agency, other States and Local Governments, statutory bodies and research agencies on matters and facilities relating to environmental protection. The Ministry expects an EIA certificate (issued by the FMEnv) for major new development in the State.

1.7.2.2 Lagos State Waterfront Infrastructure Development

The Ministry of Waterfront Infrastructure Development, created in 2008, is saddled with the responsibility of formulating and evaluating of policies relating to Waterfront Infrastructure Development. The Law ensures balance between economic development and preservation that will permit the beneficial use of waterfronts while preventing the diminution of open space areas or public access to the waterfront, shoreline erosion, impairment of scenic beauty, or permanent adverse changes to ecological systems.

It is required that every person, corporation, partnership or body involved in developmental activities, sand dealing and sand dredging operations in, around or on waterfronts and embankments in Lagos State shall obtain an operations permit.

1.7.2.3 Lagos State Physical Planning and Urban Development Law 2010 (revised in 2015)

This law provides the administration of Physical Planning, Urban and Regional Development in Lagos State. Section 30 (1) of this Law states that permit of the Authority shall be required for any physical development in Lagos State.

1.7.2.4 Lagos State Environmental Protection Agency (LASEPA) Edict of 1996

The Edict establishing LASEPA was signed into law in November 1996. This states the functions of the Agency, the authority of the Agency, and acts that are prohibited within the State together with associated penalties for flouting such prohibitions.

The functions of the Agency include, amongst others, the following:

- Monitoring and controlling of all forms of environmental degradation from agricultural, industrial and government operations;
- Monitoring of surface, underground and potable water, air, land and soils within the State to determine the pollution level as well as collect baseline data; and
- Co-operating with Federal, State and Local governments, statutory bodies and research agencies on matter and facilities relating to environmental protection.

1.7.2.5 Lagos State Waste Management Authority (LAWMA) Edict 2007

LAWMA is responsible for the collection and disposal of municipal and industrial waste in Lagos State as well as the provision of commercial waste services to the State and Local Governments.

1.7.2.6 Lagos State Environmental Sanitation Law 2000 (revised in 2015)

The Lagos State Environmental Sanitation Law focuses on environmental sanitation and protection and prohibits street obstruction, littering and inadequate waste disposal.

1.7.2.7 Lagos State Environmental Management and Protection Law 2017

The purpose of this law is to harmonise all laws relating to the environment for management, protection and sustainable development of the environment in Lagos

State. The objectives of this law are to provide a clean, safe and healthy environment for all residents in the State, and to enable citizens access the various public amenities or segments of the environment for recreational, educational, health, cultural and economic purposes.

1.7.3 Local Government Laws on Environmental Protection

The cable landing site is at Elegushi beach which falls within the jurisdiction of Iru-Victoria Island Local Council Development Area (LCDA) in Eti-Osa Local Government Area (LGA) of Lagos State. The LGA has an Environmental Health Department which ensures compliance with environmental sanitation law, including proper management of wastes in line with relevant local and international guidelines.

1.7.4 International Conventions, Guidelines and Standards

1.7.4.1 International Conventions and Declarations

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

- *United Nations Convention on the Law of the Sea (UNCLOS), 1982*

Nigeria is signatory to UNCLOS and claims rights within 12 nautical mile (Nm) territorial waters and a 200 Nm EEZ.

According to the UNCLOS, the sovereignty of a coastal state extends beyond its land territory and internal waters to an adjacent area of sea. In Nigeria, this relates to maritime boundaries. The proposed Project and related activities would fall within this jurisdiction, as indicated in Figure 1.4.

The maritime boundaries are divided into the following categories:

Territorial Waters (TW): According to Territorial Waters Act CAP TS Law of the Federation of Nigeria (LFN) 2004, Nigeria territorial waters shall for all purposes include every part of the open sea within 12 nautical miles (~22.22 km) of the coast of Nigeria (measured from low water mark) or of the seaward limits of inland waters.

Contiguous Zone (CZ): The contiguous zone of Nigeria is the area beyond the territorial waters, but within a distance of 24 nautical miles (~44.45 km) from the baselines from where the area of territorial waters is measured. In this zone, Nigeria can exercise the control necessary to; prevent infringement of its customs, fiscal, immigration, or sanitary laws and regulations within its territory or territorial waters; punish infringement of the above laws and regulations committed within its territory or territorial waters.

EEZ: According to the Nigeria EEZ Act CAP E17 LFN 2004, this zone refers to an area beyond and adjacent to the territorial waters and which extends to a nominally determined distance of 200 nautical miles (370.4 km) from the baselines used to measure the breadth of the territorial waters. As already stated, the direct straight linear distance of the cable extent from the landing point to the boundary of the EEZ is, however, about 452 km. In this zone, Nigeria has sovereign rights in relation to the conservation or exploitation of the natural resources of the seabed, its subsoil and suprajacent waters and the right to regulate by law the establishment of artificial structures and installations and marine scientific research, amongst others.

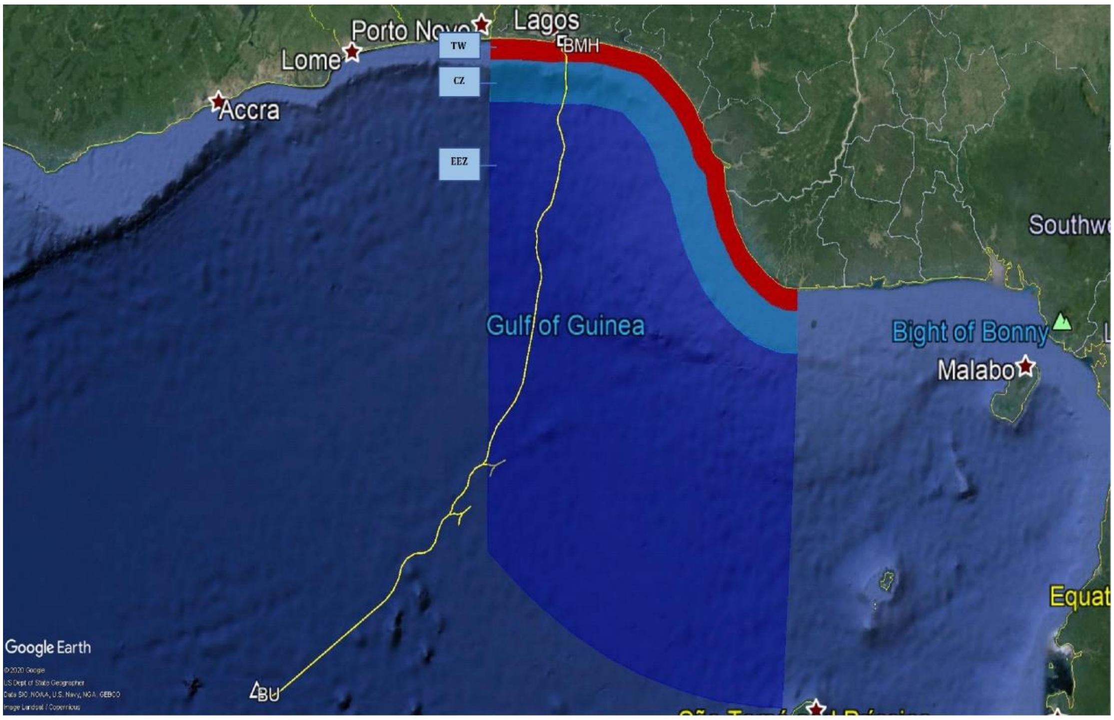

Figure 1.4: Nigerian maritime boundaries showing the EQUIANO Nigeria submarine cable route (Source: Adapted from Google Map, 2020)

Territorial waters and the EEZ, as well as the continental shelf and contiguous zone, are defined by UNCLOS and within which specific rules apply. Article 79 of UNCLOS, in particular, concerns the installation of 'submarine cables and pipelines on the continental shelf' and specifies that States (in this case reference is to the

Federal Republic of Nigeria) are entitled to lay submarine cables and pipelines on the continental shelf, in accordance with the provisions of this article as such:

- Subject to its right to take reasonable measures for the exploration of the continental shelf, the exploitation of its natural resources and the prevention, reduction and control of pollution from pipelines, the coastal State may not impede the laying or maintenance of such cables or pipelines.
- Delineation of the course for the laying of such cables or pipelines on the continental shelf is subject to the consent of the coastal State.
- Nothing in this Part affects the right of the coastal State to establish conditions for cables or pipelines entering its territory or territorial sea, or its jurisdiction over cables and pipelines constructed or used in connection with the exploration of its continental shelf or exploitation of its resources or the operations of artificial islands, installations and structures under its jurisdiction.
- When laying submarine cables or pipelines, States shall have due regard to cables or pipelines already in position and in particular, possibilities of repairing existing cables or pipelines shall not be prejudiced.

❖ *International Convention for the Prevention of Pollution from Ships (MARPOL 1973/1978)*

This convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes.

❖ *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972*

The objective of this convention is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter.

❖ *Convention on the International Regulations for Preventing Collisions at Sea (COLREG), 1972*

The regulations are published by the International Maritime Organization (IMO) and set out, among other things, the "rules of the road" or navigation rules to be followed by ships and other vessels at sea to prevent collisions between two or more vessels. COLREGs can also refer to the specific political line that divides inland waterways, which are subject to their own navigation rules, and coastal waterways which are subject to international navigation rules.

- *International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990*

Nigeria is a signatory to the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990 drawn up by the IMO to contain further measures to prevent pollution from ships. Parties to the OPRC convention are required to establish measures to manage pollution incidents.

All ships under the jurisdiction of the signatory country are required to operate with an IMO-developed shipboard oil pollution emergency plan. These procedures must be coordinated with local Nigerian systems. The convention requires that ships report pollution incidents to the coastal authorities and outlines subsequent actions to be taken. In addition, accumulation of oil spill equipment, undertaking oil spill management drills and developing detailed plans for managing pollution incidents is required. The Convention requires parties to the convention to provide assistance to others in the event of a pollution emergency.

- *International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), 2002*

This convention aims to prevent, minimise, and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments. Nigeria is a signatory to this convention.

- *International Convention for the Safety of Life at Sea (SOLAS), 1974*

The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port State control.

- *Convention on Conservation of Underwater Cultural Heritage, 2001*

The Convention on the Protection of the Underwater Cultural Heritage is a treaty that was adopted on 2 November 2001 by the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The convention is intended to protect "all traces of human existence having a cultural, historical or archaeological character" which have been under water for over 100 years. This extends to the protection of shipwrecks, sunken cities, prehistoric artwork, treasures that may be looted, sacrificial and burial sites, and old ports that cover the oceans' floors.

- *African Convention on the Conservation of Nature and Natural Resources, 1968*

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

- *Convention on the Conservation of Migratory Species of Wild Animals, 1979*

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

<u>West African Aquatic Mammals Memorandum of Understanding (MoU), 2008</u>

This MoU concerns the conservation of the manatee and small cetaceans of Western Africa and Macaronesia. It is a Multilateral Environmental MoU and entered into effect on 3 October 2008 under the auspices of the Bonn Convention (Convention on Migratory Species of Wild Animals). The MoU aims to protect these species at a national, regional and global level.

<u>MoU concerning Conservation Measures for Marine Turtles of the Atlantic Coast</u>

This MoU requires signatories to endeavour to put in place measures for the conservation and, where necessary and appropriate, strict protection of marine turtles at all stages of their life cycle (including eggs, hatchlings, juveniles, sub-adults and adults. It came into effect in 1999 and is an agreement under Article IV, paragraph 4, of the Convention on the Conservation of Migratory Species of Wild Animals.

- *Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal, 1989*

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

❖ *The United Nations Convention on Biological Diversity, 1994*

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

❖ *The United Nations Framework Convention on Climate Change, 1992*

The Convention on Climate Change was adopted in 1992 during the Rio Earth Summit in Rio De Janeiro, Brazil and entered into force in 1994 to limit Greenhouse Gas (GHG) emissions which cause global warming.

❖ *Declaration of the United Nations Conference on Human Environment, 1972*

The United Nations Conference on the Human Environment proclaims that "a point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences." The principles of this declaration relevant to the proposed Project include:

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

Principle 4: Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.

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

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

❖ *The Rio Declaration on Environment and Development, 1992*

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

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

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

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

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

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

- *International Telecommunication Regulations, 1989*

The provisions of these regulations supplement the International Telecommunication Convention, with a view to attaining the purposes of the International Telecommunication Union in promoting the development of telecommunication services and their most efficient operation while harmonizing the development of facilities for world-wide telecommunications.

The regulations establish general principles which relate to the provision and operation of international telecommunication services offered to the public as well as to the underlying international telecommunication transport means used to provide such services.

❖ *International Health Regulations, 2005*

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

1.7.4.2 <u>International Best Practice Standards and Guidelines</u>

The EIA process has considered best practice approaches as appropriate to the scope of work, although the ESIA has been developed to only comply with national permitting requirements. These include the relevant World Bank Environmental, Health and Safety (EHS) Guidelines, the World Bank Group Environmental and Social Framework, and the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability. A brief description of these guidelines and standards is provided below.

❖ *World Bank Group EHS Guidelines*

The World Bank Group EHS Guidelines are technical reference documents that include the World Bank Group expectations regarding industrial pollution management performance. The EHS Guidelines are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, reducing, and controlling potential EHS impacts during the construction, operation, and decommissioning phase of a project.

The EHS Guidelines serve as a technical reference source to support the implementation of the World Bank policies and procedures, particularly in those aspects related to pollution prevention and occupational and community health and safety.

❖ *World Bank Group Environmental and Social Framework*

The World Bank Environmental and Social Framework was released in August 2016 to replace the following Operational Policy (OP) and Bank Procedures (BP): OP/BP4.00, Piloting the Use of Borrower Systems to Address Environmental and Social safeguard Issues in Bank-Supported Projects, OP/BP4.01, Environmental Assessment, OP/BP4.04, Natural Habitats, OP4.09, Pest Management, OP/BP4.10, Indigenous Peoples, OP/BP4.11, Physical Cultural Resources, OP/BP4.12, Involuntary Resettlement, OP/BP4.36, Forests, and OP/BP4.37, Safety of Dams.

The Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity.

❖ *IFC Performance Standards on Environmental and Social Sustainability*

The IFC Performance Standards, totalling eight (8) in number, provide a robust framework for assessing and managing the environmental and social risks and impacts associated with projects to be financed by IFC or other relevant financial institutions. The Performance Standards are highlighted as follows:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples;
- Performance Standard 8: Cultural Heritage.

1.8 Report Structure

In line with the FMEnv Procedural Guidelines, this ESIA report has been organised into nine (9) chapters as highlighted below:

- **Chapter One**: Introduction containing an overview of the proposed Project, the objectives and scope of the ESIA and applicable legal and institutional framework.

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

- **Chapter Three**: Project Description containing the technical elements of the Project.

- **Chapter Four**: Description of existing environmental and socio-economic conditions of the Project's Area of Influence (AoI). It details the baseline data relevant to decisions about the Project location, development, and operation.

- **Chapter Five**: This takes into account all relevant environmental and socio-economic risks and impacts of the Project, including associated and cumulative impacts.

- **Chapter Six**: Mitigation measures for the identified environmental and socio-economic impacts and a discussion of residual impacts.

- **Chapter Seven**: Environmental and Social Management Plan for the Project. It summarizes the key measures and actions and the timeframe including responsibility for the implementation of the recommended measures.

- **Chapter Eight**: Presents the decommissioning and remediation plan for the proposed Project at the end of its operating life.

- **Chapter Nine**: Conclusion and Recommendations.

CHAPTER TWO:

PROJECT JUSTIFICATION

CHAPTER TWO

PROJECT JUSTIFICATION

This Chapter presents the rationale for the proposed EQUIANO Nigeria submarine cable project. It also includes the description of the alternative development options considered for the Project.

2.1 Need for the Project

The purpose of the Project is to install a fibre optical submarine cable to provide additional telecommunications capacity to Nigerian users as well as providing high-speed connectivity to the global network. Businesses and consumers will benefit from enhanced capacity and reliability for services such as telecommuting, internet services, video conferencing, advanced multimedia and mobile video applications.

Broadband traffic is growing rapidly as the demand for new applications like cloud computing and on-demand video significantly increases. In addition, the demand for new connectivity reflects an end-user and business environment in which ultra-broadband access is essential for sustainable growth and development.
Over the past decade, fibre optic cables have become the backbone of the world's information infrastructure. This has been necessitated due to the increased demand for bandwidth driven by the internet which has bettered by far the resources offered by satellite transmission of voice and data.

In the absence of a submarine cable system, telecommunication carriers have to rely on radio or satellite network. However, this has many disadvantages, including low speed and reliability. In contrast, submarine cables offer high reliability and large carrying capacity thus, allowing improved data access at a reduced cost. The total carrying capacity of submarine cables is in the terabits per second, while satellites typically offer only 1,000 megabits per second and display higher latency (Bryan, 2012).

2.2 Project Benefits

The direct and indirect benefits of the overall installation of the cable include the following:

- Access to substantial international bandwidth which would improve the quality of service for international voice, internet and other data services, and ensure the increased availability of such services.

- Increased competition, which may lead to cheaper access to international internet services and voice and data services.
- Contribution to the realisation of the National Telecommunications Policy objectives which include the provision of affordable and high-quality voice and data services.
- Creation of employment opportunities during construction and operation phases.
- Improved educational opportunities through increased access to information and educational resources.
- Development of a regional sense of community through greater equality of information sharing across geographical regions and across groups in society.
- Economic benefits from the enhanced opportunities for new and small enterprises that may have previously been excluded from technologies by high costs.
- Macro-economic benefits of the potential expansion of technology-reliant industries, such as information technology services and software development businesses.
- Increased penetration of internet connectivity to underserved regions of the country in order to assist in achieving the goals of the Nigerian National Broadband Plan.
- Revenue generation to the government, for example, through taxes.

2.3 Value of the Project

The envisaged cost of the Nigerian portion of the overall EQUIANO cable project is around USD 5 million. In addition, the Project has local and national economic values in terms of employment opportunities for various categories of Nigerian professionals, skilled and semi-skilled craftsmen, and business opportunities.

2.4 Envisaged Sustainability

2.4.1 Technical Sustainability

The design and installation of the Project is managed by ASN and its consultants, according to pre-established standards and procedures. ASN is a leading company in submarine communication networks with more than 600,000 km of submarine networks cable installed till date with more than 220 fibre optic systems delivered in the last 26 years.

The cable will be operated by WIOCC. The standard operating manuals and appropriate documentation regarding the proper operation and maintenance of the Project and its ancillary facilities will be developed. These documents will be used as the basis for providing topic-specific training to relevant personnel prior to start-up to further ensure technical sustainability of the Project.

2.4.2 Environmental Sustainability

Modern fibre optic submarine cables are capable of delivering much greater speed, capacity and reliability than earlier systems. The cable routing aims to minimise environmental impact; and to maximise cable protection and reliability. A comprehensive cable route study was undertaken to determine a preferred route with the lowest environmental impact and highest resource efficiency in comparison to alternative routes. In particular, the routing has sought to avoid legally protected and internationally recognised areas and other features of ecological interest that may have high sensitivity to project impacts, including:

- seagrass beds;
- shallow water reefs;
- areas with lower levels of anthropogenic beach disturbance that may be more important for nesting sea turtles;
- mangroves;
- pockmarks/seamount areas on the seabed that may be of ecological interest; and
- shorelines important for breeding and migrating seabirds.

In addition, in water depths of <1000 m the cable will be buried, which reduces the potential for cable deterioration, especially on the more dynamic continental shelf area. Undertaking installation at normal low vessel speeds will also greatly minimise the potential for ship strikes on marine wildlife. The cable installation techniques that are used also seek to minimise environmental disturbance and promote natural restoration during or after cessation of construction activities. The inherent design elements that mitigate potential impacts are discussed in Chapter 6.

The cable design will ensure that entanglement is not a risk for marine wildlife. This issue was therefore scoped out at the Scoping Study stage; and has not been considered further in the ESIA process (see Chapter 5).
The following measures shall also ensure the environmental sustainability of the Project:

- The cable installation activities shall be carried out in line with Best Available Techniques (BAT) to minimise impacts on the environment.

- The Project development activities shall be carried out to conform to all relevant international and national environmental regulations and standards, including the recommendations of this ESIA study.
- A comprehensive Health, Safety and Environment (HSE) system shall be maintained which will include sustained training and re-training of the Project employees and those of the contractors and subcontractors on the management of environmental and social (including health safety) issues associated with the Project.
- Handling, storage and disposal of wastes shall be in accordance with the applicable local, national and international requirements.

2.4.3 Economic Sustainability

There is increased demand for the telecommunication services that would be provided by the Project, which will support the economic sustainability of the Project.

2.4.4 Social Sustainability

A detailed Stakeholder consultation process has been implemented throughout the ESIA process to assist in ensuring that all relevant stakeholders, including the potentially Affected Community, have had the opportunity to provide input into the Project planning process. This has also assisted in laying a good foundation for building relationships with stakeholders. Details on the stakeholder engagement that has undertaken are provided in Chapter 4. WIOCC shall ensure that the stakeholder consultation process is sustained throughout the Project life cycle as set out in the ESMP (Chapter 7).

In water depths of <1000 m the cable will be buried to avoid cable snagging due to fisheries operations, i.e., for bottom trawling activities. Also, the cable will route through a ‘no anchorage and fishing zone’ in the water depths of <100 m, which will limit impacts on coastal fisheries and shipping during the construction phase. Finally, the cable will avoid impacts on any known sites of cultural heritage importance.

2.5 Project Alternatives

In accordance with the EIA Act CAP E12 LFN, 2004, an EIA should consider technically and economically feasible alternatives for carrying out the Project, including an assessment of the environmental effects of alternatives. The analysis of alternatives considered for the Project is discussed in the following paragraphs:

2.5.1 Technology Alternatives

2.5.1.1 Satellite Transmission Network

Although there are a number of available telecommunication mechanisms, the scale of customer demand and expectation of communication technology has made many of these inadequate for the provision of international bandwidth. Satellite links which had previously been the only alternate medium for the transmission of international traffic are being gradually phased out and replaced by the fibre optic subsea cable transmission networks. The inherent limitations of satellite transmission include restricted bandwidth, poor quality service and latency, particularly across borders (MTN Nigeria, 2011). For these reasons, the use of satellite transmission network is not selected as the preferred technology for the Project.

2.5.1.2 Land-based Cable System

Installation of the fibre optic cable across land may be an alternative to a submarine cable. However, this would require land agreements and extensive trenching over thousands of kilometres to deliver. It is likely that route alignment may not be able to avoid environmentally and socially sensitive areas. In addition, the works would be of much longer duration and natural passive restoration would be far less feasible. Installation costs are also likely to be much higher for terrestrial systems due to the increased complexity associated with the installation and maintenance activities. This option is therefore not considered to be preferred from the perspective of technical and economic feasibility, and also related to the potential impacts on environmental and socio-economic features.

2.5.1.3 Submarine Cable System

Fibre optic network is currently the only available technology that is able to submit sufficiently high volumes of voice and data traffic particularly for international traffic, with higher security, reliability and at a lower cost. Cables have more dependable installation and repair record than other communication technologies and have no frequency interactions (MTN Nigeria, 2011). The use of submarine cable system is therefore the preferred technology for the proposed Project.

2.5.2 Route Alternatives

A range of alternatives for the routing of the cable were considered during the cable route study, and the preferred route (see Figure 1.2) was determined based on a number of factors including, amongst others:

- Avoidance of crossings;
- Relation to marine navigation;

- Suitability of seabed conditions to enable good burial, thereby protecting the cable from potential risks and hazards;
- Offshore physical environmental risks (e.g. fault lines);
- Marine biodiversity and ecosystem services risks; and
- Adequate separation distance from existing cables to minimise the potential for both (or more) cables to be damaged or broken as a result of single incident.

2.5.3 Landing Site Alternatives

Three options were considered for cable landing point and associated coastal infrastructure, as briefly described below and as shown in Figure 2.1:

- *Lagos Elegushi Beach Option 1:* The landing site is located at Yemi Adetayo Street, Elegushi Beach, Lekki, Lagos. It is at or near to Low Water (LW) and between two groynes (approximately 400 m apart). As reported by Pelagian (2019), the Nigerian Government, in 2014, began a process of building beach protection groynes, working from west to east along the coast, and as at January 2019, 19 groynes had been installed. The landing site is between Groynes 8 and 9. The proposed CLS area for this option is adjacent the landing point. The beach stabilisation works would provide protection to the cable from shipping in shallow water and protection from beach erosion processes, which have affected other Lekki subsea cables (Pelagian, 2019). In addition, the area directly offshore of the preferred landing site is a designated 'no fishing and no anchoring zone' (Pelagian, 2019). Also, due to the high levels of disturbance on the beach within the vicinity of the preferred site (as noticed during the site visit) from human activity, including recreational use, manufacture of cements block and sand dredging disposal for the raising of development land, the presence of small coastal road and erosion banks, the presence of domestic garbage and sewage runoff, etc., the likelihood of sea turtle nesting in the area is low.

- *Lagos Elegushi Beach Option 2*: This site is approximately 400 m to the east of the Option 1 landing site, also on Yemi Adetayo Street, Elegushi Beach. It is located between Groynes 9 and 10. The proposed CLS site for this Option is a 2 ha walled area of overgrown vegetation which contains a number of derelict buildings on the western wall. The site is uneven and heavily vegetated with thick grass, reeds and some trees. This option had similar benefits as Option 1.

- *Lagos Redline Beach Option 3*: This is located 16 km to the east of the Option 1 and 2 landing sites, and approximately 1 km west of the existing West Africa Cable System (WACS) cable landing on open beach. This site is not afforded any artificial coastal protection. The Option 3 CLS site is a small 0.21 ha open area of grassland with palm trees, which has its 4 corners marked by low brick walls.

Figure 2.1: Site options considered for cable landing point and associated coastal infrastructure, showing the offshore cable seaward of the connection to the BMH at Option 1 (Source: Adapted from Google Map, 2019)

Option 1 was selected as the preferred alternative for a variety of environmental and technical reasons such as: relation to important coastal biodiversity and ecosystem service sensitivities; relation to important socio-economic factors; connectivity to existing terrestrial telecommunication systems to limit the extent and impact of work; and a relatively stable nearshore and beach environment that is not too erosive, thereby ensuring that the cable is not exposed at the shore crossing and that the coastal infrastructure is protected from loss of land and flooding.

2.6 Project Development Options

2.6.1 No Project Option

The 'no-project' option assumes that the cable would not be installed. In this scenario, the region would continue to be constrained by inadequate telecommunications capacity, especially in the area of international data transfer. This could significantly hinder economic growth and cause Nigeria to become increasingly more isolated from the global community as sophisticated data transfer mechanisms are employed elsewhere that Nigeria would not be able to access. The 'no-project' option will also not be in line with the Federal Government's goal of increasing the penetration of internet connectivity to underserved regions of the country as part of the Nigerian National Broadband Plan. Therefore, the 'no-project' option is not considered as a viable economic option. This option would lead to lower environmental impacts. However, as noted in Chapters 5 and 6 of this ESIA Report, the expected environmental and socio-economic impacts of cable installation are minor at worst, especially with the adoption of an appropriate management and mitigation strategy.

2.6.2 Delayed Option

This option implies that the planned Project will be delayed until a much later date. Such an option is usually taken when conditions are unfavourable to project implementation such as an in-war situation, or where the host communities are deeply resentful of the project. Also, if the prevailing economic climate is not quite favourable to the project, then 'delayed project' option may be feasible. None of these conditions are applicable in the timeframe proposed for cable installation.

Certainly, both the economic and the political environments are favourably disposed towards the Project. The implication of the 'delayed project' option will mean that all the preliminary work and associated efforts may need to be duplicated or amended. Also, because of inflationary trends, such a delay may result in unanticipated increase in project costs, which may affect the final profit accruable from the project. The delayed option is not considered to be a preferred option for the Project.

2.6.3 Go-ahead option

The inherent benefits of allowing the Project to go-ahead as planned are multifarious both to the proponent and the Nigeria populace. Job opportunities for Nigerian professionals, skilled and semi-skilled craftsmen will increase. The cable installation is aimed at providing additional telecommunications capacity to Nigerian users as well as providing high-speed connectivity to the global network. Thus, given the above-mentioned considerations - construction of the proposed

Project with efficient technology, cost minimisation and environmental friendliness – the 'go-ahead' option is preferred.

CHAPTER THREE:

PROJECT DESCRIPTION

CHAPTER THREE

PROJECT DESCRIPTION

This Chapter presents a description of the Project, including information on its location, components and planned activities. The waste streams associated with the Project activities are also discussed.

3.1 Project Location

The Nigeria branch of the EQUIANO cable system will extend from the main BU connection point at Latitude 0°2.3833’N and Longitude 0°42.2292’E and passes through Nigeria’s EEZ and the Territorial Waters (see Chapter 1) to a landing site at Elegushi beach where it will be connected to a proposed BMH that will be located around 70 m behind the beach in land acquired by WIOCC.

Further information on the cable route, landing site and the BMH location is provided in the sub-sections below.

3.1.1 Cable Route

As indicated in Figure 1.2 in Chapter 1, the cable route will extend across the entire EEZ to the point of duct connection to the BMH at Elegushi beach in Lekki, Lagos.

The selection of the route has been informed by detailed desktop studies and the undertaking of a comprehensive cable route survey. The geographical coordinates of different positions along the route are provided in Appendix 3.1, while information on the environmental conditions of the cable route is included in Chapter 4.

3.1.2 Landing Site

The preferred landing site on Elegushi beach will connect directly to the BMH (see below for BMH location). The landing site was identified from the analysis of a number of alternatives as described in Chapter 2.

The site is characterised by sandy beach, and there are no natural intertidal rock outcrops apparent near the site (Plate 3.1). The landing site is at or near LW and between two groynes (approximately 400 m apart). Administratively, the landing site falls within Eti-Osa Local Government Area (LGA) of Lagos, Nigeria (Figures 3.1 to 3.3). The nearest community to the landing site is Ikate-Elegushi. Further information on the community is provided in Chapter 4.

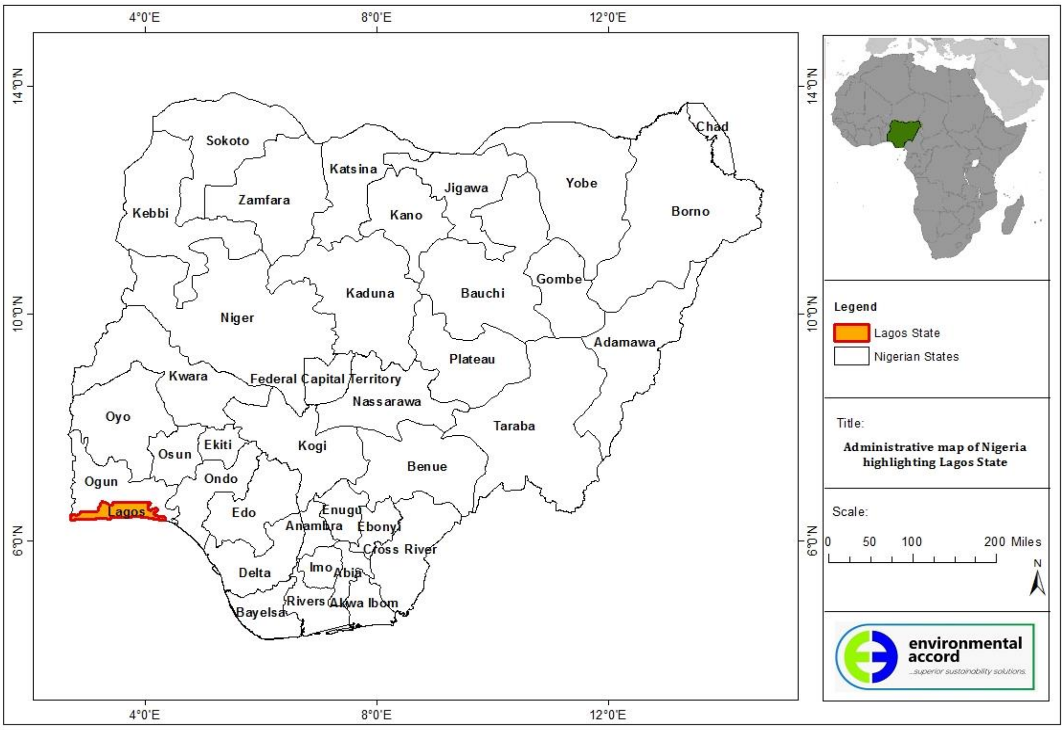

Figure 3.1: Administrative map of Nigeria highlighting Lagos State

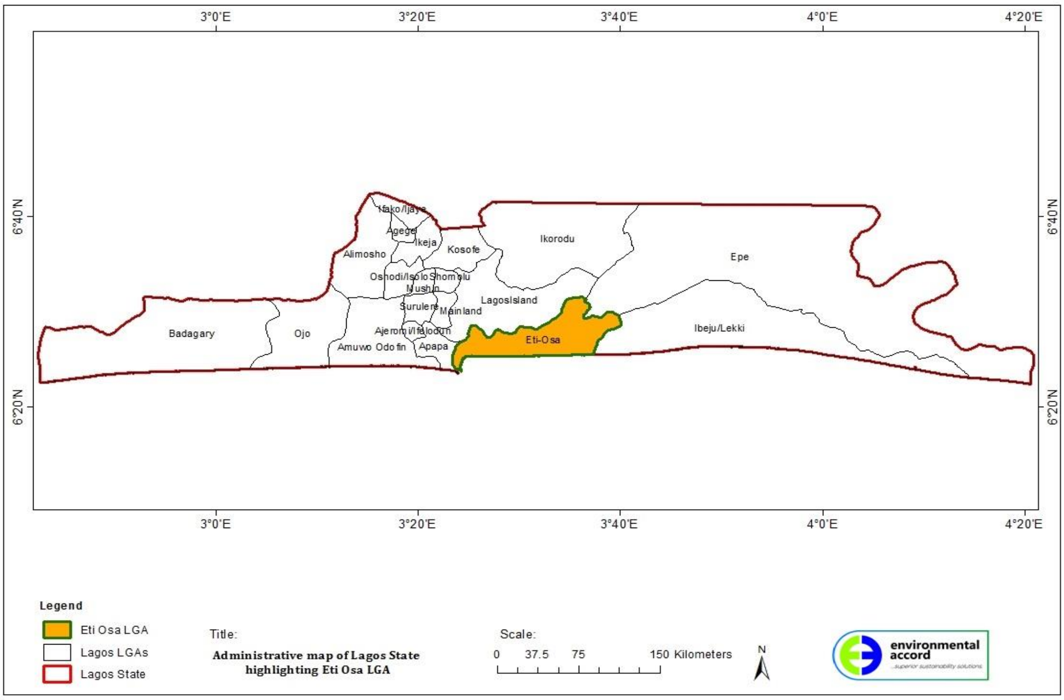

Figure 3.2: Administrative map of Lagos State highlighting Eti-Osa Local Government Area

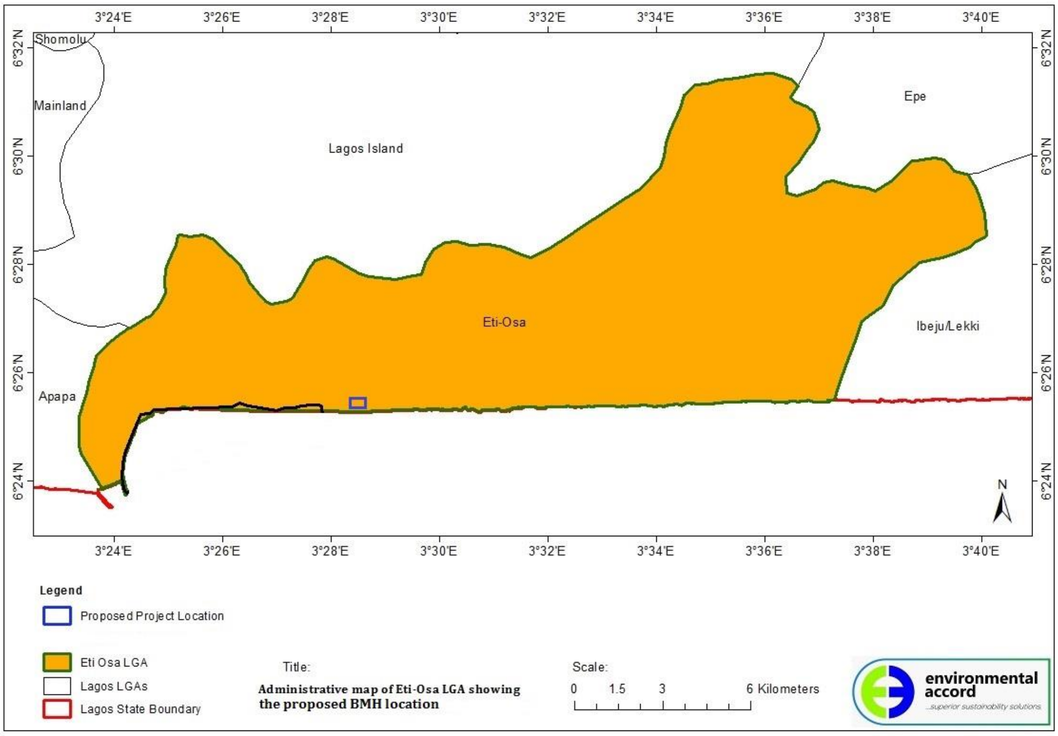

Figure 3.3: Administrative map of Eti-Osa Local Government Area showing the proposed landing site

Plate 3.1: The landing site and its surroundings at Elegushi Beach in Lekki, Lagos

3.1.3 BMH Location

The BMH is located approximately 140 m landward of Elegushi beach at the end of the submarine cable at Latitude 6°25.45'N and Longitude 3°29.829'E (Figure 3.4). The BMH lies within the boundary of 4 ha of land (Plot 99 and Plot 100, Maiyegun Tourism and Recreational Zone, Lekki Phase II, Lagos) that has been acquired by WIOCC to house the BMH, CLS and related land-based infrastructure for the Project. 2 ha of this site will be used for the terrestrial cable infrastructure components; and 2 ha has been allocated for future development. Only a small portion of this land will be used for the proposed BMH (typically 4 m long x 2 m wide x 2 m high). Plate 3.2 shows the BMH location inside the WIOCC plot.

Figure 3.4: Proposed EQUIANO Nigeria submarine cable route up to the BMH location within the WIOCC plot (red box) at Elegushi beach, Lagos (Source: Adapted from Google Map, 2020)

Plate 3.2: BMH location within the WIOCC plot at Elegushi beach, Lagos

3.2 Telecommunications Cable Components

A general overview of a typical telecommunications cable system is shown in Figure 3.5. The core component of the cable system is an inner optical fibre, surrounded by a polyethylene core for strength and fibre separation. The optical fibre is used for data transmission.

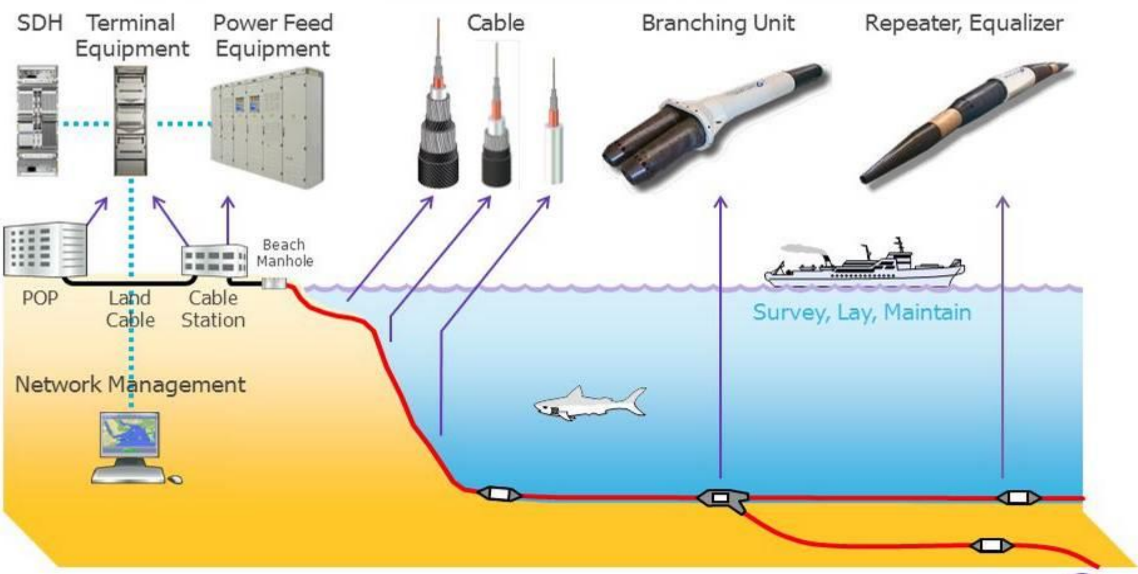

Figure 3.5: A typical submarine cable system (Source: ASN, 2012)

As discussed in Section 1, the cable system can be classified into two parts, namely:

- Marine system components
- Terrestrial system components

These elements are discussed below. Although not forming a core scope for assessment in this ESIA, The terrestrial system components although are discussed to provide some understanding of potential associated impacts (see Chapter 5).

3.2.1 Marine System Components

The key marine components of the Project are described below:

3.2.1.1 Fibre Optic Cable

- ***Overview***

The core of the Project system is fibre optic cable, comprising optical fibres encased in plastic. The optical fibres are glass fibres that carry light along their length. They are widely used in telecommunications because they allow for transmission of data over long distances and at very high rates.

- ***Cable Design***

The cable is designed to minimise environmental impact. The cable design selected can accommodate up to seven pairs of fibres, which are housed in a jelly-filled stainless-steel tube, surrounded by two layers of steel wires that form a protective vault against pressure and external contact, and also provide tensile strength. The vault is then enclosed in a hermetically sealed copper tube and insulated with a layer of polyethylene to form the basic deep-sea Light Weight (LW) cable. The outer low-density polyethylene coating provides high voltage electrical insulation, as well as abrasion protection.

The main design function of a cable is to protect the optical fibre transmission path over the entire service life of the system, including laying, burial, and recovery operations. A secondary function is that its metallic conductor elements are used either to feed an electric current to the repeaters (see below) or to monitor on a permanent basis the status of the transmission system and to localise cable breaks.

For shallow water applications, external layers of steel armour wires are added to suit route conditions and installation methods. The various cable types that may be used for the Project including their diameters and the water depths in which they are suitable are presented in Table 3.1. Also, illustrations of the different cable types are provided in Figure 3.6 (a – d).

The cable design ensures that negligible strain and ultra-low pressure are applied to the fibres in normal operation. Even if the cable breaks, high strain on the fibres and sea-water ingress are limited to a short length, so that the bulk of the cable will remain serviceable.

Table 3.1: Cable Types to be used for the proposed Project

S/N	Cable Type	Outside Diameter (mm)	Water Depth (m)
1.	Light Weight (LW)	17	0-200, max. 500
2.	Light Weight Protected (LWP)	23	20-1500, max. 2000
3.	Single Armour Light (SAL)	28	1000-3500, max. 7000
4.	Medium Double Armour (MDA)	37.5	1000-8000

Source: ASN, 2020

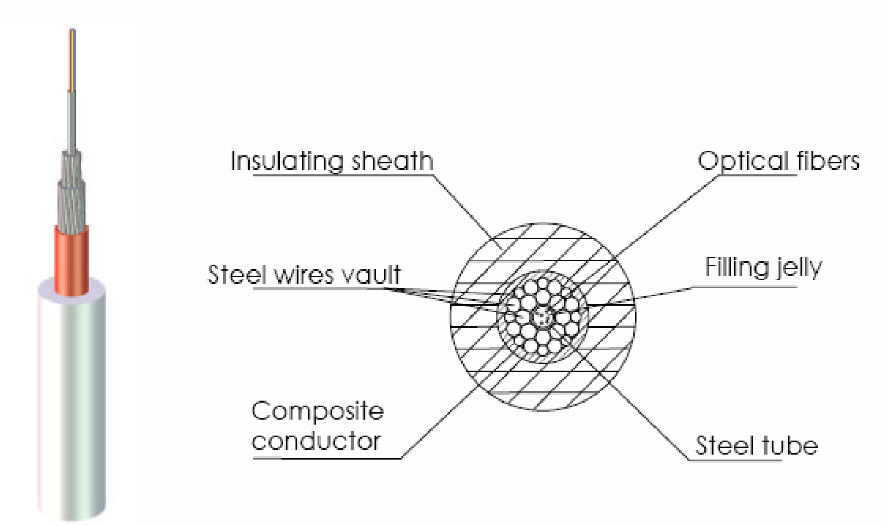

Figure 3.6 (a): Light Weight (LW) Cable (Source: ASN, 2020)

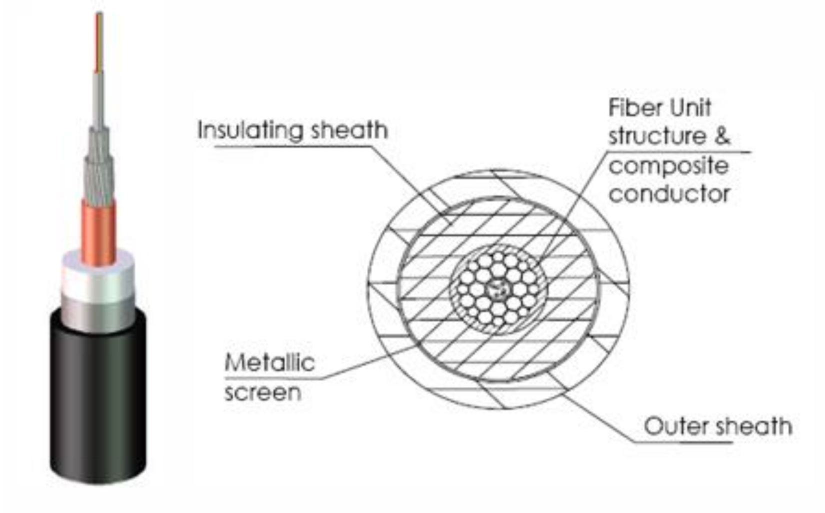

Figure 3.6 (b): Light Weight Protected (LWP) Cable (Source: ASN, 2020)

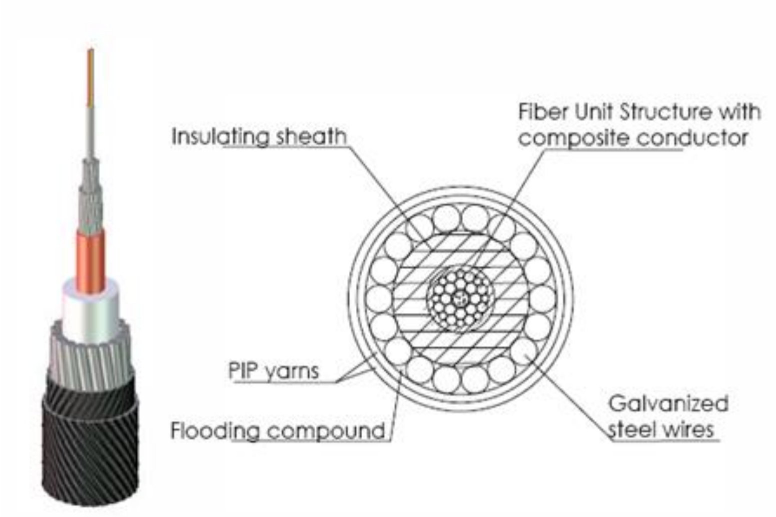

Figure 3.6 (c): Single Armoured (SA) Cable (Source: ASN, 2020)

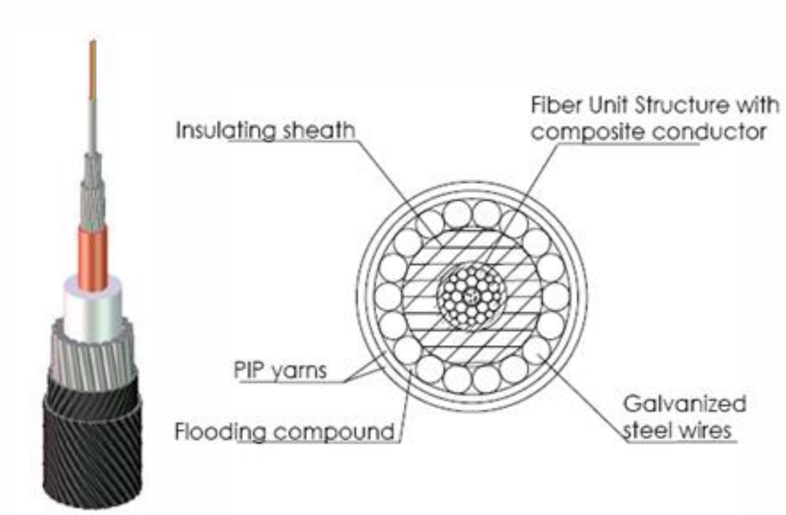

Figure 3.6 (d): Double Armoured (DA) Cable (Source: ASN, 2020)

3.2.1.2 Repeaters

Repeaters are optical amplifiers that are installed along the length of the cable and are used to extend the reach of optical communications links by overcoming loss due to attenuation of the optical fibre. A typical repeater is shown in Plate 3.3. The diameter of the rigid sea-case (white tube section in Plate 3.3) is approximately 270 mm while the length of the sea-case section of the repeater is approximately 980 mm. The total length of repeater is approximately 3900 mm to 4240 mm depending on cable coupling.

Plate 3.3: A Typical Repeater (Source: ASN, 2020)

The spacing between repeaters is approximately 75 to 83 km.

Each repeater is powered via an electrical current that is fed into the submarine cable system from the shore-based terminal station. The cable includes a copper conductor to transfer the electrical current. Modern repeaters comprise optical amplifiers (glass strands containing the element erbium) are enclosed in the cable to boost signals across the cable. Strands are spliced at intervals along a cable and then energised by lasers that cause the erbium-doped fibres to 'lase' and amplify optical signals (ICPC Ltd, 2016). Section 5 provides a discussion of Electric Magnetic Effects (EMF) arising from cable operation, which are considered to be negligible.

3.2.1.3 Branching Units (BUs)

BUs are pieces of equipment used in submarine telecommunications cable system to allow the cable to split in order to serve more than one destination.

3.2.1.4 System Earth

This is also called Earth Array and it is required to provide an earthing ground for the subsea cable system. Every powered submarine cable system needs power feed from the shore to operate the underwater components. This power is supplied by power feed equipment (PFE), which is located in the CLS. The PFE requires a dedicated earth, separate from the station earth, for optimum operation. This dedicated system earth is also known as 'system ground' or 'ocean ground bed' (OGB).
Two types of OGB can be used as follows:

- Earth Rods (array)
- Sea Earth plate

Earth rods will be used as OGB where the soil has a suitable conductivity. For this Project, metal rods will be buried close to the BMH within the portion of land assigned for construction of the CLS. The number of rods required is typically eight or four depending upon the soil resistivity. Each rod will be around 0.22 m in diameter and 1.8 m long (ERM, 2013). The works will require some minor land disturbance for installation of rods, duct and covering concrete slab for protection. Each rod will be separated by a distance of 5 m.

The sea earth plate must be installed min 25 m from the submarine cable and any other steel objects. The Sea earth plate is 25 mm thick steel plate 2 m in diameter. The sea earth plate must be installed in saturated soil so is often close to the water line on the beach. However, as discussed in Chapter 4, a geotechnical investigation that has been carried out within the CLS site has determined that the groundwater level was found to range between 1.4 m to 1.7 m below existing ground level (Arup, 2019). The position of the sea earth plate could therefore be located away from the waterline but in vicinity of the cable route and BMH.

Both system earth approaches are entirely subsurface and will not be visible upon completion of installation.

The current preferred approach for the Project is for the system earth to be constructed in the CLS site to protect it from future coastal erosion impacts.

3.2.1.5 BMH

The BMH is the structure where the subsea portion of the cable is connected to the terrestrial system components. For the Project, the extent of the ESIA relates to connection to the BMH. The BMH will be located inside the boundary fence of land acquired by WIOCC for the CLS (see Plate 3.2).

The BMH will be an underground, concrete vault with an access port. It will have a tamper-proof cover to prevent unauthorized entry. The BMH construction will involve the excavation of a pit followed by the installation of a concrete vault (typically up to 4 m x 2 m x 2 m) with ducts seaward for the cable entry. Ducts will be inserted seaward of the BMH to allow connection of the submarine cable. These will be installed by trenching. The top hatch of the BMH will sit flush with the ground level and is therefore not visually intrusive.

3.2.2 Associated Terrestrial System Components

Whilst this ESIA is being completed for marine system components only, there are some associated facilities that comprise terrestrial infrastructure for the overall cable Project, which are required to operate the cable. As already noted in Chapter 1, the associated terrestrial system components of the Project will be covered under a separate ESIA study and additional permitting as part of a different scope of work being led by WIOCC. However, for information and to aid the consideration of associated impacts for this EIA study, a brief description of the associated terrestrial system components is provided below.

3.2.2.1 Cable Connection from the BMH

From the BMH, the cable will run to the CLS. The cable will therefore be located entirely within the acquired CLS site. Installation of the land cable is independent of installation of the submarine cable, but normally the land cable installation is completed up to the BMH before the cable landing may take place.
The cable will be connected from the CLS to the wider WIOCC Metro Fibre network. The details for this connection are not confirmed at this stage and will be addressed in the separate ESIA study being completed as already discussed.

3.2.2.2 CLS

This is typically a building that functions as a control centre for the cable system and where the submarine system is connected to the wider domestic telecommunication network. The CLS will be fenced and incorporate a number of facilities such as:

- Internal road system;
- Two storey site office;
- additional office space;
- substation;
- security guard hut;

- car parking area;
- masts; and
- generators and diesel storage area.

3.3 Project Activities for Marine System Components

The phases of the Project include:

- Planning and pre-installation;
- Cable installation;
- Operation (including potential for maintenance and repair); and
- Decommissioning.

A description of each phase and the associated activities is provided below. The activities discussed under Route Clearance (RC), Pre-Lay Grapnel Run (PLGR) and cable installation all comprise the construction phase of the Project. Other planning and pre-installation activities have already been undertaken as part of the initial design work, and therefore, are not included in the ESIA.

3.3.1 Planning and Pre-Installation

3.3.1.1 Route Planning and Survey

Cable design and selection of cable types are developed in the planning stage based on cable route engineering considerations identified during the route planning process. As stated in Chapter 2, the cable route was engineered to avoid potential environmental and socio-economic risks and to secure long-term protection of the cable. The cable route and Project design have been developed and refined through the following main stages:

1. Environmental Desk-top Study

This study has been carried out to support the determination of the preferred cable route and landing point, including the location of associated coastal infrastructure for the Project. The study approach included a literature review to gather baseline information needed to identify the presence of any key environmental and social constraints and permitting risks; a rapid ecological coastal walkover survey (including the flying of drones) where cable landings may be located to provide additional information on local biodiversity values (with a particular emphasis on sea turtle nesting potential); and pre-application stakeholder consultation to obtain information on the cable route and optional landing locations; and also to identify any key permitting risks.

2. Technical Cable Route Study

A technical cable route study has been completed to determine the optimum route for the submarine cable. The study included desk-top research including analysis of charts and satellite imagery, site visits to each proposed landing points, and preliminary meetings with key government agencies. The study took a range of factors into account, including:

- Seafloor physiography and geography;
- Seismicity and volcanism, such as avoidance of faults;
- Oceanography, such as waves and tides;
- Climate, such as winds and seasonal variations;
- Offshore activities;
- Natural and man-made hazards;
- Marine traffic;
- General landing site features; and
- Accessibility.

The objectives of the study were to minimise potential risks to the cable and make preliminary recommendations on the routing, landing site and cable type.

3. Cable Route (Marine) Survey

Following the completion of desktop studies, a cable route survey has been completed. The survey information provides the necessary information for detailed engineering, construction, installation and subsequent maintenance of the cable. It has also provided environmental information to inform the ESIA. The survey operations along the cable route were carried out by MV Fugro Gauss and Alumaster in 2019. The survey comprised an investigation of the bathymetry, seabed features, shallow geology and marine sediment composition along the proposed route. Bathymetric and other data were collected and analysed in order to define the optimum route for cable installation. Seabed samples were taken as required in order to help the classification of seabed sediments in nearshore waters. In addition, Cone Penetration Tests (CPTs) were performed in water depths between 15 m and 700 m (see Chapter 4).

3.3.1.2 RC and PLGR

Immediately prior to cable installation, a clearance operation will be conducted to remove any obstacles from the path of the final subsea cable route in water depths of <1000 m where cable burial is proposed (see below).

RC will be performed in areas where old out-of-service cables are known to cross the cable route through capture by grapnel chains or using a de-trencher tool (Figure 3.7). The RC operations are planned to be carried out via 2 – 6 passes of 1 km centred on the theoretical position of crossed out-of-service cables, with an offset 500 m laterally from the cable route. The width of the footprint left on the seabed will range from 0 – 2.5 m, while the depth of the footprint left on the seabed will range from 0 – 1.5 m depth, both according to the nature of the seabed.

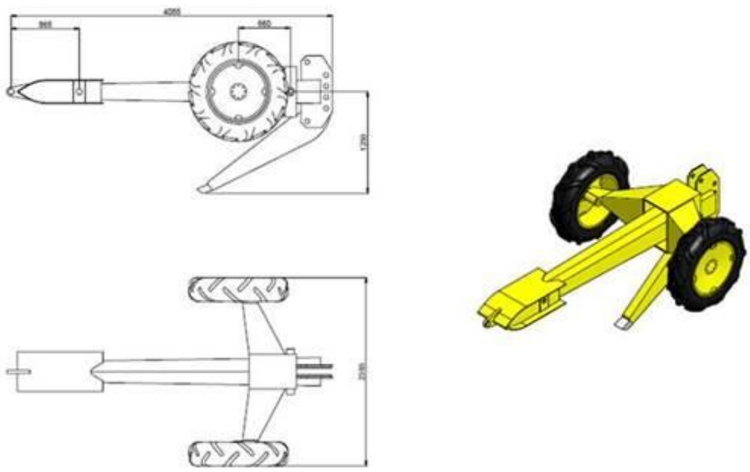

Figure 3.7: A typical RC de-trencher tool

In water depths <1000 m, a PLGR will take place along the subsea cable route where burial is required as a final check of the seabed for items (such as wires or hawsers, fishing equipment, etc.) that might interfere with installation or otherwise damage the subsea cable. The PLGR is undertaken by the main cable laying vessel or another designated vessel. The operation involves the towing of one or an array of grapnels (Figure 3.8) along the route where burial is required. The vessel proceeds at a rate to ensure that the grapnel maintains continuous contact with the seabed. The grapnel is usually a sliding prong type which can penetrate up to 40 cm into the seabed.

As the vessel moves along the route, the towing tension is monitored, and the grapnel is recovered if the tension increased indicating that an obstruction has been hooked. As a matter of routine, the grapnel is recovered and inspected at minimum intervals of 15 km along the route. Any debris recovered during the PLGR is discharged and disposed of ashore in an approved waste site upon completion of the operations.

For the proposed Project, only one pass along on the cable route is proposed. PLGR operations will be stopped at 250 – 500 m from any subsea assets. The width of the footprint (i.e. the zone of disturbance from the grapnel and snagging of seabed materials) on the seabed will range from 0 – 1 m while the depth will range from 0 – 0.5 m depending on the nature of the seabed and type of grapnel used.

Figure 3.8: Typical grapnel tool for removing seabed debris prior to plough burial operation

3.3.2 Cable Installation

3.3.2.1 Overview

The cable laying vessel is 140 m long and purpose-built for cable installation. The vessel conforms to MARPOL regulations, including general requirements over the control of waste oil, engine oil discharges and grey and black wastewater discharges; prevention of pollution by garbage from ships and prevention of air pollution; and maintain operating procedures for dealing with incidents such as oil and waste spillages.

Vessel propulsion is provided by 2 fixed pitch propellers and thrusters. These are integrated with a "dynamic positioning system", providing exceptional manoeuvrability and position holding during ploughing and surface-lay cable operations. No anchoring is required to hold station. A typical cable laying ship is shown in Figure 3.9.

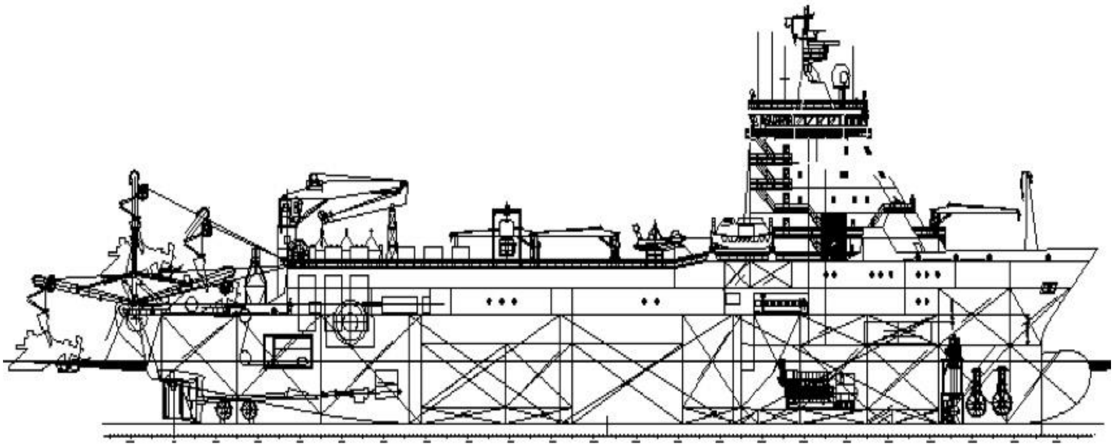

Figure 3.9: Typical cable laying vessel (Source: ASN, 2020)

3.3.2.2 Deep Sea Surface Lay

The cables will be laid unburied on the seabed in water depths of >1000 m, where the risks of damage by activities such as fishing or vessel anchoring are minimal. In surface lay mode, the precise horizontal position of the vessel, and advanced cable lay software (Makai Lay) will predict where the cable will be on the seabed. Makai Lay (Figure 3.10) is the state of the art software used by the industry to mathematically predict and determine where the cable will be installed in deep water. The software model uses inputs such as the position of the vessel, hydrodynamic properties of cable and cable bodies in the water column, water depth, vessel speed and pay-out rate of cable, to calculate and record the "as-laid" position of the cable as it touches down on the seabed.

The surface lay will normally be performed at a vessel speed of 4 knots or around an average of 168 km per day, subject to weather and current.

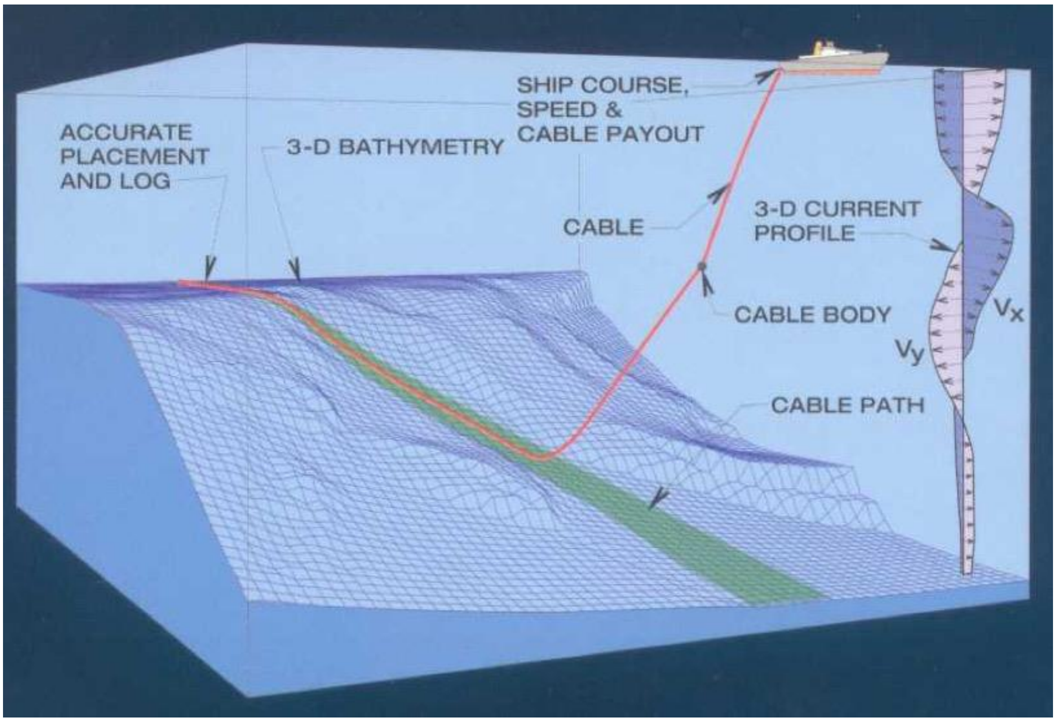

Figure 3.10: Model for direct cable laying on seabed (Source: ASN, 2020)

3.3.2.3 Plough Burial

In water depths between 15 m and 1,000 m, the cable will be buried by ploughing. This will be undertaken by a specialised sea plough (Plate 3.4). The sea plough is equipped with a share which allows the cable to be buried below the seabed approximately 1 m deep in a trench with a width of 0.2 m. The skids and/or wheels supporting the plough are hydraulically tensioned to control the stability and depth of plough burial. An illustration of the ploughing operations is depicted in Figure 3.11.

The overall width of the plough is approximately 6 m. However, the physical footprint of the submarine cable plough is limited to where the four plough skids are in contact with the seabed surface and the plough share. Each skid is around 1.5 m wide. The overall horizontal footprint of disturbance from the skids and the plough share is therefore 3.2 m. The plough will be towed at a speed of around 0.5 knots.

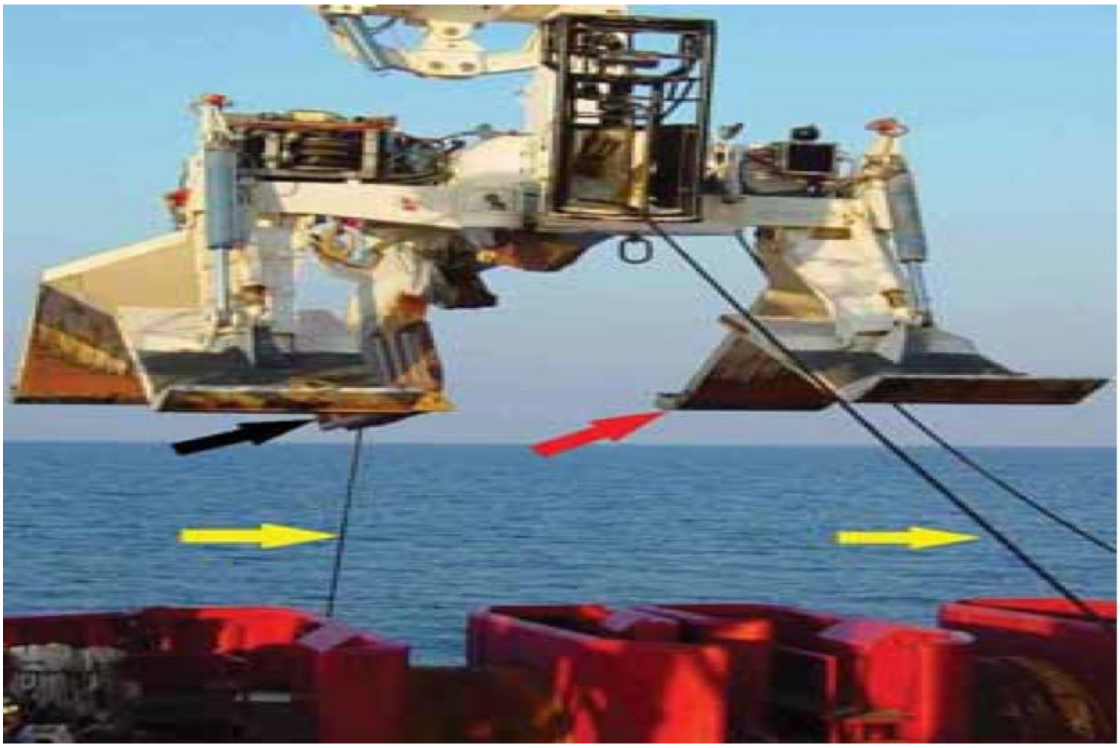

Plate 3.4: A typical sea plough about to be deployed from a cable ship. The fibre-optic cable (yellow arrows) is fed into a furrow cut by the plough-share (black arrow), which is towed across the seabed on skids (red arrow) (Source: Carter et.al; 2009)

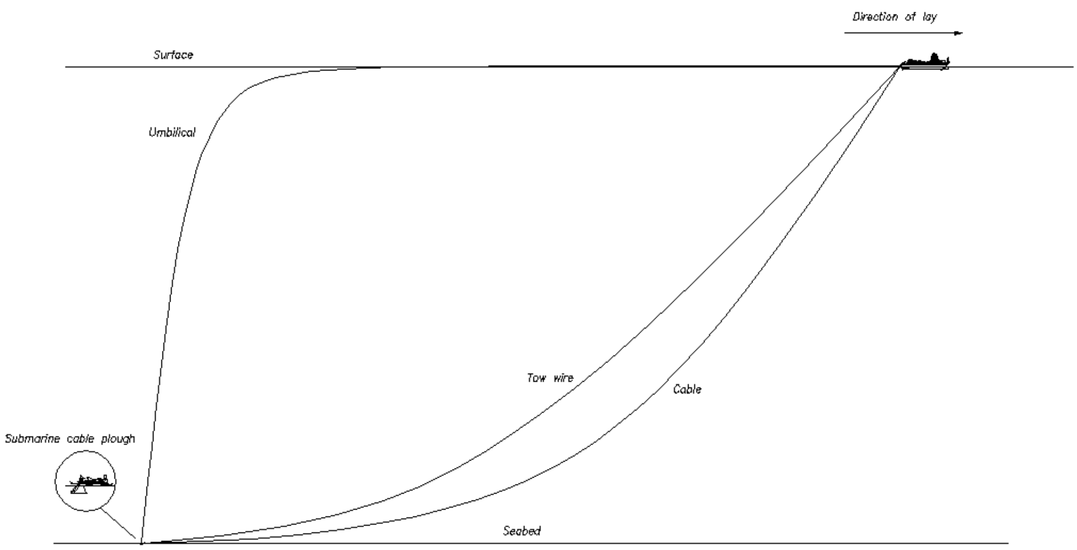

Figure 3.11: Typical ploughing operation where the plough often will be 2-3 times the water depth behind the vessel (Source: ASN, 2020)

The skids will lead to temporary surface disturbance. Sands and soft sediments such as those along the proposed route are collapsible, so the trench created by the plough will backfill as the sediments collapse back into place. However, the plough trench may remain visible just after installation but will over time disappear due to seabed currents and wave action, especially on the continental shelf area which is more dynamic.

The ploughing process is a well proven industry standard cable burial process that will keep the environmental impact to an absolute minimum compared to other burial techniques available for cable protection, like water jetting, airlifting, sediment dredging, rock cutting and rock dumping. However, jetting is still required in nearshore waters (>15 m water depth) (see below).

3.3.2.3.1 Cable and Pipeline Crossing

Based on the findings of cable route survey conducted (Fugro, 2019), the proposed route crosses three (3) in-service cables and four (4) out-of-service cables in water depths of <1000 m; whilst five (5) in service cables and five (5) out-of-service cables were crossed in deeper waters. The cable route does not cross any pipelines (Fugro, 2019).

Ploughing will not be performed within a specified distance to in-service-cables or pipelines. Generally, this distance is 500 m, but can be reduced to 250 m for in-service cable crossing that have been positively identified during Survey operations subject to the cable owner's agreement. The cable will be surface laid within this corridor along the planned/agreed route. Crossings in water depths of >1000 m will be in the surface lay sections of the cable system.

All crossings will follow the ICPC guidelines and the crossing angle should normally be as perpendicular as possible.

3.3.2.3.2 Post Lay Inspection and Burial (PLIB)

Post Lay Inspection (PLI) will be carried out to validate plough burial data where required up to the agreed maximum length of the route where plough burial is planned. Visual inspection will be subject to visibility of the water at the time of inspection. Inspection may also be based on cable tracking sensors and forward-looking sonar.

Post Lay Burial (PLB) operations will normally be performed in the planned plough burial areas at the following locations:

- at shore ends around the point of plough launch/recovery
- initial, intermediate and final splices

- crossings of in-service power and telecommunications cables
- branching units
- unplanned plough skips
- areas where seabed slopes are not suited for ploughing and jetting burial is possible

PLB in water depths greater than 20 m will be carried out by jetting, by deployment of a remotely operated vehicle (ROV). This ROV (Figure 3.12) may be deployed from a specifically mobilised vessel or from the main cable installation vessel and will be either tracked or free swimming, depending on the seabed and currents.

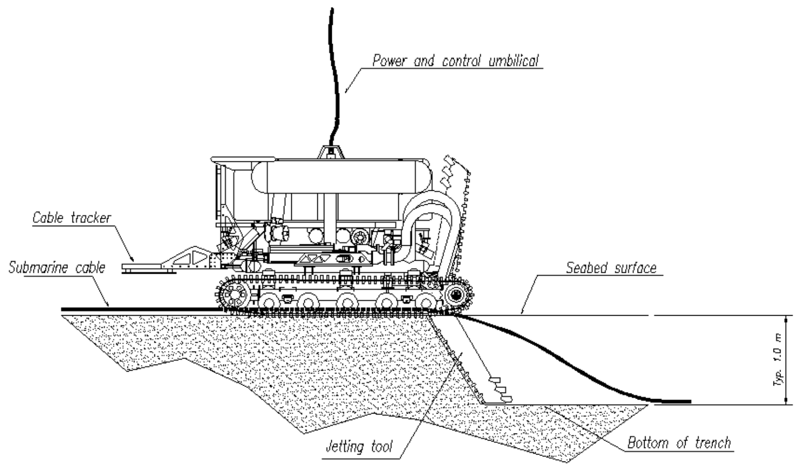

Figure 3.12: A typical ROV

3.3.2.4 <u>Connection to the Shore and BMH</u>
From water depths of approximately 15 m (the point up to the position of main lay vessel burying with the plough), the cable will be buried in a trench up to the shoreline.

Burial will be performed by diving team(s) using jetting tools which using hand-held water jetting, air lifting or burial sledge. Burial of the cable will be to the target depth (1 m).

Handheld water jetting is a system where the diver is using a small portable water pump and fire hose often fitted with a special double nozzle (either end of tool) to counter-balance the reaction force. This can be used from the waterline and out. This tool can also be used to fluidise the sediment around the cable to allow it to sink deeper into the sediments.

The jetting sledge principle is based on fluidisation of the sediment around the cable to allow it to sink to the required depth into the soft sediments. The jetting sledge is the most powerful inshore burial tool as this often is supported by a more powerful water pump. This pump can be in the range 100-400 HP. This system needs a small barge/vessel platform to support the diving team and pumping unit. When the jetting tool is deployed onto the seabed divers will install the tool on the cable. The jetting sledge will then fluidise the sediment around the cable and lower cable to the required depth (where possible). The jetting sledge may tow the pump barge as burial progresses. Burial tool can be disconnected from water hose(s) and left behind on the seabed for the night, if required.

Air lifting will require a long air hose and compressor. The airlift can typically be a 6-10 inch diameter x 2 m long hard PVC pipe section fitted with a diver operated valve that will feed compressed air into the pipe. By holding the tube/pipe section in near upright and allow air into the pipe this will generate a flow up and out of the pipe which in turn will start a suction process at the bottom end. A compressor may need to be accommodated onto a small boat when working. The airlift system can only normally be considered at water depths of more than e.g. 2 m. The principle here is based on suction removal of sediments and will discharge all sediments in the water column.

Prior to the cable landing operation, divers will place a marker buoy at the inner limit of the cable laid by the cable vessel. From this point towards the shore, divers will identify the best route – they may identify gullies / slopes and rocky areas along the route centre line and mark the positions of these features.

During the shore end landing operation, the cable laying vessel will position itself as close as reasonably practicable to the first marker buoy. Once the vessel has achieved a stable station-keeping condition, the cable is floated off the stern and pulled into the beach using a winch or tractor. This will enable the cable to be initially aligned as close as possible to the target route selected by the divers. During the pull-in operation, additional slack cable (approximately 10 m to 15 m) will be pulled inshore so that the divers have enough spare cable available to manipulate the cable towards the target alignment – this may involve deviations to avoid any detected rock to the greatest extent possible.

Divers will release the slack cable from inshore and where necessary move the cable manually, using the slack cable available, to finalise the position of the cable on the seabed. Whilst the cable is held in position, the floats are removed by the divers so that the cable is sunk on its correct line. This work is carried-out from the beach towards the ship (Plate 3.5).

Plate 3.5: Typical cable landing operation (ASN, 2020)

The beach contractor will have mobilised all necessary equipment to the site not later than the day before the planned landing. The end of seaward ducts should be exposed and working perimeter/area should be clearly marked and defined. The excavators will prepare the beach, set-up in beach pulling mode where one excavator will be positioned near the landing point with the quadrant and the other excavator will be prepared with necessary rigging and pulling rope. A full diver swim will be attempted no later than the day before the landing so known debris can be removed or be avoided before later sinking the cable. Final notification and coordination with local authorities is completed.

The cable landing operation will normally start at first light or around 0600 hours local time.

A quadrant on the beach will normally be used to perform "beach pulls" along the beach in order to pull cable shore. One heavy excavator will be used as "anchor point" for quadrant. The quadrant will allow the pulling rope and cable to be pulled along the beach in a 90 degree angle from the direction of landing. Normal beach pulling will require one excavator to pull the rope attached to the cable along the beach. Cable/rope will be secured every time the excavator will have to go back to perform a new pull. These beach pulls will continue to all required cable is safely landed on the beach. The main lay vessel will pay out cable with floats at the same rate/speed as the excavator performing the beach pulls.

Security guards may be used in some areas to restrict public access and to look after equipment at landing site during the night-time.

When the cable is landed on the beach and has been pulled through to the BMH cable testing will be performed to ensure the cable is ok.

From the landing site to the BMH, the cable will be buried to a depth of around 2 m across the beach and terrestrial zone through trenching. The cable will cross the small coastal road or be routed beneath it. The area of overall disturbance for these coastal works is estimated to be about 20 m wide, including the movement of people and plant and temporary storage of excavated material. However, the footprint of excavation is likely to be within an area of <2 m wide. The trenching work is normally completed, and the area restored, a few days after the landing.

3.3.2.5 Protecting the Cable

Articulated pipe (Plate 3.6) will be installed on the cable seaward of the BMH ducts to a point of around 550 m offshore (in about 8 m water depth). This will afford protection to the cable within the intertidal where local community recreation occurs, where erosion has been noted and where the cable route survey (Fugro, 2019) has identified the outcropping rock in the nearshore environment to water depths of around 7 m. Fugro (2019) reported that the rock appears to be potentially artificial dumped material that is part of the erosion control effort. In the subtidal area, the articulated pipe is normally applied by divers. However, in some situations articulated pipe may be pre-installed onboard cable ship during cable landing operation e.g. in areas with strong surf or high energy waves that will not allow post installation by divers. This pre-installation of articulated pipe onboard main lay vessel can be arranged in part (in critical surf area only) or in full.

If essential to prevent further lateral movement of the articulated pipe in high energy surf zones, saddle clamps may be considered and installed by divers at suitable intervals where seabed conditions permit along the articulated pipe to provide ultimate stability. Saddle clamps for articulated pipe are normally made in same material as the articulated pipes themselves. Clamps will only be considered for articulated pipe on hard ground in high energy surf zones where there is a significant risk of cable movements. Normally, at most cable landings, the cable route heading is perpendicular to the dominant wave front why the sideways drag component is very minimal. Stainless-steel studs rods are usually drilled into a healthy rock surface and secured and anchored by special resin, which will cure quickly. The length of rods required will be subject to rock hardness and quality, and may vary from 0.2 – 1.5 m.

Plate 3.6: Typical articulated pipes installed on cable (ASN, 2019)

3.3.3 Operation Phase

Once installed, the submarine cables do not require routine inspection and should not require repair during their operational lifetime. They are, however, installed in a way that enables repairs to be carried out if necessary. However, subsea cable repair may be required as a result of physical damage or failure. Subsea cables can be damaged or broken by human activity (fishing trawlers or other large ships dragging anchor), natural events (seismic activity), and animals (sharks have been reported to bite the cable). The design of the cable installation (e.g. burial in water depths <1000 m) and routing studies will provide very limited potential for damage to occur.

3.3.3.1 Submarine Cable Repair

Overhaul and maintenance operations occur when a problem is detected in the system and analysis determines that the best repair solution is partial cable replacement. The recovery of a cable at any depth is usually carried out by an installation vessel.

A cable vessel will be mobilised and will perform the following repair operations:

- The cable fault location will be determined. ROV or Electrodes may be used for this purpose.
- The cable will then be cut using grapnels or by the ROV at the fault position.
- One side of the cable end will then be recovered on board.

- The cable will be tested, and the faulty part of the cable will be identified and removed.
- This side of the cable will be capped and buoyed off or streamed on the seabed.
- The other side of the cable end will then be recovered on board and tested.
- The vessel will then join a new piece of cable to this side, and then drawn along the original cable route towards the buoyed off/ streamed cable end.
- The buoyed off/ streamed cable will be recovered, and the two parts will be joined together, tested and laid on the seabed.
- The cable may be inspected with the ROV to check it is well laid and perform post repair inspection burial operations (PRIB).
- When repairing a submarine telecommunication cable is required, it is essential that the work is done as soon as possible, restoring service to the system to avoid disruption to users.

3.3.4 Cable Deactivation / Decommissioning

The EQUIANO system has a shelf life of about 25 years, and its deactivation can only be performed by the shutdown of the electrical / electronic system and disabling the transmission of information. There are no plans to remove the cable from the seabed or in the coastal zone.

Options for decommissioning of the system at the end of the Project's lifetime include retirement in place, or removal and salvage. The subsea portion of the cable is likely to largely be retired in place, as is current global industry practice for minimal environmental and social disruption. This would be done in accordance with a Decommissioning Plan, details of which are provided in Chapter 8.

3.4 Personnel Requirements

The cable installation will be carried out by ASN and its contractors. Where possible, local employees will be recruited from the local and regional area of the Project location to perform specific tasks (especially during operation). The specific number of workforce that would be involved in the construction and operation phase of the Project is yet to be finalised.

3.5 Waste Generation and Management

It is the goal of ASN/WIOCC to design, construct and operate the Project with environmental excellence. To this end, effective and integrated waste management practices shall be implemented during all phases of the Project to avoid or minimise potential impacts on the environment and protect public health, safety and welfare.

A project-specific Waste Management Plan (WMP) will be developed and implemented to manage the waste streams associated with the Project. The waste management principles and priorities for the Project will be based on an integrated approach which involves using a combination of techniques and programs to manage waste. Source reduction is at the top of the approach, followed by reuse and recycling as preferred options to disposal. Wastes will be managed using the following prioritized program:

- *Reduction at Source* - The elimination or minimization of waste (through improved operation, equipment modifications, inventory management, etc.).
- *Reuse* - Using an item for its original purpose, or similar purpose, in its original form.
- *Recycling* – conversion of waste materials into reusable objects.
- *Residue Disposal* - Safe disposal of non-recyclable or reuse wastes in a government-approved dumpsite.

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

Construction Phase

It is anticipated that minor quantities of wastes will be produced during the construction phase. A significant portion of the waste streams associated with the installation phase activities will be generated from the cable laying vessel. Solid wastes will include food wrapping, used bottles, food waste, packaging materials, etc. The liquid wastes will include wastewater such as sewage water, grey waters and potentially contaminated drainage from the ship deck. The cable laying vessel shall adhere to all local and international regulations in respect to the disposal of waste at sea. Deliberate disposal of pollutants and ballast water into Nigerian waters shall be strictly prohibited, and all wastes generated on the vessel shall be stored on board until they can be disposed at a suitably equipped port, in line with the requirements of the Basel Convention on Transboundary Shipment of Hazardous Wastes as well as local regulations.

The PLGR and RC activities may recover debris from the seabed which will be brought to shore for disposal.

As part of installation activities to be carried out on the coast, excavation will occur for laying cables to connect to the BMH. The wastes generated during these activities will include excavated sediment/soil, packaging materials, and general rubbish. However, it is anticipated that the wastes will be minimal (less than 100 m^3 of excavated sediment/soil) with most of the sediment/ soil will be reused as backfill.

Non-reusable waste will be disposed by an accredited waste contractor at government-approved dumpsites, such as, the Olushosun dumpsite in Ojota, Lagos.

Operation Phase

The waste streams associated with the operational phase of the Project will be generated during maintenance activities, such as repair of damaged cable (which is very rare). Due to the nature of these maintenance activities, the wastes will mostly include damaged cables and packaging materials. Similar to the construction phase, all wastes generated during the operational activities shall not be discharged directly into the Nigerian waters but stored on board the vessel until they can be disposed at a suitably equipped port.

Decommissioning Phase

As the cable will be left *in situ* no waste is expected to be generated.

3.6 Project Schedule

Following the receipt of ESIA permit and other necessary approvals from relevant Nigerian government authorities for the Project, the cable installation is proposed to commence no later than third quarter (Q3) of 2021.

The approximate duration of cable installation activities is presented in Table 3.2. The dates are estimate and subject to weather conditions.

Table 3.2: Approximate Duration of Marine Cable Installation Activities

S/N	Activity	Duration
1.	Offshore installation (water depths >15 m)	4 days
2.	Nearshore installation (water depths <15 m)	7 days
3.	Land-based cable installation (trenching)	2 to 3 days
4.	BMH and System Earth construction	<7 days

CHAPTER FOUR:

DESCRIPTION OF THE ENVIRONMENT

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

4.1 Introduction

This Chapter provides a description of the existing environmental and socio-economic conditions in the Project's Area of Influence (AoI) and broader seascape and landscape context where appropriate to understand broader scale interactions with the Project (refer to Section 4.2). This understanding has been developed to assess the potential impacts of the Project. Specifically, this Chapter presents baseline data and information on the environment in which the Project will take place and where it may be directly or indirectly affected.

The environmental components discussed in this Chapter are as follows:

A. Physical Environment
   - Climate
   - Air Quality and Noise
   - Geology
   - Oceanography
   - Coastal Geomorphology
   - Bathymetry and Seabed Type
   - Marine Water and Sediment Quality

B. Biological Environment
   - Legally Protected and Internationally Recognised Areas
   - Terrestrial Biodiversity
   - Marine Biodiversity

C. Socio-economic Environment
   - Stakeholder Engagement
   - Socio-economic Characteristics of the Marine Environment
   - Socio-economic Characteristics of the Terrestrial Environment

4.2 Study Area Boundaries and Areas of Influence

As noted in Chapter 3, the cable route will extend across the entire Nigeria EEZ to a landing point on Elegushi beach in Lekki, Lagos. Due to the planned Project activities, the potential impacts of the Project will extend beyond the direct footprints of the cable route. This spatial area of impacts may, however, vary across environmental themes. In addition, the marine environment is dynamic and highly inter-connected, which means that the baseline understanding may need to consider a broad context to understand environmental values. In light of this, the AoIs and Study Area boundaries for the key environmental themes covered in this Chapter are discussed below. It should be noted that the AoIs being considered only relate to the boundary of permitting, which is the limit of the EEZ.

4.2.2 Marine Biodiversity

4.2.1.1 Spatial Areas for Baseline Understanding

Seascape

This section provides a discussion of the marine biodiversity features in the "seascape". For seascape definition, the understanding of the biodiversity values and project impacts are two different things. A seascape approach requires consideration of local conditions (at the Project site and Area of Influence (AoI)), but also a broader understanding of how biodiversity features are distributed in the seascape, their connectivity and their conservation status and management in the absence of the Project. This allows for an assessment to be value-based rather than risk-based; and is intended as a precautionary approach that allows direct, indirect and cumulative impacts to be taken into account, at a scale appropriate to understanding and safeguarding features.

In the marine environment, the determination of seascape requires case-by-case consideration that is driven by an understanding of baseline features across various scales, including the values that are present, the physical processes that sustain them, key ecological functions and the level of interconnectivity across the marine environment. There is a need to consider complex interconnectivities between habitats and species; and in some instances, some extremely large migratory movements of species that have varying spatial dependencies based on ecological functions may be affected. This can often require a very broad-scale understanding to determine the appropriate species-specific scale of analysis; and also means that the analysis for different species may be undertaken at various spatial scales to place the correct understanding of the value of the area in which the Project is located and how it is interconnected.

The definition of the seascape area for this Project was undertaken at habitat and species-specific levels and also at a broader ecosystem level; and was informed by the following:

- Physical factors and processes that could underpin suitable spatial limits for features, or delimit similar (or different) ecosystem complexes;
- Known or potential spatial extent of habitat mosaics and associated features, such as species presence and behaviours;

- Known and potential species distributions at a local, regional, global, subpopulation levels;
- Key ecological attributes, functions and behaviours at an appropriate species-specific scale (e.g. including breeding areas, spawning/nesting/calving areas, developmental area, foraging, migratory patterns, connectivity between shallow water nearshore and deep water offshore zones or within each zone);
- Locations of protected and internationally recognised areas and their associated key biodiversity values and processes needed to maintain connectivity of species populations supported by these areas;
- Location of other conservation zones that have been defined in the region to implement effective management of biodiversity and ecosystem services based on the determination of ecological resources and threats;
- Uncertainties in baseline understanding and where to adopt precautionary incorporation of potential values that may be present based on likely connectivity with biophysical conditions and known species behaviours; and
- How the integrity of values are influenced by other factors, such anthropogenic pressures and threats.

4.2.1.2 AoI

The AoI relates to the zone in which the Project impacts may take place. This area sits within the broader seascape as defined above. Whilst a seascape analysis provides an appropriate ecological area(s) for understanding biodiversity values, the AoI determines where impacts on those values may take place. The Project site sits within the AoI, but the AoI is a broader area where risks and potential impacts to marine receptors can be defined.

It is possible that both near-field and far-field impacts could ensue during the construction and operation phases of the Project (see Chapter 5). Given the nature of the Project, many impacts are likely to be localised to an area in proximity to where works will be undertaken (e.g. footprint impacts). However, there is potential for far-field effects to occur during construction and operation, which are largely associated with underwater sound generation and unplanned accidental discharges. There is also potential for synergistic and cumulative impacts to occur with wider activities in the area, for example, the development of the Eko Atlantic City project. Understanding the spatial extent of Project and cumulative impacts on marine biodiversity is therefore fundamental to the definition of the AoI; and the scale varies for each impact considered.

The spatial extent of AoIs for different impact sources are presented in Table 4.1. The mixing zones that have been defined for water quality impacts refers to the region of a water body where initial dilution of a pollution input takes place and where water quality criteria may be exceeded - as long as the integrity of the water body is not affected. This zone has been defined in a precautionary way.

Table 4.1: Sources of Impacts and AoIs for Marine Biodiversity

Impact Type	Impact Source	AoI
From planned activities		
Increased suspended sediment loads in the water column and degradation of water quality.	Disturbance of sediment leading to increased suspended sediment loads during cable installation.	Precautionary mixing zone of 300 m either side of the cable.
Increase in pollution and nutrients in the water column.	Discharges to the marine environment during construction, including vessel discharges, leaks and spills.	Precautionary mixing zone of 300 m either side of the cable.
Redistribution and deposition of disturbed sediments.	Deposition of suspended sediments on to the seabed following their disturbance during construction.	Precautionary maximum zone of 300 m.
Underwater sound generation.	Underwater sound generated by cable installation and vessel movements during construction.	Precautionary zone of 10 km.
Physical loss and disturbance of marine habitats.	Temporary disturbance of habitats and species from cable laying.	Maximum zone of 3.2 m in water depths between 1000 m and 15 m. Precautionary zone of 1 m for water depths <15 m. <0.1 m for water depths >1000 m 20 m either side of the cable for coastal trenching works, but excavation within 5 m.

Impact Type	Impact Source	AoI
Lighting impacts during construction.	Lighting of vessel and coastal working areas during construction.	A precautionary zone of 20 km.
Introduction of alien invasive species during construction and operation.	Vessel movements and ballast water discharge during construction introducing alien species	Zone cannot be defined, but potential is limited to offshore waters where ballast exchange is allowed, which is nominally towards and offshore of the boundary of the EEZ.
From unplanned activities		
Vessel collision.	Vessel collision with marine wildlife during construction.	Directly along the vessel route.
Oil spills.	Oil spills from vessel collision or machinery failure during construction.	Area depending on scale and fate of spill. Potential impacts likely to be within 1 km of source.

4.2.2 Terrestrial Biodiversity
The scope of this ESIA excludes the land-based components of the proposed Project such as construction, as earlier noted. However, part of the Project activities covered by this ESIA are within the terrestrial zone (see Chapter 3). The area of overall working area for potential disturbance for the coastal work is estimated to be about 20 m wide. The trenching works would only take place within a width of <5 m. This activity has the potential to cause minimal disturbance impacts on terrestrial biodiversity in the area. Thus, the spatial extent of AoI for the impact source is considered as 250 m within the coastal work area.

4.2.3 Marine Water and Sediment Quality
For marine water and sediment quality, the spatial extent of AoIs for different impact sources is presented below in Table 4.2.

Table 4.2: Sources of Impacts and AoIs for Marine Water and Sediment Quality

Impact Type	Impact Source	AoI
From planned activities		
Increased suspended sediment loads in the water column and degradation of water and sediment quality.	Disturbance of sediment leading to increased suspended sediment loads during cable installation.	Precautionary mixing zone of 300 m either side of the cable.
Increase in pollution and nutrients in the water column.	Discharges to the marine environment during installation phase, including vessel discharges, leaks and spills.	Precautionary mixing zone of 300 m either side of the cable.
Redistribution and deposition of disturbed sediments.	Deposition of suspended sediments on to the seabed following their disturbance during cable installation.	Precautionary zone of 300 m.
From unplanned activities		
Decrease in marine and sediment quality due to oil spill	Oil spills from vessel collision or machinery failure during cable installation.	Area depending on scale and fate of spill. Potential impacts likely to be within 1 km of source.

4.2.4 Air Quality and Noise

The potential sources of air emissions and ambient noise from the Project include the use of vessel and construction equipment and activities in the coastal area. For air emissions and noise, the spatial extent of AoIs for different impact sources is presented in Table 4.3.

Table 4.3: Sources of Impacts and AoIs for Air Emissions and Noise

Impact Type	Impact Source	AoI
From planned activities		
Decrease in ambient air quality, including climate change	Release of gaseous emissions from cable installation vessel during construction	Precautionary zone of 2 km as the vessel move along cable route
Decrease in ambient air quality, including climate change	Release of gaseous emissions from machinery for beach	Precautionary zone of 1 km of coastal work area.

Impact Type	Impact Source	AoI
	burial work (i.e. trenching) during construction	
Noise emission	Increased noise level from operation of machinery for beach burial work (i.e. trenching) during construction	Precautionary zone of 1 km of coastal work area.
From unplanned activities		
Noise emission from vessel collision.	Noise generated during vessel collision during construction.	Precautionary zone of 1 km of vessel collision area.
Fugitive emission from oil spills.	Oil spills from vessel collision or machinery failure during construction.	Area depending on scale and fate of spill. Potential impacts likely to be within 1 km of source.

4.2.5 Socio-economic

The spatial extent of AoIs for the socio-economic aspects of the proposed Project is provided in Table 4.4 below.

Table 4.4: Sources of Impacts and AoIs for Socio-economic

Impact Type	Impact Source	AoI
From planned activities		
Disruption of fishing activities	Offshore cable installation during construction	Precautionary zone of 5 km either side of the cable.
Marine traffic	Offshore cable installation during construction	Precautionary zone of 5 km either side of the cable.
Disruption of in-service cable	Offshore cable installation during construction	Precautionary zone of 500 m
Disruption of beach recreational activities	Beach burial installation during construction	Precautionary zone of 500 m of coastal work area.
From unplanned activities		
Vessel collision.	Vessel collision with third party ships during construction.	Directly along the vessel route.

4.3 Baseline Data Gathering Approach

The baseline conditions described in this chapter are based on the information gathered through desktop-based review of secondary data, as well as the site-specific surveys that have been completed to date. Relevant information was also collected during stakeholder consultation. The approach to data collection is summarised below.

4.3.1 Secondary Data

The secondary data sources include:

- Survey Report for Cable Route Design and Engineering for EQUIANO Cable Route Survey Segment 18.1 (BMH Lagos to BU GNQ), October 2019;
- Permits-in-Principle Desk-top Study Report of EQUIANO Nigeria Submarine Fibre Optic Cable System, June 2019;
- Final Environmental Impact Assessment Report of the proposed 125 MW Eko Atlantic City Power Project, 2019;
- Final Environmental Impact Assessment Report of the Eko Atlantic City Development Project (Phase 2), August 2015;
- Final Environmental and Social Impact Assessment Report of Lekki Port and Harbour Facilities, March, 2013;
- Final Environmental Impact Assessment Report of the Eko Atlantic City Development Project (Phase 1), August 2012;
- Final Environmental Impact Assessment (EIA) Report of West Africa Cable System (WACS) Nigeria, November 2011;
- Final Environmental Impact Assessment (EIA) Report of MainOne Submarine Cable, 2009;
- Nigerian Meteorological Agency (NiMet) – Climate Data of Lagos State (1991 – 2018), 2019;
- National Bureau of Statistics (NBS) – Regional socio-economic data.

The additional secondary data sources include relevant national, provincial and municipal government data and published literature.

4.3.2 Consultation

As part of data gathering approach, consultations were held with relevant stakeholders including Ikate-Elegushi community. Details of stakeholder engagement and socio-economic survey conducted are presented in Section 4.6.

4.3.3 Field Survey

A rapid ecological coastal walkover survey was completed at the cable landing site and surroundings in early April 2019 to provide additional information on local biodiversity values, with a particular emphasis on sea turtle nesting potential during the nesting season. Aerial photos and videos were captured using the DJI Phantom 4 Pro drone. In addition, further site visits were completed in mid-May 2019 to further review and walk-over the preferred landing site location.

In addition, a geotechnical investigation has been completed within the CLS site to inform the baseline on soils and groundwater in September 2019. Marine sediment sampling has also been undertaken along the submarine cable route as part of the cable route survey in August/September 2019. At this time, temperature and salinity measurements were also taken along the cable route at across the water column profile.

4.4 Physical Environment

4.4.1 Climate

4.4.1.1 Regional Climate

The regional climate in the Gulf of Guinea is influenced by two air masses: one over the Sahara desert (tropical continental, cT) and the other over the Atlantic Ocean (tropical maritime, mT). These two air masses meet at the Inter-Tropical Convergence Zone (ITCZ) or Inter-tropical Discontinuity (ITD). The seasonal migration of the ITCZ causes two distinct wet and dry seasons in Nigeria and many of the neighbouring countries further west along the coast of the Gulf of Guinea (Iloeje, 1981).

4.4.1.2 Local Climate

❖ Rainfall

Lagos has a tropical savannah climate that is similar to that of the rest of southern Nigeria. There are two rainy seasons, with the heaviest rains falling from April to July and a weaker rainy season in October and November. Overall a total of about 1,970.64 mm of rain is recorded annually. This gives an average of 164.22 mm per month. The minimum rainfall amount (24.25 mm) is received in December while the maximum rainfall amount (320.42 mm) is received July (Figure 4.1).

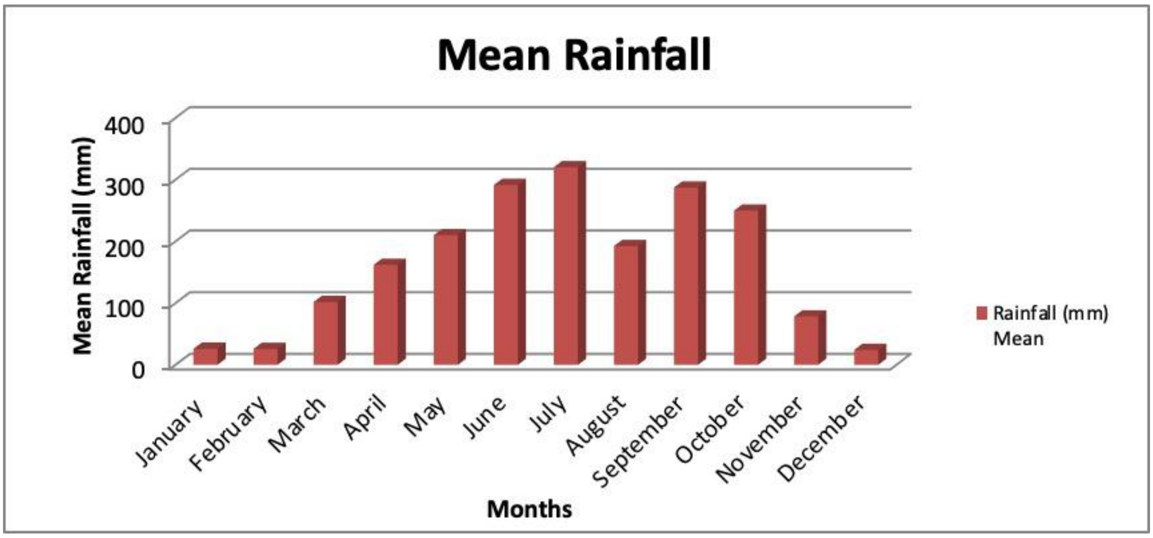

Figure 4.1: Rainfall characteristics of Lagos State (1991-2018)
(Source: NiMet, 2019)

❖ <u>Temperature</u>

The annual average temperature for Lagos is approximately 26°C with a maximum average of 31 ^{0}C and a minimum average of 23°C. Diurnal temperature variations are more pronounced than seasonal variations although highest temperatures occur during the dry season. Average daily temperatures for Lagos are shown in Figure 4.2.

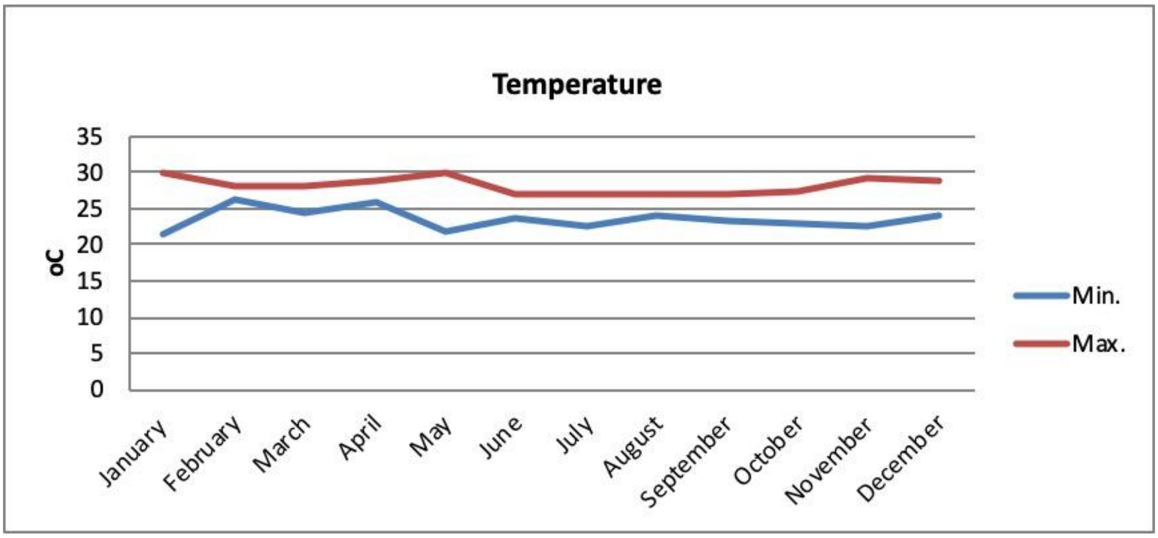

Figure 4.2: Temperature characteristics of Lagos State (1991-2018)
(Source: NiMet, 2019)

❖ Relative Humidity

Lagos State is characterised by a high relative humidity as a result of the prevailing tropical maritime air mass blowing over the environment almost all the year round. As shown in Figure 4.3, an average of 91.25 % and 73.75 % are recorded at 10:00 hrs and 16:00 hrs local time. Highest values are recorded in early mornings and late evenings while the lowest value of 64 % in the region is recorded in February.

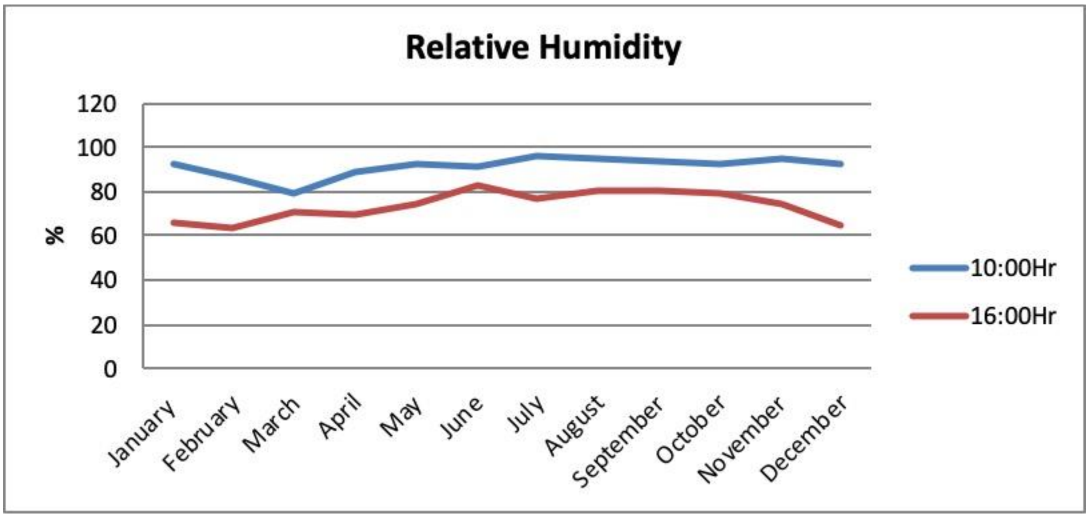

Figure 4.3: Relative humidity of Lagos State (1991-2018)
(Source: NiMet, 2019)

❖ Wind Direction and Speed

The average monthly wind speeds in Lagos range between 2 m/s and 5 m/s (NiMet, 2019). Wind speeds are highest during the July-August period and lowest during the October-January. The prevailing wind direction is from south-southwest and west-south west directions accounting for approximately 80 % of the year. Figure 4.4 shows the wind rose for Lekki, Lagos.

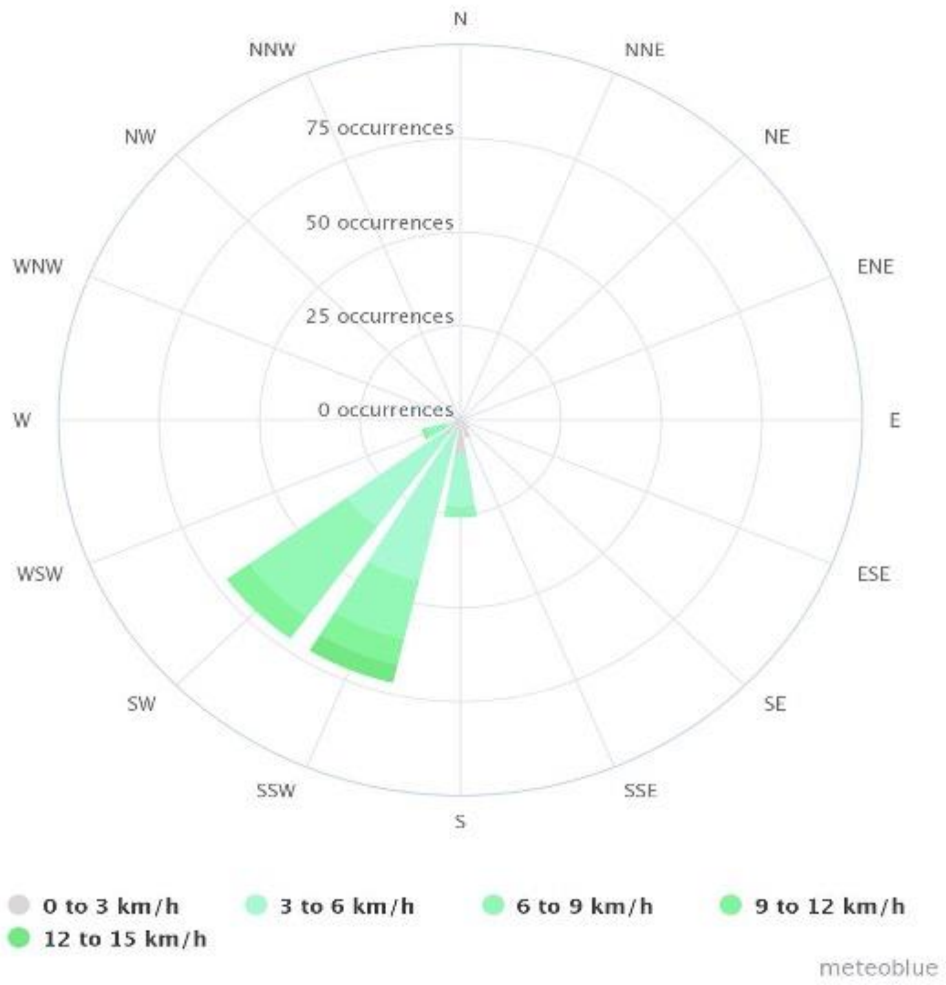

Figure 4.4: Wind Rose in Lekki, Lagos
(Source: www.meteoblue.com; accessed in May 2020)

4.4.2 Air Quality and Noise

Ambient air quality in major cities of Nigeria (e.g. Lagos) has declined rapidly with increase in motor vehicle traffic, fossil fuel electricity generators, construction activities, industrial activities, etc. (Obanya *et al*., 2018).

Air quality at the cable landing site and its surrounding environment may be influenced by a number of existing sources of air pollution, including emissions from transportation (cars, trucks and boats), dredging arising disposal, construction of buildings, cement block manufacturing etc. Vehicular emissions from road transportation are expected to have the greatest effect on ambient air quality. Petrol engine powered boats are also used for fishing in the general area, although not within water depths of <100 m along the cable route; and also, vessel movements to and from Lagos Port. High levels of particulates may occur during windy conditions due to sand and other particulates blowing from the beach.

The major air pollutants of concern are carbon monoxide (CO), oxides of nitrogen (NOx), oxides of sulphur (SOx), and particulate matter. Ambient noise is also considered. Natural noise sources in the area include those originating from the sea and occasional noise from animals/birds. Anthropogenic sources include noise generated by vehicles, by construction equipment active on other sites in the general project area, local cement block making activities, and also the presence of people in the coastal area.

There is a very limited and short-term air quality and noise impacts associated with the proposed Project based on the knowledge of the planned Project activities (see Chapter 5). The description of the ambient air quality and noise levels presented in this section is based on the review of ambient air quality and noise measurements conducted as part of the EKO Atlantic City EIA studies (final EIA report of the EKO Atlantic City Development Project, Phase 2, 2015 and final EIA report of 125 MW EKO Atlantic City Power Project, 2019). These data are considered as relevant to the Study Area. The EKO Atlantic City Development Project is approximately 3 km west of the cable landing site.

Both dry and wet season studies were carried out for the EKO Atlantic City projects. Air quality monitoring was conducted using handheld instruments such as AeroQual 500 series and Gray Wolf Particulate Counter. Noise measurements were taken using a handheld Extech noise level meter at a height of approximately 1 m above ground level with the slow response time setting and read on the ‘A’ frequency weighting scale (weighted for human hearing perception).

The concentrations of air quality parameters sourced from the secondary data were compared with the Nigerian Ambient Air Quality Standards (NAAQS) and the World Health Organization (WHO) Air Quality Guidelines adopted by the World Bank. Also, the ambient noise levels were compared with FMEnv limit and the World Bank Noise Level Guidelines. The summary of these limits is provided in Tables 4.5 to 4.7.

Table 4.5: Ambient Air Quality Standards

Pollutant	Averaging Time	FMEnv Limit (mg/m^3)	WHO Guidelines (mg/m^3)	NESREA Limits (mg/m^3)
CO	1-hour	11.4	-	10
NO_2	1-hour	0.075 - 0.113	0.2	0.2
TSP	24-hour	0.250	0.150	0.15
SO_2	1-hour	0.026	0.5	0.35

Taken from FMEnv’s Guidelines and Standards for Environmental Pollution Control in Nigeria (1991); the World Bank Group Environmental, Health and

Safety (EHS) General Guidelines 2007 and the NESREA's National Environmental (Air Quality Control) Regulations, 2014

Table 4.6: Noise Exposure Limits for Nigeria

Duration per Day, Hour	Permissible Exposure Limit dB(A)
8	90
6	92
4	95
3	97
2	100
1	105
0.5	110
0.25	115

Source: Guidelines and Standards for Environmental Pollution Control in Nigeria, 1991

Table 4.7: World Bank Noise Level Guidelines

Receptor	One Hour Leq (dBA)	
	Day time (07:00 – 22:00)	Night-time (22:00 – 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: World Bank's Environmental, Health and Safety (EHS) General Guidelines, 2007

In the dry season, the total suspended particulate (TSP) recorded at the sampling locations that extend towards the landing site ranged from 0.03 mg/m^3 to 0.079 mg/m^3, which fall below the national ambient air quality standard (maximum permissible limit of 0.25 mg/m^3) for TSP in ambient air. SO_2 ranged from 0.00 mg/m^3 to 0.01 mg/m^3, which was below the FMEnv maximum permissible limit of 0.026 mg/m^3 for SO_2 in ambient air. NO_2 values ranged from 0.000 mg/m^3 to 0.001 mg/m^3, below the FMEnv maximum permissible limit of 0.113 mg/m^3. CO_2 concentrations ranged between 920 mg/m^3 and 974 mg/m^3 with a mean value of 950.28 mg/m^3. The measured day-time noise levels ranged from 43.3 dB(A) to 51.7 dB(A) with an average of 47.04 dB(A). The noise levels were below the World Bank maximum limit of 70 dB(A), as well as FMEnv limit of 90 dB(A).

In the wet season, the measured TSP values ranged from below detection limit to 0.002 mg/m^3, which fall below the national ambient air quality standard (maximum permissible limit of 0.25 mg/m^3) for TSP in ambient air. SO_2 ranged from below detection limits to 0.0002 mg/m^3, which was below the FMEnv maximum permissible limit of 0.026 mg/m^3 for SO_2 in ambient air. NO_2 values ranged from 0.007 mg/m^3 to 0.035 mg/m^3, below the FMEnv maximum permissible limit of 0.113 mg/m^3.

In terms of seasonal variation, the concentrations of TSP and SO_2 recorded during the wet season were lower than the values recorded during the dry season. This could be expected given that the prevailing weather conditions in the dry season such as high temperature, low relative humidity and high wind speed do contribute to increase in pollutants concentrations. Also, the combination of wet deposition (washing out of particulates in the air by rain) and dry deposition (deposition of air by gravitational pull) witnessed in the wet season as against dry deposition witnessed in the dry season could be accountable for the higher TSP values in the dry season than in the wet season.

Generally, the air quality results indicate that the ambient air environment in the AoI is expected to be good.

4.4.3 Hydrogeology and Soils

The Gulf of Guinea is bounded in the north by the Guinea Fracture Zone and is characterised by a relatively narrow continental shelf, with the exception of the Niger River submarine delta, Ghana Terrace and Liberia Spur. The Cameroon Line of Islands, a tectono-magmatic feature about 750 km long, extends from Cameroon to southwest of the Nigerian border. The Guinea Abyssal Plain and the fractures south and southeast of it occupy a very large area in the centre of the Gulf of Guinea (MTN Nigeria, 2011).

Lagos State lies within the Nigerian sector of the Dahomey embayment. The Dahomey embayment is believed to have been formed during the separation of the South American and African plates in the Late Jurassic to early Cretaceous (Ihenyen, 2003). Alternate transgression and regression controlled the deposition of materials within the basin with the last period of transgression believed to have left the shoreline at the inland end of the Lagos lagoon (Ajayi, et, al; 1983). Subsequent regressive deposition of terrigenous materials led to the formation of barrier islands and coast parallel sandy ridges (Omatsola, 1970). The barrier islands are composed of ridges with trenches between them forming lagoons, swamps and creeks.

Early works on the geology of the Dahomey basin by Jones & Hockey (1964) distinguished five formations within the basin but later work by Omatsola& Adegoke (1981) proposed groups and formations. According to Omatsola & Adegoke (1981), the oldest group which is the Cretaceous Abeokuta Group lies unconformably over the basement. This group is conformably overlain by the

Paleocene to early Eocene Ewekoro group which is overlain by the Eocene to Oligocene Ilaro group. The mid to late Tertiary Benin formation overlies the Ilaro group while Quaternary to recent sediments referred to as Alluvium form the youngest formation within the basin. Figure 4.5 shows a geology map of the Nigerian sector of the Dahomey basin.

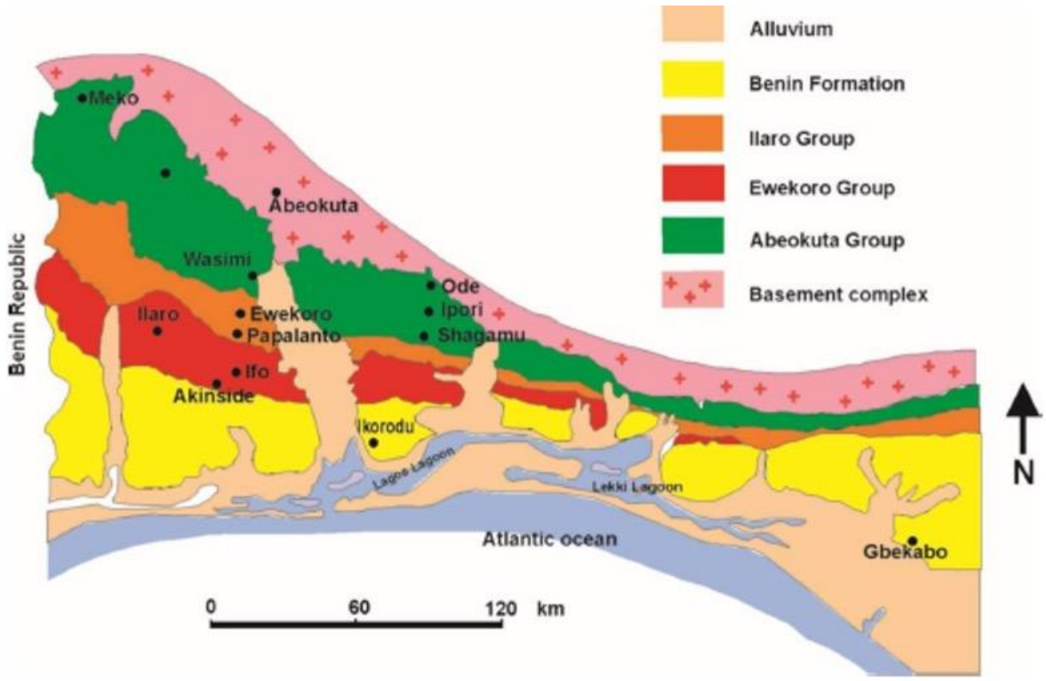

Figure 4.5: Geological map of the Nigerian sector of the Dahomey basin (Source: Arup Nigeria, 2019)

The landing site is characterised by sandy beach. A Geotechnical investigation (GI) has been completed within the CLS site (Arup, 2019). This scope of the GI included three boreholes, seven cone penetration tests (CPT) and laboratory analysis. Arup (2019) reported that the predominant soil encountered in the boreholes was sand. This was encountered from the top of the borehole to the termination depth of 30 m. The particle size distribution of the sand indicates the sand is fine to coarse with a small proportion of fine gravel. Groundwater was measured in all boreholes during drilling and was found to range between 1.4 - 1.7 m below existing ground level. Arup (2019) also reported that the profile of the CPT plots generally indicates the presence of a likely sand fill from existing ground level to about 2 m depth which overlies a thin layer of very soft organic soil. In some test points relatively thin layers (of about 0.5 m thickness) of soft clay were observed before 10 m depth. Although not surveyed, the characteristics of the soil and hydrological environment in the terrestrial area between the beach and CLS site would be expected to be similar as it lies adjacent to the area surveyed.

No natural rock outcrops are apparent on land. Fugro (2019) identified rocky in the nearshore area (see below) and also outcropping at around 28 km offshore, along the cable route.

Regarding the quality of the groundwater resource, it is understood from information collected during site visits that this is not used for drinking water. A well is present on the CLS site from which water is extracted for cleaning by local residents etc. The depth of the groundwater indicates that it will be affected by saline intrusion, especially in the area of works proposed for the marine system components.

4.4.4 Oceanography

4.4.4.1 <u>Currents</u>

The offshore waters of Nigeria are dominated by the Guinea Current, which transports water eastward roughly along the 3° N latitude along the western coast of Africa. The Guinea Current transports low saline warm waters toward the east from its western Atlantic origin. The oceanography of the Gulf of Guinea is influenced by the meteorological and oceanographic processes of the north and south Atlantic Ocean. There are three main water current systems that influence the movement of water, including the eastward flowing Guinea Current, a small westward Counter Current and the westward flowing South Equatorial Current. The oceanic gyral currents of the north and south Atlantic Ocean create the North Equatorial Counter Current (NECC), which extends to form the Guinea Current as it flows from Senegal to Nigeria (Figure 4.6).

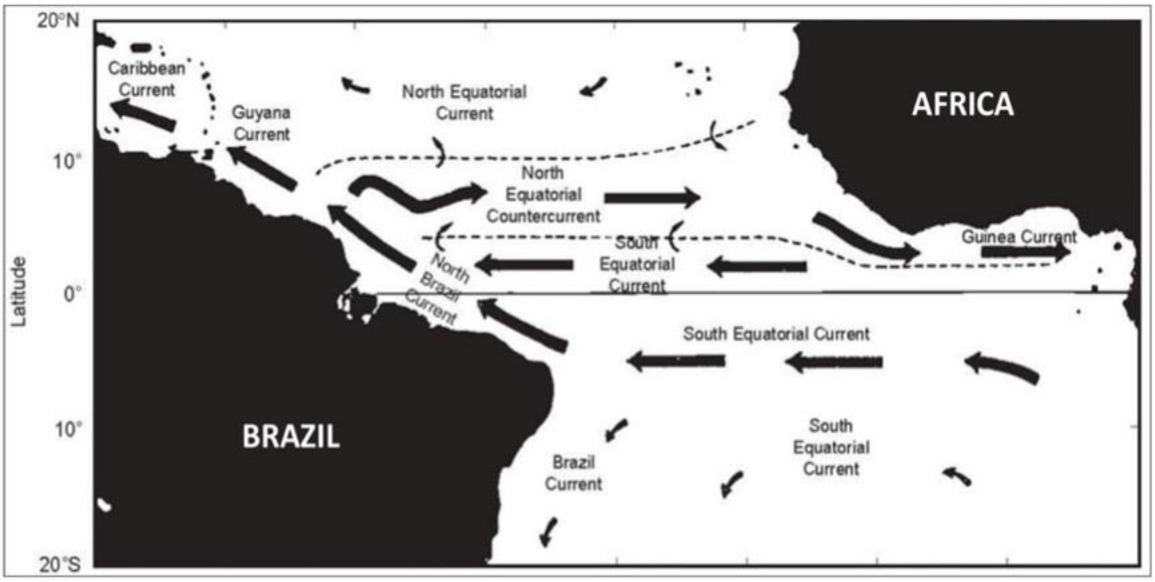

Figure 4.6: Major Surface Currents in Offshore West Africa (Source: Philander, 2001)

The NECC is driven by westward wind stress. When this subsides during February to April and October to November, the direction of the NECC is reversed. The Guinea Current reaches a maximum strength between May and July during the strongest south west monsoon winds when it peaks at 1 to 2 knots (approximately 1 m/s). The current is weaker for the rest of the year. It is also documented that the Guinea Current is an eastward superficial flow. The flow is not deep, and it overlays the Guinea Under Current (GUC) which flows westwards, which is thought to be an extension of the northern branch of the Equatorial Undercurrent which splits into two branches after impinging upon the African continent at Sao Tome Island.

4.4.4.2 Stratification

The marine environment of the eastern Gulf of Guinea can be characterised as highly stratified with a thin surface layer of Tropical Surface Water overlying cooler high-salinity subtropical water, or South Atlantic Central Water. The thermocline varies between 5 and 35 m. Strong seasonal cooling occurs during periods of coastal upwelling in some areas.

4.4.4.3 Waves

Waves reaching the West African coast are of two origins: (1) waves generated by the local weak south-westerly winds, and (2) swells generated by storms in the southern part of the Atlantic Ocean. The dominant wave direction in the study area is from the south to southwest. During the cable survey operation, the observed wave heights varied from 0.2 m to 1.2 m. A swell of up to 1.8 m was observed during deep and shallow water operations of the proposed route (Fugro 2019).

4.4.4.4 Tides and Water Level Variations

Tides in Nigeria are semi-diurnal. The average tidal range in the project area is about 1 m, and ranges about 0.5 m during neap tides and 1.5 m during spring tides. A high extreme water level is about 2.5 m above Lowest Astronomical Tide level.

4.4.5 Coastal Geomorphology

Nigeria's coastline stretches approximately 853 km between Benin and Cameroon. Geomorphologically, the Nigerian coastline can be divided into four main physiographic zones (from west to east): the Barrier-Lagoon complex, the transgressive mud beach (or the Mahin mud coast), the Niger Delta and the strand coast (Figure 4.7).

The Lagos coastline is located on the Barrier-Lagoon complex which lies between Badagry and Ajumo, east of Lekki town and extends for about 200 km. The morphology of the Barrier-Lagoon complex has largely been determined by coastal dynamics and drainage. The beaches are erosive in nature. Natural causes for erosion include low-lying coastal topography, intensity of wave and currents, vulnerable soil characteristics and the shelf geometry.

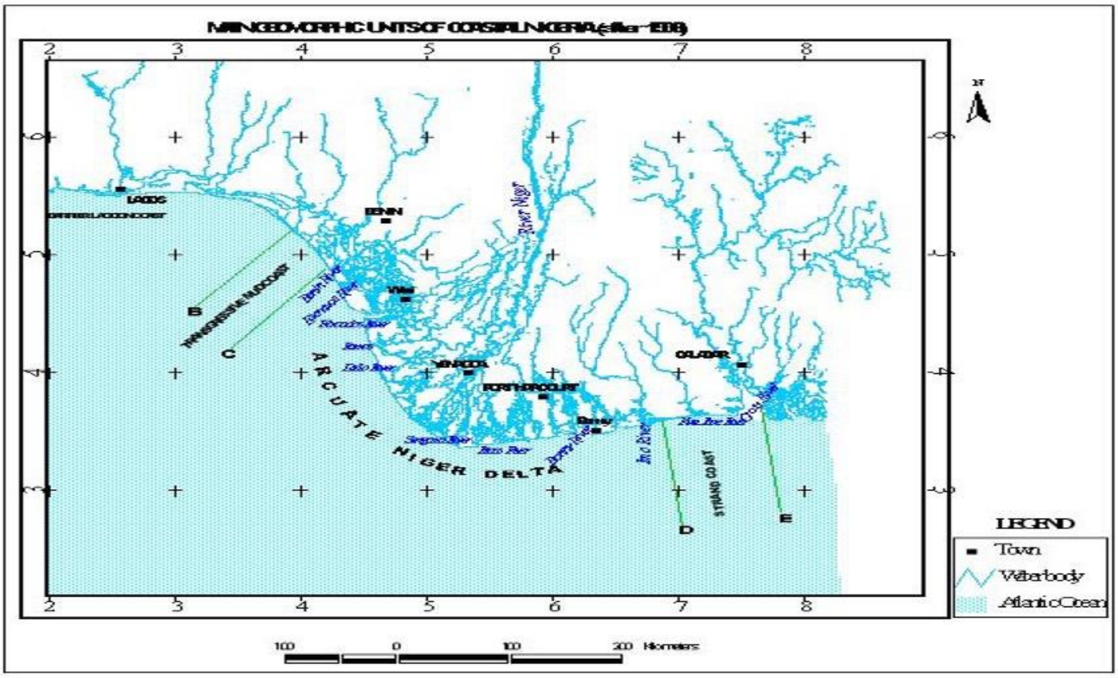

Figure 4.7: Map of Coastal Nigeria Showing Main Geomorphic Units (Source: Dublin-Green *et al.*, 1997)

The general evolution and morphology of this coastline has largely been determined by coastal dynamics and the deposition of fluvial sediments (ERM, 2013). The Lagos coast has been measured as eroding as much as 2 to 10 m per year. In Lagos, a significant part of the sediment transported from the west is trapped by three breakwaters (known as 'harbour moles') constructed to protect the entrance to Lagos Harbour; Awosika *et al.* (2002) estimated a trapped volume of 0.5 to 0.75 million m^3/year. Studies conducted during the Eko Atlantic Shoreline Protection and Reclamation Project (2012), located approximately 3 km west of the cable landing site, showed that the littoral drift of sand is clearly oriented from west to east, driven by the dominant ocean waves and their oblique direction. Literature and computer models show that an annual sand transport of the order of 800,000 m^3/yr is taking place along the shoreline. As part of the measures to mitigate coastal erosion, the Nigerian government, in 2014, began a process of building beach protection groynes, working from west (Victoria Island) to east along the coast. A total of 19 groynes had been built as of early January 2019.

4.4.6 Bathymetry and Seabed Sediment Type

In general terms, Nigeria has a narrow gently sloping continental shelf, ranging from around 30 km along the cable route to about 75 km in front of the Niger delta, and about 85 km off Calabar, along the Strand coast. According to Awosika 1990, the Nigerian continental shelf has three major canyons, namely: 1) Avon canyon just east of Lagos; 2) Mahin canyon off the Mahin mud coast, and 3) Calabar canyon off Calabar. However, these are not located within the cable route area. The cable route survey has confirmed the bathymetry along the cable route. The water depth recorded along the cable route is summarised in Figure 4.8.

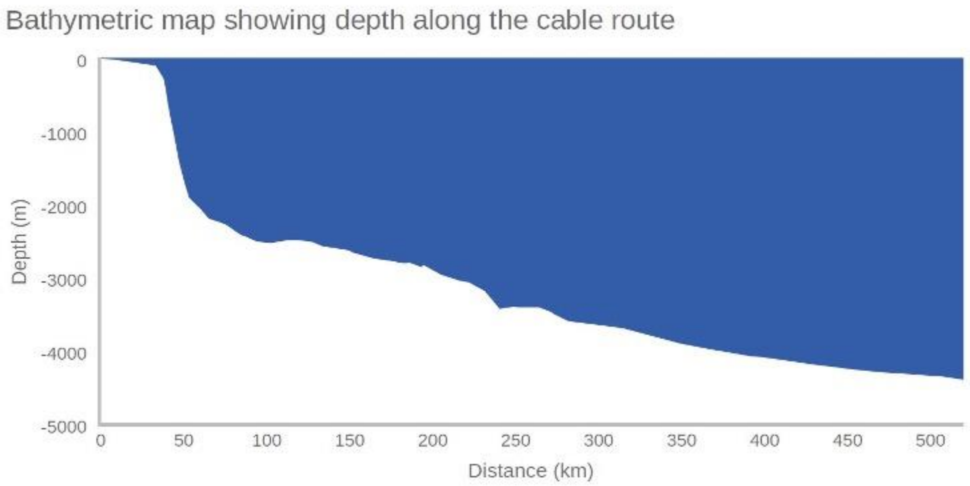

Figure 4.8: Bathymetry map showing water depth along the cable route (Adapted from Fugro, 2019)

From the edge of the continental shelf, the bathymetry drops more steeply; and this area comprises the continental slope. The continental slope begins at a water depth of around 100 m along the cable route. The continental slope ends to meet the abyssal plan at around 52 km offshore at water depths of around 1900 m. From here the bathymetry falls to a maximum depth of approximately 4400 m at the BU GNQ, which is outside of the EEZ.

<u>Seabed Sediment Type</u>

The cable route survey has summarised the prominent seabed features and sediments along the cable route (Fugro, 2019).

To also inform the understanding of seabed conditions, 6 grab samples with a spacing of approximately 500 m were taken in the nearshore survey area (the zone up to approximately 14.5 m water depth) and in water depths up to 1080 m 6 gravity cores and 2 grab samples were taken at points along the cable route. No samples were taken in deeper waters. The inshore shallow water survey identified medium coarse shelly sand close to shore with very fine clayey sands in deeper waters of the nearshore survey area (Fugro, 2019). The additional sampling along the cable route again showed sand sediments to dominate in the inshore areas becoming dominated by finer clay sediments further offshore (Fugro, 2019).

A summary of the prominent seabed and sediment features along the proposed cable route is presented in Table 4.8. The seabed generally comprises very clay soft to medium dense sand. Two areas of rock outcrop were encountered along the cable route; one in the nearshore area and around 28 km from the shore (Figures 4.9 and 4.10). in the nearshore area the cable will pass through the sand channel between the rocky areas. However, as can be seen across the majority of the seabed the substrate primarily comprises soft sediments. Seamounts are recorded on the abyssal plain at around 490 km and 520 km offshore. These are avoided by the cable route and they also lie outside of the EEZ (Fugro, 2019).

Table 4.8: Summary of seabed and sediment features of the cable route to BU GNQ (Fugro, 2019)

From	To	Water Depth (m)	Description
Kilometre Point (KP) 0.000	KP 0.169	< 3	BMH Lagos to inshore survey. Very fine to fine clays SAND
KP 0.169	KP 2.191	3	Predominantly very fine to fine SAND; passes outcropping ROCK near KP 0.466
KP 2.191	KP 3.589	3 - 14.5	Inferred boundary between SAND over CLAY and SAND; end of inshore survey
KP 3.589	KP 5.248	14.5 – 26	Very loose to loose SAND
KP 5.248	KP 6.939		Very loose to medium dense SAND
KP 6.939	KP 7.484		Soft CLAY overlying loose clayey SAND
KP 7.484	KP 9.275	26 – 107	Very loose to medium dense SAND
KP 9.275	KP 11.524		Soft CLAY overlying SAND- potential dredging area
KP 11.524	KP 16.500		Soft CLAY to very loose SAND
KP 16.500	KP 25.366		Very soft CLAY
KP 25.366	KP 27.551		Very soft CLAY with isolated pockmarks
KP 27.551	KP 32.620		Very soft CLAY and outcropping ROCK
KP 32.620	KP 36.243	107 - 141	Very soft CLAY with numerous pockmarks; route passes areas with pockmarks and HARDGROUND
KP 36.243	KP 37.823	141 - 279	Very soft CLAY with numerous depressions

From	To	Water Depth (m)	Description
KP 37.823	KP 44.205	279 - 1080	Very soft CLAY
KP 44.205	KP 52.286	1080 - 4390	Continental slope and beginning of abyssal plane
KP 52,286	KP 519.802		Abyssal plane with channels and ridges.

KP = Kilometre Point (Source: Fugro, 2019)

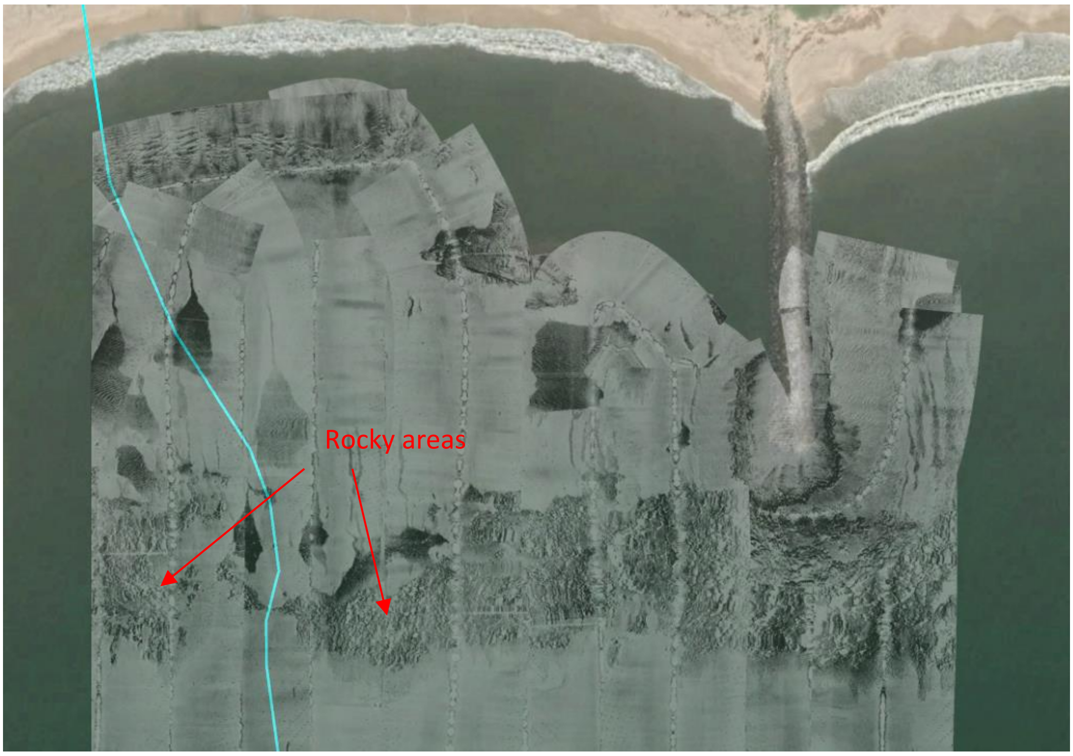

Figure 4.9: Side Scan Sonar showing an area of outcropping rock along the cable route in the nearshore area (Source: Fugro, 2019)

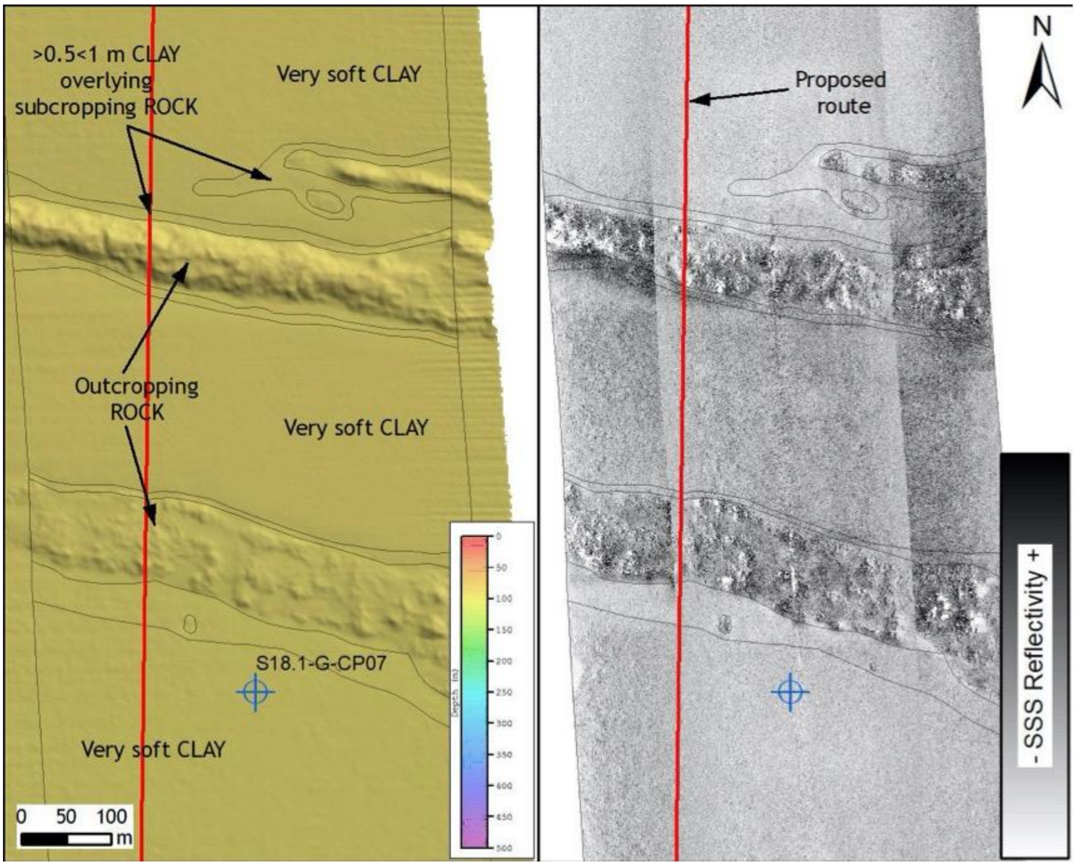

Figure 4.10: Side Scan Sonar showing an area of outcropping rock at around 28 km from shore (Source: Fugro, 2019)

4.4.7 Marine Water and Sediment Quality

There is a very limited and short-term marine water quality impact associated with the proposed Project (see Chapter 5). Hence, the baseline data presented in this section are based on the review of a recent marine survey conducted for EKO Atlantic City projects, located 3 km west of the cable landing site. The reports of the studies are Final EIA Report of Eko Atlantic Power Project, 2019 and final EIA report of the Eko Atlantic City Development Project, Phase 2, 2015. The studies covered both dry and wet seasons; and were witnessed by FMEnv representatives. During the survey, water samples for analyses of various parameters were collected at 1.5 m below the water surface using a water sampler and transferred to appropriate sampling containers with standard fixatives and/or preservatives and stored in standard conditions (e.g. maintaining the samples at 4°C using ice chest). Sediment samples were collected using a Van Veen grab sampler. Analyses of different parameters in the samples were carried out at government-approved laboratories. The results of the laboratory analysis for the marine and sediment quality are summarized in the sub-sections below. It is noted that surveys were only completed in nearshore areas and no deeper water baseline information is available. However, greatest disturbance of sediments from Project activities will likely be in the nearshore zone from jetting activities (see Chapter 5) and in closest proximity to land-based anthropogenic inputs that may lead to pollution.

4.4.7.1 Marine Water Quality

Due to the absence of marine water quality criteria in Nigeria, the Australian and New Zealand Guidelines for Fresh and Marine Water Quality by Australian and New Zealand Environment and Conservation Council (ANZECC) was adopted for the assessment of marine water quality. The ANZECC guidelines are recognised worldwide as an integrated approach to water quality management and ecologically sustainable development. The guidelines provide a list of recommended trigger values for ecosystem protection. The trigger values represent the concentration below which adverse biological effects are expected to occur. Only parameters of interest for impact assessment are presented (Table 4.9).

Table 4.9: Parameters and Default Trigger Values of Physical and Chemical Stressors for Slightly Disturbed Ecosystems

Parameter	Trigger Values for marine water
pH	8.2
DO (mg/L)	6.68
Turbidity (NTU)	1-20
Copper (mg/L)	0.0013
Lead (mg/L)	0.0044
Zinc (mg/L)	0.015
Nickel (mg/L)	0.070
Cd (mg/L)	0.0055
Cr (mg/L)	0.0044

Source: ANZECC, 2000

- *Dry Season*

In the dry season, the pH of the marine water ranged from 7.54 to 7.68, indicating that the water body is slightly alkaline (typical of Atlantic Ocean), and below the ANZECC trigger values for offshore marine ecosystems. Factors that could lead to fluctuations in the pH of seawater include the presence of organic acids and biological and physical processes that affect the concentration of dissolved carbon dioxide.

Dissolved Oxygen (DO) values recorded in the marine water samples ranged from 5.20 mg/l to 5.60 mg/l, with a mean value of 5.38 mg/l; these values are typical of marine water and of sufficient level to support aquatic life. The DO values are also within the ANZECC trigger values for offshore marine ecosystems. The concentration of DO in seawater is affected by several factors which include physical, chemical and biological attributes such as temperature, depth, surface diffusion rate, sea depth, current flow, aeration and the net rate of respiration and photosynthesis by aquatic biota.

The turbidity values recorded in the marine water were 0.00 NTU at all the locations sampled.

The mean concentrations of Lead (Pb), Zinc (Zn), Cadmium (Cd), Copper (Cu), and Chromium (Cr) in the surface water samples exceeded their respective ANZECC trigger values for offshore marine ecosystems for aquatic life. The recorded mean values for Zn, Cr, Cu, Cd and Pb were 0.170 mg/l, 0.058 mg/l, 0.081 mg/l, 0.113 mg/l and 0.181 mg/l respectively. This may be attributed to anthropogenic inputs.

- *Wet Season*

In the wet season, the measured pH values ranged from 7.71 to 8.83. The turbidity values of the surface water samples collected during the survey ranged from 1.53 to 15.73 NTU. The higher values recorded were attributed to the storms and high river flows in the area. However, these values still fall within the ANZECC trigger values for offshore marine ecosystems for aquatic life.

The mean values recorded for Zinc and Chromium were 0.02 mg/l and 0.02 mg/l, respectively. Other heavy metals analysed such as Copper, Manganese, Nickel, Lead, and Cadmium were below detection limits. The Zn and Cr concentrations recorded were slightly above the ANZECC trigger values for offshore marine ecosystems for aquatic life.

4.4.7.2 Sediment Quality

There are currently no published sediment guidelines in Nigeria to assess the quality of marine sediments against. However, in the absence of Nigerian guidelines, there are a number of international guidelines which can be used to assess the baseline sediment quality data. The Canadian Interim Marine Sediment Quality Guidelines (CISQG) issued by Canadian Council of Ministers of the Environment (CCME), as well as the ANZECC Sediment Quality Guidelines have been adopted for this study.

The CISQGs and ANZECC Guidelines are used to assess whether organisms are at risk from high concentrations of toxic substances present in the sediment. The CISQGs include threshold effect levels (TELs) and probable effect levels (PELs). The lower value, TEL, represents the concentration below which adverse biological effects are expected to occur. The upper value, PEL, defines the level above which adverse effects are expected to occur frequently (Table 4.10).

Table 4.10: Canadian Interim Marine Sediment Quality Guidelines

Parameters (mg/kg) Dry weight	CISQGs (TEL)	CISQGs (PEL)
Cadmium	0.7	4.2
Chromium	52.3	160
Cobalt	NS	NS
Copper	18.7	108
Mercury	0.13	0.7
Manganese	NS	NS
Lead	30.2	112
Iron	NS	NS
Vanadium	NS	NS
Nickel	15.9	42.8
Zinc	124	271
Arsenic	71	416

Source: CISQG, 2002

The ANZECC guidelines for the assessment of sediments outline methods for sediment sampling and analysis, sediment quality assessment and biological testing. The guidelines identify lower and upper values, referred to as screening and maximum levels respectively (Table 4.11). The guidance in relation to the application of these values indicates that in general, contaminant levels in sediment below trigger value are of no concern and are unlikely to influence water quality. However, contaminant level above ISQG-high, it is considered not suitable for dredging/ disposal of sediment which would bring in negative water quality impact. Sediment with contaminants level between trigger value and ISQG-high requires further consideration and testing before a decision of any activity to disturb sediment.

Table 4.11: Selected Recommended Sediment Quality Guidelines by ANZECC

Parameters (mg/kg) Dry weight	ISQG-Low (Trigger Value)	ISQG-High
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1
Nickel	21	52
Silver	1	3.7
Zinc	200	410
Arsenic	0.020	0.070
Total PAHs	4.00	45.00
Total DDT	0.0016	0.046

Parameters (mg/kg) Dry weight	ISQG-Low (Trigger Value)	ISQG-High
Total PCBs	0.023	-

In the dry season, the pH of the sediment samples ranged from 7.32 to 7.65, with an average of 7.51. These values are a reflection of the pH of the water body which was also slightly alkaline. For heavy metal profile, the mean concentration recorded in the sediment samples for Copper, Cadmium, Lead, and Nickel were 0.020 mg/kg, 0.029 mg/kg, 0.097 mg/kg, and 0.212 mg/kg respectively. The values were below the CISQGs TEL and PELs, as well as the ANZECC ISQGs. This implies that the sediment quality is good. However, the elevations found in the water quality samples suggests that there is potential for the discharge of contaminants into the marine environment. Nearshore sediments are predominantly sandy and the hydrodynamics of the nearshore area are quite dynamic, which limits the potential for contaminant sinks to be present.

In the wet season, the concentration of heavy metals in the sediment samples were generally low at the sampling locations that extend towards the landing site. The average values recorded for Copper, Cadmium, and Lead were 5.95 mg/kg, <0.001 mg/kg, and <0.001 mg/kg respectively. The values were below the CISQGs TEL and PELs, as well as the ANZECC ISQGs. However, the average concentration for Nickel was 36.93 mg/kg which exceeded the CISQGs (TEL) and the ISQG-Low (Trigger Value).

4.5 Biological Environment

4.5.1 Legally Protected and Internationally Recognized Area

There are no coastal or marine legally protected or internationally recognised areas within the AoI and also within the broader interconnected seascape area.

4.5.2 Terrestrial Biodiversity

Typical of an urbanised coastal area, the majority of the land cover in the AoI comprises bare sand and low-level vegetation interspersed with areas for concrete drainage structures, commercial and residential buildings and piles of scrap and waste materials.

The terrestrial zone behind the beach landing location has a coastal road running parallel to shore adjacent to the beach. Behind the road the vegetation has been cleared for open grass areas, dwellings (marked as illegal by the Lagos State Government), and fenced properties. These areas have high levels of human disturbance and have been largely cleared of vegetation. The CLS site, which will also house the BMH, has been infilled and levelled and is highly disturbed.

However, some low-level vegetation is present. A section of the land is used as a recreational ground (football field) and the land is also grazed by domesticated animals. Plate 4.1 shows the terrestrial conditions between the beach and CLS site and also within the site.

Aerial view of the BMH location

Aerial view across the CLS site

Vegetation at the BMH location and immediate surroundings

Vegetation at the BMH location and immediate surroundings

Ground view across the CLS site

Aerial view of the terrestrial area between the beach and CLS site

Plate 4.1: Images showing the condition of the terrestrial zone within and surrounding the area of Project works

The vegetation characteristics of the area were studied using visual observations, photographs and collection of specimens. Plant identification was carried out both in the field and herbarium (University of Lagos) using appropriate botanical guides. Based on the field assessment and information from desktop review of relevant documents, the habitats of the coastal area in the AoI have low ecological value.

The dominant plant species observed in the immediate surroundings of the cable landing site are presented in Table 4.12.

Table 4.12: Dominant plant species observed in the immediate surroundings of the cable landing site, including areas dune vegetation areas

S/N	Botanical Name	Family	Common Name	IUCN Status
1	*Ageratum conyzoides* L.	Asteraceae	Belly goat weed	Least Concern
2	*Calotropis procera* (Ait) Ait.Fil.	Apocynaceae	Apple of Sodom	Not Evaluated
3	*Commelina diffusa* Burm.f.	Commelinaceae	Climbing dayflower	Least Concern
4	*Eleusine indica* (L.) Gaertn	Poaceae	Indian goose grass	Not Evaluated
5	*Gomphrena celosoides* Mart.	Amaranthaceae	Bachelor's button	Not Evaluated
6	*Lantana camara* L.	Verbenaceae	Common lantana	Not Evaluated
7	Cymbopogon schoenanthus (L.) Spreng.	Poaceae	Lemon grass	Not Evaluated
8	*Tridax procumbens* L.	Asteraceae	Coatbuttons	Not Evaluated
9	*Commelina erecta L.*	Commelinaceae	White mouth dayflower	Least Concern

Observations in the CLS indicate that there are no important bird nesting sites. Egret species were identified in the CLS site area during the site visit but these are very common to the area. These are classed as Least Concern by the IUCN Red List.

4.5.3 Marine Biodiversity

4.5.3.1 Intertidal Habitats and Species

4.5.3.1.1 Beach Habitat Condition and Value

The cable will land on a sandy beach. The beach at and adjacent to the landing location is highly disturbed by humans, with activities such as, recreation activities (e.g. walking and horse riding); and a small area is being used for small-scale cement block manufacture immediately adjacent to the beach, including associated sand excavation on the beach immediately adjacent to this area. Small-scale sand extraction on the beach is evident and is spread sporadically across the beach frontage. There are some small informal settlements in the area behind the beach which indicates ongoing local disturbance by residents.

The beach frontage is fragmented by groynes that run perpendicular to the coast. Other structures are present on the beach, including individual concrete coastal armour structures. Litter is widespread across the beach with some localised accumulation of large amounts of material adjacent to groynes.

Erosion of the beach is evident in areas with exposure of structures that lie at or immediately adjacent to High Water (HW), including the small coastal road that is situated behind the beach, and through undercutting of the low dunes behind the beach. Starting at approximately 250 m to the east of the landing site, a significant area extending approximately 1.5 km on and adjacent to the beach has been infilled with large volumes of sand deposited to raise land levels for development, which has completely altered the natural situation.

The conditions of the beach at and adjacent to the landing site are shown in Plate 4.2.

Beach at the cable landing site

Structures on the beach approx. 250 m to the east of the landing site

Accumulated litter adjacent to groynes

Sand excavation on the beach above HW

Exposure of the coastal road structure

Piles of sand stored behind the beach following excavation

Sand deposition on the beach approx. 250 m east of the landing site area

Aerial view of the landing location showing the area of cement block manufacture adjacent to the beach area

Cement block manufacture at the landing site area

Informal settlement behind the beach

Aerial view of the landing site location

View to the east at the landing site area – showing recreational uses and cement block manufacture

Plate 4.2: Images showing the condition of the beach area at the landing site

The conditions at the landing location are characteristic of the beach frontage along Elegushi beach with a sequence of groynes and coastal hinterland development being present in many areas. To the west of the area where groynes are present, the area is defined for development under the Eko Atlantic City development project. To the east of the area where groynes are located, the coastal zone is less disturbed, but development is still present behind the beach, and human activities on the beach still occur.

The overall context for the coastal area is therefore of highly disturbed sandy beaches with coastal hinterland development. The zone where groynes are present represents an area with the most common characteristics across the coastal region. This Elegushi coastal zone is therefore defined as the broad seascape area for consideration with respect to intertidal beach habitat.

4.5.3.1.2 Sea Turtle Nesting Habitat

As noted above, the sandy beaches along the Elegushi coastline are highly disturbed. Human disturbance is a factor that can minimise the potential for the nesting of sea turtles. However, there is evidence of sea turtle nesting on beaches along this frontage and elsewhere in Lagos state (see below). Therefore, at the outset of the ESIA studies, it was considered that there was possibility for nesting at the landing site area. The following provides a discussion of the potential for sea turtle nesting habitat to be present in the AoI related to broad information that is available.

Protection to sea turtles in Nigeria is afforded through the Convention on the Conservation of Migratory Species of Wild Animals that Nigeria is a party to, specifically relating to the Memorandum of Understanding (MoU) concerning Conservation Measures for Marine Turtles of the Atlantic Coast. All sea turtle species are also protected in national law under The National Wildlife Species Protection Act (2015), which provides which are endangered from overexploitation or habitat change as required under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migratory Species of Wild Animals (CMS) and its daughter Agreements and protocols, and the Convention on Biological Diversity (CBD) to which Nigeria is a signatory.

<u>Published and unpublished information</u>

Five marine turtle species are known to be present in Nigerian waters, including the leatherback turtle (*Dermochelys coriacea*), olive ridley turtle (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*) and hawksbill turtle (*Eretmochelys imbricata*). The IUCN Red List classification for these species is provided below:

- Leatherback turtle: Southeast Atlantic subpopulation - Data Deficient. The Southwest Atlantic subpopulation may be present in offshore waters during its marine life-cycle with nesting grounds in Brazil. This subpopulation is classified as Critically Endangered. The extent of the movement of the Northwest Atlantic subpopulation also covers the western edge of Nigeria; and thus, individuals from this subpopuation could be present in offshore waters. This subpopulation is classified as Endangered.
- Hawksbill turtle: Critically Endangered.
- Green turtle: South Atlantic subpopulation – Least Concern.
- Loggerhead turtle: Globally Vulnerable. It is not clear if there could be come connection with the Northeast Atlantic subpopulation, which is the closest nesting population to Nigeria located in Cape Verde. However, movements from this nesting ground have only been recorded in the pelagic waters off Cape Verde and foraging grounds in Sierra Leone. This subpopulation is Endangered.

- Olive ridley turtle: Vulnerable

Unpublished information available from studies undertaken in Nigeria confirms nesting by leatherback, olive ridley and green sea turtles on beaches in Lagos state. Figure 4.11 presents a summary of where nesting activity has been recorded by local researchers.

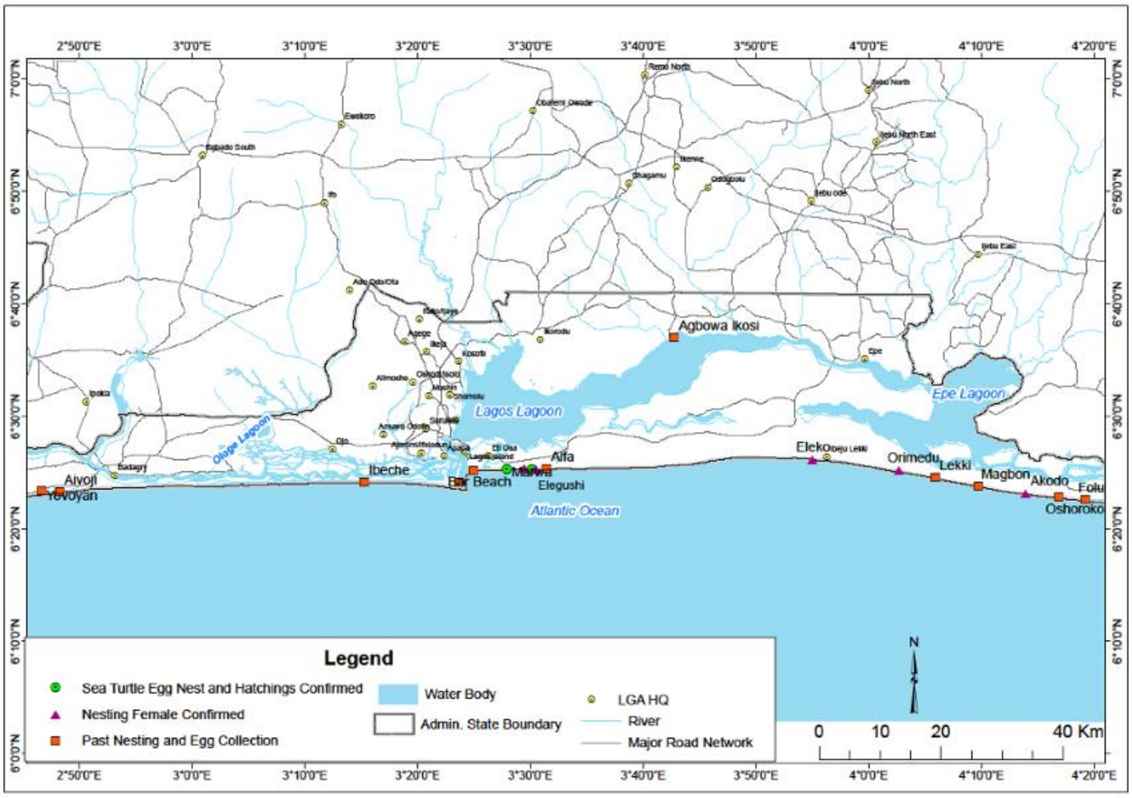

Figure 4.11: Known sea turtle nesting records in the Lagos area (Source: Adegbile; unpublished 2019)

The main species recorded to be nesting are leatherback and olive ridley turtles. Green turtles are less common (Adegbile, pers. comm., 2019). As noted above, none of the nesting populations are classified as Endangered or Critically Endangered. Hawksbill and loggerhead turtles have not been recorded as nesting. However, the nesting of hawksbill and loggerhead turtles cannot be discounted due to the general paucity of sea turtle nesting information in Nigeria. There is, however, no evidence of nesting of these species in this eastern part of the Gulf Guinea from available data, with the exception of hawksbill nesting on the islands of Bioko, São Tomé and Príncipe. There is some evidence of mating loggerhead turtles in the waters off São Tomé and nesting and nesting has been reported in Cameroon (Fretey, 2002). It is possible that the identification of loggerhead turtles in fisheries by-catch could be due to false identification by fishermen and therefore the presence of this species in Nigerian waters may not be confirmed.

Solarin et al. (2008), stated that loggerhead, green, hawksbill, olive ridley, and leatherback turtles have been reported in gillnet fishing bycatch in Nigeria. The bycatch of these species was most prevalent between August and December. Adegbile, pers. comm. (2013) have reported that surveys conducted in coastal communities since 2008 revealed that green and olive ridley turtles were the most commonly captured turtles by fishermen. It is not known whether the turtles caught are part of nesting populations in Nigeria or represent foraging or migrating turtles. Lewison and Moore (2012) report upon sea turtle by-catch from fisheries consultation in the Lagos area. The species reportedly caught by fishermen included all five species identified above. As stated above, the identification of sea turtle species through consultation with fishermen should be treated with some caution due to the possibility for the misidentification of some species.

Fishermen interviews conducted by researchers at Nigerian Institute for Oceanography and Marine Research (NIOMR) between 1978 and 2000 have reported that sea turtles nest on several sandy beaches in Lagos. These areas include Ibeche, Aivoji and Badagry on the western flank of Lagos, Takwa bay, Victoria Island beach, Kuramo, Orimedu, Osoroko, and Folu on the eastern flank of Lagos. Some of the interviewees stated that they had eaten roasted sea turtle eggs. Species identified as nesting from these consultation exercises were thought to include leatherback, hawksbill, olive ridley and green turtles. However, these responses were not supported by any evidence and must therefore be considered to be anecdotal.

A sea turtle survey that was completed at Badagry (Aivoji) to the west of the cable landing locations identified a number of sea turtle nesting events in November 2013 across a 10 km area, comprising of nesting by leatherback and olive ridley turtles (unpublished data). Olive ridley turtles represented the greatest number of nesting emergence events (nests and tracks) recorded. Evidence of juvenile olive ridley and green turtle sea turtle by-catch were also noted through discarded carapaces within the coastal fishing communities. Sea turtle surveys completed for the proposed Lekki port in the 2013/2014 dry season. The surveyed area is approximately 55 km to the east of the cable landing options have also confirmed sea turtle nesting (Lekki Port LFTZ Enterprise, 2013). The species recorded during these surveys were leatherback, green and olive ridley turtles. Similarly, to the survey results at Badagry, olive ridley turtles represented the greatest number of nesting emergence events recorded (Lekki Port LFTZ Enterprise, 2013; Adegbile, pers. comm., 2019). Leatherback turtles were well represented, but there were only a couple of the nesting records for green turtles (Adegbile, pers. comm., 2019).

A range of specific records are available for the area in proximity to the landing site on Elegushi beach. These are summarised below:

- February 2010: olive ridley tracks at Marwa beach
- March 2010: the collection of 120 olive ridley eggs from Marwa beach
- July 2012: several green turtles hatchlings recorded on Elegushi beach
- September 2012: olive ridley nesting recorded on Elegushi beach
- November and December 2012: relocation of sea turtle eggs that were being inundated at Elegushi beach
- December 2012: olive ridley turtle tracks on Elegushi beach
- February 2017: 22 leatherback hatchlings recorded on Elegushi beach
- August 2017: olive ridley sea turtle by-catch was rescued at Elegushi beach
- November 2017: olive ridley hatchings recorded on Elegushi beach
- December 2017: green turtle rescued at Elegushi beach from fisherman
- October 2018: olive ridley sea turtle captured and sold at Elegushi beach
- November 2018: olive ridley captured and displayed at Elegushi beach

Some of the of the activities undertaken by the sea turtle rescue and release project at Elegushi beach have been to relocate turtle eggs from areas of erosion and inundation by storms. As discussed above, groynes have since been established in the area to perform coast protection. A number of the records on Elegushi beach for 2017 in the above list relate to sea turtles that have been transported to the 'Kids Beach Garden' approximately 1.8 km to the west of the landing site where a local community member has been involved in the release of turtles. The origin of these sea turtles is unknown but may include fishermen by-catch and/or poaching from beaches. No sea turtles have been released since 2017.

The main nesting season for leatherback and olive ridley turtles is during the dry season between October and April. The peak nesting season is considered to be between November and December (Adegbile, pers. comm., 2013). However, nesting of turtles can also occur in the wet season based on records of nesting, including evidence of green turtle and olive ridley nesting records at Elegushi beach in July and September 2012 and August 2017 (Adegbile, pers. comm., 2013). However, the nesting records for green turtles during the Lekki Port surveys were in the dry season (Adegbile, pers. comm., 2019).

Rapid sea turtle walkover survey

On 5 April 2019, a rapid site walkover survey was undertaken to coincide with the end of the sea turtle nesting season. Three areas were surveyed to assess the value of the habitat for nesting sea turtles based on an early understanding of possible alternative cable landing locations at that time. The areas surveyed are shown in Figure 4.12.

Figure 4.12: Rapid sea turtle walkover survey locations

The area surveyed approximately 10 km to the east of the landing site, identified one old leatherback turtle nest with old hatched shells present, as well as one additional possible olive ridley nest.

Approximately 200 m west of the landing site location, a possible green turtle nest, as well as an additional nesting site with the presence of old shells, possibly from a hatched olive ridley turtle nest, were recorded – see Figure 4.13. The nests could not be fully confirmed as they were old and subject to high levels of disturbance. There were no recorded observations of sea turtle tracks in the survey areas due to high level of human disturbance or due to no recent emergences occurring in the area immediately prior to the rapid walkover survey. Therefore, they only represent evidence of nesting and species cannot be confirmed based on the information available.

Informal interviews with the local community during the survey indicated that nesting occurs in the area where landing location is located and also indicated that poaching of turtle eggs is an issue in the area. They identified that nesting occurs from September to April, which is generally in line with the understanding of the main nesting season for sea turtles in Nigeria from available data.

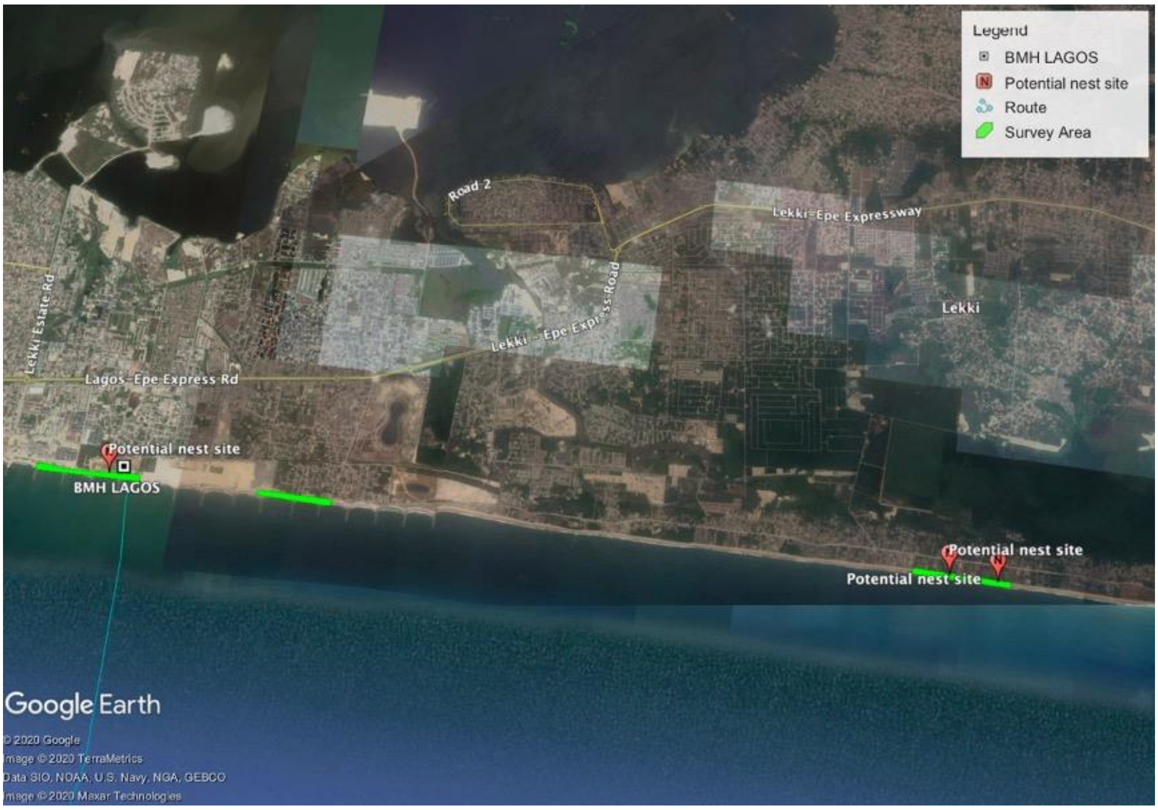

Figure 4.13: Location of sea turtle nesting records

In general, all survey sites were categorised as having high levels of disturbance on the beaches from human activity, including recreational use, construction, landing of artisanal fishing vessels, commercial and residential development, as well as, the presence of waste via domestic garbage and sewage runoff. The survey at the Project landing site was undertaken prior to any disturbance associated with cement block making activities. These activities have led to cement block storage just above HW and also excavation of sand on the beach, including in the area where the cable route will traverse the beach (see Plate 4.2).

A further rapid walkover of the beach at and immediately adjacent to the landing location was undertaken on a single day in October 2019 coinciding with the start of the nesting season. No evidence of nesting or sea turtle emergence was recorded, but this can only be considered to be a further snapshot assessment.

Based on the results of the rapid sea turtle walk over surveys, it is generally concluded that the frontage of the landing location provides potential sea turtle nesting habitat although this cannot be confirmed with the data available at this stage. However, based on existing knowledge of nesting in this area and review of the potential nesting habitat and disturbance, it is expected that if nesting does occur it will likely be at a low level. The disturbance of the beach area from cement block activities, including excavation of sand on the beach, provides limits to the potential for nesting of sea turtles in the area where construction activities for cable installation will take place. The area of space above HW where nesting is preferred is also small in this area, which means that nesting potential is relatively low. The cement block making activities on the beach in this location are informal and not fixed; and changes have been noted during site visits with expansion of activities. It is possible that the impacted areas on the beach may naturally restore or that there may be further disturbance that has taken place. Therefore, it is recommended that prior to construction that the baseline situation is reviewed again to understand current conditions and the potential for sea turtle nesting. At the time of baseline data collection, the potential for nesting along the cable route is very low due to the level of disturbance noted, although in general, the beach does have some nesting potential as previously discussed.

4.5.3.1.3 Other Intertidal Fauna

The description of other littoral organisms recorded in the cable landing site and its immediate surroundings is provided below:

- *Pagurus armatus* (hermit crab)

Pagurus armatus (hermit crab) belongs to Phylum Arthropoda, Class Crustacea and Family Paguridae. Its legs, including claws, have bands of colour in red, orange and white and the claws bear short spines on the dorsal surface. The species lives on a variety of substrates.

- *Ocypoda africana* (ghost crab)

Ocypoda africana (ghost crab) belongs to Phylum Arthropoda, Class Crustacea and Family Ocypodidae. It creates burrows on sandy beaches. It has a square to rectangular carapace with its eyes on long stalks. It inhabits burrows in the sediment during the day and comes out at night to forage.

- *Littorina angulifera* (winkle)

Littorina angulifera (winkle) belongs to Phylum Mollusca, Class Gastropoda and Family Littorinidae is a common snail on the seashore. The littorinid is a herbivore that feeds on detritus and scrapes minute algae off rocks.

4.5.3.2 Subtidal Habitats and Species

The subtidal area provides habitat for a wide range of marine species, including benthic habitats for seagrass, corals, soft and hard bottom communities and associated epi and infauna as well as pelagic and demersal habitats for plankton, fish, large marine mammal species etc. There has been limited research in the offshore area of Nigeria, but the following provides a broad understanding of key biodiversity values that are of note to the Project that has been gathered from the literature review.

4.5.3.2.1 Deep water corals

Deep sea coral ecosystems are important habitat for supporting rich associated megafauna, and as such, they are regarded as biodiversity hotspots. The deep-sea corals are non-photosynthesising species and as such have extremely slow growth rates, with vast reef structures needing thousands of years to accumulate. Their slow growth rates make them susceptible to damage from footprint impacts.

Studies have demonstrated the presence of such reefs on the fringes of the Gulf of Guinea along the outer edges of continental shelf break, continental slope and in deeper waters further offshore where habitat allows (Yesson *et al.,* 2012; Buhl-Mortensen *et al.,* 2016). Deep sea coral reefs, dominated by *Lophelia pertusa* and *Madrepora oculate*, have been recently identified in the Gulf of Guinea, close to Ghana (Buhl-Mortensen *et al.,* 2017), as well as the reef off Annobon island. The reef complex measures as 70 m high and 1400 m long and is situated at a depth of 400 m. Small non-reef building cold water corals have been identified approximately 30 km east of the cable route at the edge of the continental shelf, including species, such as *Leptogorgia aureoflavescens*, *Eunicella verrucosa*, *Eunicella Pillsbury*, *Isidella elongate*, *Ellisella paraplexauroides* and *Paramuricea grayi* have been documented (Friewald et al., 2017). The majority of these species require hard substrate but Isididae require soft bottom substrate. The cable route will cross the continental slope where the depth, substrate and upwelling parameters may allow for cold water corals to be present. The cable route survey and literature review has not identified any records of cold-water corals along the cable route, but presence is considered possible where suitable conditions allow.

4.5.3.2.2 Pockmarks

The cable route survey has identified the presence of pockmarks on the seabed in two areas as reported by Fugro (2019).

Fugro reported on the presence of isolated pockmarks within an area of very soft clay in water depths of approximately 80 m (25-27 km offshore) on the outer continental shelf (in water depths of around 80 m). The cable route does not cross any pockmarks visible in the data and the nearest is located 36 m east of the route (Fugro, 2019). Pockmarks in this area do not show any signs of fluid expulsion, such as bubbles in the water column or gas horizons in the data.

Fugro also reported that in water depths of approximately 107 m and 141 m numerous pockmarks were recorded in very soft clay on the continental slope.

Pockmarks observed along the proposed route are on average 3.6 m in diameter by 0.2 m deep and scattered about the seafloor with no ordered pattern. No hardgrounds are associated with these pockmarks. Pockmarks inside the areas with patches of hardgrounds are on average 6 m in diameter by 0.5 m deep and often contain high-reflectivity centres that indicate the presence of hardgrounds. The hardgrounds may consist of carbonates or shelly biota related to possible past hydrocarbon expulsion. SBP data show refraction parabolas over the pockmarks, further indicating hardgrounds. The presence of active gas expulsion was not interpreted from the available datasets, e.g., bubbles in the SSS water column or gas attenuation. The proposed cable route avoids the areas of hardgrounds.

In general, pockmarks could be of note as they indicate areas of fluid / gas seeps from the seabed into the water column and provide a hard substratum for refuge and support a faunal assemblage similar to that of stony reef, which is different from the surrounding soft sediment (Judd, 2001; JNCC, 2014). These areas may therefore be colonised by cold-water coral species and if the seep is active, mat-forming bacteria may be evident. As already stated, the presence of active gas expulsion was not interpreted from the available datasets in either of these areas and their conservation value on this basis is not considered as being high.

4.5.3.2.2 Subtidal Benthos

Offshore benthos comprises infauna (species that live within the seabed sediments) and the epifauna (species that live on the surface of the seabed). The benthic subtidal environment forms an important marine ecological component, being home to assemblages of epi- and infauna species, which play an ecological role in maintaining the integrity of the marine ecosystem and supporting marine productivity, and, in turn, livelihoods and economies. Several studies have found significant correlations between the relative abundance of such benthic organisms with primary productivity in the water column and demersal fish production (CMFRI 1999). For instance, many benthic macrofauna play crucial roles in supporting detritic and pelagic food webs (Lee 2008), and the burrowing activities of some infauna facilitate sediment aeration and alteration of the chemical properties of sediment and overlying waters. The composition and diversity of benthic epi- and infaunal communities is affected by a range of physical factors, including water depth, water temperature, sediment type and transport, and water currents.

There is no data available for benthic fauna communities in deep offshore waters beyond the continental slope in Nigeria. However, within this far offshore zone, there will be limited disturbance to the seabed as the cable will be placed on the surface (see Chapter 5).

In the deeper waters of the continental shelf and on the continental slope, where seabed disturbance will occur from burial of the cable, some very limited data is available from macrobenthic grab sample surveys undertaken between 2005 and 2007 - as reported upon by the Guinea Current Large Marine Ecosystem (GCLME) programme (GCLME, 2010). GCLME (2010) reported upon the abundance, taxonomic and community structure of the soft bottom sediment areas on the continental shelf from sample locations presented in Figure 4.14. GCLME (2010) reported that a total of 590 individuals were identified belonging to 126 species were found from 13 sampling stations. Of the 590 individuals, polychaetes comprised 25.6%, molluscs constituted 22.9%, crustaceans and echinoderms constituted 10.8% and 1.7% respectively. Other taxa recorded included cnidarians, hirudinea, coelenterates, pteropods, foraminiferans and juvenile fishes which together constituted 39%. However, out of the 126 species recorded, polychaetes accounted for 78 species (61.9%), molluscs constituted 16 species (12.7%), 19 species (15.1%) were crustaceans. Echinoderms and species placed in category of ―others comprised 2 species (1.6%) and 11 species (8.7%) respectively. The species composition of samples showed spatial variation across the sampling sites in Nigeria. In sites that are in closest proximity to the cable route the abundance of different groups was similar to those for Nigeria as a whole; with the abundance of polychaetes was higher than any other sampling station. The most commonly occurring species in Nigeria included the polychaetes *Glycera sp*., *Lumbrineris aberrans* and *Lumbrineris coccinea*. The highest value of species richness and diversity were recorded from the site in closest proximity to the cable route. However, comparison with samples collected from other countries in the Gulf of Guinea, indicates that samples in Nigeria had relatively low species abundance and biomass (GCLME, 2010).

Nearshore benthic fauna communities are more studied than offshore deep-water communities. The following provides a summary of existing information that provides some understanding of the baseline conditions.

Sediment and infauna samples were collected in the nearshore environment during the wet and dry seasons for the Lekki Port development in 2013, which is located approximately 55 km to the east of the cable route area (Lekki Port LFTZ Enterprise, 2013). The results from sediment analysis showed the sediments were comprised primarily of sand will low fine material content, which is similar to the conditions found along the cable route. The results showed that the total benthic species abundance was low, which was attributed to the high energy marine system in the nearshore area. Species recorded were comprised only of molluscs, including, *Anadara Senilis*, *Mercenaria sp*., *Donax rugosus*, *Mya sp.*, *Tellina sp.* and *Togelus sp.*

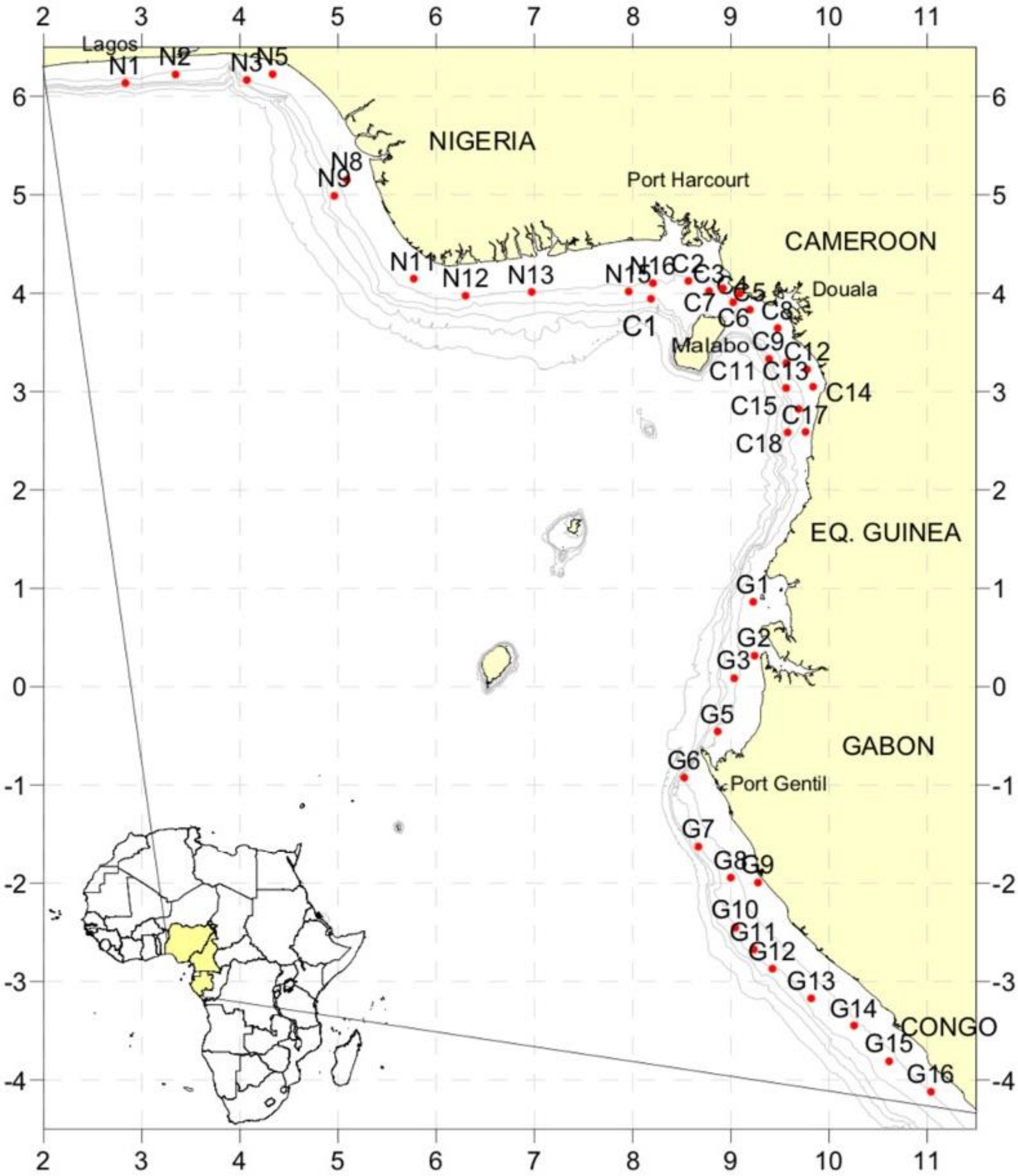

Figure 4.14: Location of Benthic Grab Sampling Stations by R/V Dr Fridtjof of Nansen (source: Henriksen, 2009)

Inshore benthic fauna dry and wet season surveys have also been completed for the proposed Badagry Port development approximately 70 km to the west of the cable route (ERM, 2013). ERM report that molluscs were the dominant group recorded with bivalvia accounting for 95.6 percent of the total individuals in the wet season and 91.3% in the dry season (ERM, 2013). *Mactra glabrata* was the most abundant species in both seasonal surveys. *Anadara Senilis*, *Tellina sp.*, and *Donax, sp.* were recorded. The survey results again showed low species richness and diversity (ERM, 2013). The results of the nearshore survey at Badagry is therefore similar to the results of the survey at Lekki Port.

In closer proximity to the cable route, sediment quality and benthic surveys were completed for the Eko Atlantic Shoreline Protection and Reclamation Project in the nearshore waters within the area that the cable will be located (South Energyx Nigeria Ltd, 2012). Again, the surveys showed that marine sediments in the nearshore comprised mainly of sand. Three borrow pit areas were identified for reclamation works in the nearshore marine zone. The cable route survey identified dredging locations along and adjacent to the route corridor (Fugro, 2019). The benthic communities of these and adjacent impacted areas may have been affected by dredging operations with lower benthic and abundance possible following disturbance. The amount of natural restoration to such areas is unknown. Dry season surveys undertaken in 2010, identified a total of 34 taxa from the groups: mollusca, polychaeta, crustacea, echinodermata, nemertea, sipuncula and echiura. The benthic community is dominated by the Molluscs (41.8%), followed by the polychaetes (24.93%) and crustaceans (24.4%). Most of the sampling stations have low population density and there was no significant spatial variation across the sampling sites. South Energyx Nigeria Ltd (2012) report that the near uniformity in the macrofauna composition and their pattern of distribution in the sediment, suggest that the sediment characteristic across the study area may be similar.

Results from surveys from the nearshore environment across a broad seascape area in Lagos state undertaken at a similar time indicate some commonality in baseline conditions. Therefore, existing secondary baseline information provides sufficient certainty on the nearshore benthic communities to inform the impacts assessment.

4.5.3.2.3 Plankton

Planktonic organisms are those that drift or float in the water column, as opposed to nekton (such as adult fish) that move independently of water currents. Plankton forms the basis of marine ecosystem food webs and consists of microscopic plants (phytoplankton) and mostly microscopic animals (zooplankton). Plankton range widely in size, from microscopic nanoplankton (2–20 µm) to megaplankton (up to 2 m long) such as large jellyfish.

There are two groups of plankton: phytoplankton and zooplankton. Phytoplankton species are autotrophic and generate energy using sunlight. They are often unicellular and include groups such as diatoms, blue-green algae and dinoflagellates. Phytoplankton species are of fundamental ecological importance as food for zooplankton and are, therefore, the basis of marine food webs, oxygen production and carbon sequestration (Lyimo, 2011). Zooplankton species are heterotrophic and generate energy by consuming organic material such as plants or animals. Zooplankton species are food sources for major groups of ecological and commercial importance such as fish larvae and filter-feeding benthic invertebrates. Zooplankton can be further subdivided into holoplankton (species that remain in planktonic form for their entire life cycle) and meroplankton (the larval stages of marine organisms, such as fish or crustaceans, which will later develop into non-planktonic animals).

Nigeria is one of 16 countries that comprise the Guinea Current Large Marine Ecosystem (GCLME). The GCLME is one of the world's most productive marine areas, based on its abundant fishery resources. As already noted, Nigerian waters are subject to a range of marine currents and fronts that occur across this region, including the Equatorial divergence and undercurrent. These conditions create upwellings that drive plankton productivity. Research on chlorophyll-a concentrations has been undertaken using satellite observations for the period 2002-2012 to define the periodicity of upwellings periods (Nieto and Melin, 2017). Chlorophyll-a concentration is used as an indicator of phytoplankton biomass; and therefore, can be indicative of upwelling periods. The understanding of upwelling zones and their timing is important as they comprise periods of high plankton and fish productivity, and therefore, may also act as a proxy understanding for the distribution, abundance and movement of marine mammals, fish and birds in the marine environment. However, ERM (2013) reported that there is no relationship between fisheries activities and upwelling periods. In Nigeria, Nieto and Melin (2017) reported upon broad period of relatively high values of chlorophyll-a from June to February. There was diversity in the system across Nigerian waters with a clear peak in October in the western part (in the zone where the cable route is located), and a period of high values from September to January in the eastern part. Nieto and Melin (2017) also reported upon chlorophyll-a concentration increasing in April and was already high in July- August, when the system displayed some characteristics associated with upwelling. Highest levels of chlorophyll-a identified by the Nieto and Melin (2017) are confined the continental shelf area.

In the deeper waters, some data is available on plankton from surveys undertaken between 2005 and 2007 - as reported upon by the Guinea Current Large Marine Ecosystem (GCLME) programme (GCLME, 2010). This involved the analyses of plankton samples collected with Continuous Plankton Recorder (CPR) from December 1996 to November 1999; and zooplankton samples collected by the Norwegian vessel RV Fridtjof Nansen between 2005 and 2007 (GCLME, 2010). This is included surveys on the continental shelf, but also in deeper waters within the Nigeria EEZ. GCLME (2010) reported upon results of the survey across the whole survey area of the programme. The reported a total of 66 phytoplankton taxa, 26 zooplankton (<2mm) taxa and 37 zooplankton (>2mm) taxa were identified from the samples. The mean diatom abundance generally declined from 6030 cells /m^3 of water in 1996 to 3618 cells /m^3 of water in 1999. *Thalassionema nitzschoides* dominated the diatoms in 1996 and 1997 but was replaced by *Rhizosolenia calcar avis* and *Thallassiosira spp.* in 1998 and 1999 respectively. The mean dinoflagellates abundance increased from 4469 cells /m^3 of water in 1996 to 4647 cells /m^3 of water in 1999. *Ceratium massilliense* dominated the dinoflagellates in 1996, 1997 and 1998 but was replaced by *Ceratium vultur* in in 1999. The mean copepods abundance decreased from 172 individuals /m^3 of water in 1996 to 153 individuals /m^3 of water in 1999. *Temora stylifera* dominated the zooplankton (<2mm) in 1996, 1998 and 1999 whilst *Chaetognath sp.* dominated in 1997 (GCLME, 2010). The zooplankton survey results showed that calanoides were the most diverse and abundant, with the species with *Temora stylifera*, *Eucalanus crassus* and *Centropages furcatus* mostly recorded. The least in abundance were *Chiridius poppei* and shrimp larvae. The results also showed seasonal variations in species abundance. Species diversity is minimal in upwelling seasons with species such as the *Calanoides carinatus* dominating the copepods zooplankton *T. stylifera*, *E. crassus* and *E. Pileatus* dominated the samples irrespective of location, season and the year and could be concluded that these species are tolerance of wide range of environmental conditions and could do well in most environments (GCLME, 2010).

For the ESIA for the proposed Badagry Port, plankton samples were collected in the nearshore environment in the wet and dry seasons (ERM, 2013). Although this development is located approximately 70 km to the west of the cable route, the results of surveys provide a broad seascape context for baseline conditions in the Lago state at the time of survey. The results of the wet season phytoplankton survey reported upon by ERM (2013) identified four classes: Bacillariophyceae (diatoms), Chlorophyceae (green algae), Dinophyceae (dinoflagellates) and Euglenophyta (euglenophytes). Out of the 48 algal taxa identified, 30 were diatoms species belonging to 20 genera. Six green algae taxa belonging to six genera were recorded, while dinoflagellates and euglenophytes were represented by 7 and 3 taxa belonging to 2 and 4 genera, respectively. The dry season phytoplankton survey identified three classes, namely Bacillariophyceae, Cyanophyceae (blue-green algae) and Dinophyceae, were recorded. Out of the 34 algal taxa identified, 29 were diatoms species belonging to 15 genera with *Asterionella japonica* as the dominant taxa. The remaining taxa were comprised of *Trichodesmium* of Cyanophyceae and *Ceratium* of Dinophyceae. ERM (2013) note that the marine phytoplankton diversity in wet season was higher than that in dry season. ERM (2013) also report upon wet and dry season zooplankton surveys. For the wet season the reported that a total of 7 classes and in the wet season they reported five classes, including Copepoda, Branchiopoda, Malacostra, Hydrozoa, Spriotrichea, Ancantharia, Sagittoidea and Lavacea, In the wet and dry season, copepoda were most abundant and diverse (ERM, 2013).

Phytoplankton and zooplankton sampling were also undertaken for the Lekki Port development, which also provides some seascape context for nearshore planktonic conditions at the time of survey. Of the 19 species recorded, seven species belonged to Bacillariophyceae, five species to Cyanophyceae, six species to Dinophyceae, and one species to Haptophyceae (haptophyta). Overall, Cyanophyceae had the highest density (68 percent), followed by Bacillariophyeae (27 percent). The most dominant species amongst the Cyanophyceae was *Microcystis aeruginosa* and *M. botrys*. The most prevalent Bacillariophyceae species was *Coscinodiscus concinnus*. The zooplankton survey results show that the most abundant class was copepoda in the wet and dry seasons (South Energyx Nigeria Ltd, 2012).

In closer proximity to the cable route, plankton surveys were completed for the Eko Atlantic Shoreline Protection and Reclamation Project in the nearshore waters within the area that the cable will be located (South Energyx Nigeria Ltd, 2012). Three classes of phytoplankton were identified, including Bacillariophyceae, Chlorophyceae and Dinophyceae. Bacillariophyceae were most abundant representing 75.3 % of records, following by Dinophyceae representing 24.5 % of records and Chlorophyceae 0.1 % of the records. For zooplankton, 33 zooplankton species in seven groups were identified. The most abundant are the Crustaceans. This group comprised copepods, cladocerans, mysids, decapods, amphipods and ostracods; and represented 60 % of the zooplankton population. There was no significant variation across sample site; and population density, species richness and diversity were also considered to be high (South Energyx Nigeria Ltd, 2012).

The results from surveys from the nearshore environment across a broad seascape area in Lagos state indicate some commonality in results. Therefore, existing secondary baseline information therefore provides sufficient certainty on the nearshore planktonic conditions to inform the impacts assessment.

4.5.3.2.4 Marine Mammals

Nigeria is a signatory to the West African Aquatic Mammals Memorandum of Understanding (MoU), along with 28 other countries in West Africa. This MoU aims to protect the African manatee and small cetacean species at national, regional and global levels.

The marine mammal communities inhabiting the eastern tropical Atlantic are among the most poorly studied worldwide. No systematic at-sea cetacean monitoring programmes exist in Nigeria for marine mammals. This data paucity means that there is uncertainty with respect to baseline conditions. In order to inform the understanding of species presence precautionary approaches are taken forward using records available from neighbouring countries that may provide an indication of potential presence. Therefore, a literature review has been undertaken to seek to determine the presence of marine mammals in the Gulf of Guinea from a number of sources as listed below in Table 4.13, which presents a list of confirmed and potentially present species in Nigeria based on confirmed records and also those species that are present in the Gulf of Guinea and West African region. This information provides a precautionary overview of likely species presence in Nigerian waters. Based on fishermen interviews, Lewison and Moore (2012) reported that bottlenose dolphins (*Tursiops truncatus*) followed by rough-toothed dolphins (*Steno bredanensis*) were the most commonly reported marine mammal in the three western coastal states of Nigeria (Lagos, Ogun and Ondo). They also reported that other species reported fairly commonly included spotted dolphins (*Stenella attentuata* and *S. frontalis*), spinner dolphin (*Stenella longirostris*), and *Kogia spp* (Lewison and Moore, 2012).

Table 4.13: List of confirmed and potentially present cetacean species in Nigeria

Species	Common Name	IUCN Red List Classification	Nigeria	Cote d' Ivoire	Ghana	Togo	Benin	Cameroon	Equatorial Guinea	Sao Tome & Principe	Elsewhere in West Africa
Baleen whales (mysticetes)											
Balaenoptera borealis	Sei whale	Endangered	X	X	X	X	X	X	X	X	5,9,12
Balaenoptera physalus	Fin whale	Vulnerable	X	X	X	X	X	X	X	W	4,5,9,12
Balaenoptera acutorostrata	Minke whale	Least Concern	X	X	X	X	X	X	X	X	4,8
Balaenoptera edeni	Bryde's whale	Data Deficient	S[15]	W	W	X	X	X	W	W	5,9,10,11,12
Balaenoptera musculus	Blue whale	Endangered	X	X	X	X	X	X	X	X	1,4,5,6,7,8 9,12
Megaptera novaeangliae	Humpback whale	Least Concern	S[13, 15]	X	Str	S	S	X	S, W	S, W	4,5,7,8,9,190 ,11,12
Toothed whales and dolphins (odontocetes)											
Delphinus delphis	Short-beaked common dolphin	Least Concern	S[13, 15],C S[14]	Str, C	C	X	S	X	X	X	4,5,7,8,9,10, 12
Feresa attenuata	Pygmy killer whale	Least Concern	CS[14]	X	P	X	X	X	X	X	5

Species	Common Name	IUCN Red List Classification	Nigeria	Cote d' Ivoire	Ghana	Togo	Benin	Cameroon	Equatorial Guinea	Sao Tome & Principe	Elsewhere in West Africa
Globicephala macrorhynchus	Short-finned pilot whale	Least Concern	X	S, C	C	X	X	X	X	S	1,4,5,6,7,8,9,12
Globicephala melas	Long-finned pilot whale	Least Concern	X	X	X	X	X	X	X	X	6
Grampus griseus	Risso's dolphin	Least Concern	CS[14]	S	C	X	X	X	X	X	4,5,7,9,12
Kogia breviceps	Pygmy sperm whale	Data Deficient	X	X	X	X	X	X	X	X	5,7,8
Kogia sima	Dwarf sperm whale	Data Deficient	CS[14]	X	C	X	X	X	X	X	5,12
Lagenodelphis hosei	Fraser's dolphin	Least Concern	CS[14]	X	C	X	X	X	X	X	5,12
Mesoplodon densirostris	Blainville's beaked whale	Data Deficient	X	X	X	X	X	X	X	X	5
Mesoplodon europaeus	Gervais' beaked whale	Data Deficient	CS[14]	X	X	X	X	X	X	X	5,7
Orcinus orca	Killer whale (Orca)	Data Deficient	CS[14]	S	S, C	X	X	X	U	S	4,5,6,8,9,12
Peponocephala electra	Melon-headed whale	Least Concern	X	X	C	X	X	X	X	X	1,4,5,7,9,12
Physeter macrocephalus	Sperm whale	Vulnerable	S[15]	S	S	X	X	X	W	S, W	4,9,10,11,12
Pseudorca crassidens	False killer whale	Near Threatened	X	Str	C	X	U	X	X	X	5,9,12
Sousa teuszii	Atlantic humpback dolphin	Critically Endangered	?[2], CS[14]	X	X	X	X	Str	X	X	2,5,6,7,8,9,12
Stenella attenuata	Pantropical spotted dolphin	Least Concern	S[15]	X	S, C	X	X	X	X	S	1,4,5,8,9,12
Stenella coeruleoalba	Striped dolphin	Least Concern	CS[14]	Str	X	X	X	X	X	X	4,12
Stenella frontalis	Atlantic Spotted dolphin	Least Concern	S[13], C[14]	C	C	X	S	X	U	X	5,8,9,12

Species	Common Name	IUCN Red List Classification	Nigeria	Cote d' Ivoire	Ghana	Togo	Benin	Cameroon	Equatorial Guinea	Sao Tome & Principe	Elsewhere in West Africa
Stenella longirostris	Long-beaked spinner dolphin	Least Concern	CS[14]	C	C, S	X	X	X	X	X	1,5,8,12
Stenella clymene	Clymene dolphin	Least Concern	CS[14]	X	S, Str, C	X	X	X	X	X	4,5,6,12
Steno bredanensis	Rough toothed dolphin	Least Concern	X	C	S, C	X	X	X	X	X	4,5,8,9,12
Tursiops truncatus	Common bottlenose dolphin	Least Concern	S[15], CS[14]	C	C	U	X	X	X	S	1,4,5,6,7,8,9, 12
Ziphius cavirostris	Cuvier's beaked whale	Least Concern	X	X	P	X	X	X	X	X	5,12

As taken from Weir (2010): S, at-sea sighting; Str, stranding; C, capture; W, whaling record; U, record of unknown origin; X, no record, ?[2]Possible range state stated by Van Waerebeek *et al.,* (2004) and Weir and Collins (2015); CS[14] Fisheries consultation by-catch sighting reported by Lewison and Moore (2012). P species record reported by Van Waerebeek et al. (2009). [1] Presence confirmed in Sierra Leone through Marine Mammal Observation survey; [3]confirmed presence, but data limited. [4]Presence confirmed in Liberia through Marine Mammal Observation survey. [5]Species recorded in Senegal. [6]Species recorded in The Gambia. [7]Species recorded in Guinea Bissau. [8]Species record in Guinea. [9]Species record in Gabon. [10]Species recorded in Congo. [11]Species recorded in the Republic of Congo. [12]Species recorded in Angola. [13]Reported sighting in ERM (2013). [15]Reported sighting in WAPC (2004) (Key source refs: Weir, 2010; Lewison and Moore (2012), WAPC (2004), Balmy *et al.,* (2010); Jefferson *et al.,* (1997); Weir and Collins (2015); Maigret, (1994); Van Waerebeek *et al.,* (2000); Van Waerebeek *et al.,* (2003); Waerebeek *et al.,* (2004); Fulling *et al.,* (2008); and Spaans (1990)

When reviewing baseline conditions and possible interaction with project activities, it is important to understand the general habitat preferences of marine mammals. All of the species listed above, except for the Atlantic humpback dolphin (which is not confirmed in Nigeria), may be present in offshore waters. Of the species listed above, the following may be considered as likely being present in nearshore waters at times: humpback whale, bottlenose dolphins (although these can also be found in deeper waters), spinner dolphins (resting during the day and offshore when foraging at night), pantropical spotted dolphin (during the day). Some other species may also occur in coastal waters at times, including Bryde's whale, blue whale, minke whale, fin whale and orca. The Atlantic humpback dolphin is exclusively a nearshore species. In addition, the West African manatee

(*Trichechus senegalensis*) is also recorded in Nigeria and is an exclusively coastal species. This species is classified by the IUCN Red List as Vulnerable.

Of note, the humpback whale (*Megaptera novaeangliae*) is a congregatory and migratory species. Humpback whales in West Africa are from a southern hemisphere population that migrates to the region each year from the Antarctic (Olsen, 1914) to the Gulf of Guinea (Budker and Collignon, 1952; Gambell, 1976; Best 1994; Walsh et al., 2000; Findlay, 2000). Van Waerebeek et al (2001) have identified the presence of breeding humpback whales in the Bight of Benin. They suggested that these whales are connected to the southern hemisphere breeding stock. They confirm that the wintering grounds of humpback whales in this area are thought to stretch over shelf waters of at least western Nigeria, Benin, Togo, the Volta estuary area in eastern Ghana, and possibly further west into Ivory Coast. Although activities of humpback whales in Nigeria are poorly understood, it is a confirmed range state and the shallow nearshore waters of the Bight of Benin are considered to be a calving and mating area (Van Waerebeek et al, 2001). Rosenbaum et al. (2014) have researched the long-range movement of humpback whales from the south east Atlantic population (Breeding substock B1) in Gabon using satellite tagging. This research was undertaken to understand the movement of humpback whales and localised behaviour that may indicate important foraging or breeding areas, including within the Gulf of Guinea. Whales were recorded as migrating to Nigeria waters and an area of localised behaviour was recorded in the Gulf of Guinea within 30–40 km of Nigeria, Cameroon, and Bioko, which is identified as a potential breeding area. This area is far to the east of the cable route. The whales spent 18.13% of their time in the waters of the Nigeria EEZ, but longer periods in Gabon and Angola. All localised behaviour was seen to occur in the EEZ. The tagging data also recorded the movement of individuals to the offshore waters of Ghana and thus crossing the area where the cable will be installed. ERM (2013) report upon marine mammal surveys undertaken for a proposed Petroleum Products import, storage and distribution facility in Lagos State ("proposed petroleum facility"), which is located approximately 55 km west of the cable route. Humpback whales were recorded at this time, including mothers and calves. Humpback whale presence in the area is strongly seasonal, which is expected to be very similar to the known seasonality of substock B1, i.e. May/June to December. August is considered to be a peak of activity in Gabon, but not enough is known about the peak activity in the Gulf of Guinea to be certain of a similar peak prevailing here. A similar peak period may, however, be possible in Nigeria. The sighting of humpback whales to the west of the cable route were undertaken in November (ERM), and Van Waerebeek et al., (2001) reported upon the observation of humpback whales in the Bight Benin in November, September and August, which all aligns with the expected seasonality for the overall migratory subpopulation.

Another species of note is the Critically Endangered Atlantic humpback dolphin (*Sousa teuszii*). The species is also thought to have restricted range and is regionally endemic to the tropical and subtropical eastern Atlantic nearshore waters of West Africa. Its habitat is predominantly inshore coastal and estuarine, over soft-sediment bottoms and therefore it is often vulnerable to human pressure as reflected in its IUCN status. At this time, No Atlantic humpback dolphin records are yet confirmed for Nigeria although this may be due to a lack of systematic survey in the country (Weir and Collins, 2015; and Waerebeek et al., 2001). Therefore, presence cannot be discounted based on information available (Weir and Collins, 2015). As noted above, this species only inhabits nearshore waters in depths of less than 20 m (Weir and Collins, 2015) where vessel movements will be minimal.

Sperm whales (*Physeter macrocephalus*) are also a species of note as they are likely to comprise nursery groups of females with young (Weir, 2010). Although the distribution of this species is not known in Nigeria, sightings data from elsewhere along the west coast of Africa show that sperm whales occupy the area across the continental slope and oceanic areas (Weir, 2011). Weir (2010) provided a summary of the biology of sperm whales in the West Africa. They reported that sperm whales in Southern Hemisphere waters have their peak calving period during February and March (Best et al. 1984). They also reported that sperm whales occur within in the tropical waters of West Africa throughout the year (Townsend 1935, Mikhalev et al. 1981, Weir 2008), however, seasonality may occur within particular regions. For example, Weir (2008) found that sightings offshore of Angola peaked between January and May. Finally, as reported by Weir (2010), Best (1969) showed that catches of sperm whales were consistent with a northward movement in autumn and a southward movement in spring.

As well as understanding the preference of species for nearshore and offshore areas, information on dive profiles is valuable for determining where in the water column marine mammals are likely to be and how long they stay underwater before resurfacing to breathe. Depths are important with respect to operations in ascertaining the areas marine mammals are likely to be. Table 4.14 provides information on some key species likely to be present in Nigerian waters is based on information from Felgate & Lloyd (1997), Carwardine, (1995) and Harwood (1999).

Table 4.14: Dive profiles of marine mammals possibly present in Nigerian waters

Species	Dive Profile
Baleen Whales	
Bryde's Whale	Dives are variable and depend on prey location, they range from shallow surface dives to more than 300 m, they can last 10 min but are usually shorter.
Humpback whale	Dives usually last 3-9 min. Occasionally up to 45 min, followed by 4-8 blows at 15-30 sec intervals. At breeding grounds, usually blows 3-6 times between dives. Humpbacks do not generally dive deeper than 120-150 m.
Toothed whales and dolphins	
Sperm whale	Can remain submerged for over 2 hrs, but typical dive time is about 45 mins. Intervals between dives may be up to an hour, but usually 5-15 min. Breathes at regular 12 – 20 sec intervals. For every foot (30 cm) of its length, the sperm whale will breathe once at the surface and spend about 1 min underwater during the next dive. Typically dive to depths of 300-600 m though some evidence suggests that they can dive to depths of at least 3000 m. Dive descent is over 80 m per min.
Dwarf sperm whale	Likely to be deep divers, regularly diving to >200 m
Cuvier's beaked whale	Dives typically last 20 to 40 min, possibly with 2 to 3 blows 10 to 20 sec apart in between. A deep diver.
Blainville's beaked whale	Typically performs a series of shallow dives at 15-20 sec intervals, then dives for 20-45 min. A deep diver.
Gervais' beaked whale	A deep diver.
Pygmy killer whale	No available information.
Risso's dolphin	Typically dives for 1 to 2 mins then takes up to a dozen breaths at 15 to 20 sec intervals; can stay underwater for up to 30 mins
Killer whale	Orcas will typically dive synchronously. Residents breathing patterns consist of 4-5 short dives 10-30 sec apart, followed by a longer dive of 3-4 mins. Transients' behaviour is less consistent. Resting animals flat on the surface, blowing slowly several times for a minute, submerge for 3-4 min and then resurface in the same place/ dives are usually <100 m but can reach 200 m or more.
Spinner Dolphin	Usually dives 10 sec to 1 minute but can last longer.

Species	Dive Profile
Rough-toothed dolphin	May remain submerged for as long as 15 min.
Bottlenose dolphins	Dives can last up to 8 mins but usually 10 sec to 2 min.
Common dolphins	Dives can last up to 8 minutes, but usually 2 sec to 2 min.
Fraser's dolphin	A deep diver. Diving to depths of at least 250-500 m
Atlantic humpback dolphin	Surfaces approximately every 40-60 sec, but can stay underwater for several minutes.
Striped dolphin	Dives typically last 5 to 10 min. When feeding, dives to at least 200 m in depth.
Spotted dolphins	Typically dives to sec depth of 9 to 11 m. Rarely exceed depths of 20 m.

4.5.3.2.4 Fishes

Section 4.6.2.1 provides a discussion on marine fisheries that may be affected by the Project. These activities, however, provide an indication of the fish resources present in Nigeria waters. However, as most fishing activity is in inshore waters coastal it only provides part of the baseline understanding across the seascape area. The following provides a summary of fishes that may be present in the seascape area.

Industrial fisheries mainly trawl for croakers, grunts, soles, catfish and shrimps (ERM, 2013). Other fish that are targeted include sharks, crabs, shad, cuttlefish, groupers, snappers and spiny lobsters (ERM, 2013). ERM (2013), Ssentongo (1986), Olaoye and Ojebiyi, (2018) Lekki Port LFTZ Enterprise (2013), South Energyx Nigeria Ltd (2012) and Sikoki (2013) and IUCN Red List distribution records have reported upon species recorded in Nigeria waters and these are presented in Table 4.15. Table 4.15 provides a list of marine fish species that have habitat ranges that includes Nigeria's nearshore and offshore areas. Due to data paucity there is uncertainty of their presence, distribution and populations of these species in relation to cable route but notes on general preferred habitat types are provided in Table 4.15. The majority of the species under pressure in Nigeria are sharks, skates and rays which are under threat from overfishing and bycatch (IUCN, 2020). Their habitats range from marine intertidal habitats to deep benthic environments. *B. Burtoni* is a small goby species with a very restricted geographic range in Nigeria and it is unknown as to whether is located within the Area of Influence for Project activities (IUCN, 2020). The Cassava croaker is listed as Endangered due to overexploitation from regional fishing vessels.

Table 4.15: Marine fishes and shellfish recorded in Nigerian waters. IUCN Status: NE (Not Evaluated); NT (Near Threatened); DD (Data Deficient); LC (Least Concern); E (Endangered); CR (Critically Endangered)

Family	Scientific name	Common name	IUCN Status	General habitat
Fishes				
Ariommatidae	*Ariomma bondi*	Silver-rag driftfish	LC	Demersal or near bottom within continental shelf at depths 50-500 m
	A. melanum	Brown driftfish	LC	Demersal or near bottom within continental shelf at depths 180-600 m
Engraulidae	*Engraulis encrasicolus*	European Anchovy	LC	Mainly coastal but can be found in depths 0-400 m
Scombridae	*Thunnus albacares*	Yellowfin tuna	NT	Migratory pelagic species in depths 1-250 m, usually 1-100 m
	Katsuwonus pelamis	Skipjack tuna	LC	Migratory pelagic species in depths 0-260 m
	Thunnus obesus	Bigeye tuna	VU	Migratory pelagic species in depths 0-1500 m, usually 0-500 m.
	Scomber japonicus	Chub mackerel	LC	Coastal pelagic species in water depths 0-300 m, usually 50-200 m
Carangidae	*Caranx senegallus*	Senegal jack	NE	Coastal pelagic species up to depths of 200 m.
	Caranx hippos	Crevalle jack	LC	Neritic pelagic species up to depths of 1-350 m, usually 1-200 m.
	Decapterus rhonchus	False scad	LC	Coastal near-bottom and pelagic species in water depths of 30-200 m, usually 30-50 m.
	Hemicaranx amblyrhynchus	Bluntonse jack	LC	Coastal pelagic species in shallow water up to a depth of 50 m.
	Chloroscombrus chrysurus	Atlantic bumper	LC	Coastal pelagic species in depths of 0-110 m.

Family	Scientific name	Common name	IUCN Status	General habitat
	Naucrates ductor	Pilotfish	LC	Oceanic species with a semi-obligate commensal relationship with sharks, rays, other bony fishes and turtles. Found in water depths 0-300 m
	Trachurus trachurus	Atlantic horse mackerel	VU	Coastal pelagic species usually in depths 100-200 m.
Sphyraenidae	*Sphyraena barracuda*	Great barracuda	LC	Coastal pelagic species in depths of 1-100 m, usually 1-30 m
Drepaniedae	*Drepane africana*	African sicklefish	LC	Coastal benthopelagic species in depths 10 – 75 m, usually 20-50 m
Sciaenidae	*Pseudotolithus typus*	Longneck croaker	LC	Coastal demersal species in depths 0-150 m
	Pseudotolithus elongatus	Bobo croaker	LC	Coastal demersal species in depths 0-100 m, usually 50-100 m
	Pseudotolithus senegalensis	Cassava croaker	EN	Coastal demersal species in depths 0-70 m
	Pteroscion peli	Boe drum	LC	Coastal benthopelagic species in depths 0-200 m, usually 0-50 m
Polynemidae	*Galeoides decad actylus*	Lesser African threadfin	NT	Coastal demersal species in depths 10-70 m
	Pentanemus qui nquarius	Royal threadfin	VU	Coastal demersal species in depths 10-70 m
	Polydactylus quadrifilis	Giant African threadfin	LC	Coastal demersal species in depths 15-55 m
Sparidae	*Dentex angolen sis*	Angolam dentext	NT	Coastal demersal species in depths 15-300 m

Family	Scientific name	Common name	IUCN Status	General habitat
	Pagellus bellotti i	Red pandora	LC	Coastal demersal species in depths up to 250 m, usually 10-50 m
Ariidae	*Carlarius heudelotii*	Smoothm outh sea catfish	LC	Coastal demersal in depths 15-75 m
	Arius latiscutatus	Rough-head catfish	DD	Coastal demersal species in depths up to 70 m, usually 30 m
Haemulidae	*Pomadasys jubelini*	Sompat grunt	LC	Coastal demersal species in depths up to 100 m, usually 20-50 m.
	Pomadasys suillus	N/A	NE	Coastal reef associated species
	Pomadasys incisus	Bastard grunt	LC	Coastal demersal species in depths 10-100 m
	Pomadasys perotaei	Parrot grunt	LC	Coastal benthopelagic species
	Brachydeuterus auritus	Bigeye grunt	NT	Coastal benthopelagic species in depths 10 – 1OO m, usually 15-80 m
Lutjanidae	*Lutjanus goreensis*	Gorean snapper	DD	Coastal reef associated species in depths 0-50 m
	Lutjanus fulgens	Golden African snapper	LC	Marine demersal species in water depths from 60 m, including deep offshore waters
	Lutjanus agennes	African red snapper	DD	Coastal demersal and reef associated species
	Lutjanus dentatus	African brown snapper	DD	Coastal demersal and reef associated species
Cynoglossidae	*Cynoglossus browni*	Nigerian tonguesol e	DD	Coastal demersal species in depths 15-40 m

Family	Scientific name	Common name	IUCN Status	General habitat
	Cynoglossus canarensis	Canary tonguesole	NT	Demersal species in depths 10-300 m
	Cynoglossus monodi	Guinean tonguesole	NT	Coastal demersal species in depths 10-30 m
	Cynoglossus senegalensis	Senegalese tonguesole	NT	Demersal species in depths 10-110 m
Carcharidae	*Carcharias Taurus*	Sand tiger shark	CR	Coastal species in depths 1-191 m
Dasyatidae	*Fontitrygon margarita*	Daisy stingray	EN	Coastal demersal species in depths 1-60 m
Rajidae	*Raja miraletus*	Brown ray	LC	Mainly coastal demersal species in depths 50-150 m
	Rostroraja alba	White Skate	EN	Demersal species in depths 30 – 600 m
Trichiuridae	*Trichiurus lepturus*	Largehead hairtail	LC	Benthopelagic species in depths 0-589 m, usually 100-350 m
Nomeidae	*Cubiceps gracilis*	Driftfish	LC	Pelagic-oceanic species in depths up to 100 m
Serranidae	*Epinephelus aeneus*	White grouper	NT	Demersal species in depths 20-200 m
Pristidae	*Pristis pectinata*	Smalltooth Sawfish	CR	Estuarine and shallow coastal waters
	*Pristis pristis**	Largetooth Sawfish	CR	Estuarine and shallow coastal waters
Rhincodontidae	*Rhincodon typus*	Whale Shark	EN	Coastal and oceanic pelagic, species in depths 0-1928 m, usually 0-100 m
Sphytnidae	*Sphyrna lewini*	Scalloped Hammerhead	CR	Coastal pelagic, semi-oceanic species in depths 0-1000 m, usually 0-25 m
Rhinidae	*Rhynchobatus luebberti*	African Wedgefish	CR	Coastal demersal species in depths 0-35 m

Family	Scientific name	Common name	IUCN Status	General habitat
Glaucostegidae	*Glaucostegus cemiculus*	Blackchin Guitarfish	CR	Coastal benthic species in depths 9-100 m
Squatinidae	*Squatina oculata***	Smoothback Angelshark	CR	Demersal species on continental shelves and upper slopes in depths 5-500 m, usually 50-100 m
Rhinobatidae	*Rhinobatos rhinobatos*	Coastal demersal species in depths 0-100 m	EN	Coastal demersal species in depths 0-100 m
Lamnidae	*Isurus oxyrinchus*	Shortfin Mako	EN	Mainly oceanic species, but present inshore at times in depths 0-750 m, usually 100-150 m
Gobiidae	*Bathygobius burtoni****	Goby sp.	EN	Demersal species in intertidal pools along rocky shores
Shellfishes				
Penaeidae	*Penaeus notialis*	pink shrimp	NE	Benthic species in depths 3-100 m, rarely as deep as 700 m, usually 3-50 m
	Parapenaeopsis atlantica	Guinea shrimp	NE	Benthic species in depths 1-60 m, usually 10-40 m
	Parapenaus longirostris	Rose or red deep-water shrimp	NE	Benthic species in depths 20-700 m, usually 150-400 m
	Penaeus monodon	Stripped or tiger shrimp	NE	Benthic species in depths 0-110 m.
Palaemonidae	*Palaemon hasta tus*	white shrimp	NE	Bentho-pelagic species in estuarine environments at depths 3-740 m.

**Possible locally extinct, **Presence uncertain ***Few small populations found, may not be present (IUCN 2019).*

Other commercially important species not included in Table 4.15 includes squid, octopus and cuttlefish. Some of the exploited fish species, e.g., bonga, croakers, sardinella, snappers, threadfins, shrimp and barracuda, make seasonal migrations from the sea into the creeks and back to sea. The mechanism of migrations and their significance to the coastal inshore fisheries has still to be evaluated, but creeks and lagoons are likely to act as nursery grounds (ERM, 2013).

Information on fishes in offshore deep waters is very limited. Table 4.15 provides information on some species that may be present in deeper waters. Weir (2010) reported on the sighting of a single whale shark 100 km offshore at a water depth of 1000 m at a location approximately 130 km west of the cable route. ERM (2013) reported upon the results from Remote Operated Vehicle (ROV) surveys around deep sea oil and gas installations completed in 2009 in Western Nigeria as part of the SERPENT project (http://www.serpentproject.com). During these surveys sharks (Squalidae), chimaeras (Chimaeridae), grenadiers (Macrouridae), rays (Rajidae), jellynose fish (*Guentherus altivela*) of the Ateleopodidae family, lobsters (*Munidopsis spp*.) and king crabs (Lithodidae), were observed (ERM, 2013).

4.5.3.2.5 Seabirds

Related to the coastal zone, a total of 13 bird families, comprising 45 species, have been recorded in Nigeria. The west coast of Africa forms an important section of the East Atlantic Flyway, an internationally important migration route for a range of bird species, especially shore birds and seabirds. The majority of coastal birds are regarded as migratory, utilising the mangrove shoreline areas of the estuaries for short periods each year, while others remain as resident species. ERM (2013) reported that the highest concentrations of seabirds (are experienced during the spring (around March and April) and autumn (around September and October) migrations. They also reported that a number of species breed along the West African coast in boreal winter and many also fly along the coast on migration between their northern habitats in the summer months. The migratory seabirds include a number of tern species (Sterna sp.), skuas (S*tercorarius* and *Catharacta sp*.) and petrels (Hydrobatidae).

ERM (2013) reported that the osprey (*Pandion haliaetus*) can be seen along the coastline predating for fish. However, the species that are most commonly seen are the common tern (*Sterna hirundo*), artic tern (*Sterna paradisaea*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), little tern (*Sterna albifrons*) and black tern (*Chlidonias niger*) (ERM, 2013). Finally, they reported that only a few seabirds breed in Nigeria; and that nearshore waters are largely avoided by most of the long-distance pelagic species such as shearwaters, petrels and phalaropes (ERM, 2013).

The majority of sea birds are considered to be of Least Concern as classified by the IUCN Red list), apart from the Damara Tern (*Sternula balaenarum*), which is classified as Vulnerable on the IUCN Red List. With the local population estimated to be at 14,000 individuals, the Damara Tern is considered one of the region's most at-risk seabirds (du Toit et al., 2002; Simmons et al., 1998). They feed predominately on small fish and squid in the upper limits of the water column and their migration is tied to the upwelling events. This species winters in small numbers at the Lagos Lighthouse Beach though may occur at similar environment elsewhere along the Lagos State coast (ERM, 2013). The Cape Gannet (*Morus capensis*) is classified as Vulnerable by the IUCN. This is a strictly marine bird that is present in Nigeria (South Energyx Nigeria Ltd, 2012), with the only land utilisation stemming from nesting areas on offshore islands and cliff faces, none of which shall be influenced by the current project. The habitat range stretches the entirety of the marine habitat of Nigeria and it feeds mainly on shoaling pelagic fish such as anchovy and sardines as well as by catch from fishing vessels. It is listed as Endangered in response to population declines driven predominately by depleted fish stocks that they depend on.

The beaches of the Project area show no evidence of breeding colonies or major roosting sites for seabirds. The beach environment lacks tidal mudflats and sandbanks and are therefore not likely to represent an important area for birds.

4.6 Socio-economic Environment and Health

4.6.1 Stakeholder Engagement

Stakeholders are defined as persons or groups who may be directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.

This section describes the activities that the Project has carried out to engage and consult with the identified key stakeholders. It describes the process by which stakeholders were identified, the means by which they were consulted, and the outcomes of the consultations to date, some of which were discussed under socio-economics and health. It further describes the actions that the Project took to disclose pertinent information to stakeholders.

4.6.1.1 Defining Stakeholder Engagement

Stakeholder engagement is an ongoing process of sharing project information, understanding stakeholder concerns, and building strong, constructive and responsive relationships. Effective stakeholder engagement ensures that project affected community and other concerned individuals and organisations are kept fully informed and can meaningfully participate in project planning, implementation and monitoring.

The stakeholder engagement process for the proposed Project is designed to conform to best practice. The focus is for building two-way communication between the project proponent and its stakeholders. The key objectives of the stakeholder engagement are to:

- Inform and educate stakeholders about the proposed Project;
- Gather local knowledge to improve the understanding of the environmental and social context;
- Better understand locally important issues;
- Enable stakeholders to make input into the Project planning process;
- Take into account the views of stakeholders in the development of effective mitigation measures and management plans; and
- Lay the foundation for future stakeholder engagement by building relationships.

4.6.1.2 Stages of Stakeholder Engagement

For the proposed Project, the four stages of stakeholder engagement process are as follows:

- Scoping
- ESIA study
- ESIA disclosure
- Project execution

Table 4.16 provides a summary of the process and stages of consultation for this ESIA study.

Table 4.16: Summary of the process and stages of consultation for the ESIA

Stages/Procedure	Goals	Objectives
Project Scoping and Design	• Registration with FMEnv • Discuss project design • Ensure compliance with FMEnv regulations and guidelines • Scoping workshop	• Adequate consultation with regulatory authorities • Obtain early inputs from stakeholders including potentially affected community.
Field Consultations	• Consultation with the potentially Affected Community • Additional consultation with	• Ensure the Project developer understands the concerns and issues raised by the local community so that

Stages/Procedure	Goals	Objectives
	relevant government authorities	appropriate mitigation measures can be taken. • Obtain relevant information on the Project area from relevant government authorities
Environmental reviews, analysis, reporting and public presentation	• Present results of field study • Discuss the potential impact/mitigation measures with proponent and regulators • Present the report for public review • Allow stakeholders determine whether their concerns are adequately addressed through the ESIA report review process	• Adequate consultation with stakeholders
Final Report	• Address the gaps observed at the in-house review	• Implement mechanism to ensure continuous consultation
Production of Final Report	• Finalize mitigation and disclose to stakeholders	• Mechanisms in place to ensure ongoing consultation and compliance with agreements
Implement ESMP	• Disclose result of monitoring • Implement public complaints/ grievance process	• Implement audit of proponent's project to assess environmental and social performance. • Ensure meaningful on-going consultation with stakeholders. • Evaluate lessons that could enhance proponent services to public
Final Evaluation	• Assess effectiveness of consultation process • Consult stakeholders for their assessment	• Lessons learnt might be transferred to other projects.

The following sections describe the stakeholder engagement activities that have been carried out so far.

4.6.1.2.1 Scoping Activities

At the scoping stage, project stakeholders were identified in order to understand the individuals, groups, and organisations that may be affected by or may influence project development positively or negatively. The identified stakeholders consist of individuals, groups, and organisations that may be affected or are likely to be impacted directly or indirectly by the proposed Project, have interest on the Project or are able to influence the Project positively or negatively. The list was developed using international guidance and considered the following groups:

- National, regional and local authorities;
- Local community leaders;
- Local community members including vulnerable sub-groups;
- International, national and local non-governmental organisations with interest in environmental and social issues;
- Research institutions and academics; and
- Local businesses / cooperatives and associations.

A scoping workshop for the ESIA study was held on October 29, 2019 at May Hill Hotel located at 14 Muritala Eletu Way, Lekki Penninsula II, Lagos. The workshop had the following stakeholders in attendance:

- Federal Ministry of Environment;
- Lagos State Ministry of the Environment and Water Resources;
- Lagos State Environmental Protection Agency;
- Nigerian Maritime Administration and Safety Agency;
- Nigerian Institute for Oceanography and Marine Research;
- Nigerian Ports Authority;
- Nigerian Conservation Foundation;
- Eti-Osa Local Government;
- High Chiefs from Ikate-Elegushi Community;
- Women leader and representatives from Ikate-Elegushi Community;
- Fishermen from Ikate-Elegushi Community;
- Youth leader and representative from Ikate-Elegushi community;
- Representatives of WIOCC; and
- Representatives of Elegushi Beach Management

The consultations served to provide stakeholders with information about the proposed Project and to gather information important to the ESIA. The objective was to identify any key concerns or high-level issues that the stakeholders had at the early stage. Additional consultation shall be undertaken as the Project progresses.

Prior to the scoping workshop, notification letters and Background Information Documents (BID) were sent to the identified stakeholders to provide high level information about the proposed Project. The acknowledged copies of the notification letters and a sample BID are provided in Appendix 4.1 while sample photographs taken during the scoping workshop, including attendance lists are presented in Appendix 4.2. Table 4.17 summarises the key highlights/findings of the scoping workshop.

Table 4.17: Initial Scoping Consultation Findings

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How comments will be addressed in the ESIA	Sections of EIA report that addressed comments
Federal Ministry of Environment, Abuja	Project overview, ESIA process and stakeholder consultation	– Welcomed everyone present at the Workshop on behalf of the Honourable Minister, Federal Ministry of Environment, Abuja – Expressed the Ministry's interest in the proposed Project, especially the area of potential or inherent impacts of Project activities on the environment and people – Opinions shared will be	- Due to the short delivery time of the proposed Project, activities are likely expected to be carried out during the day-time as well as in the night (as much as practicable). Adequate security measures will be put in place to ensure safety of workers at all time - CSR is a vital aspect of WIOCC projects. There are plans for infrastructural development that will be beneficial to host community under the Project's CSR plan. These would include rehabilitation of access road to the beach, employment	- Chapters 3, 4, 5, 6, 7

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will be comments addressed in the ESIA	Sections of EIA report that addressed comments
		key consideration for the progress of the proposed Project; hence, stakeholders are encouraged to freely share their thoughts on the Project. – Requested for clarification on some Project aspects including Corporate Social Responsibility (CSR) programs, number of workers that will be engaged during the installation phase, engagement of local workers during the installation phase, timeline for operation (working hours), and measures in place for adequate security	opportunities for members of the community, amongst others - Information on employment opportunities for the Project will be documented in the ESIA report	

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will comments be addressed in the ESIA	Sections of EIA report that addressed comments
Nigerian Ports Authority	Project overview, EIA process and stakeholder consultation	– Drew the attention of the Project proponent and the ESIA consultant to compliance with local and international laws and good international industry practice – Recommended post-commission impact assessment of the proposed Project	– Partnership with key stakeholders will be initiated to get necessary details and information that will ensure compliance with regulatory requirements and best practices. This practice will be sustained throughout the Project's lifespan. – The impact assessment will cover the entire Project life cycle	– Chapters 1, 3, 5, 7, 8
Nigerian Maritime Administration and Safety Agency	Project overview, EIA process and stakeholder consultation	– Sought clarification on safety of the fibre cable and coating technique to be used, methods of waste management, and types of surveys that will be carried out to access the impact of the Project on the people and environment	- Existing information on similar projects such as the WACS submarine cable will be leveraged upon to create a detailed database for the proposed Project to ensure minimal environmental footprint and least safety risks - A Project-specific waste management plan will be developed and implemented. The plan will be designed in line with the relevant local and	- Chapters 3, 4, 5, 6, 7

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will be comments addressed in the ESIA	Sections of EIA report that addressed comments
			international guidelines	
Nigerian Institute of Oceanography and Marine Research	Project overview, EIA process and stakeholder consultation	– Suggested that appropriate surveys to learn of any inherent or potential effect of the proposed Project should be carried out – Proper maintenance and monitoring scheme should be incorporated to ensure long sustainability of the project – Expressed concerns on the biodiversity effect of the cable installation process – Identified the need to consider water and sediment quality impacts during cable installation. – Requested clarification on separation of terrestrial ESIA study from	– The marine and terrestrial system aspects of the proposed Project are being handled by two different firms, ASN and WIOCC. Hence, two (2) separate ESIAs are being carried out. However, both firms are working together on the ESIAs as the final results are interconnected – The longevity of the beach manhole will be monitored and consistently maintained to ensure the 25 years sustainability is achieved – The proposed fibre cable comes with technologically advanced features when compared to the existing cables, hence, is more reliable and will offer better services – The selection of Elegushi beach as the preferred location is based on many desktop studies and	Chapters 1, 3, 4, 5, 6, 7

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will be comments addressed in the ESIA	Sections of EIA report that addressed comments
		marine ESIA study – Requested for evidence of data from desktop studies used as the basis of selection for the cable routes – Sought to know the justification for selection of Elegushi beach and not Badagry – Raised concern on the need to lay a separate cable since there were already existing underground cables laid by other actors few years back – Certainty on the 25 years longevity of the beach manhole due to coastal erosion – Expressed concern related to electricity for marine wildlife	technical cable route survey – Minimum risk of electrical related impacts on biodiversity is expected from the fibre cable since the proposed cable is a telecommunication cable with little radiation of electrical magnetic fields. It differs from a power cable – Minimal risk of water and sediment quality impacts – Low level impacts to biodiversity are anticipated	
Youth representatives	Project overview,	- What are the impacts of the proposed	- Waste and pollution streams associated with the	Chapters 3, 5, 6, 7

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will comments be addressed in the ESIA	Sections of EIA report that addressed comments
from the Ikate-Elegushi community	EIA process and stakeholder consultation	project on economic activities? - Adequate measures should be put in place to ensure that environmental impacts such as noise and water pollution are mitigated	Project installation and alteration in biodiversity would be managed following best practices - Also, the impacts due to noise and other pollution would be easily reversed since the timeline for the Project is short - Appropriate and cost-effective mitigation measures shall be proffered for all the potentially significant impacts of the Project. Mechanism to monitor the implementation of the recommended mitigation measures shall also be put in place	
Chiefs from Ikate Community	Project overview, EIA process and stakeholder consultation	- Appreciated the Project proponent for the initiative of bringing the Project to their locality - Expressed concern on how the duration of the Project will disrupt economic activities like	- There would be continuous consultation with the community and other stakeholders. The scoping workshop is part of an early stage consultation which will be sustained throughout the Project lifecycle - The footprint of the proposed Project is very small.	Chapters 4, 5, 6, 7

Stakeholder	Priority Issues	Quotes / Comments during Scoping Workshop	Response to comments / How will be comments addressed in the ESIA	Sections of EIA report that addressed comments
		fishing within the Project area - Demanded for proper mitigation of the disruption in economic activities which may arise as a result of the Project activities - Requested that frequent contact and consistent meeting between the Project proponents and the community is sustained	Identified impacts will be properly mitigated	
Lagos State Environmental Protection Agency	Project overview, EIA process and stakeholder consultation	- Applauded the Project initiative and encouraged sustainable use of environmental resources	-	-

4.6.1.2.2 Post-Scoping ESIA Activities

A socio-economic survey was completed to inform the ESIA. This is discussed under Section 4.6.3.

4.6.2 Socio-economic characteristics of the Marine Environment

The marine environment of the Project area consists of the nearshore section of the proposed submarine cable route from the point of duct connection at Elegushi beach seaward to the limit of the EEZ. The information presented in this section is based on desktop-based review and the technical survey of the cable route. The socio-economic characteristics of the marine environment are discussed in the following paragraphs.

4.6.2.1 Fishing and Anchoring

Fishing activities in the marine and coastal areas of Nigeria are a major source of employment for coastal communities and can be categorised into two (2) types: artisanal and industrial marine fishing. Artisanal marine fishing grounds along the Nigerian coastline cover up to 5 nautical miles (Nm) offshore and are limited to 20 m depth contour. However, due to motorisation and targeted stocks, some fishermen may venture farther into the Atlantic Ocean. The fishermen operate by means of wooden canes with on board engines, and use traps, nets and hooks to target demersal species such as croakers, catfish, and shiny nose, and shrimp in the estuaries (Olaoye and Ojebiyi, 2018).

Industrial marine fishing activities are only permitted from 5-30 Nm offshore, in including the areas up to the boundary of the EEZ. This zone is the major industrial fishing ground for Nigeria's marine fisheries resources; mainly the offshore tuna fishery, coastal demersal fish fishery, and coastal shrimp fishery. Due to technical constraints, the Nigerian fishing industry is yet to fully explore this zone. Also, the inshore industrial fishing grounds are considered to be within the section from 20 to 50 m water depth, while the offshore industrial fishing grounds are considered to be sections deeper than 50 m water depth. There are trawling companies in Nigeria, under the Nigerian Trawler Owners' Association (NITOA), who actively bottom trawl fishing grounds between 20 and 300 m (MTN Nigeria, 2011; Olaoye and Ojebiyi, 2018).

Fishing vessels in Nigeria are mainly artisanal, operating on the nearshore areas as well as lagoons and estuaries. The cable landing site is within the limits of Lagos Port (Figure 4.15), which is policed by the Nigerian Port Authority (NPA). The area is protected from anchoring and commercial fishing within the region and to a distance of 30 km offshore and out to a water depth of 100 m, i.e. on the continental shelf area. During the technical survey of the cable route conducted in September 2019, no indication of fishing activities in the deep water area but many small fishing boats and fishing gear nearshore (Fugro, 2019). Fugro (2019) did record dozens of small wooden fishing boats and floats (canisters) with fishing gear were observed in water depths <55 m. It was realised that all fishermen disappeared from midday on and the route was clear in the afternoon and evening. Whenever the survey vessel came back to this area after midday, the area was clear of fishing gear and fishing boats. Fugro (2019) also reported that during coring operations at around water depths of around 1000 m, the deployment was delayed due to an abandoned float with fishing gear, but this only shows the dispersal of waste rather than confirmation of any activities in this area.

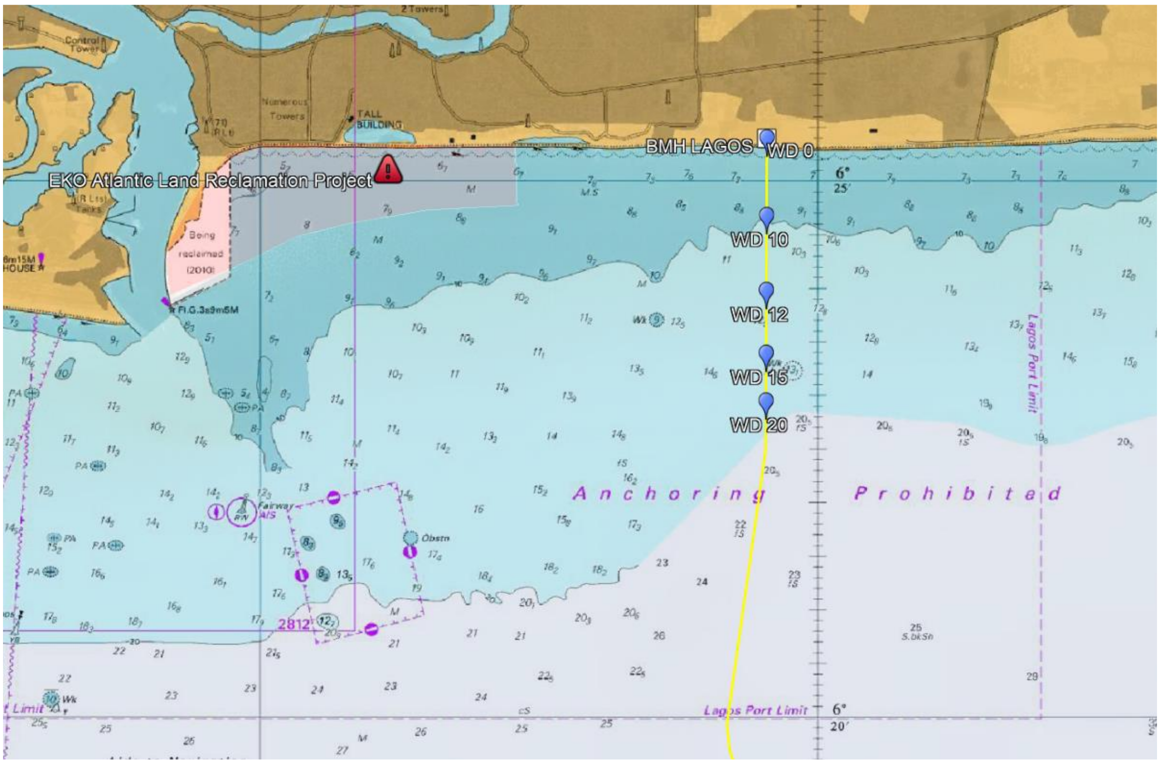

Figure 4.15: Lagos Port Limits and Prohibited Anchoring / Fishing area (Source: Pelagian, 2019)

The Commodore Channel, which runs directly to the west of the cable landing site (approximately 10 km away), is the access route to Lagos Port. This stretch of water is also under the jurisdiction of NPA. A large number (>50) of commercial vessels (cargo, container etc.) are regularly moored in the waters immediately offshore of Lagos, awaiting entry to the port. These vessels tend to be anchored in an anchorage area to the south and west of the Commodore Channel, approximately 11 km west of the cable landing site. The proposed cable route does not cross any anchorage areas. However, it was reported that there is a large anchorage area for Lagos port west of the route at about 13 Nm, as well as the Fairway Buoy about 5 Nm. The area around Fairway Buoy is frequently used as anchorage area for clearance of vessels (Pelagian, 2019).

4.6.2.2 Ports

Major ports in Nigeria include Calabar, Port-Harcourt, Warri, Sapele, Koko, Onne and Lagos port. The Apapa and TinCan ports in Lagos are located approximately 7 km west of Lagos. TinCan port handles wheat, maize and malt and is the second busiest port in Nigeria with the port at Apapa being the busiest. The NPA owns and operates the Nigerian ports, including the Lagos Port Complex (port of Lagos) which is located at the Apapa area of Lagos. Figure 4.16 presents an overview of marine traffic in the general nearshore area of the cable route based on annual 2017 density data.

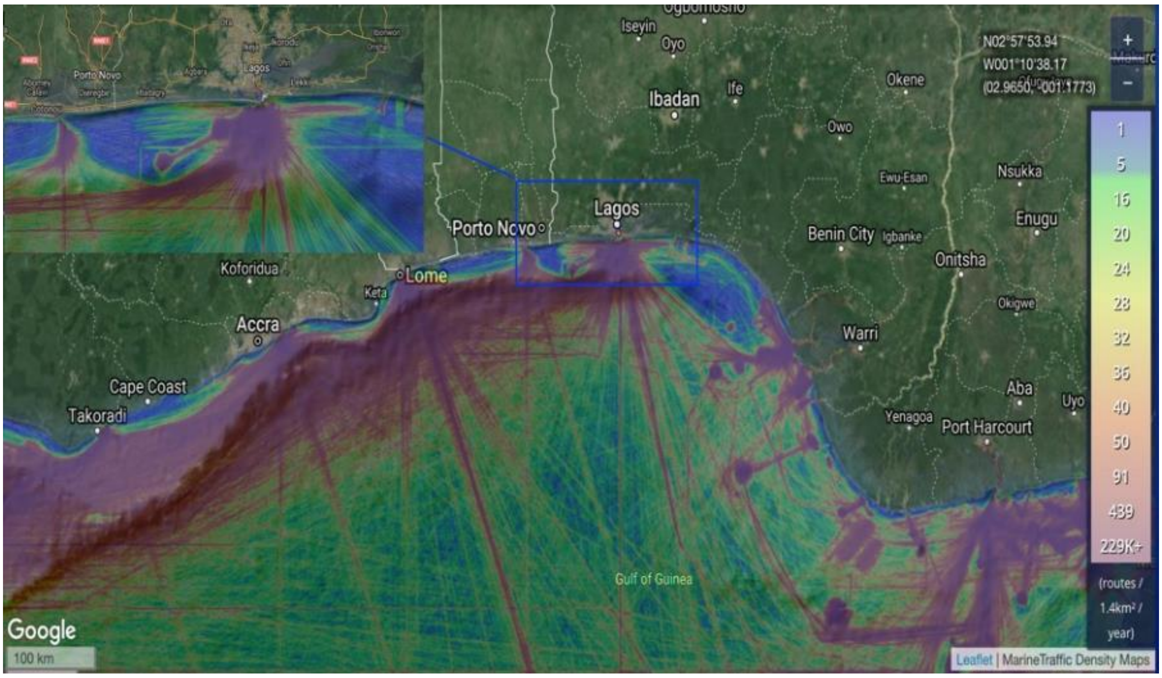

Figure 4.16: Shipping Density around Lagos (Source: marinetraffic.com 2019 showing data for 2017)

During the cable route survey, very low to no traffic was observed during the survey along the cable route. Some moderate traffic was observed closer to Lagos due to the anchorage area about 7 NM west of the route (Fugro, 2019). Based on site visits, cable route survey and review of relevant literature, the subtidal area across the cable route is not within the designated shipping channels or anchorage areas and is not used for water sports vessels.

4.6.2.3 Oil and Gas Concession and Exploration

Nigeria is Africa's largest oil producer with offshore fields replacing onshore projects in recent years. Nigeria's oil fields are predominately situated in the Niger Delta, with the majority of oil/gas activity centred in Port Harcourt (Hub), Warri, Forcados and Escravos in the south-south part of the country.

In total, the cable route crosses 14 Oil Concession Block Boundaries (Fugro, 2019). Many of these blocks have not been allocated, but desktop studies revealed that the cable route is set to pass through three licenced blocks that have companies with interests; and there are no known or planned oil and gas projects in the region. These are owned by ConocoPhillips Nigeria (OPL 318), Korea National Oil Corporation (OPL 321) and Sunlink Petroleum Limited (OPL 311) (Figure 4.17).

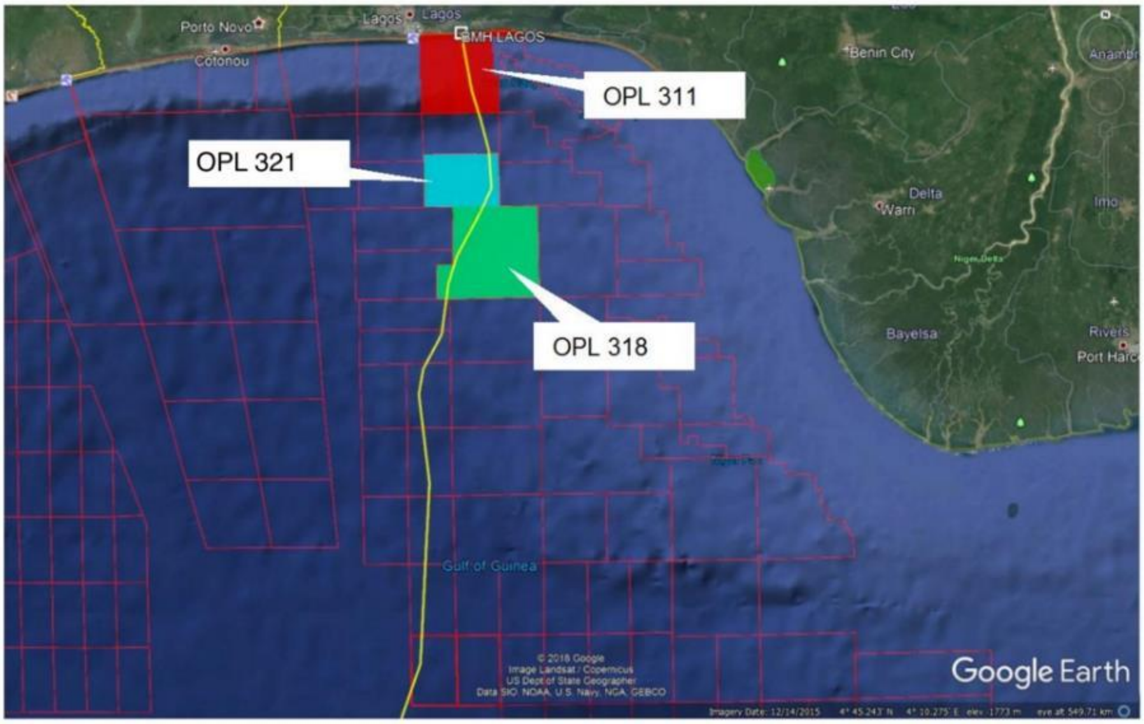

Figure 4.17: Proposed Oil Concession Blocks and the Proposed Cable Route (ASN, 2019)

4.6.2.4 Dumping, Dredging and Reclamation

There are no known dumping sites of chemical or spoilage known in the vicinity of the cable route (Fugro, 2019).

Sand dredging is prevalent around the Nigerian coastline in order to fortify eroding beachlines and for reclamation of swamplands and coastal areas.

The cable landing site is approximately 3 km east of EKO Atlantic City reclamation project, which commenced work in 2010 (Figure 4.18). The reclamation project involves dredging of sand from an offshore borrow areas for reclamation of the ocean, strengthening of the East Mole near the Commodore channel by quarry materials to enable the use of the mole as an access road, navigation of vessels from the borrowed pit to the reclamation area and operation of tug vessels to assist the berthing of dredging vessels on the East Mole.

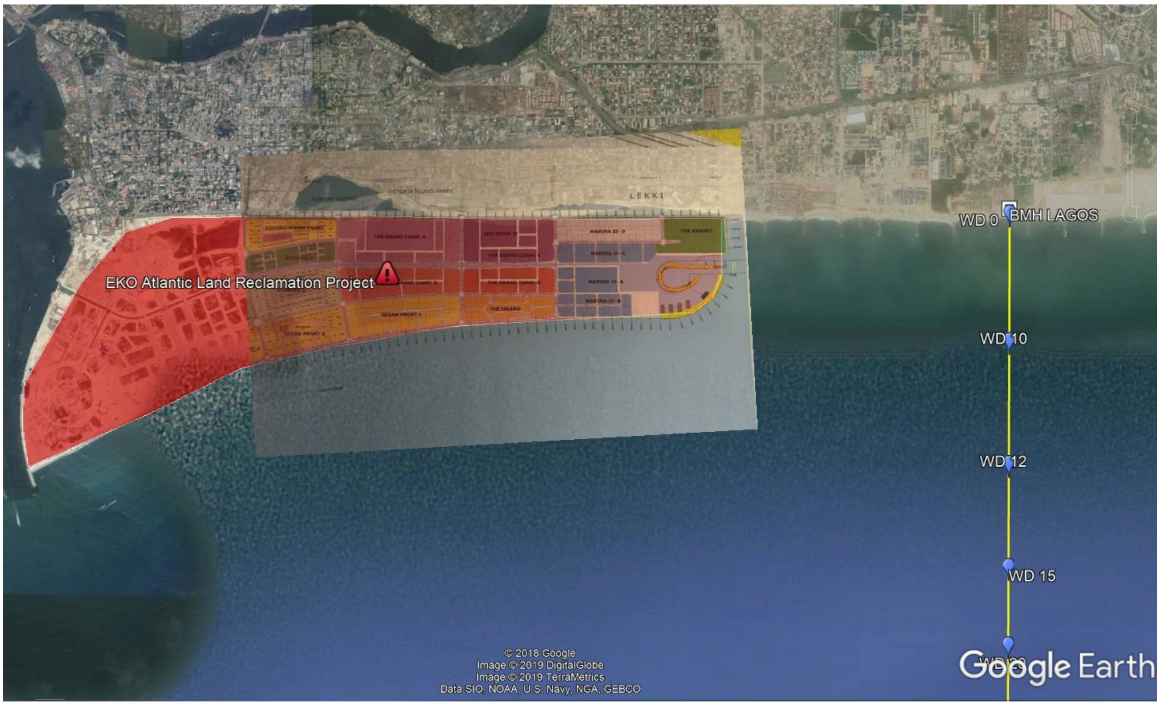

Figure 4.18: The EKO Atlantic City Reclamation Project and the cable route up to the BMH location adjacent Elegushi beach

The coastal area at the cable landing site has been subject to coastal erosion in the past, which had caused damage to coastal properties and loss of beach sand. In 2014 the Nigerian Government began a process of building beach protection groynes, working from west to east along the coast. The first western-most groyne was installed in 2013 and the works were completed in 2019. A total of 19 groynes had been completed as at January 2019 (Pelagian, 2019). The cable landing site is between groynes 8 and 9. The purpose of the groyne construction was also to alleviate coastal erosion problems relating to the EKO Atlantic land reclamation project.

The survey conducted by Fugro (2019) indicated that the cable route passes through an area of possible dredging scars in the shallow water (12 m water depth), between 06° 20.4173' N, 003° 29.6209' E (9.275 km point) and 06° 19.2343' N, 003° 29.6972' E (11.524 km point).

4.6.2.5 Cables and Pipelines

In total, the proposed cable route crosses nine out-of-service and eight in-service cables (three in-service cables and four out-of-service cables in the shallow water section while five in-service cables and five out-of-service cables were crossed in the deep-water section) (Fugro, 2019).

In the subtidal areas across the submarine cable route, there are existing cables and they include the following amongst others; Nigeria Domestic cables; GLO-1;

ACE; MAIN ONE S9; WACS SEG 2A (8.1) & 2B (8.3), SAT 3 SEG 7, WACS SEG 1K (7), SAIL etc.

There are no pipelines along the cable route.

4.6.2.6 Coastal Shipwrecks

During the cable route survey, one wreck was identified in the inshore survey area and a potential one in the shallow survey area.

The wreck in the inshore survey area was approximately 160 m east of the proposed cable route very close to shore in water depths of <7 m. The wreck is approximately 65 m west to east, and 10 m wide from north to south. It was noted to be resting in an upright position on the seabed with the main deck level facing upwards. The wreck was visible at the water surface during survey.

Another wreck was found in the shallow water survey area approximately 4 km offshore in water depths of <15 m. This wreck is located approximately 407 m west of the proposed route. According to Fugro (2019), the potential wreck appears as north-south high reflectivity striations with two mounds to the south-east, visible in the MBES bathymetry data. The potential wreck is approximately 31.7 m north to south, and 13.6 m wide from west to east.

4.6.2.6 Military Practice Areas/restricted zones

The findings from the cable route survey indicate that no military practice areas were crossed by the submarine cable route.

4.6.3 Socio-economic characteristics of the Terrestrial Environment

This section provides information on the socio-economic and health conditions of Ikate-Elegushi community identified within the AoI. The description provides information on the baseline conditions in the community, which is essential to the identification and assessment of the potential impacts of the proposed Project.

4.6.3.1 Study Methodology

The socio-economic survey involved both quantitative and qualitative methods of data gathering, analysis and reporting. Quantitative data were collected at the individual level through the administration of questionnaires. Qualitatively, consultations were conducted with representatives of relevant groups in the community (e.g. women group, men group, youths and fishermen). In addition, key informant interviews were held with the community chiefs. Direct observations were also conducted within the community by the survey enumerators. The socio-economic survey was conducted from May 27th to June 1st, 2020 and was witnessed by an FMEnv representative.

Secondary data were obtained from the desktop review of relevant published information, including reports of past surveys and studies in the area.

4.6.3.2 Sampling, Data Collection, Analysis and Reporting

❖ *Sample Size and Sampling Technique*

Due to paucity of population estimate data for Ikate-Elegushi community, the sample size for the quantitative session of this survey was determined using a margin error of 5 %, a confidence level of 1.22 and standard deviation of 0.5.

$$\frac{1.22^2 \times 0.5(0.5)}{0.05^2} = \frac{1.5 \times 0.25}{0.0025}$$

$$\frac{0.375}{0.0025} = 150.00$$

Therefore, 150 respondents were interviewed for the quantitative study. The target population were men, women, youths, and the elderly.

❖ *Data Collection, Analysis and Reporting*

The quantitative data (questionnaire administration) was conducted through the use of Open Data Kit (ODK) using KoboToolBox online data gathering platform. The questionnaire was scripted and downloaded on Kobo Collect server, then administered to individuals in the community using KoboCollect mobile app on Android phone. Convenience sampling method was adopted for the questionnaire administration in the community. The respondents from the community were chosen because they met the criteria established for this survey, such as easy accessibility for the survey team, geographical proximity to the Project site, availability at a time of survey, and the willingness to participate in the study. This was adopted with the expectation that each participant will provide unique and adequate information of value to the study.

To gain access the community for the qualitative survey, the survey team identified and engaged a "gatekeeper". The gatekeeper was Chief Ayuba Babalola Elegushi, a high-ranking Chief in Ikate-Elegushi Community. Upon gaining access, the survey team was able to conduct interviews, organise focus groups and collect the essential qualitative data during the survey.

The key informant interviews (KII) and focus group discussions (FGDs) were audiotaped (after getting the consent of the responders) using a digital recorder. The questionnaire survey data collected were later downloaded into Stata software for analysis, while the audiotapes were transcribed for reporting. The reporting of the socio-economic survey has been structured using the Social

Framework for projects developed by Smyth and Vanclay in 2017. The framework was adopted for this study due to its suitability in understanding, assessing, planning and managing of Project-related social issues.

4.6.3.3 Ethical Considerations

All interviews commenced with the informed verbal consent of participants. Confidentiality and anonymity were maintained through secure storage of data in password-protected computers. Participation was voluntary and respondents were allowed to withdraw at any point they feel uncomfortable to continue with the study. Sample photographs of socio-economic survey activities in the study area are shown in Plate 4.3 while the field data gathering tools are presented in Appendix 4.3.

Questionnaire administration with FMEnv Representative

Questionnaire administration within the community

Questionnaire administration within the community

Interview with the Secretary of Association African Traditional Religion Practitioners in the community

Focus Group Discussion with representatives of fishermen in the community

Focus Group Discussion with representative of men group in the community

Focus Group Discussion with Youths representatives in the community

Focus Group Discussion with representative of women group in the community

Plate 4.3: Sample pictures of socio-economic survey

4.6.3.4 The Socio-Economic Baseline Report Structure

In line with the social framework for projects developed by Smyth and Vanclay in 2017, the socio-economic baseline report is structured as follows:

- Overview of key socio-economic indicators of Nigeria
- Demographic Profile
- Administrative and socio-cultural institutions
- Livelihood Assets and Activities
- Infrastructure and Services
- Housing, Business Structures and Settlement Patterns
- Land Acquisition
- Health Profile
- Gender Assessment
- Community Concerns, Perceptions and Expectations

Where required, the general information on the socio-economic conditions of Nigeria and Lagos State is provided to better understand the baseline data gathered during the socio-economic survey of the Ikate-Elegushi community.

❖ Overview of Key Socio-Economic Indicators

According to the data presented by the World Bank, Nigeria is Africa's most populous country with the 2020 population estimate of 202 million people based on a population growth rate of 3.2 % per annum (NBS, 2018). The UN Department of Economic and Social Affairs (2018), projected that Nigeria will add 189 million to her current population between the year 2018 and 2050. Approximately 51 % of the national population is male while 49 % are female (NBS, 2019). Nigeria is a multi-ethnic country with socio-cultural differences among its component ethnic groups. Although the major ethnic group can be categorized into Hausa, Igbo and Yoruba, each manages separate geographical location distinctive from another. These cultural dissimilarities have been manifested by the differences in culture which include language, diet, dress and choice of social system. Table 4.18 shows key socio-economic indicators for Nigeria.

Table 4.18: Key Socioeconomic indicators for Nigeria

Socio-economic indicator	National Level	Source
Population (m)	202 million (2020)	World Bank https://worldbank.org/en/country/nigeria/overview#1
Population growth rate	3.1 % (2019)	Nigeria Bureau of Statistics Report, 2019
Life expectancy (Years)	53.9 (2017)	UNDP Human Development Report 2018 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NGA.pdf
HDI Index Value	0.532 (2017)	UNDP Human Development Report 2018 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NGA.pdf
Religion	Christianity 46.3 % Muslim 46 % Traditional 7.4 % Others 0.3 %	ACS ITALIA https://acs-italia.org/wp-content/uploads/Nigeria.pdf
GDP per capita	USD 6,030.4 (2018)	IMF: World Economic Outlook http://nigeria.opendataforafrica.org/pjeqzh/gdp-per-capita-by-country-statistics-from-imf-1980-2023?country=Nigeria
Inflation rate (%)	13.39 (May 2020)	Statista https://www.statista.com/statistics/383132/inflation-rate-in-nigeria/
School enrolment, primary	25,591,181 (2016)	Nigeria Education Indicators https://www.nemis.gov.ng/downloads_fold/Nigeria%20Education%20Indicators%202016.pdf
Adult Literacy rate (15 years and above) (%)	62.1 % (2018)	Knoema Data https://knoema.com/atlas/Nigeria/topics/Education/Literacy/Adult-literacy-rate#:~:text=Nigeria%20adult%20literacy%20rate%20was,up%20from%2051.1%20%25%20in%202008
The proportion of total	67.3 (2015)	World Health Organisation

Socio-economic indicator	National Level	Source
population served with piped water (%)		https://www.who.int/water_sanitation_health/monitoring/investments/nigeria-10-nov.pdf?ua=1#:~:text=Access%20to%20water%20supply%20was,third%20of%20the%20rural%20population
Hospital beds (per 10,000 population)	8 (2014)	Healthcare Resources Guide: Nigeria https://2016.export.gov/industry/health/healthcareresourceguide/eg_main_092285.asp
People Living with HIV/AIDS	1.9 million (2018)	UNAIDS https://www.unaids.org/en/regionscountries/countries/nigeria

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

- Demographic Profile

Population Distribution

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

Using 2006 population census with a population growth rate of 3.2 % (National Bureau of Statistics, 2018), Lagos State has a 2020 population projection estimate of approximately 15 million people, of which 51.8 % are estimated to be male while 48.2 % are estimated to be female. The bulk of the state population is skewed towards economically active people, with the age group of 15-64 years making up about 65 % of the total population, while 32.4 % of the population are within the age group of 0-14 years.

Lagos State is divided into 20 Local Government Areas (LGAs) and the cable landing site falls in Eti-Osa LGA of Lagos State. The LGA had a total population of 283,791 in 2006, which constituted approximately 3 % of Lagos State's population. The LGA has land size of 193.5 km², which translates to an average density of 1467 people per square kilometres, a very high density resulting from shortage of dry buildable land. The national population commission (NPC) had projected that the LGA will experience a growth rate of 4.37% per year but available records from the Lagos state government, revealed that the Eti-Osa LGA actually has the highest growth rate of 10.28.

Marital Status

In Nigeria, marriage is regarded as a union of a man and woman. However, in some regions, marriage of a man to more than one woman is acceptable. According to the 2018 Nigeria Demographic and Health Survey, 70 % of women and 57 % of men within the age range of 15 – 49 are currently married. The median age at first marriage among Nigerian women within the age range of 20-49 is approximately 19 years. Men marry later than women, with the median age at first marriage being 27.7 years. The 2018 Nigeria Demographic and Health Survey revealed that 99.3 % of married men in Lagos State are monogamous while less than 1 % of married men are in polygamous marriages.

The marital status of the respondents interviewed during the survey showed that about 51.17 % were married, 45.97 % were single, 1.04 % were divorced and 1.82 % were widowed. Also, 39.44 % of those married were from monogamous families and 60.56 % were from polygamous families.

Culture, Ethnicity, and Religion

Nigeria has over 250 ethnic groups, the most populous and politically influential are the Hausa and Fulani having a 29 % share of the country's population, Yoruba with 21 %, Igbo (Ibo) with 18 %, Ijaw with 10 %, Kanuri with 4 %, Ibibio with 3.5 %, Tiv with 2.5 % and others have 12 % share of the population (CIA World Factbook, 2018). There are over 500 indigenous languages spoken in Nigeria but the most populous ones are Igbo (Ibo), Hausa and Yoruba. English is the official spoken language in Nigeria.

The Yoruba language is the dominant language spoken by the locals in Ikate-Elegushi Community. According to the data collected during the KII and baseline survey, Ikate-Elegushi community is composed majorly of Yoruba ethnic group. People from other ethnic groups such as Hausa and Igbo are also present in the community.

The predominant religions in Nigeria are Islam and Christianity, although there are also traditional worshippers and few atheists. The traditional African religion is acknowledged to be prevalent in most parts of the Eti-Osa LGA before the introduction of Islam and Christianity. Today, there exists within the community, a mix of various religious bearings, with Islam and Christianity being predominant. During the survey, 41.82 % of the respondents professed to be Muslims while 57.14 % stated that they were Christians.

In Lagos State generally, the people engage in various forms of festivals and carnivals such as Eyo Festival, Lagos Black Heritage Festival, Lagos International Film Festival, Lagos Seafood Festival, Yoruba Arts Festival. However, the Eyo festival (otherwise known as the Adamu Orisha Play) seems to be the major and internationally recognized festival in Lagos.

Ikate-Elegushi community celebrates different festival and traditional rites. Some of which are Oroo, Osun festival, Olokun festival, Elegba, Awon Idile fraternity, Ogun Ajobo, Igun Nuko and Egungun, among others. Table 4.19 shows the day / month of the year when these festivals and traditional rites are celebrated.

Table 4.19: Key traditional festivals in Ikate-Elegushi community and the celebration period

S/N	Festivals/Traditional rites	Day/Month of Celebration
1.	Oroo	October
2.	Osun	Every Thursday
3.	Olokun	August 20
4.	Elegba	February
5.	Awon Idile	Every 14 days
6.	Ogun Ajobo	December 21.

Source: EnvAccord Field Survey, 2020

Community Migration Status and Patterns

Migration in Nigeria has been very dynamic, in terms of the spatial patterns, the nature of the actors and processes (Ikwuyatum, 2016). Lagos is a commercial city-state with sound economic base, strategic location and socio-political importance which has induced a high rate of rural-urban immigration from other parts of the country.

Migration into and out of the community is evident as there are different people from different ethnicities within the community. Some of the factors identified as the cause of the migration into Lagos State and Eti-Osa LGA include economic and social development, job opportunities, and luxury. During the baseline survey, it was gathered that emigration is caused by factors such as education (there are no major tertiary institutions in the community), temporary skilled and unskilled jobs that are not readily available within the community, and high cost of accommodation.

Over 69 % of the respondents had lived in Ikate-Elegushi community for more than 10 years, 13.58 % had lived in the community between 5 - 9 years, 12.35 % had lived between 1 - 4 years and 4.94 % had been in the community for less than one (1) year. This suggests that the respondents have a good knowledge of the community.

Crime and Security

The crime statistics (NBS, 2017) of reported offences in Nigeria revealed that approximately 134,663 cases were reported in 2017. Offence against property had the highest proportion with 68,579 of such cases reported, offence against persons recorded 53,641 cases, and offence against lawful authority recorded the least with 12,443 cases. Based on the 2017 records, Lagos State had the highest percentage of total cases with 50,975 (37.9%) cases reported (NBS, 2017).

The Nigeria Police Force (NPF) is the principal law enforcement and the lead security agency in Nigeria. However, Lagos State Government has established an indigenous security agency: Lagos Neighbourhood Safety Corps (LNSC), a uniformed security agency established by a law of the Lagos State House of Assembly in 2016 to assist the Police and other security agencies to maintain law and order in the state. The LNSC operate in all the local government areas in Lagos including Eti-Osa.

Information obtained during the KII with the community chiefs and the FGD with the youths revealed that crime is not a common challenge within the community, and the community has not experienced any major crimes in the past few years.

Ikate-Elegushi Community Profile

Ikate-Elegushi is a built-up urban community with a history dated back to 1601. The community is part of the Eti-Osa land area founded by the people who migrated into the area around the 16th century. The community is one of the major settlements in Eti-Osa.

The community chiefs during the KII briefly discussed the history of Ikate-Elegushi community. The history of Ikateland started from Elegushi, one of the 36 sons of Olofin, the progenitor of Eko now called Lagos. Eleven (11) sons of Olofin's family, of which Elegushi was one of them stayed at the Lagos Island. These sons are called *Igejo*, (landowner). Elegushi communal area is named after one of the sons who stayed in one of the areas in Lagos Island called Eti-Osa.

The survey results and information obtained during KII put the average household size in the community at 6 persons with more females in the households than males. With regards to age distribution, about 40.74 % of respondents were within the age group of 18-30 years; 33.33 % were between 31-42 years; 17.28 % were within 43-54 years; while 8.64 % of the respondents were 55 years old and above. The community has an economically active population.

❖ Administrative and Socio-Cultural Institutions

Two levels of administration are recognised in the Lagos State: the formal government and the local/traditional administration. At the formal governmental level, the community is under the local jurisdiction of the Eti-Osa LGA which has its headquarters at Kilometre (Km) 15, Lekki-Epe Expressway, Igbo Efon, Eti-Osa.

Traditional leadership remains a strong and respected structure in Lagos State, just like many other States in Nigeria. The powers of traditional leaders are still much relevant in modern times, the respect and ceremony that surround these positions remain strong, and also these leaders retain significant influence over their people. Although the traditional political and social systems vary in different parts of the Yoruba regions, each town usually has a leader (Oba or Baale), who achieves his position in one of the three following ways: inheritance, participation in title associations, or personal selection by an Oba/Baale already in power. A council of chiefs usually assists the Oba/Baale in his decisions.

The traditional administrative system deals more on issues relating to the peoples' culture and values. They are therefore the custodians of the peoples' cultures and values and are important and revered institutions in the settlement of the land dispute, inter and intra community disagreements. The Ikate-Elegushi community has an established traditional administrative structure (Figure 4.19) under the control of Oba Ikate-Elegushi. The Oba has a council of high chiefs and Baales. The *Baales* take charge of the affairs of their respective domains but report to the Oba and the chiefs. The *Baales* settle disputes within their jurisdiction, assist in the administration of affairs in the community, and pay royalties to the Oba. They are supported by the designated Youths and women leaders.

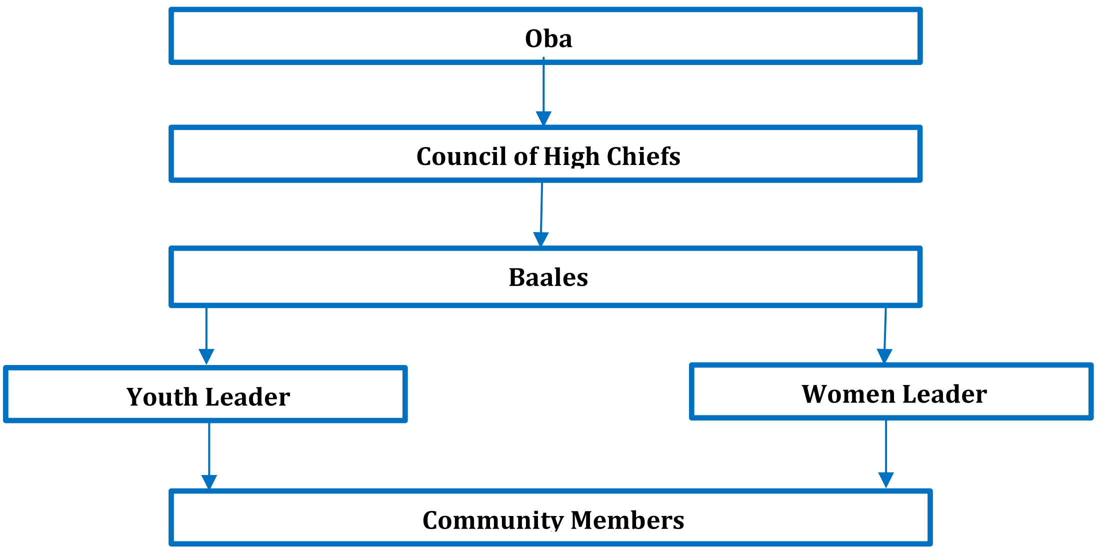

Figure 4.19: Traditional Administrative structure of Ikate-Elegushi

The administrative governance of the community ensures that peace, unity, tolerance, interactions and developments are undertaken to improve the lives of the community. The *Baales* presides at community meetings. The youth play a major role in uniting the community, while at the same time organise themselves as community protection from criminals and external aggression. The women leaders, headed by Bilikisu Elegushi, help in organising women for special occasions, festivities and other 'feminine' duties.

The King of the Ikate-Elegushi Kingdom is His Royal Majesty Alaiyeluwa Oba Saheed Ademola Elegushi (Kusenla III). The 21st monarch of Ikake-Elegushi has spent over a decade on the throne. He inherited the throne from his late father who passed on November 17, 2009. The cross-sectional view of the King's palace is shown in Plate 4.4.

Plate 4.4: A: The entrance of the Oba Ikate-Elegushi Palace. B: Inside the main palace of the Oba Ikate-Elegushi

- <u>Livelihood Assets and Activities (Economics, Livelihoods, and Employment)</u>

Key Livelihoods

Lagos state economy is dominantly driven by commerce and manufacturing, with up to 80 % of the population engaged directly or indirectly. The informal sector is strong and diverse, with numerous small and medium enterprises (SMEs) across all economic activities and contributing approximately 60 – 70 % of output and employment (Nwagwu and Oni, 2015).

As noted during the survey, Ikate-Elegushi is a well built-up environment with thriving large and medium scale businesses. There are banks, filling stations, shopping malls, business centres, restaurants, hotels, etc. in the community. Construction of housing estates is ongoing in different areas of the community, which constitutes the major thriving economic activity in the community. Informal businesses are also thriving with shop outlets stationed in different areas, local food vendors, transportation businesses (i.e. taxis and motorcycles), auto repair shops, welders, etc.

The economic activities observed in the immediate surroundings of the cable landing site at the beach include manufacture of cement block, sand dredging for the raising of development land, and sales of food items.

The use of Elegushi beach and the coastline has been for recreational purposes and has attracted both international and local tourism. Visiting the beach can be considered as an affordable way for a large part of the low- and middle-class people to spend weekends and holidays.

Economic Activities

Informal and formal sectors are major sources of employment in the community. Within the community, businesses are owned by corporations and individuals. The survey data revealed that 92.21 % of the sampled members of the community are currently employed or engaged in economic activity while 7.79 % are not formally employed or engaged in economic activity. Also, 56.64 % of the community members are self-employed; 25.17 % are engaged as salary-earned workers with formal skills; and 18.12 % of the respondents are salary earners without formal skills (e.g. petrol pump attendants and sales clerks). Figure 4.20 provides a summary of employment status of respondents during the survey.

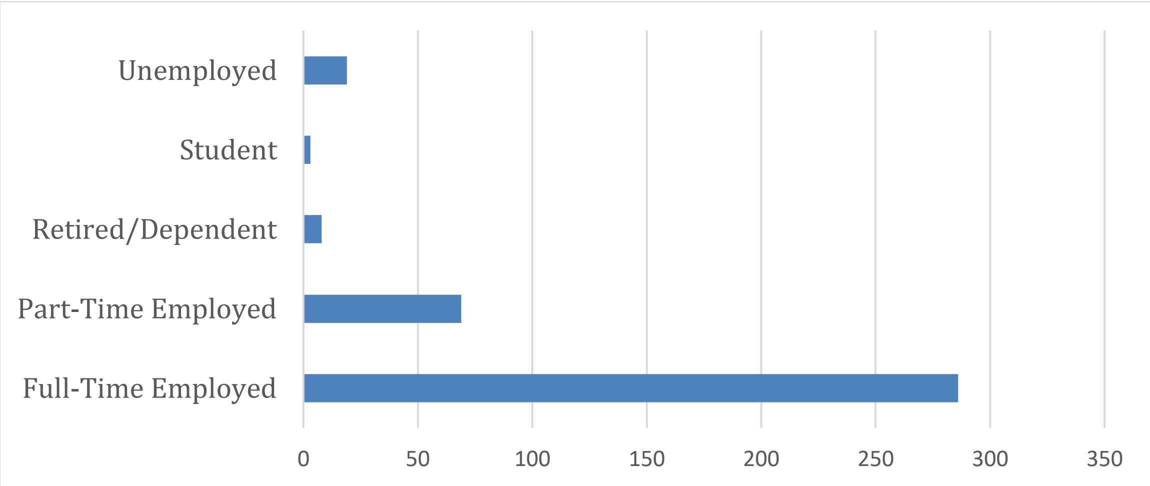

Figure 4.20: Employment status among sampled members of the community

Among the employed respondents, 80.56 % are gainfully employed on a full-time basis while 19.44 % are employed on a part-time basis. While among the unemployed respondents: 26.67 % are retired and spend their time at home with their families, 63.33 % are seeking for employment opportunities, and 10 % are students, many of whom are in tertiary institutions.

This survey also assessed the type of jobs of common among the community members. 31.55 % are artisans engaged in tailoring, hairdressing, cobblers, carpenters, furniture makers, barbers, plumbers, electricians, tilers and painters. 25.63 % are private-sector employees who work in the banks and other corporate offices located within the community. Fishing activities by local fishermen in the community were also noted during the survey (as further discussed in the subsequent paragraphs).

Information about fishing activities in the community was obtained via FGD with some of the fishermen in the community. Fishing activities at the Atlantic Ocean are conducted all year round but are limited during the rainy season because of high winds and tides. The fishermen stated that the majority of them are indigenes of the community but non-indigenes are involved as well. The fishing activities of the indigenes are sponsored by the Elegushi Family. Fishing is done using nets and traps on motorized wooden boats, and the fishermen sell their catch to the Elegushi family which functions as their re-distributor.

The fishermen also clarified that the nearshore areas of the cable landing site are not fishing grounds. However, on a few occasions, some fishermen might berth their boats on the shores temporarily. Fishing activities are carried out a few kilometres offshore, but their fishing grounds are limited due to the range and capacity of their wooden fishing boats. The fishermen also reported that trawlers are usually sighted at the offshore areas, although at several kilometres offshore of the cable landing site. The common fish species caught by the fishermen include barracudas, pala, red snapper, etc.

Also, 75.4 % of the respondents working at formal jobs live within the community but work outside the community, while 24.6 % work close to their residential houses. Less than 1 % (0.85 %) of respondents identified as a civil servant, this may be attributed to the fact that during the study, many civil servants are not available for sampling.

About 6 % of self-employed respondents in the community stated that they provide transportation services.

Plate 4.5 shows some of the business structures in the community.

Plate 4.5: Some of the business structures sighted within the community

Income Level

During the survey, the respondents provided estimates of their monthly income from their respective livelihood activities. Over 8 % of respondents to the survey claimed to be earning above ₦200,000 per month, over 4 % are earning between ₦100,000 and ₦199,999, approximate of 19 % are earning between ₦50,000 and ₦99,999 while 68 % of respondents have an income between ₦10,000 and ₦49,999. Also, the income level was disaggregated between the genders and on average, men appear to earn more than women. However, as shown in Figure 4.21, the proportion of women was higher (61.29 %) than men (38.71 %) among those who earn more than ₦200,000.

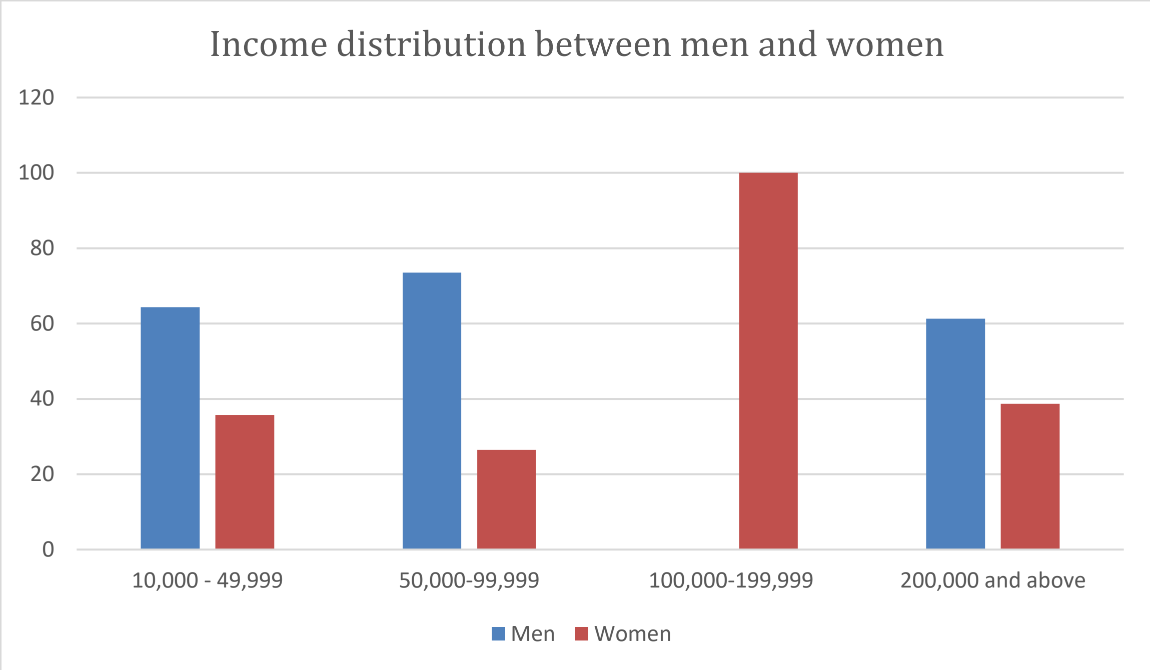

Figure 4.21: Income distribution between men and women

Gender Analysis of Livelihoods

In the study area, it was noted that there are no clear gender roles within the economic and livelihood activities of the community. The majority of traders are women and men of different age range. Men and women occupied the majority of the shops and stalls for sales of perishable and non-perishable commodities (e.g. clothing, household items, provisions, etc.). Based on the discussions held with men and women in the community, it was gathered that there is no restriction for women and men, either married or single to engage in economic activities.

There is a market within the community environment with rented shop outlets owned by individuals. Both women and men can be involved in some physical, skill and unskilled labour activities such as bricklaying and house construction. However, none of the women in the study area identified as fishermen. All the fishermen are agile youths who live within and outside the community.

❖ Infrastructure and Services

Access to Electricity

The community is connected to the national grid for electricity supply as shown in Plate 4.6. However, the electricity supply is not satisfactory as reported by the respondents. During the survey, all respondents stated that they have access to electricity. Many residents within the estates have privately owned generators to provide back-up electricity for their homes and business activities. The survey data revealed that approximately 98 % of residents in the community make use of generators while only 2 % solely depend on electricity supply from the national grid.

Plate 4.6: The Electric Transformer supplying electricity in the Community

Access to Water

Ikate-Elegushi is a built-up community where most houses have private boreholes as their source of water. However, respondents revealed that availability of potable water is an issue within their community. Commercial water tankers, bottled water and sachet water are the major sources of drinking water for members of the community. The FGDs held with the youths and men also revealed that community members do not depend on marine water for any purpose other than fishing and recreational activities. Some of the respondents also stated that they harvest rainwater when it is available for domestic uses and house chores.

Transportation and Telecommunication

Accessibility to the community is greatly enhanced by the Lekki-Epe expressway and other major roads that run from Lagos Island through Lekki. Some of the internal roads in the community were observed to be tarred but in a state of wear, while some roads are untarred. As a result of this, movement within some parts of the community was noted to be most challenging, especially during the rainy season.

The common forms of transportation within the community are private cars and commercial vehicles. Road traffic on the expressway was observed to be very high especially during the rushing hour in the morning and also in the evening when employees of different organisations are returning to their various homes. The Lekki-Epe expressway is a 49.5-kilometre expressway connecting the Lekki and Epe districts. The expressway connected Lekki Peninsula to Elegushi community (Plate 4.7).

The coastal road that runs adjacent to the cable landing site behind the beach is named Yemi Adetayo Street (approximately 0.51 km) and is one of the minor internal roads that leads to the community and eventually connects to the expressway via Silverbird road (Figure 4.22). The road is largely in good condition and was constructed with interlocking bricks. However, accessibility along this route is interrupted east to west by structure and development around the landing site location.

Plate 4.7: A: The main entrance of the Ikate-Elegushi community. B: Lekki-Epe Expressway. C: Untarred internal road and D: Tarred internal roads in the study area

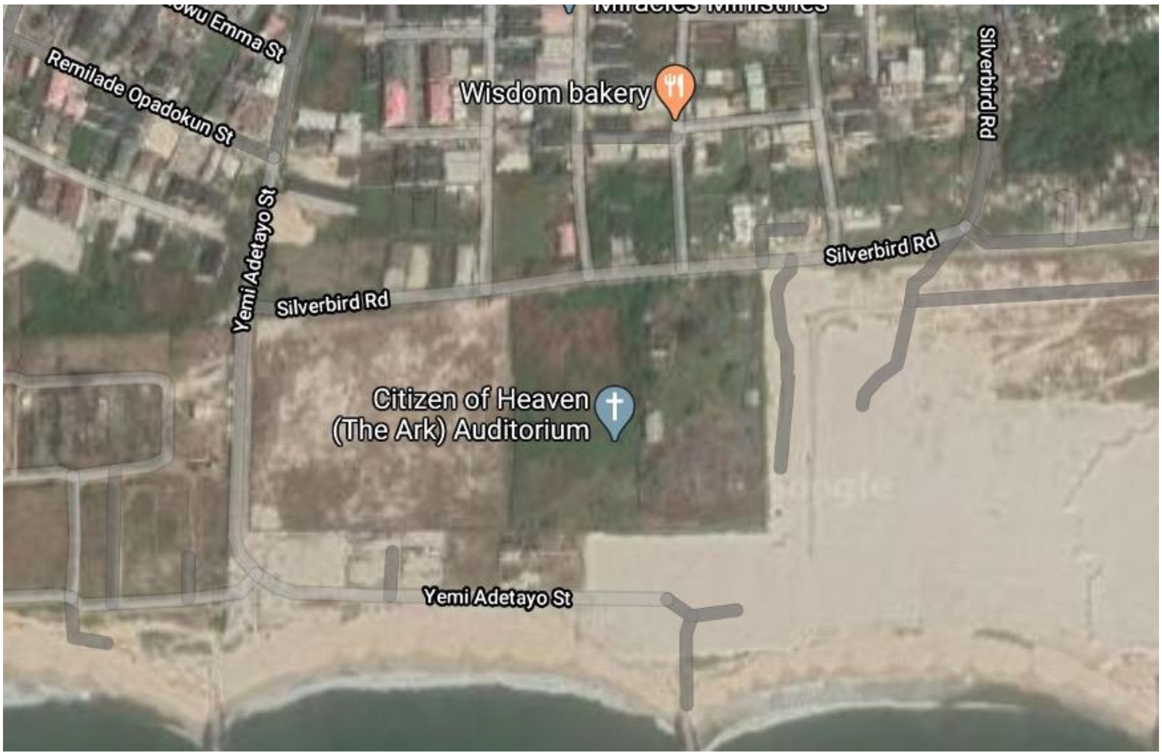

Figure 4.22: Aerial imagery of coastal road that runs adjacent the cable landing site (Source: Google Earth, 2020)

The community has access to all the available mobile telecommunication networks in Nigeria such as MTN, Airtel, Glo and 9mobile. This makes it quite easy to communicate socially and also carry out business transactions.

Access to Education

The Nigeria Demographic and Health Survey (NDHS) in 2018 published statistics on the level of education attainment of residents of Lagos State: 3.9 % have no formal education; 10.6 % have completed primary school education; 35 % have completed secondary education and 22.3 % progressed to achieve tertiary education. The NDHS (2018) report also disaggregated Lagos State literary level between the genders: female literacy level is pegged at 85.3 % while the male literary level is pegged at 93 %. Overall, the literacy level of Lagos State is 89.15 %.

The literacy level in the community is higher as all respondents during the survey stated that they have acquired some forms of education either informal or formal. A large percentage (54.03 %) of the survey respondents have attained secondary education while 33.25 % have attained tertiary level of education, about 9.09 % had only primary education while 3.64 % had no formal education but were able to acquire some vocational training such as tailoring, trading, etc. (Figure 4.23).

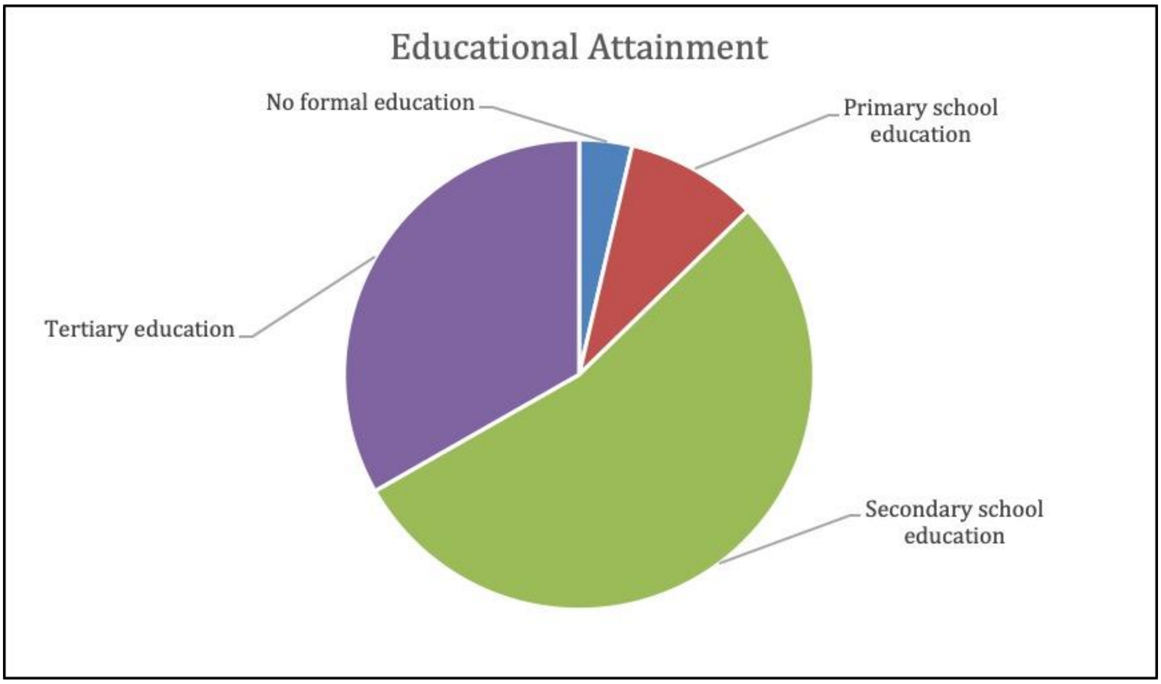

Figure 4.23: Educational attainment among respondents in the community

Some of the private schools observed in the Ikate-Elegushi community include:

1. Jasper Nursery and Primary School
2. Pleasant Places School
3. Whitesands School
4. Treten Academy
5. Alberta Academy

Waste Generation and Disposal

Waste generation in the study area is often as a result of household wastes, disposal of bottles, packaging materials, and general domestic wastes. The field observation revealed that open waste dumping and the use of waste disposal bin are the two common waste disposal management practices in the study area.

In Lagos, the Lagos State Waste Management Authority (LAWMA) is the body responsible for the collection of waste in Lagos State by keeping plastic refuse bin at designated locations in the metropolis. Some residential houses in the community were observed to have waste receptacles that are evacuated weekly by LAWMA (Plate 4.8). The baseline data revealed that respondents are fully aware of the LAWMA and their responsibilities, which corroborated the study of Onuminya & Nze (2017).

Plate 4.8: A: Open waste dumping and B: LAWMA waste disposal bin observed in the study area

- <u>Housing and Business Structure</u>

The housing structures in the community were mostly in nucleated (clustered) settlement patterns. Some houses are enclosed with fences to allow for privacy. Residential houses observed during the study were bungalows, blocks of flats and duplexes (Plate 4.9). There are several completed but unoccupied housing estates; likewise, there are several uncompleted buildings as well as buildings under construction. It was however observed some of the uncompleted buildings have been occupied by squatters who work as bricklayers within the community.

As noticed during the site visit to the cable landing site, there are a few inhabited shanty structures behind the beach. The shanty settlements are illegal shelters built by a few individuals who make use of the beach environment as their households. The shelters were built with woods and metal roofing sheets.

Plate 4.9: Different housing structures observed in the study area

Business structures such as shopping complex, banking halls, corporation offices, hotels, shop outlets among others were observed in the community. However, these structures are not concentrated in a designated area, they are available in different strategic places within the community (Plate 4.10). Some makeshift small-scale trading outlets constructed with materials such as metal roofing sheets, plank, table and umbrella were noted within the community. Also, some shop outlets within the community were noted to be attached to residential buildings.

Plate 4.10: A: Shopping complex in the community. B: Shop outlet attached to a residential building. C: Mercedes Benz Corporate office. D: Car auto dealer

❖ Health Profile

As of June 2020, COVID-19 is currently a pandemic health challenge for the Nigeria healthcare system. The surge in the number of infected people with COVID-19 threatens national public health. The Nigeria Center for Disease Control (NCDC) provides a daily update on the number of COVID-19 infected cases in Nigeria. As at June 1, 2020 there were over 10, 000 cases in Nigeria and Lagos state is the epicentre, having about 5,000 confirmed cases. With the limited capacity of the national and state level of health system, the impact of the Coronavirus can override and cripple the health system.

The Nigerian healthcare system is organised into primary, secondary and tertiary healthcare levels. The Local Government Areas (LGAs) are responsible for primary healthcare, the State Governments are responsible for providing secondary care while the Federal Government is responsible for policy development, regulation, overall stewardship and providing tertiary care (PharmAccess Foundation Report, 2015).

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

As observed during the survey, there is only one primary healthcare centre in the community: Ikate Primary Healthcare Centre. The healthcare centre also provides pre, post and ante-natal services. However, emergency cases that cannot be handled at the health centre are referred to the General or private hospitals in Lagos Island. The in-depth interview held with the nurse at Ikate Primary Healthcare Centre (Plate 4.11) during the baseline study revealed that the morbidity pattern in the community is due to diabetes, malaria, cough and other respiratory diseases, typhoid, high blood pressure. The ratio of doctors to patients is 1:35. The nurse stated that the main causative factor affecting the health of the community members can be related to some cases of poor hygiene.

Plate: 4.11: In-depth interview with a nurse at Ikate Primary healthcare centre and the cross-sectional view of the health centre

- <u>Gender Assessment</u>

The gender assessment of the community was conducted using the FGD with women. The women were interviewed by a female gender specialist in a safe and comfortable environment. The findings from the discussion are presented below.

The women of Ikate-Elegushi community are economically active and contribute to the welfare of their families. They engage in all forms of livelihood available in the community, including artisanship, formal employment, trading, and provision of services. Some of the women are also involved in male dominated livelihoods such as carpentry and bricklaying.

The majority of women in the community have some level of formal education. During the FGD, it was gathered that most of the women have at least secondary school education and some had tertiary education.

Traditional and spiritual leaders, politicians, property owners, wealthy people, and philanthropists are considered to be powerful in the community. Information gathered during FGD with women representatives revealed that there are many women who fall within the category of the powerful and influential people within the community, mostly women who have been prosperous. The culture of the community does not forbid women from acquiring wealth and properties. They can own land, inherit land and other properties. This culture has given the women the opportunity to be of help both to their families and the community.

Women are well involved in community decision-making and they have freedom of association. There are several associations for women within the community, some of them include: assistant ladies club, "bobaniyi" club, start girls club, "omolerewa" club, women in politics, etc.

Community Concerns, Perceptions, and Expectations

- *Perceptions*

During the baseline survey, it was evident that interested members of the community were aware of the proposed Project, including the terrestrial components that are not assessed in this EIA. However, it was noted that these interested individuals had participated in the scoping workshop held in October, 2019; and were aware of the Project related activities. Also, the community representatives during the workshop had conveyed project information to some key members of the community, especially the *Baales*. The leadership of the community and their members were quite positively disposed to the proposed Project, with the hope that employment opportunities can be created for the overall cable Project, including terrestrial system components.

- *Concerns*

Some members of the community expressed their concern about the Project, especially on the issue of 5G installation. Some were opposed to the idea of a 5G network based on what they had read, heard or seen the media. It was generally perceived from respondents that they believe 5G network is dangerous to the environment and people.

- *Expectations*

The community chiefs expressly stated that the Project would have a responsibility towards the community in terms of royalties to the King's Palace. They also would like to see employment opportunities be created for the overall development – marine and terrestrial system components.

CHAPTER FIVE:

POTENTIAL AND ASSOCIATED IMPACTS

CHAPTER FIVE

POTENTIAL AND ASSOCIATED IMPACTS

5.1 Introduction

This Chapter presents an assessment of the potential environmental and socio-economic impacts associated with the Project. Although as stated earlier the report, this ESIA is focused on marine system components, this Chapter also considers potential including associated impacts with the terrestrial system components related to cumulative and synergistic effects. It also includes the methodology employed to assess the significance of the impacts (due to planned and unplanned accidental events).

The impact assessment process does not take into account the application of mitigation measures other than those that are built in the design of the Project as technology specifications or operational controls (including standard practice). Additional mitigation measures to be implemented to avoid, reduce, restore or offset the identified significant impacts are presented in Chapter 6.

Many of the impacts associated with the marine system components of the cable are common to those associated with cables situated all over the world. The identification and assessment of these impacts is based on international research and understanding of the interaction between cables with environment and socio-economic conditions (specifically related to Affected Community).

As already noted in Chapter 3, cable route design work has taken into account areas of potential sensitivity. The Project has therefore included considerable inherent mitigation through design avoidance, which is an important approach to reduce impacts as far as possible in line with the best practice adoption of the Mitigation Hierarchy; and also through requirements to meet obligations of legal conventions using standard protocols – such as MARPOL 73/78 and the International Maritime Organisation (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (2004). In addition, slow vessel speed movements, cable installation approaches, daytime working in coastal areas and cable composition will limit the potential for a range of impacts. It is, nevertheless, important to systematically identify and analyse the potential adverse and beneficial impacts of the Project to ensure that these are understood; and that they are addressed through the adoption of an appropriate mitigation strategy that incorporates inherent mitigation and other additional measures. Where inherent mitigation is relevant it has been included in the assessment of pre-mitigation effects. These are summarised in this Chapter and also in Chapter 6.

In line with best practice, this ESIA has adopted a precautionary approach to the identification and assessment of impacts. Where it has not been possible to make direct predictions of the likely level of impact due to uncertainties in baseline conditions or impact quantification, conservative approaches to define the maximum likely impact are reported. The identification and implementation of the Project (including the use of appropriate mitigation measures) will ensure that unacceptable significant residual impacts do not arise as discussed in Chapter 6.

5.1.1 Overview of the Impact Assessment Process

The potential for environmental and social impacts exists where a project activity has been determined to have the potential to interact with the biophysical and socio-economic environment. The significance of each impact is then determined.

The methodology used for assessing the potential and associated impacts of the proposed Project consists of five steps as follows:

Step 1: Identification and description of proposed Project activities and their interaction (direct, indirect, associated and cumulative) with the identified environmental and social receptors/resources in the Project's Area of Influence (AoI), including consideration of the wider landscape/seascape as appropriate to provide a broader context of understanding of potential connectivity of features with the AoI.

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

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

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

Step 5: Final assessment of the severity levels of impacts through application of the results of the quantitative and qualitative characterisation of impacts developed in Step 4 to form an objective conclusion on impact significance for pre-mitigation and post-mitigation scenarios. As noted, this Chapter provide conclusions on pre-mitigation impacts; and residual impacts that are expected to result after the implementation of mitigation measures are discussed in Chapter 6.

The impact assessment process adopted for this ESIA study is illustrated in Figure 5.1.

The impacts identified and discussed in this Chapter include impacts resulting from the pre-installation and installation (defined as the construction period) and operation of the marine system components of the Project as described in Chapter 3. As previously stated, the impacts associated with the terrestrial system components of the Project are subject of a separate ESIA study, but associated and cumulative impacts are considered where it is possible to do so for common receptors.

As discussed in Chapter 3 at the end of the cable lifespan it is expected that the cable will be left *in situ* in line with standard industry practice. Therefore, decommissioning impacts do not need to be assessed. A decommissioning plan is, however, included in Chapter 8 to meet standard EIA procedures in Nigeria.

The Project has potential adverse and beneficial impacts during the following phases:

- **Construction:** activities such as the Route Clearance, PLGR and cable laying activities in marine environment up to the landing point on the beach and connection point to the BMH; and the construction of the BMH and System Earth.
- **Operation:** physical presence of the laid cable and passive data transmission associated with the cable during its lifetime.

Activities that will be undertaken during the above phases are discussed in detail in Chapter 3.

Impacts are evaluated in the context of their timing, including seasonality, duration and frequency.

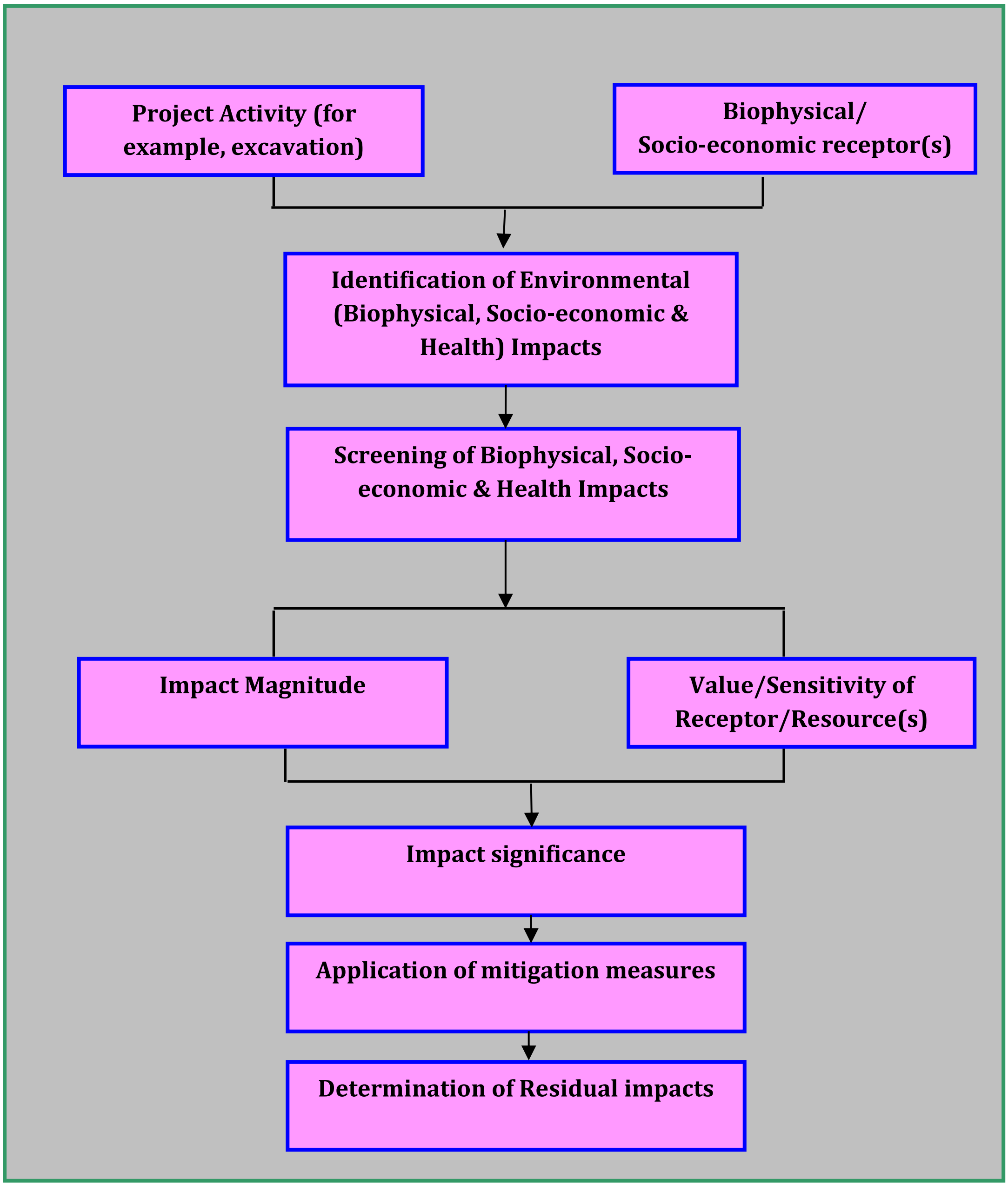

Figure 5.1: Overview of the Impact Assessment Process

5.1.2 Impact Prediction Methodology

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

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

The Leopold Interaction Matrix method, when compared to the other impact prediction techniques is simple, provides the same level of detail, requires comparable knowledge of the environment and relies on limited data unlike the other methods that rely on availability of large historical data bank. A modified Leopold Interaction Matrix was thus adopted for the purpose of impact screening for this ESIA.

5.2 Impact Assessment Methodology for Planned Events

5.2.1 Impact Identification and Characterization

5.2.1.1 Definition of Impacts

International Organisation for Standardisation (ISO) 14001 defines an environmental impact as: *"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services."*

The impact assessment process therefore establishes a link between activities and environmental receptors and defines the resulting consequence. A key component of the Scoping Stage process was to identify such linkages and provides a basis for determining the expected impacts that are discussed in this Chapter.

5.2.1.2 Potential Impact Characteristics

The following characteristics were also used to define the potential impacts associated with the Project:

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

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

iii. *Direct*: Impacts that result from the direct interaction between a planned project activity and the receiving biophysical and socio-cultural environment.

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

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

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

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

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

ix. *On-site:* Impact that is limited to the Project site.

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

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

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

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

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

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

xvi. *Residual:* Both environmental and social impacts that will remain after the application of mitigation measures to Project impacts.

5.2.1.3 Screening and Scoping for Potential Impacts

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

- Knowledge of the planned Project activities as summarised in Table 5.1.
- Detailed information on the environmental and socio-economic settings of the Project's AoI. The potential environmental and social receptors/resources that could be affected by the Project are summarised in Table 5.2.
- Review of other EIA reports on similar projects/environment.
- Series of experts group discussions, meetings and experience on similar projects.

Table 5.1: Summary of Project Activities Included in the Assessment

S/N	Project Phase	Associated Activities
1.	Construction	Route Clearance and PLGR
		Operation of cable laying vessel
		Surface lay
		Plough burial
		Connection to shore
		Installation of cable protection
2.	Operation	Cable repairs (in case of damage)

Table 5.2: Resource/Receptors and Impacts Indicators Considered in the AoI

Environmental Receptor	Comment	Impact Indicators
Physical		
Air Quality and noise	Ambient air quality and noise	Increased concentration of gaseous and particulate pollutants (such as NOx, SOx, CO, PM_{10})
Noise and Vibration	Ambient noise and vibration level	Increased ambient noise and vibration level, night and daytime disturbance, etc.
Marine waters	Marine water quality	Changes in marine water quality
Sediment	Seabed sediment characteristics	Disruption of sediment, suspended sediments, changes in sediment quality
Geomorphology	Geomorphological characteristics	Alteration to intertidal and subtidal morphology
Soil	Soil within the terrestrial area	Disturbance to soils and impacts on characteristics, etc.

Environmental Receptor	Comment	Impact Indicators
Biological		
Biodiversity	Marine and terrestrial biodiversity	Loss and disturbance of marine and terrestrial habitats and species, introduction of new alien invasive species, and indirect impacts from other biophysical changes.
Socio-economic Environment		
Transport and access	Marine and terrestrial transport systems	Disruption of existing traffic routes, increase in traffic volume, etc.
Livelihood and micro-economy	Livelihood activities and micro-economy	Disruption to existing activities and opportunities for local and national employment
Social Infrastructure	Existing infrastructure such as road, waste handling facilities	Damage to road infrastructure including road traffic; access to health facilities, communication facilities, or waste management facilities
Cultural heritage	Areas with cultural or historical significance, such as marine wreck sites	Archaeological sites affected by Project activities, denial of access to culturally significant sites, etc
Beach recreation	Recreational activities at the beach areas	Access to beach, disruption of recreational activities, etc.
Visual prominence	The aesthetic quality of the Project on the surrounding visual catchment	The compatibility of the proposed Project with the character of the locality.
Demography	Demography of communities	Changes in total population, gender ratio, age distribution, socio-economic structure etc.
Utilities	The utilities (e.g. power supply, water, sewage services, etc.)	Changes in existing utilities, damage to public utilities e.g. pipes, cables.
Health and Safety		
Workplace health and safety	The health and safety of workers involved in the cable installation and operation.	Accidents, injury, exposure to nuisance (dust, noise), fire, explosion.

Environmental Receptor	Comment	Impact Indicators
General public	Community health and safety	Unplanned vessel collision, potential for accident at construction sites etc.

The Scoping Report for the Project identified a number of baseline components that had been considered in the landscape/seascape and AoI but were scoped out for further consideration in the ESIA. The features that were scoped out and a summary of justification for that decision is provided in Table 5.3.

Table 5.3: Impacts Scoped out of the Impact Assessment

Receptor Scoped Out for Assessment	Justification
Coastal Processes	Shallow water and intertidal sediment disturbance during cable installation could lead to very localised disturbance to the seabed morphology and very temporary changes to the intertidal area in a small zone prior to restoration. These changes may also lead to very localised and small-scale alteration in sedimentation and hydrodynamics, but the impact is not likely to be discernible.
Cultural Heritage	Impact on cultural heritage are very unlikely. No wreck was identified along the cable route during the cable route survey. The wreck identified was about 160 m away (east of the proposed route) at the inshore area. Alteration to the local cultural environment is also not likely as there are no cultural/heritage sites within the immediate surroundings of the cable landing station. This impact is therefore scoped out of the impact assessment.
Legally protected and internationally recognised areas	There are no coastal or marine legally protected or internationally recognised areas within the AoI and broader seascape area. The nearest protected areas are >160 km east of the cable route (Olague and Uremure Yokri Forest Reserves). These sites primarily comprise mangrove forests, which are important threatened ecosystems that support high ecological productivity, breeding and nursery

Receptor Scoped Out for Assessment	Justification
	functions, roosting areas, feeding grounds; and providing other services such as trapping sediments and improving water quality, adding nutrients to coastal waters and preventing coastal erosion. However, these attributes relate to a zone of dense mangroves within the Niger Delta that is considered to be a different seascape habitat mosaic to the zone in which the Project is located. There is no known direct inter-connectivity of species between these zones, although the mangroves will provide broad functions for the marine environment as already outlined.
Seagrass beds	There is limited information to confirm the presence of seagrass beds in the seascape area. Modelled distribution data that is available indicates the potential presence of this habitat in the nearshore area around 20 km to the east of the cable route (Jayathilake and Costello, 2018). This is based on broad-scale consideration of potential habitat attributes and it is notable that it excludes the area adjacent to the developed Lagos zone. This therefore provides a potential seascape delineation for this habitat. There is no overlap between modelled areas of potential presence with the cable route. In addition, the cable route survey did not identify seagrass beds in the survey area (Fugro, 2019). Seagrass beds provide an important ecosystem function for a range of species, including provision of nursery and foraging habitat. There are no known interconnectivities of species between the areas where seagrass may be present and the area in which the cable is located.
Nearshore coral reefs	There is a large amount of data paucity on the presence of corals in the Eastern Atlantic and in the Gulf of Guinea. To date, no rare or endemic species have been recorded in Nigerian waters (IUCN Red List, 2019). Le Leouff et al. (2002) state that the West African area, in which Nigeria is located is completely devoid of shallow large-scale

Receptor Scoped Out for Assessment	Justification
	coral reefs. The absence of coral reef formations nearshore is seen as possibly due to the periodical strong salinity decrease associated with large regional freshwater inputs (Le Leouff et al., 2002). The cable route survey undertaken to define seabed conditions along the cable route did not indicate the presence of coral reef in the nearshore survey area (Fugro, 2019).
Mangroves	Nigeria hosts large expanses of mangrove habitat. The largest expanse of mangroves is found in the Niger Delta between the region of the Benin River in the west and the Calabar, Rio del Rey estuary in the east. Around Lagos there are small areas of mangrove remaining via forest reserves and in fragmented/remnant patches that have been affected by human disturbance. Such fragmented areas are evident in the in the eastern zone of Lagos state. The intertidal habitat mosaic that forms that area where the Project is located does not include any mangrove areas. As discussed above, there is no known direct inter-connectivity of species between these zones, although the mangroves will provide broad functions for the marine environment as already outlined.

In addition to the scoping out of receptors during the Scoping Stage, the potential for the entanglement of marine wildlife in cables was also scoped out of the assessment as cable design will ensure that entanglement is not a risk. Entanglement risks are restricted to the telegraph era (1850s to c.1950s). Improvements to design, laying and maintenance techniques, that seen no further entanglements with marine mammals have been recorded (Wood and Carter, 2008; Carter et al., 2009). Carter et al., (2009) reported that in a review of 5,740 cable faults recorded for the period 1959 to 2006 not one whale entanglement was noted.

Project activities and environmental and socio-economic receptors were integrated into a matrix; with the Project activities on the y- axis and environmental receptors on the x- axis, and the matrix was completed for each of the Project elements. The Leopold's Interaction matrix was subsequently assessed to identify every possible case of activity-receptor interaction. Where it was considered that an activity-receptor interaction was possible, the cell was marked '•' - denoting an identified environmental aspect (Table 5.4).

Table 5.4: Activity-Receptor Interaction for Impact Screening

Summary of Project Phase Activity	**Receptors**										
	Environmental					**Social**				**Health**	
	Marine waters	**Sediment and Soils**	**Intertidal and subtidal geomorphology**	**Air quality and noise**	**Biodiversity**	**Transport and access**	**Livelihood and micro-economy**	**Social infrastructure**	**Beach Recreation**	**Occupational health and safety**	**Community health and safety**
Construction Phase											
Route Clearance, PLGR and Cable installation works	•	•	•	•	•	•	•	•	•	•	•
Operation Phase											
Cable repairs (in case of damage)	•	•	•	•	•	•	•			•	•

Note that "•" is used to establish an interaction between a particular environmental/social receptor and the project activities
Decommissioning is covered separately in Chapter 8

5.2.2 Determining Impact Magnitude

5.2.2.1 Introduction

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

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

5.2.2.2 Determining Magnitude for Biophysical Impacts

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

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

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

A **Medium Magnitude Impact** affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (when compared with national or international limits and standards specific to the receptors) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it.

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

A **Low Magnitude Impact** affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (when compared with national or international limits and standards specific to the receptors) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localized area.

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

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

Table 5.5: Impact Magnitude Criteria for Biophysical Impacts

Category	Ranking	Definition
High	**4**	▪ Regional to national scale impact resulting in: ○ Medium term change and/or damage to the natural environment and its ecological processes. ○ Reduction in regional habitat and species diversity. ○ Direct loss of habitat for endemic, rare and endangered species of aquatic organism and for species' continued persistence and viability nationally and regionally (for species unable to disperse). ▪ Breach of environmental regulations and company policy and/or 100%-200% exceedance of international, national, industry and/or operator standard for an emission parameter.
Medium	**3**	▪ Local to regional scale impact resulting in: ○ Short term change and/or damage to the natural environment and its ecological processes. ○ Direct loss of habitat crucial for species' (including listed species) continued persistence and viability in the Project AoI (for species unable to disperse).

Category	Ranking	Definition
		○ Introduction of exotic species of aquatic organism to replace resident 'natural communities' within the Project AoI. ○ Environmental stress lowering reproductive rates of species within the Project AoI. ▪ Potential breach of environmental regulations and company policy and/or 50%-100% exceedance of international, national, industry and/or operator standard for an emission parameter. ▪ Complaints from the public, authorities and possible local media attention.
Low	**2**	▪ Local scale impact resulting in: ○ Short term change and/or damage to the local natural environment and its ecological processes. ○ Short-term decrease in species diversity in selected biotopes/areas within the Project AoI. ○ Increased mortality of aquatic organism due to direct impact from project activities. ▪ 10%-50% exceedance of international, national, industry and/or operator standard for an emission parameter. ▪ Public perception/concern.
Negligible/ Very Low	**1**	▪ Impact largely not discernible on a local scale being absorbed by the natural environment; areas adjacent to disturbed areas absorb exodus of species able to disperse. ▪ Up to 10% exceedance of international, national, industry and/or operator standard for an emission parameter. ▪ Public perception/concern.
Beneficial	**+**	▪ Activity has net beneficial effect resulting in environmental improvement for example: ○ Ecosystem health. ○ Increase in magnitude or quality of habitat for rare and endangered species of aquatic organism as well as for those species known to naturally occur in the area. ○ Growth of 'naturally occurring' populations of flora and fauna. ▪ Positive feedback from stakeholders.

Category	Ranking	Definition
		▪ Potential financial gains.

5.2.2.3 Determining Magnitude for Socio-economic Impacts

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

Table 5.6: Impact Magnitude Criteria for Socio-economic Impacts

Category	Ranking	Definition
High	**4**	▪ Major impacts on human health (e.g. serious injury). ▪ Significant impact on the livelihoods of individuals (i.e. access to income source restricted over lengthy period of time). ▪ Serious impact on access to community facilities and utilities ▪ Notable consequence on the economy, at a local, regional and/or national level (e.g. virtually no local sourcing of supplies or personnel). ▪ Breach of economy social policy and/or regulation.
Medium	**3**	▪ Modest impact on human health and well-being (e.g. noise, light, odour, dust, injuries to individuals). ▪ Moderate impact on individual livelihoods (e.g. restricted access to income source). ▪ Medium impact on access to community facilities and utilities (e.g. access to utilities restricted for long periods (weeks) of time). ▪ Moderate impact on the wider economy, at a local, regional and/or national scale (e.g. only moderate levels of employment and supplies sources within Nigeria). ▪ Potential breach of company social policy and/or legislation.
Low	**2**	▪ Limited impact on human health and well-being (e.g. occasional dust, odours, traffic noise).

Category	Ranking	Definition
		▪ Some impact on the livelihoods of individuals (e.g. isolated incidents related to ethnic tensions and some restrictions on access to income source). ▪ Some impact on access to community facilities and utilities (e.g. access to cultural centres restricted to a limited extent, i.e. (days). ▪ Sparse impact on the wider economy, at a local, regional and national level (e.g. limited procurement).
Negligible / Very Low	**1**	▪ Possible nuisance to human health and well-being (e.g. occasional unpleasant odours) ▪ Inconvenience experienced in accessing community facilities and utilities (e.g. electricity supply disruption for short (hours) period of time). ▪ Very limited disruption caused to those earning their livings (e.g. no noticeable impact on heralding operations). ▪ No impact on livelihood, community facilities and human health. ▪ Very limited impact on the wider economy at a local, regional and/or national scale (e.g. no discernible indirect and induced development).
Positive	**+**	▪ Beneficial improvement to human health. ▪ Benefits to individual livelihoods (e.g. additional employment opportunities). ▪ Improvements to community facilities/utilities. ▪ Increased economy (e.g. local procurement, sourcing of supplies).

5.2.3 Determining Receptor Sensitivity

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

Impacts that directly affect people or vital natural resources are deemed to be more important than impacts that indirectly affect people or vital resources. The sensitivity of the receptor criterion also refers to potential impacts to Environmentally Sensitive Areas (ESAs) and impacts to species, including loss of endangered species, effects of introduction of invasive species, and similar environmental/ecological impacts as well as the public perception about the criticality or sensitivity of the receptors.

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

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

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

The receptors-sensitivity designations employed in this impact assessment process are **low**, **medium** and **high** which are universally acceptable.

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

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

Category	Ranking	Definition
Physical (for example, air quality)		
High	**3**	All ambient conditions/concentrations exceed guideline limits and are indicative of the resource being impacted or polluted. There is no (or very little) assimilation capacity for increased concentrations/ change in conditions.
Medium	**2**	Some ambient conditions/concentrations exceed guideline limits while others fall within the limits. There is some small assimilation capacity for increased concentrations/ change in conditions. Resource use does affect other users
Low	**1**	All ambient conditions/concentrations are significantly lower than guideline limits and there is capacity for assimilation for additional concentrations/ change in conditions. Resource use does not significantly affect other users.

Category	Ranking	Definition
Biological (for example, marine ecology)		
High	**3**	Specifically protected under Nigerian legislation and/or international conventions; listed as rare, threatened or endangered e.g. IUCN
Medium	**2**	Not protected or listed but may be a species common globally but rare in Nigeria with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.
Low	**1**	Not protected or listed as common / abundant; or not critical to other ecosystem functions.
Socio-economic and health		
High	**3**	Those affected will not be able to adapt to changes and continue to maintain pre-impact status.
Medium	**2**	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.
Low	**1**	Those affected are able to adapt with relative ease and maintain pre-impact status.

5.2.4 Assessing Impact Significance

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

Impact Magnitude			
4	**4**	**8**	**12**
3	**3**	**6**	**9**
2	**2**	**4**	**6**
1	**1**	**2**	**3**
	1	**2**	**3**

Receptor Sensitivity/Fragility/Value

Figure 5.2: Impact Magnitude-Receptor Sensitivity Product Results

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

Table 5.8: Environmental impact significance rankings

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

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

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

An impact of moderate significance is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is ALARP (As Low As Reasonably Practicable).

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

5.3 Assessing Significance of Risks for Accidental/Unplanned Events

Unplanned events are those not anticipated to occur during the normal course of Project activities; for example, the unlikely event of a vessel collision that may lead to a spill of fuel or ship strike with marine wildlife. Unplanned impacts are assessed by using an impact's significance which is termed 'consequence' in this respect, and introducing the concept of probability, or the likelihood of an impact occurring.

5.3.1 Probability

Probability describes the likelihood of an event or incident actually occurring and is considered at two levels. Firstly, the likelihood of an incident or event taking place is considered (e.g. likelihood of an oil spill from construction vessels occurring). Secondly, the likelihood of a receptor and/or resource being present during the event or incident is considered (e.g. the probability of marine mammals being present in the impact area during an unplanned event or incident).

Likelihood is considered in terms of the following variables:

Low: the event or incident has occurred in other marine environments but not in the Atlantic Ocean within the last 50 years or the event or incident has not occurred in a specific industry.

Medium: the event or incident has occurred in other marine environments and in the Atlantic Ocean during the last 50 years or the event incident has occurred in a specific industry but is not common.

High: the event or incident occurs regularly (every year) in the Atlantic Ocean or the event or incident occurs on a regular basis in a specific industry.

5.3.2 Consequence

The potential consequence of an impact occurring is a culmination of those factors that determine significance for predicted impacts, namely; the magnitude of the unplanned impact (in terms of the nature, type, scale, duration and intensity of the impact), the nature of the resource/receptor (sensitivity) and compliance to the relevant legislation, polices and guidelines. Consequence is classified as follows:

Minor consequence: impacts of low magnitude, within standards, and/or associated with low or medium value/sensitivity resources/receptors or impacts of medium magnitude affecting low value/sensitivity resources/receptors.

Moderate consequence: broad category within standards, but impacts of a low magnitude affecting high value/sensitive resources/receptors, or medium magnitude affecting medium value/sensitivity resources/receptors, or of a high magnitude affecting medium sensitivity resources/receptors.

Major consequence: exceeds acceptable limits and standards, is of high magnitude affecting high or medium value/sensitivity resources/receptors or of medium magnitude affecting high value/sensitivity resources/receptors.

5.4 Impact Evaluation and Description (under Planned Events)

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

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

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

Table 5.9: Leopold's Activity-Receptor Interaction Matrix (Impact Significance Matrix)

Summary of Project Phase Activity	Receptors										
	Environmental					Social				Health	
	Surface (marine) water	Sediment and soils	Intertidal and subtidal geomorphology	Air quality and noise	Biodiversity	Transport and access	Livelihood and micro-economy	Social infrastructure	Beach Recreation	Occupational health and safety	Community health and safety
Construction Phase											
Route Clearance, PLGR and Cable installation works	2(2)	2(2)	1(1)	2(1)	3(2)	2(2)	2(2)	1(2)	2(1)	2(2)	2(2)
Operation Phase											
Cable repairs (in case of damage)	2(1)	2(1)	1(1)	2(1)	2(2)	2(2)	1(1)		2(1)	2(2)	2(2)

Note: Decommissioning is separately covered in Chapter 8

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

Impact magnitude ranking: 1 = Negligible; 2 = Low; 3 = Medium; 4 = High.

Impact sensitivity raking: 1 = Low; 2 = Medium; 3 = High.

5.4.1 Intertidal and Subtidal Geomorphology

5.4.1.1 Construction Phase

The installation of the cable across the intertidal and supratidal area will require excavation of sediment for the cable trench. In addition, a working corridor adjacent to the excavated area will be required for the movement of people and machinery. The area of overall disturbance for coastal works is estimated to be about 20 m wide, including the movement of people and plant. However, the trenching is likely to only take place within a width of <5 m. These works will therefore lead to a change to beach morphology. The major marine physical processes that configure the coastal zone and shorelines are waves, tides, and currents. The coastal zone is constantly exposed to waves, currents, and tides of varying degrees and types (Mitra and Zaman, 2016). The forces that drive beach morphology relate to macro-system processes; and these will not be affected by the Project. In addition, the area where works will take place is afforded some protection from extreme events and erosion from the groyne system that has been developed here. As noted in Chapter 3, construction works across the intertidal area will occur over a very short period of time and temporary occurring over a couple of days. Impacts will be very localised and are reversible. Impact magnitude is considered to be low and the sensitivity to change is also low. Therefore, only **negligible** impacts are expected.

Construction activities will lead to disturbance to the subtidal seabed. As discussed in Chapter 3, there will be various activities that will lead to disturbance to the seabed, including:

- Route Clearance and the PLGR run in water depths less than 1000 m where cable burial is required;
- Plough burial in water depths of between 15 m and 1000 m;
- Jetting cable burial in water depths of 15 m to the landing point; and
- Placement of the cable on the seabed at water depths >1000 m.

The Route Clearance and PLGR will result in the disturbance and turnover of unconsolidated sediments along the cable route within water depths <1000 m. Route Clearance will lead to temporary disturbance of the surface of the seabed with a maximum footprint width of 2.5 m wide with a depth of up to 1.5 m. Route Clearance will only be performed at specific locations, in areas with planned burial where old out-of-service cables are known to cross the cable route. Impacts are therefore expected to be small-scale and localised for such activities. For the PLGR, this will lead to a maximum footprint impact width of 1 m with a depth of up to 0.5 m. Impacts will occur over a very short period of time as the pass is made and will be temporary.

Where plough burial is proposed, a horizontal footprint of disturbance of approximately 0.2 m expected for plough burial to a depth of 1- 1.5 m. In most instances, the disturbed sediment along the plough trench will re-settle to cover the cable, especially in shallower waters. However, in deeper waters with limited seabed currents or in consolidated substrates burial may result in only partial closure of the furrow with sediment displaced to the margins (Carter et al., 2009). These areas are expected to be covered from natural processes, but the timeframe for this relates to local conditions. It is expected that the extent of sediment deposition will be spatially limited to a localised settlement area; and that settlement would occur rapidly. The majority of sediment settlement occurs immediately adjacent to the ploughed area. ICPC (2001) reported that the height of the spoil heap is normally less than 0.25 m and will be eroded with time due to bottom currents. In addition, the skids that support the plough can also leave their footprint on the seabed, particularly in zones of soft sediment. This will lead to some compression/ compaction and disturbance but is less intrusive than the plough burial. Overall, the general area of disturbance produced by both skids in direct contact with the seabed is about 3 m. Nearshore cable installation and burial from jetting may lead to a disturbance an area of about 1 m wide; but again, disturbed areas are expected to naturally in-fill and any sediments deposited on the seabed will be worked back to natural conditions in the short term, especially as this disturbance will occur in the nearshore dynamic environment.

In water depths >1000 m seabed disturbance may occur from laying the cable on the surface, but the scale of this will be very limited due to the size of the cable (being 17-37.5 mm wide).

Impacts on subtidal geomorphology will be very localised and are reversible. Impact magnitude is considered to be low and the sensitivity to change is also low. Therefore, only **negligible** impacts are expected.

5.4.1.2 Operation Phase

Upon installation, submarine cables are usually regarded as benign in the marine environment. However, surface-laid cables may physically interact with the seabed under natural or human influences. Continental shelves are typically exposed to wave and current action, including tidal flows that move sediment and result in the burial, exposure, or even undermining of submarine cables (Carter and Lewis, 1995; Carter *et al.*, 1991; Carter *et al.*, 2009). This may lead to abrasion, chafe, fatigue, and abrading of surface-laid cables. However, in water depths <1000 m, the cable will be buried and therefore will not interact with the seabed surface once buried on the continental shelf. Disturbance of the seabed in water depths >1000 m is possible but will be very limited based on the natural physical dynamics of this marine zone. In this zone, the cable is expected to remain stationary under its own weight once it is in place; and no further substantial sideways movement is anticipated. In addition, the area for potential disturbance is very small based on the size of the cable.

The design life of the cable system is 25 years. Once the cable is installed, there is generally no requirement to access and maintain the cable. The probability of cable damage is low given that the cable route survey has been conducted and that the cable will be buried in water depths of <1000 m. The route survey provided the necessary information for detailed engineering, construction, installation and subsequent maintenance of the cable across its whole length. The optimal route for the submarine cable was selected to avoid potential factors that might damage the cable during its operational lifetime. If unplanned maintenance is required, cable maintenance activities necessitate that the cable be retrieved from the seabed. This has the potential to disturb sediments that lie within the footprint of retrieval activities and immediately adjacent to the footprint. Cable maintenance operations (including associated vessel movements) have the potential to occur across a large span of marine seabed, perpendicular to the portion of the cable needing repair. The area of potential disturbance associated with cable retrieval activities depends on water depth, and the number of grapnel passes required in retrieving the cable. Any cable maintenance will be performed by a specialist group who have established targeted procedures to manage identified risks. Localised, short-term disturbances to sediments and/ or epibenthos living on unburied cable/ within the disturbance footprint of the grapnel are expected to occur as a result of unplanned maintenance. Localised disturbance impacts on the seabed are expected to recover rapidly. Cable repairs during operation will have similar effects as cable installation already discussed under construction, albeit to a much smaller extent limited to areas where repairs are needed.

Operation impacts will be very localised and are reversible. Impact magnitude is considered to be low and the sensitivity to change is also low. Therefore, only **negligible** impacts are expected.

A summary of the potential impacts of the Project on intertidal and subtidal geomorphology during construction and operation is provided in Table 5.10.

Table 5.10: Summary of potential impacts of the Project on intertidal and subtidal geomorphology during construction and operation

Activity	Receptor	Impact	Significance
Route Clearance and PLGR	Seabed topography, bathymetry	• Disturbance to seabed morphology	Negligible

Activity	Receptor	Impact	Significance
	and substrate		
Cable installation works	Intertidal and seabed topography/ bathymetry and substrate	• Disturbance to intertidal and subtidal morphology	Negligible
Cable lay on to the seabed	Seabed topography, bathymetry and substrate	• Disturbances to seabed morphology	Negligible
Cable repairs (in case of damage)	Seabed topography, bathymetry and substrate	• Disturbance to seabed morphology	Negligible

5.4.2 Water and Sediment/Soil Quality

5.4.2.1 Construction Phase

Direct impacts of the Project activities on marine water and sediment quality will primarily result from the cable installation works. Impacts on soil quality and groundwater could occur also occur from cable installation works in the terrestrial zone, and also for the construction of the BMH and OGB. These impacts are discussed below. Impacts from waste release are discussed separately in the subsequent paragraphs below.

Decrease in water quality due to sediment suspension

The cable installation will lead to disturbance to the seabed. The cable route design has avoided hard grounds where possible to enable cable burial across its length. Therefore, soft sediment habitats will be primarily affected across the cable route length in the EEZ. Seabed disturbance of soft sediments will lead to the suspension of sediments into the water column. This is especially the case in water depths of <1000 m where Route Clearance, PLGR and cable burial activities will occur. In all instances, the scale of seabed disturbance is small and any increases in suspended sediments is expected to very localised to the area of disturbance;

and impacts will be temporary as activities are undertaken. Cable burial activities will be undertaken in a linear manner. As such, impacts are not expected along the entire cable route for the entire period of the cable laying duration and relate to activities at each point along the cable route. The zone of elevation will be dependent on waves and currents conditions during the works with maximum concentrations occurring within and immediately adjacent to the works. In deeper waters it is expected that suspended sediments will largely remain towards the lower part of the water column where current velocities are lower than at the surface limiting dispersal and promoting rapid deposition. Cable burial from jetting activities in nearshore waters provide greater potential for dispersal of sediments due to the more dynamic nature of hydrodynamic processes in this area and the greater level of sediment disturbance. This may extend the zone of sediment dispersal and also lead to greater dilution as sediment are dispersed. The jetting activities are likely to lead to the highest level of sediment suspension across the cable route, but these activities will only occur in water depths <15 m in a small area with areas of disturbance constrained to within a horizontal footprint of 1 m. Outside of a mixing zone close to activities, it is likely that levels will reach baseline levels very quickly. A mixing zone of 300 m is defined taking a precautionary approach. It is expected that a lot of the sediment disturbed will be deposited very locally, especially related to Route Clearance, PLGR and plough burial activities – as discussed under the consideration of geomorphological impacts. In water depths >1000 m some very minor seabed disturbance may occur from the surface lay of the cable, but the cable width is small and the potential for the release of sediments into suspension is very low. The magnitude of impacts is considered to be low. Taking a conservative approach, the sensitivity to the predicted change is considered to be medium, which largely relates to nearshore jetting activities. Impacts will be very localised, but are irreversible. Therefore, only **minor** impacts are expected.

Decrease in water quality from vessel discharges

In addition to the suspension of sediments, impacts on water quality may result from discharges to the marine environment during construction from vessel discharges, leaks and spills and uncontrolled waste disposal. Vessels provide potential for pollutant release from deck drainage, ballast water (in emergency situations only), contaminated drainage from machinery spaces, fuel, cable oils and grey water etc. In addition, vessels produce wastewater that could be discharged to the marine environment. In any case, the scale of these impacts is expected to be low as volumes will be small in comparison to the volume of water in the open sea. Studies have established the rapid dispersion and dilution of vessel discharge within hours of release into surrounding waters (Walker and McComb, 1990; Costello and Read, 1994; Parnell, 2003; Woodside, 2008). Inherent adoption of strict guidelines and legal requirements will ensure that pollution from vessel discharges will be minimised. This includes the requirements of MARPOL 73/78, which includes best practice measures to avoid harmful discharges at sea. Impacts from discharges are therefore expected to be of low magnitude. Sensitivity is a function of receptors affected, which includes indirect impacts on features that rely upon good water quality. Taking a conservative approach, sensitivity is considered to be medium, which relates to the presence of marine biodiversity receptors that are protected and could be sensitive to pollution releases. Impacts will be very localised but irreversible. Therefore, only **minor** impacts are expected.

Sediment Quality

As stated above, sediment disturbance will occur during construction. However, this is unlikely to lead to significant alteration to physical characteristics in intertidal and subtidal areas. Impact magnitude is low and the sensitivity to changes is low. Impacts are also reversible. Therefore, **negligible** impacts are expected.

There is also potential redistribution and dispersal of contaminants in sediments if present in areas that are disturbed. The extent of deposition is a function of the level of disturbance and settlement; and also, the level of contamination. As discussed under the consideration of impacts on geomorphology it is expected that the majority of sediment lifted into suspension will settle in the localised area therefore limiting the potential for widespread dispersal and also redistribution within areas of similar baseline condition. The potential for disturbance and dispersal is greatest in nearshore areas associated with jetting activities. Also, as discussed in Chapter 4, contaminants were largely within ecotoxicological thresholds, except for one incidence showing elevated levels of Nickel above lower trigger values in nearshore areas. Impacts are expected to be of low magnitude. Sensitivity is a function of receptors affected, which includes indirect impacts on features that rely may be affected by contaminant redistribution. Based on the potential for redistribution and baseline values, a conservative approach has been taken to define sensitivity as medium. Impacts are also potentially irreversible. The assessment has concluded that **minor** impacts are expected.

Soil quality

The construction works will require minor excavation of soils in the terrestrial zone. The footprint of excavation for installation of the cable will be small and will lead to the excavation of around 280 m^3 of soil. Construction of the BMH will lead to excavation of 16 m^3 of soil. The area of disturbance required for the OGB is dependent upon the preferred design but the level of disturbance will also be low. As discussed in Chapter 4, the soils of the affected areas are predominantly sandy and comprise of relatively recent in-fill. Therefore, they will have relatively low sensitivity to physical disturbance. The magnitude of impacts is considered low. Impacts are also reversible. Therefore, **negligible** impacts are expected.

Groundwater

As discussed in Chapter 4, groundwater levels are relatively close to the surface. There is therefore potential for impacts to occur to the groundwater resource. Impacts from planned activities would largely relate to increased localised suspended sediments. The groundwater resource is likely to be formed by saline intrusion and does not comprised drinking water. No alteration to flows of the wider groundwater system will occur; and all impacts would be very localised to the area of works. The sensitivity of the overall groundwater resource is low. The magnitude of impacts is considered low. Impacts are also reversible. Therefore, **negligible** impacts are expected.

5.4.2.2 Operation Phase

Cable repair works during the operation phase are expected to have similar effects (albeit at a much lesser extent) on the marine water quality, sediment quality and soil quality along the cable route in a localised area where works take place. Cable repairs are infrequent and are usually completed in short duration. Consequently, the magnitude of the impact will be low and the receptor sensitivity is also rated as low. Therefore, the overall impact significance is rated as **negligible**.

In water depths >1000 m the cable is unlikely to lead to disturbance of the seabed once in position and therefore long term localised impacts related to suspended sediments and deposition are not expected.

Also, the proposed cable is an optical fibre subsea cable incorporating material with low environmental discharges. Carter et al. (2009) reported on the potential for impacts from cable leaching. They reported that cable-grade polyethylene is essentially inert in the ocean. The effects of ultraviolet light on cable integrity will be avoided through burial in water depths where such light may penetrate. Any potential for mechanical breakdown on the energetic continental shelf is again limited through burial. The cables will include a copper conductor. Carter et al. (2009) report on the potential for the leachate of metals from conductors and armour into the water column. They conclude that experiments suggest negligible impacts in this regard. Therefore, the magnitude and sensitivity of impacts is expected to be low. The overall significance of discharge of pollutants from the cable laying vessel on the marine water is rated as **negligible**.

A summary of the potential impacts of the Project on marine water and sediment quality during construction and operation is provided in Table 5.11.

Table 5.11: Summary of potential impacts of the Project on marine water and sediment quality and soils during construction and operation

Activity	Receptor	Impact	Significance
RC, PLGR and cable installation works	Marine water quality	• Increased suspended sediments from release of pollutants from cable installation vessel	Minor
		• Vessel discharges	Minor
	Sediment quality	• Disturbance to sediments leading to increase changes to characteristics	Negligible
		• redistribution of contaminants affecting sediment quality	Minor
Cable installation, BMH and OGB	Soil quality	• Disturbance to soils leading to a change in characteristics	Negligible
Cable installation, BMH and OGB	Groundwater quality	• Increased turbidity and alteration to the resource	Negligible
Cable repairs (in case of damage)	Water quality, sediment quality and soil quality	• Increased suspended sediments and vessel discharges • disturbance sediments and soils during repair works	Negligible
Leaching from cables	Marine water and sediment quality	• release of contaminants and cable degradation	Negligible

5.4.3 Marine Biodiversity

Submarine cables may have a range of potential impacts on the marine biodiversity as a result of the nature of activities during their installation. Impacts from planned events relate to the following impact sources:

- Physical loss and disturbance to habitats and species.
- Increased suspended sediment loads in the water column and deposition of disturbed sediments.
- Pollution of marine waters.
- Underwater sound generation from vessel movements and equipment use.
- Artificial lighting.
- Introduction of alien invasive species.
- Electromagnetic field effects.

5.4.3.1 Physical loss and disturbance

Impacts associated with the physical degradation and disturbance of habitats may result from the following:

- Temporary disturbance of intertidal and subtidal habitats from cable installation and/or for cable repairs during operation; and
- Permanent loss of seabed habitats in the footprint of the cable.

These impacts are discussed below.

5.4.3.1.1Construction Phase

Intertidal and supratidal zone

The installation of the cable across the intertidal and supratidal area will require excavation of sediment for the cable trench. In addition, a working corridor adjacent to the excavated area will be required for the movement of people and machinery. These works will therefore lead to disturbance of habitats and species, potentially including sea turtles, shorebirds, flora and infauna. The area of overall disturbance for coastal works is estimated to be about 20 m wide, including the movement of people and plant. However, the trenching is likely to only take place within a width of <5 m.

As noted in Chapter 4, the intertidal area is not expected to be of importance for shorebirds and any impacts will be very localised with displacement of any individuals to adjacent unaffected areas likely. The benthic infauna of the intertidal area will provide some ecological function, but the area of disturbance is very small in comparison to the presence of beaches across the seascape and no flora and infauna species of specific conservation note are noted.

As discussed in Chapter 4, the intertidal beaches within the general Project area provide potential habitat for sea turtle nesting, although this is expected to be at a low level due to habitat conditions. The species that may nest in this area are most likely to be olive ridley and leatherback turtles but nesting by green and hawksbill turtles is also possible. Footprint related impacts on sea turtle nesting beaches relate to key zones on the beach that support nesting activity. Turtles will leave the sea and crawl to a suitable nesting position. The 'turtle crawl zone' includes the intertidal beach to the area where nesting takes place. The nesting position is normally above HW and will normally extend to the dune system. This area is classed as the 'turtle nesting zone'. Nesting can occur in the intertidal zone, but this is a rare occurrence and eggs laid in this zone have a naturally low chance of survival. The 'turtle nesting zone' refers only to natural beach habitat. The space for nesting above HW where works will take place is small, although there is some potential room for nesting to occur. This area is, however, being impinged upon by cement block making activities. As discussed in Chapter 4, no sea turtle nesting has been confirmed in the area where Project activities may occur. The level of disturbance at the preferred cable landing site and the surrounding areas is high due to human activities, including recreational use and the manufacture of cements block and sand dredging disposal for the raising of development land, as well as, the presence of waste via domestic garbage and sewage runoff. A small coastal road is also located immediately above high water and some structures extend on to the beach. Also, erosional banks are present at or above HW. In addition, there is human inhabitation behind the beach. All of these aspects reduce the potential for nesting and also the likely importance of the beach for nesting. It is likely that the nesting potential here is lower than other less disturbed areas in the seascape. Therefore, the potential for nesting in the area where work will take place is very low. However, even with the very low probability of nesting it cannot be completely discounted based on the knowledge that turtles may nest in this general area; and therefore, it is considered appropriate to take a precautionary approach. As mentioned in Chapter 4, much of the disturbance on the beach above HW is from informal cement block making activities and sand extraction. The baseline conditions are therefore fluid with both natural restoration and further disturbance possible before works commence. Therefore, it is recommended that an assessment of baseline conditions is taken place prior to construction as part of any mitigation strategy as detailed in Chapter 6. This will help to inform the likelihood for nesting based on the levels of disturbance to the beach at that time. Temporary short term activities that may lead to impacts during the construction phase include:

- Onshore excavation and dredging works;
- Movement of plant and people in the turtle crawl and nesting zone;
- Laydown of materials in the turtle crawl and nesting zone;

- Total loss of habitats under new structures, either temporary or permanent;
- Fragmentation of habitat due to the presence of obstacles interrupting movements of adults and hatchlings;
- Installation of work boundaries;
- Accidental releases of pollutants;
- Uncontrolled activities of the local workforce introduced to the area, including poaching and harassment;
- Smothering due to reinstatement works or demobilisation; and
- General activities leading to nesting avoidance or forced egg deposition offshore.

The type of impacts that may ensue as a result of such temporary activities include:

- Injury/mortality to adult turtles that crawl across the beach to their nesting zones or injury/mortality to hatchlings moving to sea;
- Loss or damage to nesting habitat and/or nests;
- Disturbance that means that the area where nesting normally occurs is no longer suitable;
- Obstruction of turtles and hatchlings on nesting beaches, which could lead to injury or mortality and/or prevent turtles from nesting;
- Pollution and entanglement leading to injury, mortality or reduced quality of life;
- Off-duty activities of workforce resulting in disturbance through hunting and/or harassment and also the potential use of lights/lighting of fires; and
- Disturbance that causes forced egg deposition offshore.

As noted in Chapter 3, construction works will occur over a very short period of time. Cable burial work and beach restoration normally occurs within a few days. The spatial extent of impacts is relatively small, especially in relation to other nesting and inter-nesting habitat present across the seascape. In addition, although nesting is possible, if it occurs it is expected to be at a low level across the beach and unlikely in highly disturbed area. Impacts are also irreversible, but the magnitude of impacts is low. Given the status of sea turtles that may nest sensitivity is rated as high. Therefore, impacts are rated as **moderate**.

Subtidal zone

As discussed above under the consideration of geomorphology impacts, construction works will lead to disturbance to the seabed. There will be various activities that will lead to some small-scale disturbance to the seabed for Route Clearance, PLGR and cable installation activities.

The cable routing design has already considered the potential to impact sensitive marine habitats of conservation importance, such as pockmarks. The cable route design has avoided pockmarks and hard grounds where possible to enable cable burial across its length. Therefore, soft sediment habitats will be primarily affected across the cable route length in the EEZ. It is possible that benthic infauna and epifauna may be damaged, disturbed or displaced across the footprint, but the extent of such impacts is small, particularly in relation to the extent of similar habitat across the seascape. Species in disturbed sediments would be expected to naturally recolonise in a relatively short period of time given the spatial scale of the impacts and the nature of habitats affected. Rates of benthic recovery will depend on the restoration of seabed characteristics. However, where immediate infilling of disturbed areas occurs this will allow for more rapid benthic recovery.

There is potential for the cable route to disturb areas where cold water corals may be present, as discussed in Chapter 3. The presence of such communities within the footprint of the cable route has not been confirmed but neither can they be discounted. Cold water coral communities are of note as they provide important ecological functions in the marine environment and are very slow growing and take a long time to recover from disturbance. However, potential disturbance of seabed habitats from cable burial is limited to water depths of <1000 m. In addition, pockmark areas with hardgrounds on the continental shelf and slope have been avoided by the cable route design. Therefore, there is limited potential for cables to impact on potentially important areas for cold water corals as a result of burial. Some disturbance could, however, take place where the cable traverses soft sediment communities in areas where the cable laid on the seabed on the continental slope. The footprint area of impact from surface lay in water depths >1000 m would be very small based on the diameter of a cable being between 23 and 37.5 mm.

With the extent of impacts that are expected it is unlikely that alteration to seabed conditions will have an adverse effect on fishes, including on their ecological functions (i.e. foraging resource). However, impacts are considered to be small-scale.

Impacts are temporary and reversible in the medium term. The magnitude of impacts is low and the sensitivity of receptors to impacts is also considered to be low. Therefore, **negligible** impacts are expected.

5.4.3.1.2 Operation Phase

Articulated pipe will be installed on the cable seaward of the duct connection to the BMH to a point about 550 m offshore (at around a water depth of 8 m) to afford protection to the cable. Within the intertidal area this pipe will be buried but it will be placed on the seabed by divers in the nearshore subtidal zone. The cable route survey identified outcropping rock in the nearshore environment to water depths of around 7 m (Fugro, 2019). Fugro (2019) reported that the rock appears to be potentially artificial dumped material that is part of the erosion control effort. Therefore, very limited additional hard substrate will be provided by the articulated pipe structure. Although they provide opportunity for colonisation the opportunity will be similar to existing rock material.

In water depths >1000 m the cable will be placed on the seabed. Where soft sediment substrate exists, this may provide an alternative substrate for colonisation and use by benthic and demersal species. Carter et al. (2009) reported on the growth of epifauna and epiflora on the surface of submarine cables, including attachment of anemones (*Metridium farcimen*). This may alter community structure on a localised scale. This may provide positive impacts for local biomass and species diversity. Carter et al. (2009) reported that studies suggest that cables have no or minimal impact on infauna community structure adjacent to cables. Where hard substrate is already present it is likely that similar conditions will be present over time. In any case, the area of impact is small based on the diameter of a cable being potentially being between 23 and 37.5 mm.

The potential need for cable repairs is limited by the burial of the cable in water depths <1000 m where greater protection is needed for physical processes and human activities. For buried cables, repairs will lead to localised disturbance due to unburial of the cable and jetting of the repaired cable section by a Remotely Operate Vehicle (ROV). These impacts will be very localised and limited, especially given the likelihood of failure that exists of the cable lifetime.

The magnitude of impacts is low and the sensitivity of receptors to impacts is also considered to be low. Therefore, **negligible** impacts are expected.

5.4.3.2 <u>Increased suspended sediments and redistribution of disturbed sediments</u>

5.4.3.2.1 Construction Phase

As discussed above, cable installation in the subtidal zone will lead to seabed disturbance and this will lead to increases sediments suspended in the water column, especially in water depths <1000 m. However, the impact of the sediment plume is expected to very localised to the area of disturbance and temporary along the cable route as activities are undertaken. It is also expected that the extent of sediment deposition will be spatially limited to a localised settlement area; and that settlement would occur rapidly, especially in deeper waters.

Impacts will occur in soft sediment substrate areas. No seabed habitats of specific conservation note would be affected, such as highly light sensitive nearshore coral or seagrass habitats. It is noted that the cable route will pass through areas of pockmarks with hard grounds, which may contain species sensitive to impacts, but the extent of change in these areas is low and these pockmarks are not thought to have active gas seeps. Benthic fauna communities may be affected by changes, including sessile and mobile filter-feeding organisms. Impacts from sediment smothering and elevated suspended sediment will vary widely by organism based on their mobility, size, functions and tolerances. It is likely that many species affected would have some tolerance to the level of change that will likely result from the construction activities, especially in wave and current dynamic zones and where natural sedimentation occurs. Impacts would occur over a very short space of time along each section of cable. Where very limited adverse impacts occur community structure will naturally restore in the short term.

Fishes will be adapted to natural temporary increases in both turbidity and sedimentation. Many demersal species that are closely associated with the seabed can withstand high levels of turbidity and sedimentation. Fishes are mobile and whilst their tolerance will vary based on species and their exposure, it is expected that the very limited impacts that are expected will be well tolerated and no species of conservation note will be significantly affected. It is unlikely that sediment deposition will affect important nursery areas and lead to any significant impact on eggs and larvae. In addition, indirect impacts on foraging resource are expected to be minor.

Impacts on sea turtles and marine mammals from suspension of sediment will be very limited. Such species are being adapted to natural localised temporary increases in turbidity and sedimentation and will be able to easily traverse any affected areas. Furthermore, as surface air-breathing organisms with lungs they will not be exposed to the significant risks (e.g., asphyxiation) that organisms with gills or submerged feeding structures may be exposed. Suspended sediments can lead to behavioural alterations, but the extent of impacts that will occur means that this is unlikely. In addition, indirect impacts on foraging resource are expected to be low.

Elevated turbidity generated near the seabed in highly localised area will represent a very small fraction of the much larger areas over which similar planktonic communities exist. Planktonic communities will also by definition be transient through the area via tidal and wave-driven water movements and will therefore not have prolonged exposure to any higher concentrations. Sedimentation onto the seabed cannot directly affect plankton. It may indirectly impact plankton (e.g., by smothering adult benthic organisms that produce planktonic larvae, or by reducing settlement or survival of planktonic stages of benthos that would otherwise go on to produce further planktonic stages).

However, such impacts will be highly localised and likely represent a small contribution to the planktonic community.

Impacts are short-term and temporary. The magnitude of impacts is considered to be low. Taking a conservative approach, the sensitivity to the predicted changes is considered to be medium, which largely relates to nearshore jetting activities. Impacts will be very localised, but are irreversible. Therefore, only **minor** impacts are expected.

The laying of the cable on the seabed beyond at water depths of >1000 m in areas of soft sediments will also lead to some very localised seabed disturbance but such impacts would be very small and of **negligible** significance.

5.4.3.2.2 Operation Phase

As noted above, a requirement for cable repairs during operation may lead to some seabed disturbance to recover cable and also for re-burial. However, such impacts will be very localised and of much smaller magnitude than during construction, especially given the likelihood of failure that exists of the cable lifetime. Impacts are therefore expected to be of **negligible** significance.

5.4.3.3 Pollution of marine waters

5.4.3.3.1 Construction Phase

As discussed above, vessels provide potential for pollutant release from deck drainage, ballast water (in emergency situations only), contaminated drainage from machinery spaces, fuel, cable oils and grey water etc. In addition, vessels produce wastewater that could be discharged to the marine environment. Sewage and sanitary effluent have the potential to adversely affect the quality of the receiving marine water body unless properly treated and managed. Wastewater is generally characterised as having a high concentration of solids (suspended and dissolved), oil and grease, biochemical oxygen demand (BOD) and chemical oxygen demand (COD), nutrients (ammonia) and E. coli counts. Such discharges could lead to indirect impacts on marine biodiversity. However, due to the nature of activities impacts are expected to very small, especially if best practice approaches are adopted in line with MAPROL 73/78. Impacts from discharges vessels are therefore expected to be of low magnitude. Taking a conservative approach, sensitivity is considered to be medium which relates to the presence of marine biodiversity receptors that are protected and could be sensitive to pollution releases. Impacts will be very localised but irreversible. Therefore, only **minor** impacts are expected.

5.4.3.3.2 Operation Phase

A similar type of impacts from vessel discharges as discussed under construction may occur if cable repair is required during operation, but the scale of impacts would be expected to be lower than during this phase related to the extent of work that may be required. Therefore, the overall impact significance is rated as **negligible**.

As discussed above, cable-grade polyethylene is essentially inert in the ocean; and the effects of ultraviolet light on cable integrity mechanical breakdown will be avoided through burial and also cable design. The potential for leachate is also very low. Carter et al. (2009) reported that the potential for the leachate of metals from conductors within the cable is negligible and impacts would not cause ecotoxicological effects on any marine biodiversity receptors. Therefore, the overall impact significance is rated as **negligible**.

5.4.3.4 <u>Underwater sound generation</u>

5.4.3.4.1 Construction Phase

<u>Introduction</u>

Noise may be generated by vessels during construction. In addition, disturbance to the seabed within water depths <1000 m may also generate underwater sound. There are few data on the underwater ambient baseline noise conditions where impacts may occur. However, the area will be subject to a range of noise from anthropogenic and natural sources. Key anthropogenic sources include existing vessel movements from Lagos port and beyond and also be local fishing vessels etc.

Large commercial vessels generally produce relatively loud, low frequency non-impulsive sounds. They typically generate underwater sound at a frequency range between 10 Hz and 1000 Hz (1 kHz). However, higher frequencies (up to tens of kHz) can occur at relatively close ranges (typically <1 km) (Southall et al., 2017). Sound is generated from hydrodynamic flow noise, onboard machinery, and, primarily, from propeller cavitation (Southall et al., 2017). Sound from larger vessels can travel hundreds of kilometres and can increase ambient noise levels over large areas of the ocean (see Southall, 2005 and 2017; Popper et al., 2014). Vessel noise contributes to ambient noise from natural sources such as waves, wind and animals (Southall et al., 2017). Larger vessels (exceeding 100 m) typically generate louder, lower-frequency sounds than smaller boats, with faster vessels being typically louder (although there are exceptions) (Southall et al., 2017). McKenna et al. (2012) report upon measured underwater sound generated by large vessels such as container ships and tankers as being around 180 dB re 1 μPa^2, and a sound exposure level of 118 to 122.2 dB re 1 $\mu Pa^2 s$ at 3 km from source. Richardson et al. (1995) reported that sound source levels for these and comparable kinds of vessels are typically 155 to 170 dB re 1µPa m. Nedwell et al. (2003) reported upon measured sound levels for cable installation operations of 178 dB re 1µPa m. However, it should be noted that these measurements were taken in shallow water in the UK with particular local conditions.

Marine mammals

Cetacean species can be arranged into hearing frequency groups. The noise generated by large vessels overlaps the hearing range of low frequency species (7 Hz to 35 kHz) (baleen whales), mid frequency species (150 Hz to 160 kHz) (dolphins, toothed whales, beaked whales, bottlenose whales) and also high frequency species (275 Hz) (e.g. *Kogia spp*.) (NOAA, 2016). It is therefore possible that the underwater sound generated by large vessels is in the hearing range of all of the cetacean species that are known to occur, or potentially occur, in the AoI. Southall et al., (2019) have also set out a different grouping of marine mammals that differs from NOAA (2016) in that they state 'mid frequency' species as being 'high frequency' species and 'high frequency' species as being 'very high frequency' species. Southall et al. (2019) have identified a sirenian hearing group that is relevant to manatee, although this species is not expected to be in the AoI. They report that this group (using West Indian manatee as an indicator species) would be sensitive from the infrasound range to less than 20 kHz, with peak sensitivity around 8 kHz, but direct measurements indicate that hearing can extend from low frequencies to above 60 kHz. This therefore also overlaps with the sound produced by large vessels.

The possible effects on marine mammals have been placed into the following zones of influence (Richardson et al., 1995):

- Physical (including physiological) effects: to include damage to body tissues, gross damage to ears, permanent auditory threshold shift (PTS), temporary auditory threshold shift (TTS) with eventual recovery, and chronic stress effects that may lead to reduced viability.
- Perceptual effects: including masking of biologically significant sounds (e.g. communication signals, echolocation, and sounds associated with orientation, finding prey or avoiding natural or manmade threats).
- Behavioural effects: including disruption of foraging, avoidance of particular areas, altered dive and respiratory patterns, and disruption of mating systems.
- Indirect effects: including reduced prey availability resulting in reduced feeding rates.

Of note with respect to underwater sound impacts, breeding humpback whales may to be located in nearshore waters during their migratory period of May to

January. In addition, nursery sperm whales may be present on the continental slope area and deeper waters. However, the area where works will take place is a small part of the overall range of these species and the AoI is not considered to be unique or have any primary ecological function importance in the context of the broad seascape for these species.

NOAA (2016) have set out thresholds to identify the level of underwater sound that would produce the onset of PTS and TTS. This guidance builds upon previous information produced by the National Marine Fisheries Service (NMFS, 2003), where a standard threshold of sound at which harassment or injury to cetaceans may occur was defined as being 180 dB re 1 μPa for cetaceans. NOAA (2006) provide a range of weighted TTS onset thresholds for non-impulsive sounds using a Cumulative Sound Exposure Level (SELcum), which is used to measure multiple transient pressure wave events and is calculated by summing the SEL from the individual events (the events may be temporally and spatially separated. They propose SELcum thresholds of 153 dB re 1 $\mu Pa^2 s$ for high frequency cetaceans, 178 dB re 1 $\mu Pa^2 s$ for mid-frequency cetaceans and 179 dB re 1 $\mu Pa^2 s$ for low-frequency cetaceans. They also reported a PTS weighted onset threshold of 199 dB for low frequency species, 198 dB re 1 $\mu Pa^2 s$ for mid frequency species and 173 dB re 1 $\mu Pa^2 s$ for high frequency species. Southall et al. (2019) provides an update to the guidance that was provided in Southall et al. (2007). In this guidance, the SEL weighted TTS and PTS onset values are the same as those presented by NOAA (2016) for the same hearing groups. However, Southall et al. (2019) also provide TTS and PTS onset values for sirenians, which are relevant as West African manatee may be present in the seascape. Thresholds for these species are 186 dB re 1 $\mu Pa^2 s$ for TTS onset and 206 dB re 1 $\mu Pa^2 s$ for PTS onset. NOAA (2016) reported that the guidance states that the exposure criteria are median levels, and therefore, may be higher or lower than real world impact levels. However, the thresholds provided can be used as a guide to determine whether injuries could potentially occur. The thresholds in recent guidance may suggest that the sound generated by cable installation could potentially lead to TTS effects for cetaceans in very close proximity to working areas but are very unlikely to be of sufficient scale to create PTS effects – using large vessel noise and evidence from measurements elsewhere (i.e. Nedwell et al., 2003). It is acknowledged that noise levels produced by the vessel may at the limit or below TTS thresholds for mid and low frequency cetaceans that are likely to be present in greatest numbers across the seascape; and that animals would need to be very close to source and not displace. This is considered to be unlikely. NMFS (2017) reviewed the potential underwater sound impacts for subsea cable-laying and maintenance activities in the Beaufort, Bering, and Chukchi seas proposed by Quintillion Subsea Operations LLC. Their assessment was of a vessel 140 m long, which is the same length as that proposed for the Project. This assessment is, of course, specific to local conditions (physical and biological) and also relates to the proposed activities. The area does include some marine mammals present in Nigeria waters, e.g. humpback whales. This assessment considered vessel noise, plough burial, anchoring and ROV operation. The review concluded that based on NMFS assessment, injurious impacts would only occur within 0-4 m of sound sources for all marine mammal hearing groups considered. It was concluded that it is highly unlikely that an animal would reach to this close distance from the vessel (NMFS, 2017). For the Project, it is expected that animals would move away from source as the vessel approaches, so the risk of injury is likely to be negligible (although current understanding of the response of an individual marine mammal to sound is uncertain). The ability to move away could be restricted by various factors and may differ across the transit area but given that works will occur in open sea areas the likelihood for movement away from the sound source is very high.

In addition to injurious impacts, underwater sound from large vessels is likely to lead to behavioural effects, including impacts on communication, social interactions, foraging, and predator avoidance (Southall et al., 2017). Behavioural responses of marine mammals can theoretically take place anywhere in the zone of audibility, which will extend over a long distance from source. The type of response to underwater sound generation will vary greatly from small changes, such as a startle response, to strong avoidance. The understanding of behavioural responses is complex and dependent upon a number of factors such as the age of the animal, its sex, its condition, season etc. and properties of the source sound/transmission.

All cetaceans, including the species known to occur, or potentially occur, in AoI, produce sounds for communication, orientation and navigation purposes. Masking resulting from vessel noise can interfere with breeding, foraging and navigation. Southall et al. (2017) report upon numerous sources that demonstrate that underwater sound from vessels may lead to marine mammals altering their behaviour. As example of effects, Southall et al. (2017) report upon effects on the North Atlantic right whale, where shipping noise, combined with present-day ambient noise to which shipping is a major contributor, has been found to severely mask communication more than 70% of the time. However, Southall et al. (2017) report that for odontocete cetaceans (toothed whales and dolphins), the potential acoustic interference from vessel noise is limited to short range (hundreds of meters) effects or is restricted to those animal signals with the lowest frequencies in this range. They report that baleen whales are most susceptible to potential negative effects from noise interference from vessels due to the overlap between the frequency of vessel noise and communication signals. The potential impacts on baleen whales is of note related to confirmed presence of migratory humpback whales in the seascape. Other behavioural effects that have been reported include, changes in swim direction and speed, surface times and inter-breathing intervals, changes in proximity to other individuals, etc. (Lemon et al., 2006; Kruse, 1991 and Lusseau, 2003). Boat traffic can disrupt important behaviours such as feeding, courtship and mating in response to perceived strike risk, and can be energetically costly and affect the reproductive success of individuals or groups. Other social responses can also occur. Richardson et al. (1990) studied bowhead whale reaction to vessel noise (particularly dredging noise) and found a decrease in call rates, cessation of feeding and change in surfacing and respiration cycling in some individuals. Bottlenose dolphins in Florida show preference for deeper channels over primary foraging habitats when boat traffic densities are high (Allen et al., 2000). In the review undertaken by Southall et al. (2007) several studies showed altered behaviour or avoidance by dolphins to increased sound related to boat traffic. A study on dugongs (Hodgson, 2006), showed that these animals were less likely to continue feeding if a boat passed within 50 m. It was concluded that boat traffic may reduce dugong's feeding time budget by 0.8–6.0 % (based on 65 boat passes in 19 days or around 24 passes per week). Studies on manatee, a close relative of dugong, show that they are passive listeners that do not use sonar to navigate and detect objects in the environment and they merely listen to the noises around them (Gerstein, 2002). Manatees also prefer habitats with less low frequency noise. This thus suggests that manatees may avoid areas of sound generation and this would reduce the chance of interactions with the works (Miksis-Olds et al., 2007). Manatees can show avoidance of areas utilised by vessels (Nowacek et al., 2004). Nowacek et al. (2004) recorded manatees as responding to approaching vessels by changing fluke rate, heading, and dive depth.

Southall et al. (2007) developed threshold levels for behavioural effects using the Root Mean Square Sound Pressure Level SPL_{rms} metric, which is the mean square pressure level measured over a given time. Southall et al. (2007) derived thresholds for behavioural responses on a severity scale: "weak responses" indicate brief and/or minor changes in e.g. vocal behaviour, respiration and locomotion. By contrast, "strong responses" are represented by extensive and/or prolonged changes in the behavioural traits mentioned above as well as aggressive behaviour amongst individuals and brief or minor separations of females and dependent offspring. As stated above the accuracy of these thresholds are only a guide given data paucity and variations in animal behaviour. Thresholds reported by Southall et al. (2007) would suggest that strong behavioural responses may occur within a few hundred m of the cable laying operations and weak behavioural responses would occur within a conservative approximate boundary of 5-10 km from the operations.

NMFS (2016) defined the behavioural threshold for non-impulsive sound sources as he root-mean-square (rms) sound pressure level (SPLrms) 120 dB re 1 µPa.

NMFS (2017) refer to this threshold as being appropriate for cable laying activities such as those produced by machineries during anchor handling, pre-trenching, and cable-laying with DP thruster and sea plow associated with the proposed subsea cable-laying and maintenance) underwater. Llingworth and Rodkin (2016) conducted sound source verification (SSV) measurements of the Ile de Brehatwhile operating near Nome at the beginning of the 2016 field season; and found that the primary noise source emanated from the drive propellers while towing the sea plow. Their research determined that the NMFS behavioural threshold would be reached at 5.35 km from this sound source. Nedwell (2003) surveyed a sound level of 123 dB re 1m Pa at 160 m from the sound source. Data available from ASN (unpublished) has determined noise levels for Ile de Class vessel during cable ploughing operations. This survey defined sound levels of 143 dB at 245 m and 133 dB at 586 m from the source during the plough deployment.

Sea turtles and fishes

Popper et al. (2014) provided sound exposure guidelines for sea turtles and fish. They state that there is no direct evidence of mortality or potential mortal injury to fish or sea turtles from ship noise.

Sound is an important source of sensation and communication in fish. Fish are sensitive to sound, which is detected by the sensory hair cells on otolith organs of the inner ears. There are marked differences in both acuity and frequency response between and within species, although in most cases sensitivity is in the 50-3,000 Hz range. Broadly, fishes can be categorized as hearing specialists (broad hearing frequency range with low auditory thresholds) or hearing generalists (narrower frequency range with higher auditory thresholds). The hearing generalists, such as sharks, rays, flatfish, flounder and many large pelagic fish do not have swim bladders and are likely to be at less risk from noisier activities than those that do. The hearing specialists are fish with swim bladders, which are present in the AoI. Most information on the response to fish relates to impulse impacts, which are not relevant for this Project. For non-impulsive sounds, Popper et al. (2014) provided criteria for 'recoverable injury' and TTS for fish with swim bladders as being 170 dB and 158 dB, respectively. This means that injury from large vessel movements for fish may occur, but this is based on exposure other 48 and 12 hours, respectively with recovery occurring with 2-8 days. They state that no data exists to determine the non-impulsive source impacts on eggs and larvae. Popper et al. (2014) reported that TTS onset is very variable with some species showing no effects even with long periods of exposure. Popper et al. (2014) stated that continuous noise can mask signal detection, and thus affect behaviour. They state that vessels can change fish behaviour (e.g. induce avoidance, alter swimming speed and direction, and alter schooling). It should be noted that the cable installation will be across a large area that provide ecosystem functions for many fish.

Popper et al., (2014) reported that the ear of sea turtles appears to be adapted to detect sound in water. The retention of air in the middle ear of these sea turtles suggests that they are able to detect sound pressure. Nelms et al (2016) stated that the hearing ability of sea turtles allows them to perceive important biological signals, the proposed functions of which include predator avoidance, navigation, communication and the identification of nesting beaches. Nelms et al (2016) also stated that hearing damage may lead to a reduced ability to avoid natural and anthropogenic threats, such as fisheries by-catch and vessel collisions, which are major sources of turtle mortality. Popper et al. (2014), also stated that sound generated by vessels could produce a moderate risk of TTS near to the sound source for sea turtles, but beyond this area the risk is considered to be low. They state that there is a high risk of behavioural effects in the near-field zone to the sound source, and moderate risk in the intermediate zone. However, the report also states that there is no data for understanding impacts on sea turtles for such impacts. Due to a lack of research, it is not known what levels of sound exposure (or frequency) would cause permanent or temporary hearing loss or what affect this may have on their fitness or survival (see citations in Nelms et al. 2016). No absolute thresholds exist for behavioural responses. Nelms et al (2016) stated that electrophysiological and behavioural techniques have found that sea turtles can detect frequencies between 50 Hz and 1600 Hz, which overlaps with the frequency of large vessels. A number of experimental studies have found that exposure to sound elicits a behavioural response in turtles. Nelms et al (2016) cite Lenhardt (1994) found that loggerhead turtles exposed to low frequency sound in a tank responded by swimming to the surface and remaining there or staying slightly submerged, possibly because received sound levels were lower at the surface. McCauley et al. (2000) observed caged green and loggerhead turtles while they were exposed to increasing levels of sound generated by airguns. Turtles noticeably increased their swim speed when airgun levels exceeded 166 dB re 1 μPa rms. Their behaviour became more erratic, potentially indicating that they were in an agitated state, when airgun levels increased to above 175 dB re 1μPa rms. Experimental studies, however, are often carried out in artificial surroundings and as such, the results may not be representative of real, open-water situations where the propagation of sound differs and the turtle is able to move away. Turtle behaviour is difficult to interpret; and many observational data are often somewhat qualitative. This makes comparing response results among studies problematic (Nelms et al., 2016). It should be noted that vessels will be moving through habitat that provides foraging and inter-nesting ground for sea turtles, between October and April. Impacts on individuals could result, including females that will nest.

Seabirds

Underwater sound generation may impact birds that obtain prey underwater by plunge diving birds (e.g., terns) or pursuit (e.g., cormorants). If such species are foraging across the coastal and offshore areas of the seascape – although no precise data are available on their abundance and distribution. As plunge divers, they are potentially vulnerable to direct impacts of underwater noise, whether physiological or behavioural. Vulnerability to impacts is uncertain, but the spatial extent of impacts is small in comparison to the overall range of birds. These species are also highly mobile and would not be present in water at all times. Key breeding areas would not be impacted it is unlikely that significant population level affects would occur. Therefore, resilience is considered to likely be high.

Indirect impacts

Sea turtles, fishes and marine mammals may also be affected by indirect and cumulative impacts on the prey base that may be affected by underwater sound generation. The vulnerability to such impacts is expected to be low and resilience is expected to be high based on the scale of impacts that are predicted.

Conclusions

In summary, based on criteria available from best available guidance, it is possible that underwater sound from large vessels could lead to injurious impacts if animals are present very localised to source; and also, behavioural impacts on marine mammals, sea turtles and fish over a broader area. Strong behavioural impacts will be more localised to source (nominally a few hundred metres based on data available). There are, however, some uncertainties in this understanding based on available data. However, operations will be short term with operations being completed within 4 days; and the impacts that will ensue have to be considered in this context, especially related to the larger marine traffic movements that will likely occur from wider port movements and fishing activities. It is not expected that significant impacts will occur due to the displacement of animals from the sound sources. Although impacts may occur in areas where species of conservation note are present, the cable burial activities will be undertaken in a linear manner. As such, impacts are not expected along the entire cable route for the entire period of the cable laying duration and relate to activities at each point along the cable route. Impacts are reversible through cessation of activities, especially as PTS is not expected. Impacts are therefore considered to be of low magnitude. The potential sensitivity of some species will be high. Therefore, impacts are rated as being of **moderate** significance.

5.4.3.4.2 Operation Phase

A similar type of impacts from vessels as discussed under construction may occur if cable repairs are required during operation, but the scale of impacts would be lower than during this phase related to the extent of work that may be required. Impacts on marine biodiversity receptors is expected to be of **minor** significance.

5.4.3.5 Artificial Lighting

5.4.3.5.1 Construction Phase

Introduction

Construction lighting within land-based works areas, lighting of construction vessels and equipment can result in detrimental impacts on marine fauna (i.e., fishes, sea turtles and birds). A receptor-specific discussion of impacts is provided below. Given the nature of works, it is unlikely that night-time working will be required for land-based activities. However, some lighting at night cannot be avoided (i.e. for vessel navigation or security lighting). The following presents an overview of impacts should lighting be required.

Sea turtles

Nesting sea turtles populations are particularly sensitive to light impacts. As stated in Chapter 4, the beaches at and adjacent to the landing point have the potential for sea turtle nesting, albeit at low expected numbers. At the cable landing site where the works will take place the level of disturbance and the space above HW limits the potential. However, lighting impacts can occur at distance from the source so are relevant for discussion. Threats from lighting to turtles are most pronounced on nesting beaches and nearshore waters (DEE, 2020). It is unlikely that lighting from vessels will lead to impacts, but if artificial lighting is used on the coast during construction, this could lead to impacts as discussed below.

Adult sea turtle are known to avoid nesting on beaches that are brightly lit. In addition, adults and hatchlings may be disorientated or misoriented and unable to find the ocean in the presence of direct light or sky glow. Females sometimes may not emerge from the sea due to the presence of artificial lighting or may emerge at an alternative site or they may be disturbed during emergence. Females that complete nesting may also have difficulty finding the sea again due to the effects of artificial lighting. Light pollution may also cause hatchlings trying to find the sea to move in the wrong direction (mis-orientation) as well as interfering with their ability to orient in a constant direction (disorientation). These impacts can lead to mortality as hatchlings become exhausted, dehydrated, predated or crushed by vehicles etc. Lights can also interfere with the in water dispersal of hatchlings (DEE, 2020). In addition, all impacts may reduce the reproductive output of nesting beaches.

DEE (2020) present a 20 km threshold which is a precautionary limit based on observed effects of sky glow on sea turtle hatchlings. It is a nominal distance but shows that lighting for construction may have broad-scale impacts dependent upon local conditions.

The impact of lights is dependent upon the type of light being emitted (DEE, 2020). Some light types do not appear to significantly affect nesting densities (Low Pressure Sodium (LPS) and filtered High Pressure Sodium (HPS), which excludes wavelengths below 540 nm), so not all lighting will cause significant effects. However, brightness can be a factor with lights that may induce smaller effects due to wavelengths.

Inherent mitigation means that planned activities on the coast will be undertaken during the day. Some security lighting may, however, be required. Given the timeframe and nature of such lighting, impacts would be temporally and spatially very limited. The area where works will take place is already highly urbanised, which means that impacts already occur. However, lighting for the Project could lead to cumulative effects, but the contribution is low. Impacts a therefore considered to be of very low magnitude. However, sea turtles may have high sensitivity to light impacts. Therefore, impacts are rated as being of **minor** significance.

Seabirds

Artificial light may disorient seabirds and potentially cause injury or death through collision with infrastructure (DEE, 2020). As noted above, seabirds in the seascape includes migratory birds, although local habitat is not considered to be important for roosting, breeding or foraging for such birds. DEE (2020) reported that seabirds that are active at night while migrating, foraging or returning to colonies and are directly affected by artificial illumination. This includes terns that are known to be present in the seascape.

DEE (2020) reported that high mortality of seabirds occurs through grounding of fledglings as a result of attraction to lights and through interaction with vessels at sea. DEE (2020) also reported that the degree of disruption is determined by the combination of physical, biological and environmental factors including the location, visibility, colour and intensity of the light, its proximity to other infrastructure, landscape topography, moon phase, atmospheric and weather conditions and species present. As stated above, the landing site is highly urbanised and any construction works would be very short term. Therefore, if there is a need for lighting the construction on the coast impacts would be very low magnitude. Sensitivity is also considered to be low. Therefore, **negligible** impacts are expected.

Cable laying vessels will also emit light during the night, including navigation and deck lights etc. Bright white deck lights may attract seabirds at night, particularly on nights with little moon light or low visibility. However, the vessel will not navigate through any area of specific importance for seabirds, i.e. foraging or breeding areas. Whilst it is possible for some seabirds to be attracted to the vessel, the marine installation works will be completed within four days and therefore very small impacts are expected. The vessel will be continually moving and will not be anchored in any position for any time, which will again limit the potential for impacts to occur. The marine installation works will also be completed within 4 days. Therefore, impacts would be very low magnitude. Sensitivity is also considered to be low. Therefore, **negligible** impacts are expected.

Fishes

Many fish species are attracted to light, from zooplankton and fish larvae, to commercially targeted species such as squid and herring, a fact exploited by commercial fisheries who use lights to improve catches (Ben-Yami 1976, Pascoe 1990). Marine fish distribution, abundance and assemblage composition varies through the dial cycle which separates diurnal, nocturnal and crepuscular species (Myers et al. 2016). This temporal separation of predators, prey and resources is key to healthy ecosystem functioning. Owing to the short duration, local extent of impacts and sensitivity of receptors to these changes, the pre-mitigation effect of lighting on fishes is, however, considered be of **negligible** significance.

5.4.3.5.2 Operation Phase

A similar type of impacts from vessel lighting as discussed under construction may occur if cable repair is required during operation, but the scale of impacts would be expected to be lower than during this phase related to the extent of work that may be required. Impacts on marine biodiversity receptors is expected to be **negligible**.

5.4.3.6 Alien invasive species

5.4.3.6.1 Construction Phase

Vessels can be a pathway for the introduction of invasive species. Alien invasive species may be introduced from fouling on vessel hulls, underwater fittings (e.g., propeller, rudder, bow thrusters), anchors, submerged or damp internal structures (e.g., chain lockers, bilges, sea-chests and internal seawater systems), ancillary equipment (e.g., ropes, cables, fenders and buoys), and ballast or bilge water (IPIECA 2010).

The risks from alien species are complex but known to be significant in some areas where introduction has occurred from vessels. Impacts may include displacement of native species, loss of ecosystem function, altered trophic dynamics etc.

Invasions are well documented in many other parts of the world in coral and seagrass communities where invasive invertebrates and algae have been introduced; or in port areas where there are specific niches that support colonisation. The resulting impacts on the environment can be extremely severe and almost impossible to reverse. One of the most significant problems with the introduction of alien species is when invasive species, due to being transported from a distant location, have no natural predators in their new environment. This lack of predators allows them to expand their population rapidly. In some instances, potential native predators are naïve to the non-indigenous species, preventing biological control and effective predation of the invasive species. The introduction of alien species can lead to a change in the ecosystem balance that can then lead to degradation of environments.

As inherent mitigation to meet international obligations, all vessels will adhere strictly to the International Maritime Organisation (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (2004). Part of the requirement under this Convention is to ensure that ballast water exchange operations are to be carried out in the deep water, open ocean as far as possible from the shore. The exchange should be conducted, wherever possible, at least 200 nautical miles (370 km) from shore and in the water where the depth is 200 m or more. Whilst there is potential for the introduction of invasive alien species during the construction period the marine installation works will also be completed within 4 days and a single cable laying vessel will be used so the potential is very limited. In addition, habitats that may be most affected by alien invasive species are not present in any proximity to the cable route. Therefore, **negligible** impacts are expected.

5.4.3.6.2 Operation Phase

A similar type of impacts from vessel lighting as discussed under construction may occur if cable repair is required during operation, but the scale of impacts would be expected to be lower than during this phase related to the extent of work that may be required. Impacts on marine biodiversity receptors is expected to be **negligible**.

5.4.3.7 <u>Electromagnetic Field Effects (EMF)</u>

5.4.3.7.1 Operation Phase

Fibre optic submarine communication cables carry a constant direct current (DC) of 1 Amp – 1.6 Amp power to power the underwater repeaters. This current is fed along the conductor and depending on the length of the cable span it may require several thousands of volts to maintain it. Williams (2000) states that the total requirement for a typical 7500 km transatlantic crossing with 100 repeaters would be close to 10 KV.

There is no external electric field associated with the power on the inner conductor. The ratio of the conductivity of the polyethylene insulation to that of seawater means that the electric field is confined within the cable insulation. The DC in the inner conductor creates a stationary magnetic field in the form of concentric rings emanating from the cable. For a cable carrying 1 Amp the magnetic flux density emanating from the cable at a distance 1 m is 0.2 micro Tesla. This is two orders of magnitude smaller (i.e., 100 x smaller) than the vertical component of the earth's magnetic field. Marine life that may be sensitive to changes in the electromagnetic field would need to be within a few centimetres of the cable to detect the field above that of the earth. Therefore, the electromagnetic radiation associated with fibre optic communication cables is very low and the environment is shielded from any adverse significant effects (ICPC, 2001). Burial of the cables in water depths of <1000 m will reduce the level of magnetic and electric fields occurring at the seabed surface. There is therefore very limited potential for very localised impacts on electroreceptive demersal fish species that traverse a cable, but these are considered to be of **negligible** significance, especially within.

A summary of the potential impacts of the Project on marine biodiversity during construction and operation is provided in Table 5.12.

Table 5.12: Summary of potential impacts of the Project on marine biodiversity

Activity	Receptor	Impact	Significance
RC, PLGR and cable installation works	Marine biodiversity	• Physical loss and disturbance (intertidal and supratidal) during construction	Moderate
		• Physical loss and disturbance (subtidal) during construction and operation)	Negligible
		• Increased suspended sediment and sediment deposition	Minor
		• Pollution of marine waters	Minor
		• Underwater sound generation	Moderate

Activity	Receptor	Impact	Significance
		• Artificial lighting	Negligible to Minor
		• Introduction of alien invasive species	Negligible
Cable repairs (in case of damage)	Marine biodiversity	• Physical loss and disturbance (subtidal)	Negligible
		• Increased suspended sediment and sediment deposition	Negligible
		• Pollution of marine waters	Negligible
		• Underwater sound generation	Minor
		• Artificial lighting	Negligible
		• EMF	Negligible

5.4.4 Terrestrial Biodiversity

5.4.4.1 Construction Phase

There is no risk for the introduction of alien invasive species on land as no off-site material will be introduced to the environment, i.e. only excavated material from the site will be used as in-fill.

Cable laying activities and construction of the BMH and OGB may result in the disturbance of terrestrial flora and fauna habitats within the footprint and immediately adjacent area. These activities will result in the disturbance or clearing of some low-level ground vegetation. The footprint of disturbance in these areas will be small and the conservation value is low. Terrestrial fauna species subject to disturbance may be displaced temporarily until active and passive natural restoration occurs. Disturbance (such as noise from increased human and vehicular presence, increased artificial light from site security and dust pollution) will result in localised impacts to fauna within the area and surrounds. As many terrestrial fauna species are largely mobile, and the total amount of habitat that will be lost and disturbed due to the development is small and involves only common and widespread habitat types that are abundant in the environs, no major impacts on terrestrial fauna are predicted as a result of the Project activities. Disturbance from installation activities will have impacts that are short lived, localised and easily reversible. The ecological value of the areas affected is low. Furthermore, WIOCC will conduct a separate ESIA study for the terrestrial components of the project. The overall impact significance of installation activities on terrestrial fauna is rated as **minor**.

5.4.4.2 Operation Phase

It is very unlikely that cable repairs will be required in the terrestrial zone. Therefore, **negligible** impacts are expected.

A summary of the potential impacts of the Project on terrestrial biodiversity is provided in Table 5.13.

Table 5.13: Summary of potential impacts of the Project on terrestrial biodiversity

Activity	Receptor	Impact	Significance
Cable installation, BMH and OGB	Terrestrial biodiversity	• Disturbance of terrestrial fauna species in the project AoI	Minor
		• Clearing of vegetation on the beach	Negligible

5.4.5 Climate, Air Quality and Noise

5.4.5.1 Construction Phase

Climate

Submarine cables are unlikely to be exempt from the anticipated changes in the ocean resulting from human-influenced climate change. Rising sea levels, more intense storms, extremes of precipitation and drought, changes in the position and strength of zonal winds, together with effects on ocean currents, all have the potential to impinge directly on submarine cables (Carter *et al*., 2009).

The construction activities for the Project will have some carbon footprint. The major source of emission of carbon dioxide and other greenhouse gases will be the burning of fossil fuels during the operation of the cable-laying vessel and use of fuel burning equipment for cable installation on land.

Ships accounted for approximately 1 billion tonnes of GHG emissions over the period 2007 to 2012 (Smith *et al*., 2015), which is a significant contribution to the global climate change issue. Recent studies show that the GHG emissions from shipping vessels are still on the rise, despite improvements in operational efficiency for many ship classes. However, container ships, bulk carriers, and oil tankers account for the largest percentage of emissions (ICCT, 2017). The cable-laying vessel to be used for the Project will be a smaller vessel compared to the major emitters of GHGs. The vessel will have well maintained engines that and operated by an experienced team to reduce its consumption of fuel and its emissions of GHGs. In addition, due to the slow speed of the vessel engine required for offshore cable operations, it is anticipated that the emissions will be minimal. It is highly unlikely that the Project will lead to any measurable effect on climate change. Therefore, the impact significance is rated as **negligible**.

Air Quality

The Project has the potential for impacting air quality. The main sources of air emissions during the construction phase are engine driven construction machinery, diesel generators, transport vehicles, excavation works and the use of vessels. The main pollutants released from these sources include dust and particulate matter (PM_{10}), oxides of nitrogen (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO) and unburned hydrocarbons (HC). These releases have a wide variety of environmental effects over different geographical ranges and time scales. The excavation works on land are relatively small-scale and will be undertaken within a few days. The amount of fuel burning equipment used is small and emissions will be very small-scale, particularly in relation to wider traffic movements in the area. The primary impacts of increased emissions are on human health within the site and neighbouring areas and a reduction of overall air quality. The key local effects from the Project will be limited to the areas immediately adjacent to the development and its access routes because of the rapid dispersion and dilution of any emissions over further distances (i.e. between the emission sources and the receptors), quickly reducing levels.

Vessels typically use lower grade (more polluting) fuels than the majority of terrestrial vehicles. MARPOL 73/78 provides inherent controls on air polluting emissions, including limits on SO_2 and NO_x emissions from ship exhaust and the prohibition of ozone depleting substances. There is also a global limit of 4.5 percent (by mass) on the Sulphur content of fuel. The vessel will install the cable within 4 days and emissions will therefore be temporary. Emissions will also occur at sea were receptors are few. Also, it has been established that limiting ship speeds reduces fuel consumption and emissions (ICCT, 2017) and vessel speeds during construction are low.

The magnitude and the sensitivity are both rated low considering the short duration of the cable laying operations, slow speed of the vessel during operations, and the implementation of control measures. Thus, the overall impact significance is rated as **minor**.

Noise and Vibration

Construction noise and vibration will include sources such as excavators and vehicles transporting materials. Key receptors likely to be affected by the works include local residents, recreational beach users, as well as construction workers. With respect to the surroundings, noise is attenuated by distance (typically noise levels drop by about 40 dB(A) at 100 m distance from source, based on standard sound wave divergence in an homogeneous loss-free environment). It is envisaged that the construction work will be conducted only during daytime for a few days only. Noise from transport vehicles will be only transient for a given location. These nature of works means that increases in noise will be localised to source and very short term.

Overall, the sound generated during construction activities will be low and not injurious or expected to create a wide-scale disturbance. The overall significance of the impact is thus rated as **minor**.

5.4.5.2 Operation Phase

Cable repairs during operation may require the use of vessels, but this will not lead to significant impacts on receptors from air quality and noise impacts. Any repairs on land or in the nearshore area will be avoided through the use of articulated pipe protection. Impacts on climate will also be negligible.

A summary of the potential impacts of the Project on climate, air quality and noise during construction and operation is provided in Table 5.14.

Table 5.14: Summary of potential impacts of the Project on Climate, Air Quality and Noise

Activity	Receptor	Impact	Significance
Cable installation (onshore and offshore) and construction of the BMH and OGB	Climate	• Climate change impacts • Release of GHGs	Negligible
	Air quality	• Emissions of air pollutants in the marine environment	Minor
		• Emission of air pollutants during installation works at the coastal shore areas	Minor
	Noise and vibration	• Generation of noise and vibration to the marine environment during cable laying activities	Minor
	Climate	• Climate change impacts	Negligible

Activity	Receptor	Impact	Significance
Cable repair in case of damage	Air quality	• Decrease in ambient air quality	Negligible
	Noise and vibration	• Generation of noise and vibration to the marine environment during cable laying activities	Negligible

5.4.6 Socio-economic Environment

5.4.6.1 Construction Phase

The immediate community within the Project AoI is Ikate-Elegushi community in Eti-Osa Local Government Area (LGA) of Lagos State. The discussion of potential impacts of the Project activities on the socioeconomic environment is discussed below.

Economy and Livelihood

The construction phase of the Project will have beneficial impacts on the economy and livelihoods of Ikate-Elegushi community, which may even extend outside the community. Construction phase activities may generate some low-level employment opportunities for members of the local community.

Another beneficial impact is that there may be income opportunities for local suppliers of material and equipment, as well as revenue generated from purchases by work crews will benefit the local economy.

The duration of construction phase will be short term, and only a few (< 20) personnel will be engaged for trench excavation activities. Based on the consultations within the community as discussed in Chapter 4, the generation of employment opportunities is one of the key expectations of the community leaders from the Project. However, the beneficial impact is considered to be of **minor** significance given the scale of work required for the submarine cable and the limitation of opportunities to the construction phase**.**

Fishing and Fisheries

As noted in Chapter 4, fishing activities in the marine and coastal areas of Nigeria are a major source of employment for coastal communities, and can be categorised into two (2) types: artisanal and industrial marine fishing. Artisanal marine fishing grounds along the Nigerian coastline cover up to 5 Nm offshore and are limited to 20 m depth contour. Industrial marine fishing activities are only permitted from 5 to 30 Nm offshore, in including the areas up to the boundary of the EEZ. This zone is the major industrial fishing ground for Nigeria's marine fisheries resources;

mainly the offshore tuna fishery, coastal demersal fish fishery, and coastal shrimp fishery. Due to technical constraints, the Nigerian fishing industry is yet to fully explore this zone.

There is the potential for fishing gear in deep waters, and anchorage in shallower waters, to cause damage to the cable and this may result in revenue loss to the cable owners and telecommunication problems in Nigeria. Snagging of the cable may also destabilise the fishing vessel with associated health and safety risks and may result in lost fishing gear. Trawl fishing is the dominant form of industrial fishing in Nigeria, which may pose a risk to the submarine cables at depths between 15 m and 1,000 m. However, the industrial fleet is made up essentially of shrimp trawlers for targeting demersal fin fish and shrimps in the inshore coastal waters mainly between 10 and 50 m depth. Although no indication of fishing activities in the deep-water area was observed during the cable route survey, many small fishing boats and fishing gear nearshore were sighted.

Burial of the cable in water depths of <1000 m metres reduces the potential for impacts to occur. Also, research indicates that when a trawl crosses a communications cable lying on the seabed, more than 90 per cent of such crossings do not result in cable damage (Wilson, 2006). The cable will be placed on the seabed protected by articulated pipe in nearshore area. However, as noted in Chapter 2, the cable will route through a 'no anchorage and fishing zone' in the water depths of <100 m. This implies that it is unlikely that the cable laying activities for the Project will have any impacts on fishing activities or cause any damage to fishing gear in this area.

Cable installation activities and associated presence of the cable laying vessel may temporarily impede and hinder industrial fishing activities in offshore areas during the installation phase. However, such impacts would occur over a very short period of time and limited to a small number of vessels. Also, bottom longlining operations can interact with cables because the longlines are often recovered by grapnel.

Given that the duration of cable laying activities will be temporary, and it is unlikely that the cable will affect fishing gears or key fishing grounds, the overall impact significance thus rated as **minor**.

Offshore Oil and Gas Concessions

Based on a desktop review and cable route survey, there are no anchorage areas, military practice areas, and dumping grounds along the cable route. However, there are some inactive oil concession blocks along the route (as discussed in Chapter 4). The Project will have no impacts on access to the oil concession blocks.

It is not anticipated that the installation of the cable and associated presence of the cable laying vessel will impede activities in oil and gas concession blocks during the time that the cable is being laid in Nigerian waters.

Landscape and Aesthetics

The land-based Project's AoI is characterised by residential, business, and recreational structures. It was observed that the immediate areas of the cable landing site are characterised by shanties (illegal structures), small cement block making activities, vacant plots of land and land in-filling.

The potential impacts of the Project on the landscape and aesthetics of the AoI may include the visual distraction of the cable laying vessel on the beach to local residents and visitors; presence of Project vehicles; and security lighting during installation activities. These impacts may cause a direct negative impact on the scenic attributes of the area.

These impacts will be short term, localised and easily reversible. The sensitivity of the receptor is rated low as there are no major commercial activities close to the cable landing site. Therefore, the significance of impact is rated as **minor**.

Recreation

As discussed in the above paragraph, there are recreational activities ongoing within the Project's AoI. Most notably is the Elegushi beach which attracts visitors and fun seekers from within and outside Lagos State. Such recreational activities may be disrupted in the construction area, but the extent and duration of such impacts is small. The Project is not envisaged to significantly affect the recreational activities at the beach and the impact is rated as **minor**.

Marine navigation

Cable installation may cause temporary disruptions to the flow of shipping traffic as installation vessels are slow-moving and may have to operate in stationary positions at times. However, construction operations will be short in duration and can generally be accommodated without significant disturbance to other shipping activities. Cable installation vessel will also obtain operational permissions from the relevant Nigerian government authorities (e.g. NIMASA and NPA). In addition, cable installation vessel will display cable laying signals to warn passing traffic. Other marine users will be notified of the location of marine activities associated with the Project and the cable location. However, it is again noted, that the cable route avoids fishing zone which limits the potential impacts on fisheries vessel movements. The magnitude of the potential impact of the Project on marine traffic is considered to be medium since any potential interruption of marine traffic would be localised to cable laying areas. Furthermore, the potential of collisions between the cable laying vessels and other marine vessels is very unlikely with the adoption of appropriate vessel management and communication protocols. Thus, the impact significance is rated as **minor**.

Terrestrial Traffic

During construction phase, the movement of Project vehicles in and out of the cable landing site at Elegushi beach for coastal works could potentially increase traffic volume in the area, and the potential for road accident. As noted in Chapter 4, there is a coastal road that runs adjacent to the cable landing site behind the beach, which eventually connects to the Lekki-Epe Expressway via Silverbird road. The road is largely in good condition and was constructed with interlocking bricks. However, accessibility along this route is interrupted east to west by structure and development around the landing site location.

The potential impact is considered to be short term, negative and localised. The magnitude of the impact is considered to be low, given that coastal installation activities will take place only for a few days. Based on site observations, vehicular movement on the road leading to the landing site is relatively low. Based on a precautionary approach, the impact significance is rated as **minor**.

Occupational Health and Safety (OHS)

There is potential for impacts on human health and safety to occur as a result of accidents and unplanned events that may occur during the Project activities. Although these events are unlikely, if they did occur, they could have a significant impact on human health and safety.

Cable laying operations in the offshore section of the cable route will present challenges to the health and safety of the workers. These challenges usually arise from the use of specialised equipment on the ship, in addition to man overboard risks. Cable laying projects usually require a large number of personnel working offshore, all of whom require training, certificates, and inductions before they can begin working on the Project. To ensure the safety of the operation, careful planning and close monitoring of daily tasks will be mandated. The appropriate health and safety regulations will be implemented and maintained throughout the duration of installation activities. All personnel carrying out the cable laying tasks shall have the relevant, valid certifications needed, and have completed full health and safety training before the task.

Another impact of the Project activities is the risks associated with the use of divers for nearshore cable installation. Only trained divers with approved diving qualifications, a valid certificate that proves their medical fitness to dive as well as being trained in first-aid techniques will be engaged for the Project. Their activities will be closely supervised with appropriate safety protocols put in place. Also, at risk are fishing vessels that may move at night-time or in reduced visibility conditions when the project activities are taking place. The collision of the cable-laying vessel with fishing boats and nets or other vessels could result in damage to vessels and equipment, injury or loss of life.

The impact magnitude of health and safety impacts may range from low to high. However, the extent of the impact will be localised and risks will occur over a short period of time. The impacts may range from temporary to permanent as some impacts will last only a short while (minor injury) and some may cause a permanent change (mortality related to vehicle or vessel strike). The overall unmitigated impact significance is rated as **moderate**.

Community Health and Safety

The potential impacts of the Project on the local community will be mostly linked to activities that take place nearshore and coastal area. Due to the technical and specific nature of the Project, the Project will require a high level of global expertise especially during installation phase, including appropriate site management to address any localised risks. The scale of land-based transport required for the activities is small so the risks from traffic accidents is low. The risk to communities undertaking fisheries activities is low given the level of interaction with works. In addition, the cable landing activities will be short period of time. The impact significance is rated as **minor**.

5.4.6.2 Operation Phase

Cable repairs in the marine environment could lead to similar impacts as discussed for construction. However, the level of risk is lower.

In terms of beneficial impacts, the objective of the Project is to provide additional telecommunications capacity to Nigerian users as well as providing high speed connectivity to the global network. This will have major and minor beneficial impacts across all a wide range of sectors such as economy, health, education, security, etc.

The major beneficial impact to existing business entities is the improvement in their business performance and delivery of services, thereby improving returns on investment and creating opportunities for growth and expansion. The Project will also improve communications with external entities, and improve trade relations within and outside Africa. The lowering data and communication costs due to the Project operation will be an advantage to new companies and start-ups, while providing improved communication service.

These impacts will also be experienced in the educational sector, as there will be improved access to information and collaboration with foreign educational institutions. Furthermore, there is an ongoing expansion of technology-reliant companies in Nigeria who will benefit from improved data availability and increase in the quality of network transmission. This will enhance innovation and create additional employment opportunities in these sectors. All of these will lead to major beneficial impacts.

Table 5.15 provides a summary of potential impacts of the Project on socioeconomic environment.

Table 5.15: Summary of potential impacts of the Project on Socio-economic Environment

Activity	Receptor	Impact	Significance
Construction works	Economy and Livelihoods	• Employment opportunities for local labour • Income opportunities for local fishing boats • Improved business opportunities for local traders and suppliers	Positive (Minor)
	Fishing and fisheries	• Damage to fishing gear and fishing boats • Damage to submarine cables by fishing gear • Restriction of access to fishing zones	Minor
	Recreation	• Disruption of recreational activities at the beach area	Negligible
	Landscape and aesthetics	• Visual distraction of the cable laying vessel • Cable burial activities at the beach • security lighting	Minor
	Marine navigation	• Temporary disruptions to the flow of shipping traffic • Potential collisions of marine vessels	Minor
	Traffic	• Temporary increase in traffic and disruptions to the flow of traffic	Minor

Activity	Receptor	Impact	Significance
	Occupational health and safety	• Accidents and injuries during offshore Installation activities	Moderate
	Community health and safety	• Accidents and injuries to community members during installation activities at the landing site	Minor
Cable operation	Economy and livelihoods	• Improved internet connectivity for Nigerian users • Enhanced service delivery and business performance • Improved data availability and quality of network for access to information and collaboration	Positive (Major)

5.4.7 Waste Generation

5.4.7.1 Construction Phase

There is potential for the release of waste from vessels and land-based construction areas associated with increased human presence in the area.

On land

On land waste may include the need for the removal of excavated material from cable trenching and construction of the BMH and OGB. As noted in Chapter 3 the volume of waste dispose off-site is expected to be low based on the reuse of material for restoration of excavated areas wherever possible. In addition, littering and garbage that may fall or be thrown from construction areas and this has the potential to impact, for example on sea turtles and birds, particularly if ingested (e.g. plastics) and if they are an obstacle on the nesting beach. Littering and garbage that may fall or be inappropriately discarded from construction areas. It should be noted that large amounts of litter debris (including) plastics are commonly found on the beaches in the landing and construction works are very unlikely to contribute to this if good practice standard waste management approaches are adopted. The impact significance from land-based activities is rated as **minor**.

At sea

PLGR operations may recover debris from the seabed which has to be brought to shore for disposal. The debris may consist of old fishing cables, fishing nets, fishing traps, dropped objects, plastics, etc. The debris will be disposed of at local dumpsites in Lagos by accredited waste disposal contractors. A potential impact will be the increased stress on existing waste disposal facilities. The removal of any marine waste from the seabed could be considered to be a beneficial impact for the marine environment. However, the volume of the wastes is anticipated to be minimal and the impact significance is rated as **minor**.

A variety of solid and liquid wastes may be released into the environment during cable laying operations. Although the release of the wastes may be intentional or unintentionally into the environment, this section focuses on the intentional discharge of wastes. Offshore project activities will result in the production of minor quantities of waste from the cable laying vessel. These wastes may include general wastes (e.g. food waste, plastics, packaging, and paper materials and products) and hazardous waste (such as oily waste, batteries, and paints), etc. If not properly handled and disposed of, these wastes may have deleterious impacts on the marine environment. The immediate removal of some of these wastes from the activity area to appropriate regulated waste facilities is not considered a practicable solution. Therefore, some of these wastes may be stored onboard the ship or treated before discharge into the marine environment. The pollution of the immediate environment with the release of wastes has the likely consequence of decreasing the marine water quality and have indirect effects on marine habitats and species (see above).

Inherent adoption of strict guidelines and legal requirements will ensure that waste generated on board vessels will be minimised. This includes the requirements of MARPOL 73/78, which includes best practice measures to avoid harmful waste discharges at sea.

Given the very small quantities of waste that may be generated, the impact is rated as minor. The effects of the discharged wastes are considered to be regional given that pollution arising from poor waste management can extend beyond the immediate vicinity of the Project. The sensitivity of the receptor is therefore rated as medium and the overall significance of the impact is rated as **minor**.

5.4.7.2 <u>Operation Phase</u>

In the event of cable repair being required, it is anticipated that the wastes generated will be similar to what was obtained in the construction phase. However, the duration of cable repair operations is usually short and impacts from the activities will be localised and easily reversible. The overall impact significance is therefore considered to be **negligible**.

A summary of the potential waste impacts of the Project is provided in Table 5.16.

Table 5.16: Summary of potential waste impacts of the Project

Activity	Receptor	Impact	Significance
Cable installation, BMH and OGB	On land (waste disposal facilities)	• Increased stress on existing waste disposal facilities	Minor
	At sea	• Decrease in marine water quality	Minor
		• Physical and chemical impacts on marine flora and fauna	
		• Introduction of diseases to marine organisms	
		• Injury to marine organisms	
Cable repairs (in case of damage)	On land and at sea	• Decrease in marine water quality • Physical and chemical impacts on marine flora and fauna	Negligible

5.5 Impact Evaluation and Description (under Unplanned Events)

In addition to predicted impacts from planned activities, some impacts that could result from accidents or unplanned events during the Project implementation are discussed below. In these cases, the likelihood (probability) of the event occurring is considered. The impact of non-routine events is therefore assessed in terms of the risk, taking into account both the consequence of the event and the probability of occurrence.

5.5.1 Accidental Release of Solid Wastes

A variety of hazardous and non-hazardous solid wastes may be released unintentionally into the environment from overfull and/or uncovered bins or if blown off the deck of a vessel. Accidental spillage during transfers of waste from vessel to vessel, and incorrectly disposed items may also cause the unintentional release of solid waste into the surrounding environment. The non-hazardous solid wastes in this context includes plastics, packaging and paper materials and products while examples of hazardous solid wastes include oily and contaminated solid wastes, aerosol cans, fluorescent tubes, batteries and medical waste. There is capacity for non-hazardous solid waste to impact on marine wildlife (see above).

The unplanned release of non-hazardous and hazardous solid wastes through inadequate containment and practices is unlikely to have any significant environmental effects, as impacts would be temporary and localised (**minor** consequence). Appropriate management controls will be implemented, as they are considered effective in reducing the potential environmental impact to the marine environment. As such, the likelihood and risk associated with unplanned releases of non-hazardous and hazardous solid wastes is rated as **low**.

5.5.2 Dropped Objects

Damage to benthic habitats can occur due to an object being dropped overboard (e.g. equipment falling from vessel deck). Any marine organisms associated with the affected benthic habitat within the dropped object's footprint may also be harmed.

Disturbance of marine biota within the affected habitat would occur although the habitat itself would not be permanently destroyed. Due to the gradual infill process of such seabed disturbances, the effects on the seabed caused by a dropped object may persist for a length of time even if the object was retrieved. Physical damage of any sessile or slow-moving fauna (e.g. Syngnathids) and epibenthos (e.g. algae, sponges) may occur within the area of disturbance caused by the dropped object. Direct impacts from dropped objects to the seabed can include smothering/disturbance or damage of habitat and epibenthos. Objects that are not retrieved (where that action would cause significant disturbance or safety risk) would be expected to be colonized by epifauna relatively quickly (primary fouling will occur within weeks to months). Eventually dropped objects will degrade, but that may take years. Immediate localized and short-term impacts would be related to increased suspended sediment and turbidity; however, sands are predicted to settle quickly and the impacts to water quality will be so localized and short term they are not predicted to have any effect on filter feeders.

The likelihood of this impact is rated as **low** as there are procedures which have to be implemented for each specific lifting/handling requirement, and would be performed should any equipment lifting be needed. In addition, the equipment used for lifting operations will be maintained as specified in the planned maintenance system. Therefore, the impacts will be of **minor** consequence.

5.5.3 Ship strikes

A cable laying vessel will be used during construction. Vessels can pose a collision risk with marine wildlife, particularly marine mammals and sea turtles. That are surface-breathing and can be injured and killed by vessels. Rockwood et al. (2017) reported that mortality from collisions with vessels is one of the main human causes of death for large whales, including species known to be present in Nigerian waters. Slow moving whales and manatee are particularly vulnerable, but small cetaceans are also known to be affected. Of note to ship strike risks, breeding humpback whales may to be located in nearshore waters during their migratory period of May to January. In addition, nursery sperm whales may be present on the continental slope area. In addition, sea turtles may be present in greater numbers in nearshore waters during the nesting season (October to April).

Ship strike incidence is known to be greater for fast moving vessels. In a review of 292 ship strikes by Jensen and Silber (2003), vessel speeds were record for 58 ship strikes; range of speeds at which vessels were operating when a whale was hit was 2–51 knots; and the mean speed was 18.1 knots. The mean vessel speed which resulted in injury or mortality to the whale was 18.6 knots. Ritter and Panigada (2014) reported that the risk to whales is substantially less from ships travelling at 10 knots compared to 15 knots or more; and IWC (2017) reported that reducing vessel speeds in areas of high interactions is also a key element in mitigating adverse impacts on cetacean populations. Often, mitigation measures include seasonal and permanent restrictions of vessel speeds to 10 knots greatly reduces the chance of a lethal ship strike but is also practical for shipping purpose (IFAW, undated).

Hazel et al. (2017) reported that lower vessel speeds may be required for sea turtles in comparison to those implemented for marine mammals from their study of green turtles in Moreton Bay, Australia. They reported that cannot be relied upon to avoid vessels travelling faster than 2 knots, but this was in a coastal area with high levels of turtle activity. In Moreton Bay Marine Park go slow areas have been defined. These require vessel to be operated off-the-plane or in displacement mode; or for vessels over 8 m to have a maximum speed limit of 10 knots. In Zakynthos Marine Park, vessel speeds are restricted to 6 knots where vessel movements are not prohibited to mitigation collision risks with sea turtles.

Understanding above approaches to standard vessel speed restriction are important in the context of vessel speeds proposed for cable laying. Within water depths of 1000 m the plough will be towed after the main lay vessel at a speed of around 0.5 knots. In water depths of > 1000 m the vessel will lay the cable at a speed of 4 knots. Therefore, the risk of a ship strike injury or mortality to marine mammals and sea turtles are inherently **low**. The cable laying vessel speed is below the restriction speeds identified for international areas where there are important concentration of marine mammals and sea turtles, which does not apply to the cable route specifically. Therefore, the impacts will be of **minor** consequence.

5.5.4 Hydrocarbon, Chemicals and Other Liquid Waste

There is potential for the accidental release of pollutants to the environment on land and at sea during construction and operation.

The risks primarily relate to the use of equipment and vessels that may lead to a discharge of potential pollutants, for example, chemicals, hydraulic liquids and hydrocarbons. Releases may result from a variety of scenarios, but most likely would occur from equipment failure. As inherent mitigation, it is expected that all re-fuelling activities will be undertaken in port and be subject to local port management arrangements. However, given the nature of works the quantity of pollutants that may be accidentally discharged is relatively small. The likelihood that a leak or spill of hydrocarbons or other liquids (including environmentally hazardous chemicals and wastes) may occur during activities is low.

Removal of the use of chemicals or hydrocarbons on-board vessels or for land-based equipment is not an option for the operation of the vessel and associated cable laying activities. Since open deck drainage is an essential safety feature of any marine vessel, the risk of discharge from deck drainage cannot be eliminated. Likewise, equipment failure on land cannot be completely prevented. However, it is anticipated that any impacts resulting from a hydrocarbon or chemical spillage would be temporary, low-level and constrained to a localised area, if such an incident did occur.

The cable laying vessel will also adopt safety measures consistent with the requirements of the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and MARPOL 73/78 Annex I, II and III. These safety precautions and safeguards include emergency response to spill events. The risks of discharges to the marine environment is inherently mitigated by the adoption of these safety control measures, resulting in the reduction of these risks to levels as low as reasonably possible.

Due to these limited impacts and the management controls implemented to reduce the risk of contaminants reaching the surrounding environment to levels as low as reasonably possible, the risks of a small hydrocarbon spill are considered to be environmentally acceptable. The likelihood of impacts is considered to be **low** and impacts of **minor consequence** are expected to result in the case of unplanned discharge.

5.5.5 Damaged Fuel Tank Associated with Vessel Collision

During the activities, there is a possibility that vessels could collide. The rupture of a vessel's fuel tank is the predominant risk resulting from a potential vessel collision. The significance of the risk is attributed to the release of marine diesel into the aquatic environment from the damaged fuel tank. Collision between vessels and other obstacles is **unlikely**, with no additional sub-surface hazards found in the vicinity. Such obstacles would typically be infrastructure or regions of shallow seabed; none of which overlap with the proposed cable laying route.

5.6 Associated Impacts

As noted earlier, this ESIA focuses on the marine system components of the Project up to the point of duct connection to the BMH. The associated terrestrial system components are subject of a separate ESIA study. However, the associated impacts with respect to the terrestrial system components are summarised below, based on the available information regarding the nature of activities that will be involved in the construction and operation of these wider elements. It is not possible to define the significance of associated impacts as no details are available and the impact assessment has not been completed, but the cumulative contribution to impacts from the Project is considered. The land where terrestrial works will take place is called the 'CLS' site in the discussion below.

5.6.1 Construction Phase

5.6.1.1 Impacts on Ambient Air Quality

Construction of the terrestrial system components have the potential to generate gaseous emissions and particulate matter (dust) which may have adverse impacts on ambient air quality in the Project AoI. Particulate matter will be generated during excavation activities, while gaseous emissions (including CO_2, SO_2 and NOx) will be emitted from fuel burning equipment and vehicles that will be during construction. The impacts from these emissions are anticipated to be localised and reversible. As noted above, the Project will have minor impacts on air quality, and therefore, the contribution to associated effects is low.

5.6.1.2 Noise and Vibration

The construction activities for the terrestrial system components will generate noise, particularly from the construction vehicles and generators that will be used for the Project. Furthermore, noise from transport vehicles will be only transient for along the roads leading to the site and the overall impacts are not expected to create a wide-scale disturbance. As noted above, the Project will have minor impacts on noise, and therefore, the contribution to associated effects is low.

5.6.1.3 Soil

During site visits, it was observed that the soil within CLS site is predominantly sandy soil, which is typical of the Project AoI (characterized by sandy beaches along the coastline). The proposed construction activities for the terrestrial system components will include excavation, loosening of soil, stockpiling, mixing, wetting, filling, etc. These activities can directly impact soil environment negatively contributing to soil degradation. Soil environment of the CLS site could be impacted in terms of soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms resulting from compaction during excavation activities. As noted above, the Project will have negligible impacts on soil quality, and therefore, the contribution to associated effects is low.

5.6.1.4 Terrestrial Biodiversity

Construction of the terrestrial system components will also result in the disturbance of the terrestrial fauna and fauna habitats within the CLS site. The disturbance will arise from activities such as site clearing. The impact magnitude is rated low as the extent of the disturbance will be limited to the CLS plot (approximately 4 ha). While the sensitivity is also rated low due to the existing conditions of the CLS site (i.e. the site has been severely modified by human activities), which has low ecological value. No ecologically endangered species based on IUCN classifications are present within the CLS site. As noted above, the Project will have minor impacts on terrestrial biodiversity, and therefore, the contribution to associated effects is low.

5.6.1.5 Socioeconomic and Health

During the construction of the terrestrial system components, the envisaged impacts on the socioeconomic characteristics of the Project AoI are anticipated to be comparable to some of the marine components which have been discussed in Section 5.4.6. However, some impacts are greater magnitude will be experienced, especially adverse impacts related to impacts on traffic and landscape/ visual amenity. However, the construction phase will bring larger beneficial impacts associated with employment, supply of materials etc. As noted above, the Project will have minor impacts on the socio-economic environment, and therefore, the contribution to associated effects is low.

5.6.1.6 Waste Generation

The construction of terrestrial system components will generate unavoidable quantities of waste. The potential waste stream includes solid, semi-solid and liquid; generated during the construction phase may be classified into four groups:

- Non-hazardous non-recyclable wastes such as excavated soil/sediments, domestic waste, etc.;
- Non-hazardous recyclable wastes such as wooden packaging material, paper waste and empty metal and plastic containers;
- Hazardous non-recyclable wastes such as construction chemicals; and
- Hazardous recyclable wastes such as waste oils and containers of hazardous materials.

All waste generated has the potential to create associated adverse impacts for human and environmental health (i.e. disease, fouling), ecology and could lead to aesthetic issues.

Excavated materials could present the greatest amount of waste produced during construction if not reused. The volume of waste likely to be generated not known, but is likely to be large. Construction activities could generate Construction and Demolition (C&D) waste. The techniques and designs pursued should help minimise waste generation and, wherever possible, the re-use of existing waste materials will be implemented. However, in some instances this may not be possible; and material will need to be disposed to landfill.

There is potential for the generation of hazardous wastes, which will require storage, management and disposal. Hazardous waste has potential to cause significant adverse environmental effects if not properly managed. The amount of chemical waste that will arise from activities will be highly dependent on the Contractor's activities and the quantity/type of plant and equipment utilised and the outcome of detailed design work for removal.

All waste eventually requires a landfill for disposal of the remaining components that cannot be reused or recycled or treated. This requires space for dumping, which can have impacts on the surrounding environment if not carefully located and managed. Disposal by landfill is the final step in both the Basic Waste Management System and Waste Management hierarchy. It is expected that existing landfill sites would be used for this Project.

All waste associated has potential associated impacts for human and environmental health (i.e. disease, fouling), impacts on ecology and aesthetic issues (i.e. reduction on recreational value). Due to the scale of the development these impacts could be high if proper waste management protocols are not established during the construction phase of the Project.

As noted above, the Project will have minor impacts on waste generation, and therefore, the contribution to associated effects is low.

5.6.2 Operation Phase

The operation phase of the terrestrial system components typically involves generation and provision of electric power to the cable and ancillary facilities within the CLS. Submarine repeated optical cables require electrical power to feed the submerged repeaters (MTN Nigeria, 2011). The adverse impacts associated with the operation of the terrestrial system components of the Project are the gaseous emissions, as well as the noise from the power generating sets. Based on review of similar Projects, the common means of generating power are the diesel generating sets which will be installed within the CLS. While in some cases, power is sourced from the national grid. There will also be longer term increased in traffic flows and waste generation. The operation of the submarine cable will bring minimal impact that relates only to cable repairs, and therefore, the contribution to associated effects is low.

As discussed in Section 5.4.6.2 the operation phase will bring major socio-economic beneficial impacts.

5.7 Cumulative Impacts

5.7.1 Introduction

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones (IFC, 2012). Cumulative impacts are contextual and encompass a broad spectrum of impacts at different spatial and temporal scales.

In some cases, cumulative impacts occur because a series of projects of the same type are being developed. While in other cases, cumulative impacts occur from the combined effects over a given resource of a mix of different types of projects.

The determination of potential cumulative impacts as a result of the proposed Project considered the activities which are known to be taking place in the AoI of the project (marine and terrestrial) and / or activities planned for the near future in the area. At present, there is little information about future developments in the Project AoI. The ongoing projects and activities identified within the Project AoI, covering the marine and terrestrial environment include the following:

- Movement of marine vessels along the submarine cable route;
- Fishing activities nearshore;
- Construction activities for the development of the EKO Atlantic City Project;
- Construction projects for residential structures within the area of influence of the landing site; and
- Recreational activities at Elegushi Beach.

The potential for cumulative environmental and social interactions caused by the project in combination with these activities were identified as:

- Increase in GHG emissions;
- Increase in underwater and ambient sound generation;
- Disturbance to benthic communities;
- Deterioration of marine water quality; and
- Impact on fisheries.

The identified potential cumulative impacts are discussed in the following paragraphs.

5.7.2 Increase in GHG emissions

The GHG emissions from project activities will contribute to the total GHG emissions by offshore and onshore development activities in Nigeria. The addition of the project activities' GHG emissions to the cumulative levels of GHG in the Project AoI will be of **negligible** significance considering the duration of the construction activities and will not lead to any measurable contribution to which may have an impact on climate change.

5.7.3 Increase in noise generation

Marine environment

As discussed above, underwater sound will be generated from vessel movements and cable laying activities with potential very localised temporary injurious impacts and wider behavioural impacts. This will contribute to underwater sound generated by other marine activities, including vessel movements (i.e. fishing vessels and movements to and from Lagos port), offshore dredging for the EKO Atlantic City development and extraction in oil and gas blocks. The addition of the project activities to the cumulative levels of noise in the Project AoI will, however, be of **minor** significance.

Terrestrial environment

Ongoing construction of the various development projects in the project AoI are bound to generate noise emissions. The associated noise emissions are likely to result in additional and cumulative potential noise impacts to the construction workers and other people in proximity to the source. Noise from recreational activities at the beach such as entertainment shows and festive events may also exacerbate the cumulative noise levels. This may particularly be during high-noise generating activities such as trench digging. High noise levels will be of short duration and so are considered to be of **minor** significance.

5.7.4 Disturbance to Benthic communities

The primary impacts to benthic communities associated with the installation of the submarine cable relate to physical disturbance of the seabed during installation activities. Some of the submarine installation phase activities, in combination with dredging and sand filling operations at the Eko Atlantic City project, may have cumulative impacts on benthic communities. The cumulative impacts from other submarine cable ventures and dredging operations in the area may increase in future. However, based on available information on the benthic community characteristics along the Lagos coastal areas, there are no rare or endemic species that would be significantly impacted and impacts from project activities are small. Therefore, cumulative impacts of the proposed submarine cable and other identified projects and activities along the Lagos coastal areas can be considered to be of **minor** significance.

5.7.5 Deterioration of Marine Water Quality

The construction activities of the proposed project and the identified projects and activities have the potential to release substances that will result in deterioration of marine water quality in the AoI of the cable route. The potential for contamination may occur as a result of unplanned events related to accidental releases, discharge of wastewater, run-off from deck of marine vessels, and construction activities related to one or more of the ongoing and future development projects in the AoI of the cable landing site. However, these impacts are envisaged to be of minor magnitude and short term due to dilution in the marine environment. Thus, the potential cumulative impacts on marine water quality are expected to be of **minor** significance.

5.7.6 Impact on Fisheries

The cumulative impacts associated specifically with the submarine cable installation which relates to fisheries are the temporary disruption of fishing activities, temporary loss of access to fishing grounds, and potential for an additional exclusion zone. This could be inconvenient for the fishermen and may have negative commercial consequences. From a purely environmental perspective, an additional exclusion zone does contribute to protection of marine resources, although the relatively narrow corridor to which the exclusion would apply would not make this positive impact particularly significant.

Furthermore, construction activities have a relatively short duration, and it is expected that the cable will be out of reach of most fishing vessels and associated equipment. In addition, the nearshore area where works will take place is a no fishing zone.

The cumulative impact of the current Project on affected fisheries sectors is not expected to increase the overall significance of cumulative impacts on any fisheries sectors and can be considered to be of **negligible** significance.

CHAPTER SIX:

MITIGATION MEASURES

CHAPTER SIX

MITIGATION MEASURES

6.1 Introduction

Following the description of impacts in Chapter 5, the appropriate mitigation measures for the identified adverse impacts (for planned and unplanned events) are presented in this Chapter. No mitigation is proposed for beneficial impacts. In addition, residual impacts are presented following the application of mitigation measures. As no mitigation is proposed for the beneficial impacts that are discussed in Chapter 5, the residual impacts for these aspects are unchanged.

As discussed in Chapter 5, the Project has embedded inherent mitigation to avoid and minimise impacts as far as possible within the design, installation techniques and the need to adopt protocols to meet international conventions. These mitigation measures were included in the assessment of pre-mitigation impact significance as they are embedded in the approach to the Project. However, these measures are highlighted again to show how the Mitigation Hierarchy (MH) has been implemented seeking to reduce impacts as far as possible. However, residual impact significance is identified in relation to the adoption of additional measures.

6.5 Mitigation Hierarchy (MH)

The MH is defined by CSBI (2013) as "the sequence of actions to anticipate and avoid impacts on biodiversity and ecosystem services; and where avoidance is not possible, minimize; and where impacts occur, restore; and where significant residual impacts remain, offset." Avoidance and minimisation are seen as preventative measures; and restoration and offset are seen as remediative measures. Some typical measures across the MH are provided in Table 6.1.

Table 6.1: The MH and typical measures (CSBI, 2013)

MH	Measures
Avoidance	Site selection Design Scheduling
Minimisation	Physical controls Abatement controls Operational controls
Restoration	Re-establishment of values
Offset	Restoration Averted loss

The following provides summary of avoidance, minimisation and restoration mitigation measures that have been defined for the Project. The assessment has determined the need for additional mitigation at each step of the MH where residual impacts remain. Additional mitigation is only proposed where residual impacts of note remain. Therefore, minimisation measures are proposed when avoidance is not sufficient to address impacts. Restoration is only proposed when avoidance and minimisation are not adequate to address impacts and where restoration is possible. As these measures would satisfactorily mitigate impacts to a minor or negligible level, no offsets have been proposed.

6.6 Mitigation Measures (Planned Events)

The recommended mitigation measures for the identified adverse impacts associated with the Project are discussed below.

A common inherent mitigation measure that applies to all construction impacts is that the duration of works is of very short duration and will be completed in a matter of days for each activity, as discussed in Chapter 3.

6.3.1 Intertidal and Subtidal Geomorphology

6.3.1.1 <u>Construction Phase</u>

6.3.1.1.1 Inherent mitigation

Avoidance

Cable burial through ploughing and jetting works will only occur in water depths <1000 m, which avoids seabed disturbance in deeper offshore waters.

Minimisation

The level of disturbance of the seabed is limited by the cable installation techniques that seek to minimise the footprint of impact. In areas where the cable will be laid on the seabed (water depths >1000 m) the cable size is small, which limits the potential for disturbance of laying the cable on the surface in these deeper waters.

Restoration

The cable ploughing technique and also jetting shall ensure that disturbed sediments can infill the trench wherever possible. This will ensure natural restoration of disturbed areas as quickly as possible, especially as it will be soft-sediment habitats that will largely be disturbed. These approaches will allow for more rapid restoration of the seabed.

6.3.1.1.2 Additional measures

Minimisation

Disturbance to the seabed shall be minimised as far as possible during construction. Activities such as Route Clearance and PLGR shall be done in a way to minimise seabed disturbance as far as possible. In addition, disturbance of intertidal areas shall be minimised and works set within established working corridors that are as small as practicable.

Restoration

Following construction, and in line with standard industry practice, the coastal construction area shall be restored and stabilised to as close to its former condition as possible. Given that the movement of beach sediments is affected by the presence of groynes this will require active restoration. No sediments shall be removed from the beach or material sourced from locations away from the beach to ensure that restoration is as natural as possible.

6.3.1.2 Operation Phase

As discussed in Chapter 5, cable repair works in the operation phase may lead to similar, but lower magnitude impacts than during construction. Impacts are negligible; however, the additional minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken during operation.

6.3.2 Water and Sediment/Soil Quality

6.3.2.1 Construction Phase

6.3.2.1.1 Inherent mitigation

Avoidance

Disturbance to the seabed will largely be limited to where cable burial occurs (water depths <1000 m), which will avoid the suspension of sediments in deeper waters, including on the continental slope.

Minimisation

The level of disturbance of the seabed is limited by the cable installation techniques that seek to minimise the level of seabed disturbance. This is especially the case for plough burial and surface lay approaches. This will reduce the potential for suspended sediment plumes and associated deposition of sediments. In areas where the cable will be laid on the seabed (water depths >1000 m) the potential for creating suspended plumes is very limited.

The cable laying vessel shall be required to meet the requirements of MARPOL 73/78, which includes requirements to avoid and minimise the discharge of harmful substances to the marine environment. This includes the following non-exhaustive list of measures:

- Relating to deck drainage, bilge water, machine space drainage etc: drainage and bilge water systems shall have separators that isolate and contain oil from machinery spaces/working areas. All drainage and other effluents with low oil content shall be treated to ensure compliance, including a maximum oil content of 15 mg/l, without dilution, before discharge to sea. Wastewaters with a high oil content from the drainage systems of vessels shall be contained, diverted and then treated as part of the product. Oily waste and sludges from separation processes shall be transported to shore for eventual safe disposal at government approved facilities.
- Liquid sewage wastewater shall be discharged at more than 3 nautical miles from the nearest land, or sewage that is not communited or disinfected at more than 12 Nm from the nearest land. Discharge shall not lead to visible floating solids or cause of discoloration of the surrounding water. Any sewage that has been stored in holding tanks shall not be discharged at sea but shipped to shore.
- Food waste shall only be discharges to sea after passing through a comminutor or grinder, preferably beneath the surface level. Waste shall be able to pass through a screen with openings no greater than 25 mm and discharged at more than 12 Nm from land.
- A Shipboard Marine Pollution Emergency Plan shall be put in place to address any events that occur. Appropriate spill kits or absorbent materials shall be held on board all marine construction vessels. Spill kits shall be checked during regular inspections to ensure they remain adequate for the needs of the Project.

6.3.2.1.2 Additional measures

Minimisation

As for the discussion of intertidal and subtidal geomorphology, the disturbance to the seabed shall be minimised. In the terrestrial zone the level of disturbance should ensure that impacts to soil and groundwater quality is reduced as far as possible

In addition, the cable laying vessel, and equipment on the vessel and all machinery used on land, shall be maintained regularly in accordance with the manufacturer's recommendations to minimise the potential for discharges. The vessel captain shall also ensure that the maximum carrying capacity of the sewage system is not exceeded.

Also, effective and best practice Integrated Waste Management Planning is required to ensure that all waste is adequately managed; and these measures will limit the potential for impacts on water quality (see below).

6.3.2.2 Operation Phase

6.3.2.2.1 Inherent mitigation

Avoidance

As discussed in Chapter 5, the proposed cable incorporates material with low environmental discharges. Cable-grade polyethylene is essentially inert in the ocean. The effects of ultraviolet light on cable integrity shall be avoided through burial in water depths where such light will penetrate. Any potential for mechanical breakdown on the energetic continental shelf is again limited through burial where it is possible. The cable design shall also ensure that no significant impacts from the leachate of metals from conductors and armour into the water column will occur.

6.3.2.2.2 Additional measures

Minimisation

As discussed in Chapter 5, cable repair works in the operation phase may lead to similar, but lower magnitude impacts than during construction. Impacts are negligible, however, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.3 Marine Biodiversity

6.3.3.1 Construction Phase

Physical loss and disturbance to habitats and species

Intertidal and supratidal zone

Within this zone, there is a need to adopt mitigation measures to address impacts on potential sea turtle nesting habitat.

6.3.3.1.1 Inherent mitigation

Avoidance

As discussed in Chapter 4, sea turtle nesting is known to occur where habitat allows on the beaches within Lagos State. Although the cable landing location is within in an area where the potential for nesting exists, no nesting has been confirmed in the footprint of works. Moreover, the landing site has a high level of degradation with the area being disturbed by human activities. It is therefore likely that the nesting potential here is very low. The cable route design has therefore avoided areas where there is potentially greater nesting potential as inherent mitigation.

6.3.3.1.2 Additional measures

Avoidance

No seasonal avoidance for works is proposed due to the very low risk of nesting in the footprint of works, and that fact that data suggests that nesting may occur all year round – although a main nesting season is expected (October to March).

All planned activities on the beach be conducted during day-light hours. If this is not possible, due to unplanned events, then it will require additional appropriate measures to be adopted to minimise the impacts (see below).

Minimisation

Minimisation measures will be required to address potent impacts as applicable. There are two main options that are proposed by the Project at this time that will be confirmed during the design process and through a further review of baseline conditions prior to construction commencing. The review of baseline conditions should occur at a minimum 60 days prior to works commencing as this forms the possible gestation period for sea turtle eggs if they have been laid. If the review indicates that there is a low level of disturbance currently in the intertidal area and above HW that may allow for nesting to occur then further mitigation may be needed as detailed below. If there are very high levels of disturbance and this means that nesting can be discounted then no further mitigation will be necessary.

Where there is some nesting potential, an option is for fencing off the area where nesting occurs above high water can be considered. Such fencing would be introduced before the main nesting season to preclude potential for nesting to occur in the footprint. This orientation of fencing would need to limit the disturbance of emerging turtles across the beach to the nesting zones in adjacent areas outside of the area of works and also ensure that no turtles (adults or hatchlings) could be trapped within the structure. The cement block making area and coastal road provides a physical landward barrier to meet fencing to limit such potential as nesting will not occur beyond these points. Daily monitoring of the fenced area would be required to ensure hatchlings from nests that may be in the fenced area are not trapped. Any hatchlings identified in the fenced area may be translocation to uninterrupted adjacent areas. Another proposed option is to relocate any eggs within nests laid in the footprint of works to an adjacent donor site. This would require appropriate monitoring to ensure that eggs are removed in a suitable timeframe to maximise the success of hatching from the eggs that are translocated – see Mortimer (1999), Parmenter (1980), Miller et al. (2003), Ahles and Milton (2015) and Limpus et al. (1979).

Other general minimisation measures include:

- Minimise the size of working areas in the turtle crawl and nesting zone as far as possible to limit the extent of potential impacts. Works shall only be undertaken in 'turtle clear' areas (fenced or not); and work areas shall be demarcated prior to work to limit disturbance to the beach during construction.
- Zone areas for storage/lay-down of all equipment and materials and waste storage areas away from the nesting beach. Designated areas should be defined in the terrestrial zone away from nesting areas. This will limit footprint disturbance and also reduce the potential for the obstruction of adult turtles and hatchlings.
- Only essential vehicular across to the turtle crawl zone and nesting zone to be permitted and shall only take place in areas that have been classed as 'turtle clear' through monitoring. In addition, beach disturbance shall be limited by creating lateral transport corridors inshore of the 'turtle nesting zone' using the existing coastal road with specified access points to identified working areas on the beach within the turtle crawl and nesting zone. Carefully controlling vehicle/plant access and use on nesting beaches will avoid direct impacts to recent nests and to protect beach integrity. Where access results in damage to the profile of the beach and/or creates ruts that obstruct/trap hatchlings, the beach shall be remediated/restored once works are complete. Any temporary surfaces used to support access shall not be left *in situ*. Vehicles and equipment shall not be left on the beach in identified turtle risk areas overnight as these could cause obstruction (see below).
- If any works are proposed at night, then monitoring will be required to ensure that injury is avoided or to allow eggs to be translocated in the correct timeframe should *in situ* protection not be feasible.
- Ensure that no waste or other materials are disposed of in the intertidal turtle crawl and nesting zone wherever possible to limit the potential for obstruction to adult turtles and hatchlings to occur.
- Avoid obstructing the movement of adult turtles to their 'nesting zone' with non-permanent structures at night.
- Undertake site monitoring during construction to actively intervene to remove obstructions (e.g. spills, waste, litter, logs) from the nesting beach that can be relocated without additional disturbance or damage to the environment – seek specialist advice if necessary.
- Translocate hatchlings and adult sea turtles if access to sea is unavoidably obstructed (including monitoring within trenches).
- Prohibit hunting or harassment of sea turtles and poaching of eggs within the work site by project related staff through educating the workforce

about the potential impacts on turtles and penalties for actions that would cause such impacts. Monitor for evidence of poaching.

- Prohibit touching of any sea turtles, hatchlings or eggs (except by authorised personnel in the context of nest and hatchling protection activities) by any project related staff.
- Prohibit recreational activities involving lights or fires within the port boundaries and provide awareness materials to explain rationale.

Restoration

As discussed above, following construction, and in line with standard industry practice, the coastal construction areas shall be restored and stabilised to as close to its former condition as possible. These works should be done in a way that is sensitive for turtles – either restoring beach conditions in line with conditions prior to works taking place.

Subtidal zone

6.3.3.1.3 Inherent mitigation

Avoidance

The cable routing design has avoided pockmarks. However, based on the information available, none of the pockmark areas were considered as active, which means they have not considered to be of high conservation value. In addition, ploughing will only occur in water depths <1000 m, which avoids the wider scale disturbance of habitats and species in deeper offshore waters.

Minimisation

As discussed under the consideration of geomorphological impacts above, the level of disturbance of the seabed is limited by the cable installation techniques that seek to minimise the footprint of impact on marine habitats and species.

Restoration

As discussed under the consideration of geomorphological impacts above, the cable ploughing technique and also nearshore jetting works shall ensure that disturbed sediments can infill the trench wherever possible, ensuring that natural restoration and recolonisation of seabed substrate occurs more rapidly.

6.3.3.1.4 Additional measures

Minimisation

As discussed under the consideration of geomorphological impacts above, disturbance to the seabed shall be minimised as far as practicable, which minimise impacts on marine habitats and species.

Increased suspended sediment loads in the water column and deposition of disturbed sediments.

6.3.3.1.5 Inherent mitigation

Avoidance

Disturbance to the seabed will largely be limited to where cable burial occurs (water depths <1000 m), which will avoid the suspension of sediments in deeper waters.

The cable routing design has considered the potential to impact sensitive marine habitats of conservation importance, such as seamounts and pockmarks. The cable route will not cross areas with hard grounds or active gas seeps, which shall minimise the effects.

Minimisation

The level of disturbance of the seabed is limited by the cable installation techniques that seek to minimise the level of seabed disturbance. This especially the case for plough burial. This will reduce the potential for suspended sediment plumes and associated deposition of sediments. In areas where the cable will be laid on the seabed (water depths >1000 m) the potential for creating suspended plumes is very limited.

6.3.3.1.6 Additional measures

Minimisation

As for the discussion of footprint impacts above, the seabed should be minimised the size of seabed disturbance as far as possible. This will ensure that level of sediment brought into suspension and/or deposited is low. As stated above, the techniques being used provided inherent mitigation to reduce the level of sediment disturbance and low levels of impacts are expected even without the adoption of mitigation.

Pollution of marine waters

6.3.3.1.7 Inherent mitigation

Minimisation

As noted under the discussion of water quality impacts, the cable laying vessel shall be required to meet the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78, which includes requirements to avoid and minimise the discharge of harmful substances to the marine environment. Other additional measures to minimise impacts on water quality will minimise impacts on marine habitats and species.

6.3.3.1.8 Additional measures

Minimisation

Mitigation measures are proposed to minimise impacts on water quality from land-based construction areas and vessels; and these apply directly to mitigating impacts on marine biodiversity, including avoiding and limiting the potential for pollution to marine waters and emergency response planning.

There is potential for the Project to have a beneficial impact on the beach area through the undertaking of active beach clean-up activities within and adjacent to working areas related to existing waste on the beach, which will reduce existing impacts on wildlife using these areas.

Underwater Sound Generation

6.3.3.1.9 Additional measures

Avoidance is not considered feasible for the cable laying operations as some underwater sound will inevitably be generated. Other mitigation options are considered below.

Minimisation

The impact assessment has determined some potential for very localised temporary injurious effects to occur during cable laying to some species using a precautionary assessment. Behavioural impacts are more likely to occur but given the scale of impacts no specific mitigation is required for these impacts.

Regarding the potential for injurious impacts, it is recommended that marine appropriate marine wildlife monitoring is undertaken onboard the cable laying vessel during the cable laying operation. As part of this approach, a buffer zone should be defined – noting that in defining this zone injurious impacts may not occur or will only occur at very close proximity. This buffer zone can, however, take account of strong behavioural responses; and also consider the maximum feasible distance for viewing sea turtles at the surface. Therefore, a buffer zone of 100 m is suggested as being appropriate. If marine mammals or sea turtles are recorded in this zone then a protocol for delaying works may be necessary based on observations, including delaying works until the passage outside of this zone. As part of this approach options for delaying works for 20 minutes to allow wildlife to disperse if they are not visible at the surface. Records of observations shall be made, including information on position, distance from the vessel, swimming speed and direction, and obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns). Both the identification and the behaviour of the animals, and any incidents, must be recorded.

Artificial Lighting

6.3.3.1.10 Inherent mitigation

Minimisation

Some lighting at night cannot be avoided (i.e. for vessel navigation or security lighting) and additional measures should be adopted as detailed below. However, completing planned land-based construction in daylight hours may avoid the need for larger-scale lighting requirements, therefore, minimising the potential for impacts; and need for further mitigation.

6.3.3.1.11 Additional measures

Minimisation

The Florida Marine Institute's guidelines produced by Witherington and Martin (2003) and the Light Pollution Guidelines by the Australian Department of the Environment and Energy (DEE) (2020) provide substantial guidance to mitigate the impact of light on marine wildlife. This recent DEE (2020) guidance provides information to mitigate impacts on both sea turtles and seabirds. Annex F of this guidance provides a Mitigation Toolbox for sea turtles and some key measures that may be appropriate for the proposed works are set out below. This guidance was adopted by the Convention of Migratory Species signatory states in February 2020; and therefore, has relevance to Nigeria's commitments under this Convention. Some of the key minimisation measures that can be included for activities under control of the Project are listed below:

- Review lighting requirements in consideration of potential impacts to marine wildlife and modify accordingly to reduce overall lighting needs, intensity and glow.
- Ensure that the best available technology is in place to minimise lighting impacts, such as high or low pressure sodium or filtered LED luminaires with no short wavelength blue or violet and ultraviolet wavelengths. Unfiltered white LED, fluorescent, halogen, mercury vapour and metal halide lights shall be avoided.
- Turn off unnecessary lighting and limit the times at which lights are used as far as possible. Extinguish vessel deck lights to minimum required for human safety and when not necessary. Restrict lighting at night to navigation lights only.
- Where lights cannot be turned off (even temporarily), light only the intended object or area - keep lights close to the ground, directed and shielded. Use only the minimum number and intensity of lights needed to provide safe and secure illumination for the area at the time required to meet the lighting objectives.
- Ensure that areas of the beach that are not a priority for construction works are kept dark related to lighting used by the Project;

- Control use of transient light sources from the Project, such as vehicle headlights, torches/flashlights, lighting on vessels and navigation lighting through use of best available technology and managing their directional use.
- Prohibit recreational activities by Project staff involving lights or fires within sight of the nesting beach at all times.
- Monitor beaches at night to translocate misoriented hatchlings to the sea and redirect or transport disoriented adults back to the sea if lighting from the Project may be causing a problem for sea turtles. Identify the transient any 'problem lights' and address as appropriate with through applying the mitigation discussed above to reduce the impacts of such lights.

Restoration

All temporary lighting on land shall be removed at the end of the construction period.

Alien Invasive Species

6.3.3.1.12 Inherent mitigation

Minimisation

It is not possible to completely avoid the potential for the introduction of invasive alien species. However, vessel shall adhere strictly to the International Maritime Organisation (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (2004).

6.3.3.1.13 Additional measures

Vessel operators shall follow best practice measures in the IMO 2011 Guidelines for the Control and Management of Ships' Biofouling to minimize the transfer of invasive aquatic species. Other guidance of relevance includes the Marine Biofouling and invasive species: guidelines for prevention and management produced by the Global Invasive Species Programme (GISP) (2008).

6.3.3.2 Operation Phase

6.3.3.2.1 Inherent mitigation

Avoidance

As discussed above, the proposed cable incorporates material with low environmental discharges and therefore there will be negligible impact on marine biodiversity. As EMF impacts are so small no mitigation is required for these effects.

6.3.3.2.2 Additional measures

Minimisation

As discussed in Chapter 5, cable repair works in the operation phase may lead to similar, but lower magnitude impacts than during construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.4 Terrestrial Biodiversity

6.3.4.1 Construction Phase

6.3.4.1.1 Inherent mitigation

Avoidance

The cable routing design has considered the potential to impact sensitive terrestrial habitats of conservation importance, and such areas have been avoided.

As discussed in Chapter 5, no off-site soil material will be used for restoration works on land removing any potential for the introduction of invasive species into the coastal environment.

Minimisation

The level of disturbance of the terrestrial area is limited by the cable installation techniques that seek to minimise the footprint of impact on habitats and species.

6.3.4.1.2 Additional measures

Minimisation

Disturbance of terrestrial areas shall be minimised and works set within established working corridors that are as small as practicable. Daily inspection of trenches shall be implemented to 'rescue' any animals that may have fallen in trenches. Excavated trenches will be covered as soon as practically possible to avoid extended periods of time where trenches are exposed and thus a threat to fauna

Restoration

Following construction, and in line with standard industry practice, the terrestrial construction area shall be restored and stabilised to as close to its former condition as possible.

6.3.4.2 Operation Phase

As discussed in Chapter 5, cable repair works in the terrestrial environment is unlikely. If it were needed lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.5 Climate

No mitigation measures over and above what is recommended for emissions to that may affect air quality.

6.3.6 Air Quality

6.3.6.1 Construction Phase

6.3.6.1.1 Inherent mitigation

Minimisation

Compliance with MARPOL 73/78, which provides inherent controls on air polluting emissions, including limits on SO_2 and NO_x emissions from ship exhaust and the prohibition of ozone depleting substances. In addition, normal vessels speed during cable installation will be low reducing the extent of potential emissions.

6.3.6.1.2 Additional measures

Minimisation

The following mitigation measures shall be adopted to minimise and control impacts on air quality during construction:

- After clearing, grading, earthmoving, or excavation is completed, the disturbed area shall be treated by watering, re-vegetating, or spreading soil binders until the area is paved or otherwise developed to the point where dust will not be generated under natural conditions;
- Regular water-spraying of unpaved and sweeping of paved roads to minimise dust and remove mud and debris;
- Using wheel washes for vehicles leaving the site where appropriate, to minimise the amount of mud and debris deposited on the roads;
- Reducing the quantity of dusty materials stored on site or covering stored materials to minimise the amount of dust being blown;
- Only well maintained machinery shall be used so to minimise mobile source emissions;
- Catalytic converters and exhaust filters shall be correctly fitted where appropriate and available to minimize diesel exhaust emissions.
- Idling time of diesel engines shall be limited and engines shall not be overloaded;
- Fuel oil will meet regulated Sulphur content levels in order to control SOx and particulate matter emissions; and

6.3.6.2 Operation Phase

As discussed in Chapter 5, cable repair works in the terrestrial environment is unlikely. If it were needed lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.7 Ambient Noise and Vibration

6.3.7.1 Construction Phase

6.3.7.1.1 Additional measures

Minimisation

The following mitigation measures shall be adopted to minimise and control impacts associated with noise:

- The Contractor shall seek to minimise noise impacts as far as practicable and inform local residents and beach users of noisy activities;
- Whilst noise may have an impact, good communication between the Contractor and any local residents will ensure that such impacts are kept to a minimum by correct timing, silencing or other mitigation matters;
- Plant and equipment shall be correctly adjusted and maintained to prevent excessive exhaust fumes and noise emissions and silencers fitted where possible;
- Hand-held localised noise monitoring to be conducted to ensure compliance with legislation and if complaints arise; and
- All machinery to be regularly maintained and serviced.

6.3.7.2 Operation Phase

As discussed in Chapter 5, cable repair works in the terrestrial environment is unlikely. If it were needed lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.8 Fishing and Fisheries

6.3.8.1 Construction Phase

6.3.8.1.1 Inherent mitigation

Minimisation

The Project identified the popular trawling grounds through desk top research and during in-country consultation and where possible avoided them in the design and selection of the route for the cable. The cable route will also pass through a 'no fishing zone' within water depths of 100 m, which spans the continental shelf. This will limit the potential to impact on fisheries activities.

In waters depths of <1000 m the cable will be buried reducing the potential for interaction with fisheries.

6.3.8.1.2 Additional measures

Minimisation

The following additional minimisation measures are proposed:

- Relevant agencies shall be informed of the cable route and be provided with the relevant planned route coordinates and notified of the expected dates of installation. It is anticipated that these agencies will inform local marine users following their own protocols, including fishermen.
- As-laid information will be provided to the local and UK hydrographic Office.

6.3.8.2 Operation Phase

As discussed in Chapter 5, cable repair works in the marine environment may be required, but lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.9 Offshore Oil and Gas Concessions

The cable route passes through a number of OPLs (Oil Prospecting License blocks). Communication with relevant parties shall be undertaken to ensure no conflicts may occur.

6.3.10 Landscape and Aesthetics

6.3.10.1 Construction Phase

6.3.10.1.1 Additional measures

Minimisation

The following minimisation measures are proposed:

- Efforts shall be made to minimise visual impacts; land disturbed by cable laying shall be contoured as far as possible to its original form as part of overall reinstatement;
- Community members shall be adequately informed as appropriate prior to the installation activities about the pending disruptions through mechanisms such as a resident's committee, local newspapers and signage;
- A designated member of Project personnel shall be available during construction to answer questions, receive and resolve grievances and monitor installation activities; and

- The Project shall take measures to ensure that contractors maintain the site neat and orderly during construction and installation with due regard to removal of waste and clean-up of litter. This also includes measures to reduce impacts of dust as described.

6.3.10.2 Operation Phase

As discussed in Chapter 5, cable repair works in the terrestrial environment is unlikely. If it were needed lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.11 Recreation

6.3.11.1 Construction Phase

6.3.11.1.1 Additional measures

Minimisation

The area of disturbance shall be minimised as far possible to small working area meaning that the interruption to recreation activities is very limited.

6.3.11.2 Operation Phase

As discussed in Chapter 5, cable repair works in the terrestrial environment is unlikely. If it were needed lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.12 Marine Navigation

6.3.12.1 Construction Phase

6.3.12.1.1 Additional measures

Minimisation

The following minimisation measures are proposed:

- The Project shall notify relevant marine authorities of the proposed installation and activities.
- Vessel movement and activity shall observe standard navigational safety procedures and local communication protocols, as applicable, to avoid conflicts with other vessels in the Project Area.

6.3.12.2 Operation Phase

As discussed in Chapter 5, cable repair works in the marine environment may be required, but lower magnitude impacts would occur in comparison to construction. In many instances, impacts are negligible and little mitigation is necessary. Therefore, minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.13 Terrestrial Traffic

6.3.13.1 Construction Phase

6.3.13.1.1 Additional measures

Minimisation

The following minimisation measures are proposed, as appropriate:

- The Project shall notify the local community of the proposed installation and activities;
- Where required, safety signage shall be installed at different sections of the road leading to the cable landing site;
- Drivers shall adhere to speed limits of less than 30 km/h along the road leading to the cable landing site;
- Where necessary, staff shall be engaged to direct movement of Project vehicles.

6.3.14 Occupational Health & Safety

6.3.14.1 Construction Phase

6.3.14.1.1 Additional measures

Minimisation

The following additional minimisation measures are proposed:

- Only trained and competent crew shall be engaged for cable laying activities;
- Appropriate PPE (e.g. coverall, safety boot, gloves, eye goggles, life jackets etc.) shall be provided. Training and awareness on the use of PPE shall also be carried out as part of induction for workforce;
- Development and implementation of a robust Occupational Health and Safety (OHS) Plan and Procedures shall be ensured. The OHS Plan shall be developed in consistent with all relevant national and international standards;
- Installation works shall be limited to the daytime as much as possible;
- Implementation of Health and Safety communication and training programmes to prepare workers to recognize and respond to workplace hazards shall be carried out. Daily toolbox talks prior to commencement of installation activities shall be implemented; and
- Safety training focused on operational procedures, emergency procedures and safe working practices, information on specific hazards and first aid shall be included in the induction, prior to the commencement of construction.

6.3.14.2 Operation Phase
The minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.15 Community Health and Safety

6.3.15.1 Construction Phase

6.3.15.1.1 Additional measures

Minimisation

The following minimisation measures are proposed:

- The land-based construction sites will be managed following best practices to minimise any risk to local residents and coastal users.
- Contractor personnel shall be briefed on the sociocultural norms and sensitivities of the neighbouring communities before commencement of work in the area;
- An induction and sensitisation programme, including a Code of Conduct, for all construction workers (including newcomers directly related to the Project) shall be carried out prior to installation activities. This will increase sensitivity to local norms and customs and will provide awareness to contractors and employees of appropriate and acceptable behaviours and govern worker interactions with the local communities; and
- A grievance mechanism procedure shall be developed and implemented.

6.3.15.2 Operation Phase
The minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.3.16 Waste Generation

6.3.16.1 Construction Phase

6.3.16.1.1 Inherent mitigation

Minimisation

Vessels shall be required to comply with MARPOL 73/78, which includes best practice measures to avoid harmful waste discharges at sea.

6.3.16.1.2 Additional measures

Minimisation

As discussed in Chapter 3, a project-specific Waste Management Plan (WMP) shall be developed and implemented to manage the waste streams associated with the Project. The waste management principles and priorities for the Project shall be based on an integrated approach which involves using a combination of techniques and programs to manage waste. Source reduction is at the top of the approach, followed by reuse and recycling as preferred options to disposal.

The following additional minimisation measures are proposed for marine activities:

- Hazardous waste (if any) and all debris recovered from the seabed during pre-lay clearing activities shall be safely stored on board the vessel until it can be disposed at a suitably equipped port.
- The debris shall be disposed by accredited waste contractors.
- Only approved landfills or dumpsites shall be used for disposal of the debris
- Construction rubble and excavated soil that is not used as backfill must be disposed of at a licensed landfill.
- All project works area shall be rehabilitated and restored to its original state after works are completed.

6.3.16.2 Operation Phase

The minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

6.7 Residual Impacts (Planned Events)

Residual impacts from planned events are highlighted in Table 6.2. There are no potential long-term impacts associated with the Project that cannot be mitigated to acceptable levels.

Table 6.2: Residual Impacts (Planned Events)

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
Construction Phase				
Excavation of intertidal and supratidal areas	Intertidal and supratidal zone	• Altered intertidal and supratidal morphology	Negligible	Negligible
Route Clearance and PGLR; and cable installation works	Subtidal substrates	• Altered seabed morphology	Negligible	Negligible
Route Clearance and PGLR; cable installation works; and construction of the BMH and System Earth	Marine water quality	• Disturbance of the seabed causing suspension of sediments and sediment deposition	Minor	Minor
	Marine water quality	• Vessel discharges to the marine environment	Minor	Minor
	Sediment quality	• Disturbance to sediments	Negligible	Negligible
	Sediment quality	• Redistribution and dispersal of contaminants	Minor	Minor
	Soil quality	• Disturbance to soils leading to a change in characteristics	Negligible	Negligible
	Groundwater quality	• Increased turbidity and alteration to the resource	Negligible	Negligible
	Marine biodiversity	• Physical loss and disturbance of intertidal and supratidal habitats	Moderate	Minor

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
		and species within the footprint of works		
		• Physical loss and disturbance of subtidal habitats and species within the footprint of works	Negligible	Negligible
		• Increased suspended sediments and redistribution of disturbed sediments	Minor in water depths <1000 m Negligible in water depths >1000 m	Minor in water depths <1000 m Negligible in water depths >1000 m
		• Pollution of marine waters from vessel discharges	Minor	Minor
		• Underwater sound generation	Moderate	Minor
		• Artificial Lighting	Minor (sea turtles) Negligible (seabirds and fishes)	Negligible
		• Introduction of alien invasive species	Negligible	Negligible
	Terrestrial biodiversity	• Disturbance of terrestrial fauna and flora species in the project AoI	Negligible to Minor	Negligible to Minor
	Climate	• Emissions of air pollutants	Negligible	Negligible
	Air quality	• Emissions of air pollutants	Minor	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
	Noise and vibration	• Generation of noise and vibration during cable laying activities	Minor	Negligible
	Fishing and fisheries	• Damage to fishing gear and fishing boats • Damage to submarine cables by fishing gear • Restriction of access to fishing zones	Minor	Negligible
	Offshore Oil and Gas Concessions	• Interruption to operations	Negligible	Negligible
	Landscape and aesthetics	• Visual distraction of the cable laying vessel • excavations work near the cable landing station • security lighting at the cable landing station	Minor	Minor
	Recreation	• Temporary disturbance to recreational activities	Minor	Minor
	Marine navigation	• Temporary disruption to the flow of shipping traffic	Minor	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
		• Potential collisions of marine vessels		
	Terrestrial Traffic	• Temporary increase in traffic and disruptions to the flow of traffic	Minor	Negligible
	Occupational health and safety	• Accidents and injuries during offshore installation activities • Occupational health and safety risks for land-based activities at the beach	Moderate	Minor
	Community health and safety	• Accident and injuries to community members during cable installation activities at the landing site	Minor	Negligible
	Waste generation in marine environment	• Decrease in marine water quality • Physical and chemical impacts on marine flora and fauna • Introduction of diseases to marine organisms • Injury to marine organisms	Minor	Negligible
	Waste generation in Terrestrial environment	• Increased stress on existing waste disposal facilities	Minor	Negligible
Operation Phase				

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
Cable repairs (in case of damage)	Subtidal substrates	• Altered seabed morphology	Negligible	Negligible
	Water quality, sediment quality and soil quality	• Increased suspended sediments and vessel discharges • disturbance sediments and soils during repair works • leaching from cables and cable degradation	Negligible	Negligible
	Marine biodiversity	• Physical loss of marine species and habitats • Increased suspended sediments and sediment deposition • Pollution of marine waters • Underwater sound generation • Artificial lighting • Introduction of alien invasive species	Negligible to Minor	Negligible to Minor
	Terrestrial biodiversity	• Disturbance to habitats and species	Negligible	Negligible
	Socio-economic environment	• Pollution and disturbance as per construction	Negligible	Negligible
	Waste generation	• Increased waste generation as per construction	Negligible	Negligible

Project Activity	Receptor	Summary of Potential Impact	Potential Impact Significance (without mitigation)	Residual Impact (after implementation of mitigation measures)
Cable placement on the seabed	Marine biodiversity	• Colonisation of cable substrate	Negligible	Negligible
Cable emissions	Marine water and sediment quality	• Release of pollutants	Negligible	Negligible
	EMF	• Disturbance to marine species	Negligible	Negligible

6.5 Mitigation Measures for the Identified Project Risks and Hazards Due to Unplanned Events

The mitigation measures for the identified risks and hazards (due to unplanned events) associated with the Project during construction and operation are highlighted below:

6.5.1 Accidental Release of Solid Wastes

The following management controls will be implemented in order to mitigate or remove the risk of accidental solid waste release:

- Appropriate waste containment facilities shall be included on the vessel and land and be managed to avoid overflow or accidental release to the environment;
- No waste materials shall be disposed of overboard from vessel; all non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance with the vessel's Garbage Management Plan as required under Regulation 9 of MARPOL Annex V;
- Hazardous wastes shall be separated, labelled and retained in appropriately controlled storage areas; and
- All recyclable and general wastes shall be collected in labelled, covered bins (and compacted where possible).

6.5.2 Dropped Objects

A number of management controls can be implemented when possible to reduce or eliminate the impact of dropped objects on the environment:

- All equipment and gear on the vessels shall be securely fastened during mobilization/demobilisation;
- Lifting is to be carried out by competent personnel using equipment that is suitable, certified and maintained;
- Waste management controls are to remain effective to reduce risk of release of wastes that could be ingested or cause entanglement; and
- During the activities, detailed records of equipment lost overboard or dropped shall be maintained and reviews shall be undertaken to reflect on methods to mitigate repetition of the incident.

6.5.3 Ship Strikes

As noted above, vessel speed restrictions are used to mitigate impacts on marine mammals and sea turtles where important concentration exist. However, these vessel speed restrictions are higher than those that will normally occur during cable laying operations, which means that key mitigation is already inherent within the construction technique. As noted above marine mammal observations shall be undertaken to address risks from underwater sound generation. These observations can also identify any ship strike risks as appropriate. In line with good practice, the vessel operator shall aim to maintain a distance of 100 m or greater from marine mammals and sea turtles; and also, to follow and maintain a constant route, course and speed. If the vessel is within 50 m of marine mammals and sea turtles it shall be limited to no-wake speeds. These areas are within the buffer zone defined for underwater sound impacts allowing for a combined approach for monitoring activity.

6.5.4 Hydrocarbon, Chemicals and Other Liquid Waste

The following controls can be adopted when feasible in order to mitigate or eliminate the potential for the spillage of hydrocarbons, environmentally hazardous chemicals and liquid-waste to the marine environment:

- Spill clean-up equipment shall be located on land where machinery is being used that has the potential to lead to accidental leaks or spills.
- Re-fuelling of vessels will only occur at a port and be subject to port management controls.
- Chemicals and hydrocarbons on vessels shall be packaged, marked, labelled and stowed in accordance with MARPOL Annex I, II and III regulations. These include provisions for all chemicals (environmentally hazardous) and hydrocarbons will be stored safely.
- Vessel operators shall have an up to date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills shall be managed in accordance with these plans by trained and competent crew. Related mitigation measures in place:
    - Spill exercises will be conducted at minimum of every three months and recorded in the vessel log.
    - Spill kit will be located near high risk spill areas.
    - Spills will be cleaned up immediately, spill kits re-stocked and clean up material contained, and not washed overboard.
    - Vessel decks will be bunded. Scupper plugs should be available to prevent liquid discharges from decks.
- Any contaminated material collected shall be contained on board for appropriate onshore disposal.
- Transfer deck run off discharges to the sea via the scuppers. Scupper plugs or equivalent will be available on vessel decks where chemicals and hydrocarbons are stored and frequently handled (i.e.' high risk' areas).

- Any vessel equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate.
- Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater.
- All hoses for pumping and transfers will be maintained and checked as per the planned maintenance systems.
- On board oily water disposal will be managed in accordance with the local regulations. The vessel operator will record the quantity, time and onshore location of the oily water disposal in the vessel Oil Record Book; and
- If the vessel is equipped with an oily water filter system, they may discharge oily water after treatment to 15 ppm in an oily water filter system (providing they have a current calibration certificate for the bilge alarm) as required by MARPOL Annex I Regulations (for the prevention of pollution by oil).

6.5.5 Damaged Fuel Tank Associated with Vessel Collision

The following management controls may be adopted and executed for the purposes of mitigating or eliminating the risk of hydrocarbon spillage as a result of vessel collision:

- Spill clean-up equipment will be located where hydrocarbons are stored and frequently handled (i.e. 'high risk' areas);
- Marine diesel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e. Sulphur content of less than 3.50% m/m) is the only engine fuel to be used by the vessels; and
- Oil spill responses will be executed in accordance with the vessel's SOPEP, as required under MARPOL 73/78.

6.6 Residual Impacts for the Identified Project Risks and Hazards Due to Unplanned Events

Following the adoption of mitigation measures no significant impacts are expected. All impacts are considered to be have a low likelihood and be of minor consequence.

CHAPTER SEVEN:

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

CHAPTER SEVEN

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.3 Introduction

This Chapter presents the Environmental and Social Management Plan (ESMP) for the Project. The ESMP sets out the approach to implement the environmental and social mitigation measures identified in Chapter 6 of this ESIA report. The impacts of the Project have been analysed in Chapter 5 of this report. This included the assessment of impacts with inherent mitigation measures in place. The results of the residual impact assessment after the implementation of additional mitigation measures are detailed in Chapter 6. The assessment has shown that if the recommended mitigation measures are implemented, the residual impacts of the Project are at worst of minor significance with the majority of impacts being of negligible significance.

The purpose of the ESMP is to ensure that those recommended additional mitigation measures are translated into practical management actions, which can be adequately resourced and integrated into the Project phases. The ESMP has been developed to meet national guidelines and international best practices on environmental and social management performance. It details the mitigation and enhancement measures that the Project Proponent has committed to implement throughout the life cycle of the Project and includes desired outcomes; performance indicators; monitoring; and timing for actions and responsibilities.

The Project Proponent shall have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its Contractors, where appropriate and monitor the implementation.

As stated in Chapter 3, the project activities are largely short term and mainly relate to the construction phase. The extent of works on land are very limited, and overall, activities will lead to limited loss and disturbance to the environmental and social baseline receptors. This is therefore reflected in the content of this ESMP.

7.4 Objectives of the ESMP

The ESMP is essential for effective implementation and monitoring of the Project's environmental and social performance. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision-making and day-to-day operations. It establishes a framework for tracking, evaluating and communicating environmental and social performance and helps ensure that environmental risks and liabilities are identified, minimised and managed.

The ESMP will be a living document and will continue to develop during the design, construction and operation phases to enable continuous improvement of the Project's environmental performance. In this way the ESMP can implement adaptive management approaches wherever considered appropriate.

The specific objectives of the ESMP are to:

- Provide a framework for implementing Project environmental and social commitments (i.e. mitigation measures identified in the ESIA);
- Ensure that the Project Proponent and its Contractor(s) meet legal and regulatory requirements with regard to environmental management;
- Incorporate environmental and social management into Project construction and operating procedures;
- Take account of the outcomes of the stakeholder engagement process undertaken for the EIA; and
- To provide a mechanism for reporting on the Project's environmental and social performance.

7.3 Environmental and Social Management Organisation

The Project Proponent is committed to providing resources essential to the implementation and control of the ESMP. Resources includes the appropriate human resources and specialised skills.

The Project Proponent shall engage dedicated personnel competent on the basis of appropriate education, training, and experience to manage and oversee the Health, Safety and Environment (HSE) aspects of the Project.

7.3.1 Roles and Responsibilities

7.3.1.1 <u>Introduction</u>

Well-defined roles and responsibilities and adequate institutional arrangements are central to the effective implementation of the environmental and social safeguard measures outlined in this ESMP. Accordingly, the roles and responsibilities of the various institutions in the implementation of the ESMP are discussed in this section.

Project environmental and social performance will be managed by the Project Proponent and their appointed Contractor(s), and any additional specialists, as required. The entities will play specific roles in the environmental and social management organisation and coordinate as described in this section.

7.3.1.2 Company Role

Although the Contractor(s) will have a key role in delivering on the measures set out in the ESMP, the Project Proponent will have the ultimate responsibility for ensuring the measures are delivered. In this respect, the Project Proponent will review and approve the Contractor(s) plans for delivery of the actions contained in this ESMP; and will review contractor performance through monitoring, audits and inspection as appropriate. Where the measures set out in the ESMP do not result in the achievement of objectives, the Project Proponent will work with the Contractor(s) to refine the measures.

Trained staff will be appointed to oversee the implementation of the ESMP during construction and operation who shall ensure that the overall objectives of the mitigation measures are met. This shall be done by monitoring the implementation of these actions and also by monitoring their success. The Project Proponent will require the Contractor(s) to implement systems and operational controls as required by the ESIA and ESMP.

7.3.1.3 Contractors' Role

During construction and operation, the Contractor(s) will be engaged to provide technical services associated with the installation or cable repair works. The Contractor(s) shall be responsible for ensuring compliance with all relevant legislation and adherence to all mitigation measures specified in the ESMP. The Contractor(s) will also be responsible for managing the potential environmental, social, health and safety impacts of all contract activities whether these are undertaken by themselves or by their subcontractors.

7.3.2 Awareness, Training, and Capacity Building

Although significant impacts are not anticipated, The Project Proponent shall identify, plan, monitor and record training needs. This includes awareness of measures in the ESMP and wider environmental and social policies.

7.3.3 Communication

The Project Proponent will maintain a procedure for communication with relevant stakeholders where requested.

The Project Proponent will also develop and implement a grievance mechanism whereby relevant stakeholders can raise any issues of concern.

7.3.4 Documentation

The Project Proponent will control HSE documentation and maintain records, including management plans; associated procedures; and checklists, forms and reports, through a formal procedure.

The Contractor(s) and their subcontractors will also be required to develop a system for maintaining and controlling its own HSE documentation and describe these systems in their respective HSE plans.

7.3.5 Operational Control Procedures

Where appropriate, the mitigation measures identified in this ESIA will have an operational control associated with it that specifies appropriate procedures, work instructions, best management practices, roles, responsibilities, authorities, monitoring, measurement and record keeping for avoiding or reducing impacts. Operational controls are monitored for compliance and effectiveness on a regular basis through a monitoring and auditing procedure described in the ESMP.

Operational control procedures shall be reviewed and, where appropriate, amended to include instructions for planning and mitigating impacts, or to at least reference relevant documents that address mitigation.

7.3.6 Emergency Preparedness and Response

The Project Proponent and its Contractor(s) shall maintain plans and procedures to identify the potential for, and response to, environmental accidents, health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them.

Emergency preparedness and response will be reviewed after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement. Emergency exercises will be undertaken on a regular basis to confirm adequacy of response strategies. Investigations of accidents or incidents will follow formal documented procedures.

7.3.7 Managing Changes to Project Activities

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The Project Proponent will implement a formal procedure to manage changes in the Project that will apply to all related activities.

The objective of the procedure is to ensure that the impact of changes on the health and safety of personnel, environment and social aspects are identified and assessed prior to changes being implemented.

The management of change procedure will ensure that:

- Proposed changes have a sound technical, safety, environmental, social and commercial justification;
- Changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- Hazards resulting from changes that alter the conditions assessed in the ESIA have been identified and assessed and the impact(s) of changes do not adversely affect the management of health, safety or the environment;
- Changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes;
- The appropriate Project Proponent representative accepts the responsibility for the change.

7.4 Environmental and Social Management Measures

7.4.1 Planned Events

Construction Phase

Table 7.1 provides a summary of the ESMP for planned events during the construction phase of the Project. The ESMP includes the additional mitigation measures identified in Chapter 6. Reference is only made to inherent measures where there is a need to ensure the adoption of such measures.

Table 7.1: Environmental and Social Management Measures for the Construction Phase (Planned Events)

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
Intertidal and subtidal geomorphology							
Alteration to intertidal and subtidal morphology	Disturbance to intertidal areas; disturbance and sedimentation in subtidal areas	Minimise alteration to morphology	• Disturbance of subtidal and intertidal areas shall be limited as far as practicable, including establishment of set working corridors • Restoration of the land-based working areas after construction	Minor alteration to morphology	Inspection during works and post restoration	Daily during construction	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities.
Water and sediment/soil quality							

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
Increased turbidity from release of pollutants	Planned discharges cable installation and vessels	Minimise marine water pollution	• Disturbance of subtidal and terrestrial zones areas to be limited as far as practicable • Ensure adherence to MARPOL 73/78, including management of discharges and development/ implementation of a Shipboard Marine Pollution Emergency Plan • In addition, the cable laying vessel, and equipment on the vessel and all machinery used on land, will be maintained regularly in accordance with	No significant release of suspended sediments and pollutants into the environment	Visual inspections during works	Daily during construction	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			the manufacturer's recommendations to minimise the potential for discharges. The vessel captain will also ensure that the maximum carrying capacity of the sewage system is not exceeded • Develop and implement a best proactive Integrated Waste Management Plan				
Marine Biodiversity							
Disturbance in the intertidal and supratidal zones	Cable installation	Avoidance and minimisation of impacts on intertidal	• All planned activities on the beach be conducted during day-light hours	No loss of life to sea turtles; and long term restoration of beaches to	Depending upon the adopted mitigation strategy,	Dependent upon the mitigation strategy adopted	Responsibility for implementation: Project

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
		habitats and species	• Fencing off the nesting zone in the footprint of works with appropriate monitoring or translocation of eggs to an adjacent donor site with appropriate monitoring – see Chapter 6 • Minimise the size of working areas in the turtle crawl and nesting zone as far as practicable to limit the extent of potential impacts. Works should only be undertaken in 'turtle clear' areas (fenced or not);	enable sea turtle nesting to occur	undertake monitoring as appropriate		Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			and work areas shall be demarcated prior to work to limit disturbance to the beach system during construction • Zone areas for storage/lay-down of all equipment and materials away and waste storage areas from the nesting beach, wherever feasible • Only essential vehicular across to the turtle crawl zone and nesting zone to be permitted and should only take place in areas that have been				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			classed as 'turtle clear' through monitoring. In addition, beach disturbance shall be limited by creating lateral transport corridors inshore of the 'turtle nesting zone' using the existing coastal road with specified access points to identified working areas on the beach within the turtle crawl and nesting zone. Carefully controlling vehicle/plant access and use on nesting beaches will avoid direct				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			impacts to recent nests and to protect beach integrity. Where access results in damage to the profile of the beach and/or creates ruts that obstruct/trap hatchlings, the beach shall be remediated/restored once works are complete. Any temporary surfaces used to support access shall not be left in situ. Vehicles and equipment shall not be left on the beach overnight in identified turtle risk areas as these could				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			cause obstruction (see below) • If any works are proposed at night, then monitoring will be required to ensure that injury is avoided or to allow eggs to be translocated in the correct timeframe should *in situ* protection not be feasible • Ensure that no waste or other materials are disposed of in the intertidal turtle crawl and nesting zone wherever possible to limit the potential for obstruction to adult turtles and				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			hatchlings to occur • Avoid obstructing the movement of adult turtles to their 'nesting zone' with non-permanent structures at night • Undertake site monitoring during construction to actively intervene to remove obstructions (e.g. spills, waste, litter, logs) from the nesting beach that can be relocated without additional disturbance or damage to the environment –				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			seek specialist advice if necessary • Translocate hatchlings and adult sea turtles if access to sea is unavoidably obstructed (including monitoring within trenches) as a last resort, if required. • Prohibit hunting or harassment of sea turtles and poaching of eggs within the work site by project related staff through educating the workforce about the potential impacts on				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			turtles and penalties for actions that would cause such impacts. Monitor for evidence of poaching • Following construction, and in line with standard industry practice, the coastal construction areas should be restored and stabilised to as close to its former condition as possible. These works should be done in a way that is sensitive for turtles – either restoring beach conditions				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			in line with conditions prior to works taking place				
Disturbance to subtidal habitats	Cable installation	Minimise disturbance to habitats and species	• Disturbance to the seabed should be minimised as far as practicable, which minimise impacts on marine habitats and species	Minor disturbance to seabed habitats	N/A	N/A	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Increased suspended sediments and	Cable installation	Minimise impacts on	• Disturbance to the seabed should be minimised as	Minor disturbance to seabed	N/A	N/A	Responsibility for

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
sediment deposition		habitats and species	far as possible, which minimise impacts on marine habitats and species	habitats and no significant release of suspended sediments			implementation: Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Pollution of marine waters	Cable installation	Minimise marine water pollution	• Mitigation measures are proposed to minimise impacts on water quality from land-based construction areas and vessels; and these apply directly to	No significant release of pollutants into the environment	Review of plans and visual inspections during works	Daily during construction	Responsibility for implementation: Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			mitigating impacts on marine biodiversity, including avoiding and limiting the potential for pollution to marine waters and emergency response planning. Of specific note is the need to ensure adherence to MARPOL 73/78 • Undertake active beach clean-up activities within and adjacent to working areas related to existing waste on the beach, which will				Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			reduce existing impacts on wildlife using these areas				
Underwater sound generation	Cable installation	Avoid injury to marine wildlife and limit to extent of strong behavioural disturbance as far as possible	• Undertake marine wildlife visual observation monitoring is onboard the cable laying vessel during the cable laying operation • Develop a mitigation buffer zone to inform operations, including delays as appropriate.	No injury to marine wildlife	Marine Mammal observers (MMO) observation monitoring or by vessel crew members	Daily during vessel cable laying	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Artificial lighting	Light emissions from land based	Avoid or minimise artificial light impacts	• Ensure that planned works (especially on land) are	No significant light pollution and disturbance to	Observation, especially inspection	Daily during construction	Responsibility for implementation: Project

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
	activities and vessel	on sea turtles and bird species	completed in the daytime • Adopt light management best practice protocols for activities under the control of the Project as outlined in Chapter 6, as appropriate • All temporary lighting on land should be removed at the end of the construction period	nesting/hatching sea turtles in particular	for 'problem lights'		Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Introduction of alien invasive species	Vessel use during construction	Avoid the introduction of alien species by the cable laying vessel	• Ensure adherence to the International Maritime Organisation (IMO) International Convention for	Low potentials for the introduction of alien invasive species	Observation, review of ballast water record book	During any ballast water exchange activities	Responsibility for implementation: Project Proponent /Contractor

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (2004) • Vessel operators should follow the IMO 2011 Guidelines for the Control and Management of Ships' Biofouling to minimize the transfer of invasive aquatic species. Other guidance of relevance includes the Marine Biofouling and invasive species: guidelines for prevention and				Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			management produced by the Global Invasive Species Programme (GISP) (2008)				
Terrestrial Biodiversity							
Disturbance of terrestrial fauna species in the project area	Trench digging and excavation activities	Minimise impacts on terrestrial species and ensure restoration following works	• Disturbance of terrestrial areas should be minimised and works set within established working corridors that are as small as practicable • Daily inspection of trenches will be implemented to 'rescue' any animals that may have fallen in trenches • Excavated trenches will be	Minor disturbance to terrestrial species and short-term temporary impacts on habitats	Daily observations	Daily during onshore installation activities	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			covered as soon as practically possible to avoid extended periods of time where trenches are exposed and thus a threat to fauna • The terrestrial construction area shall be restored to as close to its former condition as possible				
Air Quality							
Emissions of air pollutants	Cable installation on land and the marine environment	Minimise the emission of air pollutants	• Ensure that vessel operators adhere to MARPOL 73/78 • After clearing, grading, earthmoving, or excavation is	Low levels of emissions	Daily observations for particulate disturbance	During construction	Responsibility for implementation: Project Proponent /Contractor

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			completed, if appropriate. the disturbed area should be treated by watering, re-vegetating, or spreading soil binders until the area is paved or otherwise developed to the point where dust will not be generated under natural conditions • Regular water-spraying of unpaved and sweeping of paved roads to minimise dust and remove mud and debris • Using wheel washes for				Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			vehicles leaving the site where appropriate, to minimise the amount of mud and debris deposited on the roads; • Reducing the quantity of dusty materials stored on site or covering stored materials to minimise the amount of dust being blown • Only well maintained machinery would be used so to minimise mobile source emissions • Catalytic converters and exhaust filters				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			will be correctly fitted where appropriate and available to minimize diesel exhaust emissions • Idling time of diesel engines should be limited and engines should not be overloaded • Fuel oil will meet regulated Sulphur content levels in order to control SO_X and particulate matter emissions • Engines will be operated in a manner so that regulated NO_X emission levels are achieved				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
Ambient Noise and Vibration							
Generation of ambient noise and vibration	Cable installation	Minimise ambient noise generation	• The Contractor will make seek to minimise noise impacts as far as practicable and inform local residents and beach users • Whilst noise may have an impact, good communication between the Contractor and any local residents will ensure that such impacts are kept to a minimum by correct timing, silencing or other mitigation matters • Plant and equipment will be	Low levels emissions below relevant national standards (NO_2, 0.113 mg/m^3; SO_2, 0.026 mg/m^3; TSP, 0.25 mg/m^3; and CO, 11.4 mg/m^3). Noise limit – 90dB(A)	Monitoring of noise where activities occur on land	Daily during installation activities	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			correctly adjusted and maintained to prevent excessive exhaust fumes and noise emissions and silencers fitted where possible • Hand-held localised noise monitoring to be conducted to ensure compliance with legislation and if complaints arise • All machinery to be regularly maintained and serviced				
Fishing and Fisheries							
Impact on fishery activities	Cable installation	• Minimize disruptio n to	• Relevant agencies shall be informed of the cable route and be provided	No impact on the loss of fishing gear	Observation s,	Prior to installation activities	Responsibility for implementation: Project

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
		fishing activities • Minimize the potential for damage to the cable and impacts on fishing	with the relevant planned route coordinates and notified of the expected dates of installation. It is anticipated that these agencies will inform local marine users following their own protocols, including fishermen • As-laid information will be provided to the local and UK hydrographic Office		Review of records of consultation		Proponent/ Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Landscape and Aesthetics							
Reduction of aesthetic amenity	Cable installation	Minimise impacts of change in aesthetic quality of	• Efforts will be made to minimise visual impacts; land disturbed by cable laying will	Evidence of community engagement and	Liaison with community members and review	Daily	Responsibility for implementation: Project

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
		the project area	be contoured as far as possible to its original form as part of overall reinstatement • Community members shall be adequately informed as appropriate prior to the installation activities about the pending disruptions through mechanisms such as a resident's committee, local newspapers and signage • A designated member of Project personnel should be available during construction to	no complaints received from the communities in the Project area	of any complaints		Proponent/ Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			answer questions, receive and resolve grievances and monitor installation activities • The Project shall take measures to ensure that contractors maintain the site neat and orderly during construction and installation with due regard to removal of waste and clean-up of litter. This also includes measures to reduce impacts of dust as described				
Marine Navigation							

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
• Temporary disruptions to the flow of shipping traffic • Potential collisions of marine vessels	Cable laying activities	Avoid potential disruptions and collisions to marine navigation during the installation Phase	• The Project shall notify relevant marine authorities of the proposed installation and repair activities • Vessel movement and activity shall observe standard navigational safety procedures and local communication protocols, as applicable, to avoid conflicts with other vessels in the Project Area	Evidence of consultation and notification of marine authorities about the cable laying operations Adherence to applicable standard navigational safety procedures and local communicatio n protocols	Review of evidence to show consultation and notification of the marine authorities Vessel captain to monitor adherence to the regulations	Once prior to installation and daily during installation activities	Responsibility for implementation: Project Proponent/ Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Terrestrial Traffic							
Disruption of free flow of traffic and increased risk	Movement of Project vehicles along the road leading to the	Avoid or minimize disruption to traffic and	• The Project shall notify the local community of the proposed	No Project-related road accident	Formal and informal feedback from locals	Daily during construction phase	Responsibility for implementation: Project

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
of traffic accident	cable landing site	risks of accidents	installation and activities • Where required, safety signage shall be installed at different sections of the road leading to the cable landing site • Drivers shall adhere to speed limits of less than 30 km/h along the road leading to the cable landing site • Where necessary, staff shall be engaged to direct movement of Project vehicles		Grievance log		Proponent/ Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities
Occupational Health and Safety							
• Accidents and injuries during	Pre-installation/i	Minimise the likelihood of	• Only trained and competent crew shall be engaged	No injury or loss of life	Project's HSE Plan	Daily during installation activities	Responsibility for implementation:

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
offshore installation activities • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions • Occupational health and safety risks for land-based activities	nstallation activities Diving activities	incidents or accidents	for cable laying activities • Appropriate PPE (e.g. coverall, safety boot, gloves, eye goggles, life jackets etc.) shall be provided. Training and awareness on the use of PPE shall also be carried out as part of induction for workforce • Development and implementation of a robust Occupational Health and Safety (OHS) Plan and Procedures shall be ensured. The OHS Plan shall be developed in				Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			consistent with all relevant national and international standards • Installation works shall be limited to the daytime as much as possible • Implementation of Health and Safety communication and training programmes to prepare workers to recognize and respond to workplace hazards shall be carried out. Daily toolbox talks prior to commencement of installation				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			activities shall be implemented • Safety training focused on operational procedures, emergency procedures and safe working practices, information on specific hazards and first aid shall be included in the induction, prior to the commencement of construction				
Community health and safety							
Potential injuries and accident to local members during cable installation	Cable installation activities	• Minimize impacts on local communi ty	• The land-based construction sites will be managed following best practices to minimise any risk	No injury or loss of life	Formal and informal feedback from locals.	Daily during installation activities	Responsibility for implementation: Project Proponent /Contractor

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
activities at the landing site			to local residents and coastal users • Contractor personnel shall be briefed on the sociocultural norms and sensitivities of the neighbouring communities before commencement of work in the area • An induction and sensitisation programme, including a Code of Conduct, for all installation workers (including newcomers directly related to the Project) shall be carried out		Grievance log		Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			prior to installation activities. This will increase sensitivity to local norms and customs and will provide awareness to contractors and employees of appropriate and acceptable behaviours and govern worker interactions with the local communities • A grievance mechanism procedure (which tracks shall be developed and implemented.				
Waste Generation							

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
Generation of waste and associated potential indirect impacts on wildlife	Discharge of wastes during cable installation	Avoid or minimise impacts of waste discharge	• Ensure vessel operators adhere with MARPOL 73/78 • A project-specific Waste Management Plan (WMP) will be developed and implemented to manage the waste streams associated with the Project • Hazardous waste (if any) and all debris recovered from the seabed during pre-lay clearing activities shall be safely stored on board the vessel until it can be disposed at	No unmanaged waste disposal	Inspection and observation	Daily during construction	Responsibility for implementation: Project Proponent /Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			a suitably equipped port • The debris will be disposed by accredited waste contractors • Only approved landfills or dumpsites shall be used for disposal of the debris • Construction rubble and excavated soil that is not used as backfill must be disposed of at a licensed landfill • All project works area should be rehabilitated and				

Potential Impact	Activity/ Risk source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			restored to its original state after works are completed				

Operation Phase

As discussed in Chapters 5 and 6, cable repair works in the operation phase may lead to similar, but lower magnitude impacts than during construction. Impacts are negligible, however, the additional minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

7.4.2 Unplanned Events

Table 7.2 provides a summary of the Environmental and Social Management Plan for unplanned events during the construction phase of the Project.

Table 7.2: Environmental and Social Management Plan for the Construction Phase (Unplanned Events)

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
Accidental Release of Solid Wastes							
Pollution of the marine environment and potential for indirect impacts on marine wildlife	Uncontrolled waste discharge	Avoid of minimise the accidental pollution of the marine environment	• Appropriate waste containment facilities will be included on the vessel and managed to avoid overflow or accidental release to the environment • No waste materials will be disposed of overboard; all non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance with the vessel's	No uncontrolled waste discharge	Observation, review of waste disposal records	Daily during construction	Responsibility for implementation: Contractor Responsibility for monitoring implementation: FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			Garbage Management Plan as required under Regulation 9 of MARPOL Annex V • Hazardous wastes will be separated, labelled and retained in storage onboard within secondary containment (e.g. bin located in a bund). • All recyclable and general wastes to be collected in labelled, covered bins (and compacted where possible) for appropriate disposal at				

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			regulated waste facility				
Dropped Objects							
Damage to benthic habitats due to an object being dropped overboard	Operations conducted on vessel deck, carelessness, Accidents	Avoid or minimise the impacts dropped objects	• All equipment and gear on the vessels should be securely fastened during mobilisation/ demobilisation • Lifting is to be carried out by competent personnel using equipment that is suitable, certified and maintained • Waste management controls are to remain effective to reduce risk of release of wastes that could be ingested or cause entanglement	No dropped objects during construction	Review of records of dropped objects, retrieved objects and their location	Daily during construction	Responsibility for implementation : Contractor Responsibility for monitoring implementation : FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			• During the activities, detailed records of equipment lost overboard or dropped will be maintained and reviews will be undertaken to reflect on methods to mitigate repetition of the incident				
Ship Strikes							
Collision with marine fauna resulting in injury or mortality	Movement and operation of cable laying vessel in the marine environment	Avoid collisions	• As noted above marine mammal observations shall be undertaken to address risks from underwater sound generation. These observations can also identify any	No injury to marine wildlife	Visual observations	Daily during construction	Responsibility for implementation : Contractor Responsibility for monitoring implementation : FMEnv; Lagos State Ministry of the

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			ship strike risks as appropriate. In line with good practice, the vessel operator shall aim to maintain a distance of 100 m or greater from marine mammals and sea turtles; and also, to follow and maintain a constant route, course and speed. If the vessel is within 50 m of marine mammals and sea turtles it shall be limited to no-wake speeds. These areas are within the buffer zone defined for underwater				Environment and Water Resources; and other relevant authorities

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			sound impacts allowing for a combined approach for monitoring activity				
Hydrocarbon, Chemicals and Other Liquid Waste							
Localised reductions in water quality and contamination of marine fauna	A leak or spill of hydrocarbons or other liquids during cable installation	Avoid or minimise the risks of leak and spills to the marine environment	• Spill clean-up equipment shall be located on land where machinery is being used that has the potential to lead to accidental leaks or spills. • Re-fuelling of vessels will only occur at a port and be subject to port management controls • Chemicals and hydrocarbons will be packaged,	Shipboard Oil Pollution Emergency Plan (SOPEP) Shipboard Marine Pollution Emergency Plan (SMPEP) Spill records	Review of spill records, SOPEP, SMPEP by the HSE Coordinator	Daily during construction	Responsibility for implementation : Contractor Responsibility for monitoring implementation : FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			marked, labelled and stowed in accordance with MARPOL Annex I, II and III regulations. These include provisions for all chemicals (environmentally hazardous) and hydrocarbons will be stored safely • Vessel operators will have an up to date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP) • Any contaminated				

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			material collected shall be contained on board for appropriate onshore disposal. • Transfer deck run off discharges to the sea via the scuppers. Scupper plugs or equivalent will be available on vessel decks where chemicals and hydrocarbons are stored and frequently handled (i.e.' high risk' areas) • Any vessel equipment or				

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate • Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater. • All hoses for pumping and transfers will be maintained and checked as per the planned				

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			maintenance systems • On board oily water disposal will be managed in accordance with the local regulations. The vessel operator will record the quantity, time and onshore location of the oily water disposal in the vessel Oil Record Book • If the vessel is equipped with an oily water filter system, they may discharge oily				

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			water after treatment to 15 ppm in an oily water filter system (providing they have a current calibration certificate for the bilge alarm) as required by MARPOL Annex I Regulations (for the prevention of pollution by oil).				
Damaged Fuel Tank Associated with Vessel Collision							
Collision of vessels leading to rupture of fuel tanks	Cable installation	Avoid collision	• Spill clean-up equipment will be located where hydrocarbons are stored and frequently handled (i.e. 'high risk' areas)	No vessel collision	Observations	Before refuelling activities	Responsibility for implementation : Contractor

Potential Impact	Activity / Risks Source	Desired Outcome	Description of Mitigation Measures	Performance Indicator	Monitoring	Timing/ Frequency	Responsibility
			• Marine diesel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e. Sulphur content of less than 3.50% m/m) is the only engine fuel to be used by the vessels • Oil spill responses will be executed in accordance with the vessel's SOPEP, as required under MARPOL				Responsibility for monitoring implementation : FMEnv; Lagos State Ministry of the Environment and Water Resources; and other relevant authorities

Operation Phase

Cable repair works in the operation phase may lead to similar, but lower magnitude impacts than during construction. Impacts are negligible, however, the additional minimisation measures identified for the construction phase will apply as appropriate to the activities being undertaken.

CHAPTER EIGHT:

REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

CHAPTER EIGHT

REMEDIATION PLAN AFTER DECOMMISSIONING / CLOSURE

8.1 Need for Decommissioning Assessment

The cable system is being developed for a projected 25-year operational lifetime, however, at this time it is unknown exactly how long the cable will be in use. As discussed in Chapter 3, options for decommissioning of the system at the end of the Project's lifetime include retirement in place, or removal and salvage. There are no plans to withdraw the cable from the seabed or in the coastal area. Current global industry practice is to retire cables in place at the end of the Project's lifetime (i.e. to not remove them). Therefore, no impacts are predicted to occur in association with the Project during this stage of the Project.

CHAPTER NINE:

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER NINE

CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The ESIA of the proposed EQUIANO Nigeria submarine cable project has been conducted in accordance with the requirements of the EIA Act CAP E12 LFN 2004.

The ESIA study comprises a number of key steps, including: desktop review, scoping, stakeholder engagement and community consultation, potential impact identification and evaluation, development of mitigation measures and ESMP, and report writing and disclosure.

The essence of the ESIA process is aimed at ensuring informed decision-making and environmental accountability, and to assist in achieving environmentally sound operation throughout the life cycle of the Project.

Consistent with the regulatory standards, the assessment of the environmental status and the socio-economic aspects of the Project's AoI have been carefully carried out using universally accepted methodology. Evaluation of associated and potential impacts of the Project identified both positive and negative interactions with the receiving biophysical and socio-economic environment.

The positive impacts associated with the Project include:

- Improved access to reliable and fast data networks for businesses.
- Reduction in the cost of broadband communication to Internet Service Providers (ISPs), small enterprises and end users.
- Macro-economic benefits of the potential extension of technology-reliant industries, such as information technology services and software development businesses.
- Increase in the penetration of internet connectivity to underserved regions of the country in order to assist in achieving the goals of the Nigerian National Broadband Plan;
- Indirect benefits such as improved educational opportunities through increase in access to information and education resources.
- Direct and indirect employment opportunities (local and regional).
- Acquisition of new skills through technology transfer.
- Revenue generation to Nigerian Government at Federal, State and Local levels through taxes.
- Economic benefits from the enhanced opportunities for new and small enterprises that may have previously been excluded from technologies by high access cost.
- Enhancement of communications and connectivity directly affecting local businesses, education and employment opportunities within the country.

The Project inherently incorporates many measures to limit the adverse impacts on environmental and socio-economic receptors. Prior to the implementation of additional mitigation measures, impacts were mostly of negligible to minor significance, but some moderate impacts were identified. However, after the implementation of additional mitigation measures, residual impacts are of negligible to minor significance.

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

9.2 Recommendations

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

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APPENDICES

APPENDIX 3.1:

GEOGRAPHIC COORDINATES OF CABLE ROUTE FROM BU TO BMH LAGOS

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
1	BMH LAGOS	06	25.4070	N	003	29.8300	E				0		0.000	519.802				0.000		
									171.7°			0.000			MDA1740	N/A	0.050			
2	CABLE ALLOWANCE	06	25.4070	N	003	29.8300	E				0		0.000	519.802				0.050		
									171.7°			0.211			MDA1740	0.81%	0.213			
3	AC	06	25.2936	N	003	29.8466	E	AC		15.4° Port	3		0.211	519.591				0.263		
									156.3°			0.081			MDA1740	0.88%	0.081			
4	AC	06	25.2535	N	003	29.8642	E	AC		9.4° Port	6		0.292	519.510				0.344		
									146.9°			0.066			MDA1740	0.81%	0.066			
5	AC	06	25.2237	N	003	29.8837	E	AC		12.7° Stbd	7		0.358	519.444				0.410		
									159.6°			0.028			MDA1740	0.81%	0.029			
6	AC	06	25.2094	N	003	29.8890	E	AC		13.0° Stbd	7		0.386	519.416				0.439		
									172.5°			0.033			MDA1740	0.80%	0.034			
7	AC	06	25.1914	N	003	29.8914	E	AC		22.0° Stbd	7		0.419	519.383				0.473		
									194.5°			0.004			MDA1740	0.80%	0.003			
8	START SAND CHANNEL	06	25.1894	N	003	29.8909	E				7		0.423	519.379				0.476		
									194.5°			0.021			MDA1740	0.80%	0.022			
9	AC	06	25.1782	N	003	29.8880	E	AC		15.2° Port	7		0.444	519.358				0.498		
									179.3°			0.020			MDA1740	0.80%	0.020			
10	END SAND CHANNEL	06	25.1675	N	003	29.8881	E				7		0.464	519.338				0.518		
									179.3°			0.002			MDA1740	0.80%	0.002			
11	AC	06	25.1665	N	003	29.8881	E	AC		6.8° Port	7		0.466	519.336				0.520		
									172.5°			0.080			MDA1740	0.80%	0.080			
12	AP END	06	25.1236	N	003	29.8938	E				8		0.546	519.256				0.600		
									172.5°			0.729			MDA1740	0.80%	0.735			
13	AC	06	24.7313	N	003	29.9455	E	AC		5.4° Stbd	10		1.275	518.527				1.335		
									177.8°			0.133			MDA1740	0.80%	0.135			
14	WD 10	06	24.6589	N	003	29.9482	E				10		1.408	518.394				1.470		

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
									177.8°			0.562			MDA1740	0.80%	0.566			
15	WD 11	06	24.3546	N	003	29.9597	E				11		1.970	517.832				2.036		
									177.8°			0.522			MDA1740	0.80%	0.526			
16	WD 12	06	24.0715	N	003	29.9705	E				12		2.492	517.310				2.562		
									177.8°			1.447			MDA1740	0.80%	1.458			
17	PLDN	06	23.2870	N	003	30.0001	E				15		3.939	515.863				4.020		
									177.8°			0.002			MDA1740	0.80%	0.003			
18	SC 0.2%	06	23.2859	N	003	30.0002	E				15		3.941	515.861				4.023		
									177.8°			0.062			MDA1740	0.20%	0.062			
19	AC	06	23.2521	N	003	30.0014	E	AC		9.8° Stbd	15		4.003	515.799				4.085		
									187.6°			1.884			MDA1740	0.20%	1.888			
20	PLUP	06	22.2390	N	003	29.8654	E				18		5.887	513.915				5.973		
									187.6°			0.504			MDA1740	0.20%	0.504			
21	CX IS AF NIGERIA DOMESTIC SEG A	06	21.9684	N	003	29.8291	E				19		6.391	513.411				6.477		
									187.6°			0.096			MDA1740	0.20%	0.097			
22	CX IS NIGERIA DOMESTIC SEG A	06	21.9164	N	003	29.8221	E				19		6.487	513.315				6.574		
									187.6°			0.498			MDA1740	0.20%	0.499			
23	PLDN	06	21.6486	N	003	29.7862	E				21		6.985	512.817				7.073		
									187.6°			0.018			MDA1740	0.20%	0.018			
24	CX OOS UNION D	06	21.6391	N	003	29.7849	E				21		7.003	512.799				7.091		
									187.6°			3.087			MDA1740	0.20%	3.093			
25	EXIT LAGOS PORT LIMIT	06	19.9793	N	003	29.5621	E				29		10.090	509.712				10.184		
									187.6°			0.348			MDA1740	0.20%	0.349			
26	AC	06	19.7917	N	003	29.5369	E	AC		13.6° Port	29		10.438	509.364				10.533		
									174.1°			0.464			MDA1740	0.20%	0.464			
27	AC	06	19.5418	N	003	29.5627	E	AC		13.7° Port	30		10.902	508.900				10.997		
									160.4°			0.427			MDA1740	0.20%	0.428			

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
28	AC	06	19.3235	N	003	29.6403	E	AC		13.0° Port	32		11.329	508.473				11.425		
									147.4°			0.452			MDA1740	0.20%	0.453			
29	AC	06	19.1167	N	003	29.7723	E	AC		12.9° Port	33		11.781	508.021				11.878		
									134.5°			0.438			MDA1740	0.20%	0.439			
30	AC	06	18.9501	N	003	29.9417	E	AC		12.1° Port	35		12.219	507.583				12.317		
									122.4°			0.298			MDA1740	0.20%	0.299			
31	PLUP	06	18.8634	N	003	30.0782	E				36		12.517	507.285				12.616		
									122.4°			0.274			MDA1740	0.20%	0.274			
32	CX IS GLO-1 PHASE 3	06	18.7838	N	003	30.2036	E				37		12.791	507.011				12.890		
									122.4°			0.000			MDA1740	0.20%	0.000			
33	CX IS AF GLO-1 PHASE 3	06	18.7838	N	003	30.2036	E				37		12.791	507.011				12.890		
									122.4°			0.276			MDA1740	0.20%	0.276			
34	PLDN	06	18.7036	N	003	30.3298	E				38		13.067	506.735				13.166		
									122.4°			0.214			MDA1740	0.20%	0.215			
35	AC	06	18.6413	N	003	30.4278	E	AC		4.2° Stbd	38		13.281	506.521				13.381		
									126.6°			1.089			MDA1740	0.20%	1.091			
36	AC	06	18.2893	N	003	30.9019	E	AC		7.0° Port	43		14.370	505.432				14.472		
									119.6°			0.458			MDA1740	0.20%	0.459			
37	PLUP	06	18.1665	N	003	31.1180	E				45		14.828	504.974				14.931		
									119.6°			0.159			MDA1740	0.20%	0.160			
38	CX OOS UNION D	06	18.1238	N	003	31.1931	E				45		14.987	504.815				15.091		
									119.6°			0.137			MDA1740	0.20%	0.137			
39	CX IS ACE SEG 3.6	06	18.0871	N	003	31.2577	E				46		15.124	504.678				15.228		
									119.6°			0.006			MDA1740	0.20%	0.006			
40	CX IS AF ACE SEG 3.6	06	18.0855	N	003	31.2604	E				46		15.130	504.672				15.234		
									119.6°			0.290			MDA1740	0.20%	0.290			
41	PLDN	06	18.0078	N	003	31.3971	E				47		15.420	504.382				15.524		
									119.6°			0.500			MDA1740	0.20%	0.501			

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
42	TR MDA1740/SAL1740	06	17.8739	N	003	31.6328	E				48		15.920	503.882				16.025	16.025	
									119.6°			0.068			SAL1740	0.20%	0.068			
43	AC	06	17.8557	N	003	31.6649	E	AC		14.0° Stbd	48		15.988	503.814				16.093		
									133.5°			0.512			SAL1740	0.20%	0.514			
44	START CBC (SS)	06	17.6642	N	003	31.8662	E				50		16.500	503.302				16.607		
									133.5°			0.733			SAL1740	0.20%	0.734			
45	LINEAR CONTACT	06	17.3902	N	003	32.1543	E				52		17.233	502.569				17.341		
									133.5°			0.398			SAL1740	0.20%	0.399			
46	AC	06	17.2414	N	003	32.3107	E	AC		14.3° Stbd	53		17.631	502.171				17.740		
									147.9°			0.259			SAL1740	0.20%	0.260			
47	R18108	06	17.1222	N	003	32.3855	E				54		17.890	501.912				18.000		
									147.9°			0.058			SAL1740	0.20%	0.058			
48	CX OOS TELEGRAPH	06	17.0955	N	003	32.4022	E				54		17.948	501.854				18.058		
									147.9°			0.808			SAL1740	0.20%	0.810			
49	AC	06	16.7243	N	003	32.6352	E	AC		14.4° Stbd	56		18.756	501.046				18.868		
									162.2°			0.851			SAL1740	0.20%	0.852			
50	AC	06	16.2848	N	003	32.7758	E	AC		13.5° Stbd	59		19.607	500.195				19.720		
									175.7°			3.848			SAL1740	0.20%	3.856			
51	AC	06	14.2027	N	003	32.9319	E	AC		2.1° Stbd	72		23.455	496.347				23.576		
									177.8°			1.322			SAL1740	0.20%	1.325			
52	CX OOS UNION D	06	13.4860	N	003	32.9599	E				76		24.777	495.025				24.901		
									177.8°			0.496			SAL1740	0.20%	0.496			
53	MB TW NGA/EZ NGA	06	13.2172	N	003	32.9705	E				78		25.273	494.529				25.397		
									177.8°			0.394			SAL1740	0.20%	0.396			
54	EXIT NO ANCHOR ZONE	06	13.0034	N	003	32.9788	E				79		25.667	494.135				25.793		
									177.8°			1.746			SAL1740	0.20%	1.748			
55	AC	06	12.0573	N	003	33.0158	E	AC		3.1° Stbd	85		27.413	492.389				27.541		

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
									180.8°			0.831			SAL1740	0.20%	0.833			
56	TR SAL1740/MDA1740	06	11.6062	N	003	33.0094	E				87		28.244	491.558				28.374	12.349	
									180.8°			0.500			MDA1740	0.20%	0.501			
57	PLUP END CBC (SS)	06	11.3351	N	003	33.0056	E				89		28.744	491.058				28.875		
									180.8°			0.641			MDA1740	0.32%	0.643			
58	PLDN START CBC (SS)	06	10.9872	N	003	33.0007	E				92		29.385	490.417				29.518		
									180.8°			0.683			MDA1740	0.20%	0.685			
59	AC	06	10.6164	N	003	32.9954	E	AC		5.2° Port	95		30.068	489.734				30.203		
									175.6°			0.917			MDA1740	0.20%	0.918			
60	PLUP END CBC (SS)	06	10.1208	N	003	33.0333	E				99		30.985	488.817				31.121		
									175.6°			0.346			MDA1740	0.22%	0.347			
61	PLDN START CBC (SS)	06	09.9334	N	003	33.0476	E				101		31.331	488.471				31.468		
									175.6°			0.111			MDA1740	0.20%	0.112			
62	START CBC (SR)	06	09.8734	N	003	33.0522	E				101		31.442	488.360				31.580		
									175.6°			0.034			MDA1740	0.20%	0.034			
63	START CBC (SS)	06	09.8550	N	003	33.0536	E				102		31.476	488.326				31.614		
									175.6°			0.362			MDA1740	0.20%	0.363			
64	TR MDA1740/SAL1740	06	09.6591	N	003	33.0686	E				104		31.838	487.964				31.977	3.603	
									175.6°			0.323			SAL1740	0.20%	0.323			
65	ST 15	06	09.4845	N	003	33.0820	E				105		32.161	487.641				32.300		
									175.6°			0.459			SAL1740	0.20%	0.460			
66	START CBC (SS SB)	06	09.2359	N	003	33.1010	E				107		32.620	487.182				32.760		
									175.6°			0.446			SAL1740	0.20%	0.447			
67	EXIT CPZ	06	08.9947	N	003	33.1194	E				107		33.066	486.736				33.207		
									175.6°			0.074			SAL1740	0.20%	0.074			
68	AC	06	08.9549	N	003	33.1225	E	AC		1.5° Stbd	107		33.140	486.662				33.281		
									177.1°			4.683			SAL1740	0.35%	4.699			
69	START CBC (SS)	06	06.4173	N	003	33.2511	E				279		37.823	481.979				37.980		
									177.1°			0.611			SAL1740	0.69%	0.616			

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
70	AC	06	06.0861	N	003	33.2678	E	AC		2.5° Port	339		38.434	481.368				38.596		
									174.7°			1.073			SAL1740	0.99%	1.083			
71	START CBC (SS SL)	06	05.5066	N	003	33.3221	E				473		39.507	480.295				39.679		
									174.7°			0.359			SAL1740	1.66%	0.365			
72	LINEAR CONTACT	06	05.3126	N	003	33.3402	E				534		39.866	479.936				40.044		
									174.7°			0.061			SAL1740	1.43%	0.061			
73	LINEAR CONTACT	06	05.2799	N	003	33.3433	E				543		39.927	479.875				40.105		
									174.7°			0.309			SAL1740	1.51%	0.315			
74	END CBC (SL)	06	05.1128	N	003	33.3589	E				594		40.236	479.566				40.420		
									174.7°			1.556			SAL1740	1.02%	1.572			
75	ST 10	06	04.2720	N	003	33.4375	E				792		41.792	478.010				41.992		
									174.7°			1.931			SAL1740	0.79%	1.945			
76	PLUP END CBC (SS)	06	03.2293	N	003	33.5351	E				1000		43.723	476.079				43.937		
									174.7°			0.002			SAL1740	0.91%	0.003			
77	SC 0.5%	06	03.2279	N	003	33.5352	E				1000		43.725	476.077				43.940		
									174.7°			3.009			SAL1740	1.41%	3.051			
78	AC	06	01.6025	N	003	33.6873	E	AC		4.1° Port	1365		46.734	473.068				46.991		
									170.6°			1.149			SAL1740	1.02%	1.161			
79	EXIT OPL 311/ENT OPL314	06	00.9877	N	003	33.7893	E				1482		47.883	471.919				48.152		
									170.6°			0.187			SAL1740	0.99%	0.189			
80	SC 1.0%	06	00.8876	N	003	33.8059	E				1500		48.070	471.732				48.341		
									170.6°			2.756			SAL1740	1.37%	2.794			
81	CX OOS UNION D	05	59.4123	N	003	34.0507	E				1731		50.826	468.976				51.135		
									170.6°			2.259			SAL1740	1.33%	2.288			
82	TR SAL1740/LWP1740	05	58.2034	N	003	34.2513	E				1900		53.085	466.717				53.423	21.446	
									170.6°			0.002			LWP1740	1.16%	0.003			
83	SC 3.0%	05	58.2022	N	003	34.2515	E				1900		53.087	466.715				53.426		
									170.6°			0.161			LWP1740	3.22%	0.166			
84	AC	05	58.1160	N	003	34.2658	E	AC		11.3° Stbd	1910		53.248	466.554				53.592		

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
									181.8°			4.278			LWP1740	3.03%	4.407			
85	ST 5	05	55.7962	N	003	34.1915	E				2009		57.526	462.276				57.999		
									181.8°			1.613			LWP1740	3.02%	1.662			
86	AC	05	54.9215	N	003	34.1635	E	AC		14.9° Stbd	2041		59.139	460.663				59.661		
									196.7°			1.536			LWP1740	3.03%	1.583			
87	CX OOS UNION D	05	54.1232	N	003	33.9244	E				2078		60.675	459.127				61.244		
									196.7°			4.375			LWP1740	3.04%	4.508			
88	AC	05	51.8495	N	003	33.2432	E	AC		6.6° Port	2197		65.050	454.752				65.752		
									190.1°			5.745			LWP1740	3.01%	5.918			
89	EXIT OPL 314/ENT OPL 321	05	48.7811	N	003	32.6965	E				2240		70.795	449.007				71.670		
									190.1°			3.192			LWP1740	3.13%	3.292			
90	ST 4	05	47.0761	N	003	32.3927	E				2266		73.987	445.815				74.962		
									190.1°			1.379			LWP1740	3.03%	1.420			
91	AC	05	46.3398	N	003	32.2615	E	AC		15.0° Stbd	2278		75.366	444.436				76.382		
									205.1°			7.236			LWP1740	3.04%	7.456			
92	AC	05	42.7849	N	003	30.5980	E	AC		14.4° Port	2392		82.602	437.200				83.838		
									190.7°			2.264			LWP1740	3.01%	2.332			
93	CX OOS UNION D	05	41.5779	N	003	30.3703	E				2423		84.866	434.936				86.170		
									190.7°			2.971			LWP1740	3.01%	3.061			
94	AC	05	39.9937	N	003	30.0715	E	AC		22.2° Port	2447		87.837	431.965				89.231		
									168.5°			0.570			LWP1740	3.01%	0.587			
95	R18107	05	39.6905	N	003	30.1333	E				2453		88.407	431.395				89.818		
									168.5°			5.301			LWP1740	3.30%	5.476			
96	AC	05	36.8725	N	003	30.7077	E	AC		16.1° Port	2508		93.708	426.094				95.294		
									152.3°			3.798			LWP1740	3.01%	3.912			
97	CX IS MAIN ONE SEG 9	05	35.0473	N	003	31.6623	E				2520		97.506	422.296				99.206		
									152.3°			1.668			LWP1740	3.00%	1.718			

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
98	ST 3	05	34.2456	N	003	32.0815	E				2524		99.174	420.628				100.924		
									152.3°			3.337			LWP1740	3.00%	3.437			
99	AC	05	32.6421	N	003	32.9200	E	AC		7.3° Stbd	2530		102.511	417.291				104.361		
									159.7°			0.006			LWP1740	3.00%	0.006			
100	EXIT OPL 321/ENT OPL 325	05	32.6391	N	003	32.9211	E				2530		102.517	417.285				104.367		
									159.7°			10.776			LWP1740	3.41%	11.145			
101	EXIT OPL 325/ENT OPL 318	05	27.1562	N	003	34.9484	E				2490		113.293	406.509				115.512		
									159.7°			1.438			LWP1740	3.00%	1.480			
102	CX IS WACS SEG 2A (8.1) & 2B (8.3)	05	26.4250	N	003	35.2188	E				2490		114.731	405.071				116.992		
									159.7°			2.988			LWP1740	3.00%	3.078			
103	AC	05	24.9046	N	003	35.7809	E	AC		25.3° Stbd	2490		117.719	402.083				120.070		
									185.0°			6.486			LWP1740	3.00%	6.680			
104	AC	05	21.3991	N	003	35.4740	E	AC		11.9° Stbd	2505		124.205	395.597				126.750		
									196.9°			3.661			LWP1740	3.00%	3.772			
105	EXIT OPL 318/ENT OPL 327	05	19.4985	N	003	34.8966	E				2520		127.866	391.936				130.522		
									196.9°			5.977			LWP1740	3.01%	6.156			
106	AC	05	16.3963	N	003	33.9542	E	AC		12.3° Port	2577		133.843	385.959				136.678		
									184.6°			1.992			LWP1740	3.00%	2.052			
107	EXIT OPL 327/ENT OPL 318	05	15.3193	N	003	33.8670	E				2582		135.835	383.967				138.730		
									184.6°			13.938			LWP1740	3.04%	14.362			
108	AC	05	07.7815	N	003	33.2568	E	AC		5.9° Stbd	2632		149.773	370.029				153.092		
									190.6°			1.644			LWP1740	3.01%	1.693			
109	CX OOS TELEGRAPH	05	06.9046	N	003	33.0938	E				2659		151.417	368.385				154.785		
									190.6°			3.903			LWP1740	3.01%	4.020			
110	EXIT OPL 318/ENT OPL 328	05	04.8229	N	003	32.7067	E				2683		155.320	364.482				158.805		
									190.6°			8.851			LWP1740	3.01%	9.119			
111	R18106	05	00.1015	N	003	31.8287	E				2740		164.171	355.631				167.924		

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
									190.6°			8.380			LWP1740	3.01%	8.632			
112	EXIT OPL 328/ENT OPL 329	04	55.6317	N	003	30.9977	E				2770		172.551	347.251				176.556		
									190.6°			1.495			LWP1740	3.00%	1.540			
113	AC	04	54.8345	N	003	30.8494	E	AC		6.4° Stbd	2770		174.046	345.756				178.096		
									197.0°			7.754			LWP1740	3.00%	7.986			
114	AC	04	50.8107	N	003	29.6255	E	AC		24.5° Stbd	2808		181.800	338.002				186.082		
									221.5°			4.782			LWP1740	3.00%	4.926			
115	CX IS SAT 3 SEG 7	04	48.8664	N	003	27.9126	E				2804		186.582	333.220				191.008		
									221.5°			6.633			LWP1740	3.01%	6.833			
116	AC	04	46.1694	N	003	25.5367	E	AC		14.6° Port	2860		193.215	326.587				197.841		
									206.9°			1.126			LWP1740	3.06%	1.161			
117	EXIT OPL 329/ENT OPL 331	04	45.6243	N	003	25.2614	E				2830		194.341	325.461				199.002		
									206.9°			10.918			LWP1740	3.05%	11.250			
118	AC	04	40.3404	N	003	22.5922	E	AC		14.0° Port	2966		205.259	314.543				210.252		
									192.8°			8.362			LWP1740	3.06%	8.618			
119	AC	04	35.9169	N	003	21.5879	E	AC		24.8° Port	3027		213.621	306.181				218.870		
									168.0°			2.190			LWP1740	3.01%	2.256			
120	CX OOS TELEGRAPH	04	34.7545	N	003	21.8340	E				3044		215.811	303.991				221.126		
									168.0°			6.121			LWP1740	3.00%	6.305			
121	AC	04	31.5058	N	003	22.5217	E	AC		12.8° Stbd	3069		221.932	297.870				227.431		
									180.8°			9.635			LWP1740	3.13%	9.936			
122	AC	04	26.2784	N	003	22.4517	E	AC		12.2° Port	3190		231.567	288.235				237.367		
									168.6°			0.141			LWP1740	3.13%	0.145			
123	EXIT OPL 331/ENT OPL 334	04	26.2036	N	003	22.4667	E				3197		231.708	288.094				237.512		
									168.6°			8.267			LWP1740	3.04%	8.519			
124	R18105	04	21.8065	N	003	23.3498	E				3420		239.975	279.827				246.031		
									168.6°			0.347			LWP1740	3.06%	0.358			

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
125	AC	04	21.6218	N	003	23.3868	E	AC		14.8° Port	3430		240.322	279.480				246.389		
									153.8°			8.470			LWP1740	3.01%	8.725			
126	TR LWP1740/LW1740	04	17.4987	N	003	25.4097	E				3402		248.792	271.010				255.114	201.691	
									153.8°			2.376			LW1740	3.00%	2.447			
127	AC	04	16.3423	N	003	25.9771	E	AC		16.4° Stbd	3408		251.168	268.634				257.561		
									170.2°			12.866			LW1740	3.00%	13.253			
128	AC	04	09.4629	N	003	27.1594	E	AC		20.0° Stbd	3410		264.034	255.768				270.814		
									190.3°			7.430			LW1740	3.02%	7.654			
129	EXIT OPL 334/ENT OPL 336	04	05.4956	N	003	26.4447	E				3475		271.464	248.338				278.468		
									190.3°			2.112			LW1740	3.01%	2.175			
130	CX IS ACE SEG 3.7	04	04.3683	N	003	26.2417	E				3509		273.576	246.226				280.643		
									190.3°			8.217			LW1740	3.01%	8.464			
131	AC	03	59.9811	N	003	25.4514	E	AC		6.2° Port	3600		281.793	238.009				289.107		
									184.1°			27.703			LW1740	3.00%	28.535			
132	EXIT OPL 336/ENT OPL 337	03	44.9871	N	003	24.3907	E				3680		309.496	210.306				317.642		
									184.1°			6.303			LW1740	3.05%	6.495			
133	R18104	03	41.5759	N	003	24.1495	E				3701		315.799	204.003				324.137		
									184.1°			0.633			LW1740	3.00%	0.652			
134	AC	03	41.2332	N	003	24.1252	E	AC		3.7° Stbd	3707		316.432	203.370				324.789		
									187.8°			32.149			LW1740	3.00%	33.115			
135	AC	03	23.9489	N	003	21.7796	E	AC		1.1° Port	3902		348.581	171.221				357.904		
									186.7°			1.149			LW1740	3.00%	1.184			
136	EXIT OPL 337/ENT OPL 341	03	23.3296	N	003	21.7075	E				3908		349.730	170.072				359.088		
									186.7°			18.346			LW1740	3.00%	18.896			
137	EXIT OPL 341	03	13.4428	N	003	20.5563	E				3988		368.076	151.726				377.984		
									186.7°			5.829			LW1740	3.00%	6.004			
138	AC	03	10.3013	N	003	20.1906	E	AC		14.9° Stbd	4010		373.905	145.897				383.988		

Point No	Comment	Latitude (WGS 84)			Longitude (WGS 84)			A/C	Brg (°)	Alter Course (- P + S)	Depth (m)	Leg Dist (km)	Cum KP Dist (km)	Reverse KP Dist (km)	Cable Type	Surface Slack (%)	Leg Cable (km)	Cum Cable (km)	Cable by Type (km)	Target Burial (m)
									201.5°			17.724			LW1740	3.00%	18.256			
139	R18103	03	01.3555	N	003	16.6785	E				4080		391.629	128.173				402.244		
									201.5°			3.592			LW1740	3.00%	3.700			
140	AC	02	59.5424	N	003	15.9667	E	AC		14.2° Stbd	4084		395.221	124.581				405.944		
									215.7°			8.197			LW1740	3.00%	8.443			
141	CX IS WACS SEG 1K (7)	02	55.9317	N	003	13.3836	E				4107		403.418	116.384				414.387		
									215.7°			14.062			LW1740	3.00%	14.484			
142	SEQ	02	49.7373	N	003	08.9524	E				4153		417.480	102.322				428.871		
									215.7°			10.750			LW1740	3.00%	11.072			
143	AC	02	45.0022	N	003	05.5655	E	AC		5.8° Port	4190		428.230	91.572				439.943		
									209.9°			15.102			LW1740	3.00%	15.555			
144	R18102	02	37.8996	N	003	01.5013	E				4231		443.332	76.470				455.498		
									209.9°			8.198			LW1740	3.00%	8.444			
145	MB EZ NGA/H-SEAS	02	34.0441	N	002	59.2954	E				4256		451.530	68.272				463.942		
									209.9°			18.691			LW1740	3.00%	19.252			
146	AC	02	25.2535	N	002	54.2662	E	AC		8.1° Port	4299		470.221	49.581				483.194		
									201.8°			2.122			LW1740	3.00%	2.186			
147	TEQ	02	24.1841	N	002	53.8410	E				4302		472.343	47.459				485.380		
									201.8°			18.736			LW1740	3.00%	19.297			
148	AC	02	14.7452	N	002	50.0875	E	AC		11.2° Port	4330		491.079	28.723				504.677		
									190.6°			10.276			LW1740	3.00%	10.585			
149	R18101	02	09.2642	N	002	49.0684	E				4350		501.355	18.447				515.262		
									190.6°			3.769			LW1740	3.00%	3.882			
150	AC	02	07.2538	N	002	48.6946	E	AC		8.9° Stbd	4350		505.124	14.678				519.144		
									199.4°			14.678			LW1740	3.00%	15.118			
151	CABLE ALLOWANCE	01	59.7437	N	002	46.0599	E				4400		519.802	0.000				534.262		
												0.000			LW1740	N/A	0.500			
152	BU GNQ	01	59.7437	N	002	46.0599	E				4400		519.802	0.000				534.762	279.648	

APPENDIX 4.1:

SCOPING WORKSHOP DOCUMENTS

4.1.1:

BACKGROUND INFORMATION DOCUMENT (BID)

WIOCC
AFRICA'S CARRIERS' CARRIER

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

BACKGROUND INFORMATION DOCUMENT (BID)

OCTOBER 2019

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

A1.1 Background Information

This document is designed to provide background information on the proposed EQUIANO Nigeria Submarine Cable Project in Lagos State being delivered by Alcatel Submarine Networks (ASN) and their consultants, on behalf of WIOCC Nigeria Limited (WIOCC) (the project proponent). The ESIA study is being undertaken by Bluedot Associates Limited and Environmental Accord Nigeria Limited (EnvAccord) on behalf of the project proponent.

Fibre-optic cables have become the backbone of the world's information infrastructure. Over the past decade, the increased demand for bandwidth driven by the internet, as well as the continuing international trend of privatization of national telecommunications industries, has outstripped by far the resources offered by satellite transmission of voice and data. The total carrying capacity of submarine cables is in the terabits per second, while satellites typically offer only 1,000 megabits per second and display higher latency (Bryan, 2012).

In the world of telecommunication, connectivity and bandwidth capacity determines the competence of the service provider. The EQUIANO submarine cable is a private subsea cable that will run along the West coast of Africa between Portugal and South Africa with branching units along the way that can be used to extend connectivity to other African countries. A branch is proposed to land in Nigeria at Elegushi Beach in Eti-Osa Local Government Area of Lagos State. This branch provides the focus of the study discussed in this document.

A1.2 Project Overview

The proposed submarine cable will extend approximately 520 km from branching unit (BU) in Nigerian marine water to the proposed landing point at Elegushi Beach in Lagos State.

The proposed project will involve laying of the submarine optic fibre cable on the seabed along the preferred route using a cable laying vessel and special remotely operated vehicle (ROV). In addition, there will be a requirement for entrenchment of the cable in the coastal zone (within ducting and pipe encasement). The extent of ESIA permit being considered for the project (at this stage) relate to the offshore component of the submarine cable from the BU NGA (Nigeria) to the landing point at Elegushi Beach in Lagos State. The associated land-based infrastructure of the project are currently proposed to be subject of a separate ESIA study.

Figure 1.1 shows a generalized schematic diagram of submarine cable system.

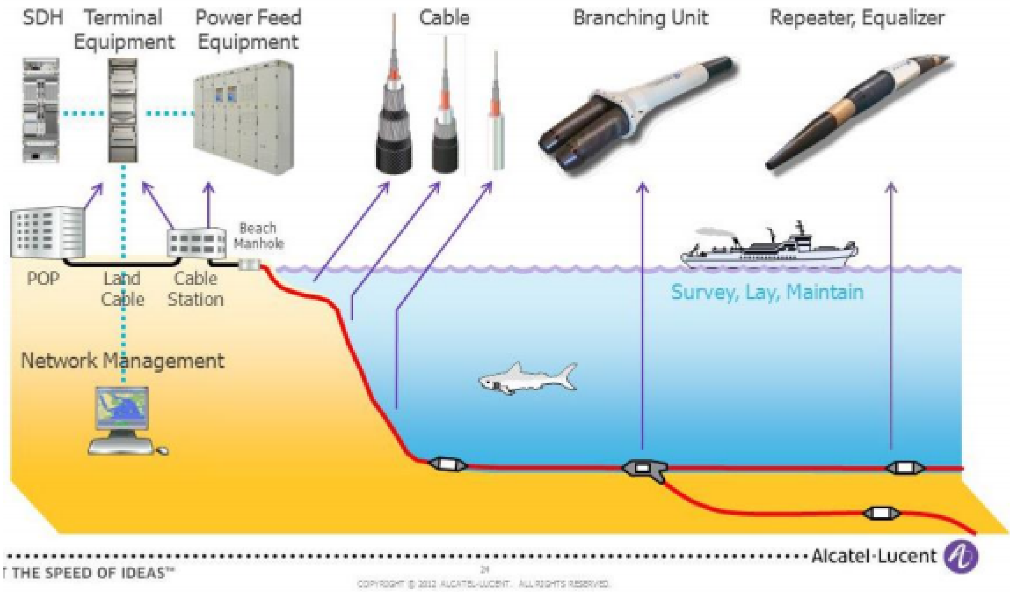

Figure 1.1: Schematic diagram of Submarine Cable System (Source: Alcatel-Lucent)

The EQUIANO Nigeria submarine cable will be the first subsea cable to incorporate optical switching at the fibre-pair level, rather than the traditional approach of wavelength-level switching. This greatly simplifies the allocation of cable capacity and would provide flexibility to add and reallocate it in different locations as needed.

The envisaged life span of the proposed Project is 25 years.

A1.3 Project Location

The proposed project covers the submarine cable seawards towards the Elegushi Beach in Eti-Osa Local Government Area of Lagos State. Geographically, the position of the cable to the beach manhole connection lies at latitude 6.423453 °N and longitude 3.497167°E (Figure 1.2). The selection of the cable route has been informed by detailed desk-top studies considering all physical, environmental and social constraints and also the undertaking of comprehensive cable route surveys. This information will be made available within ESIA documentation.

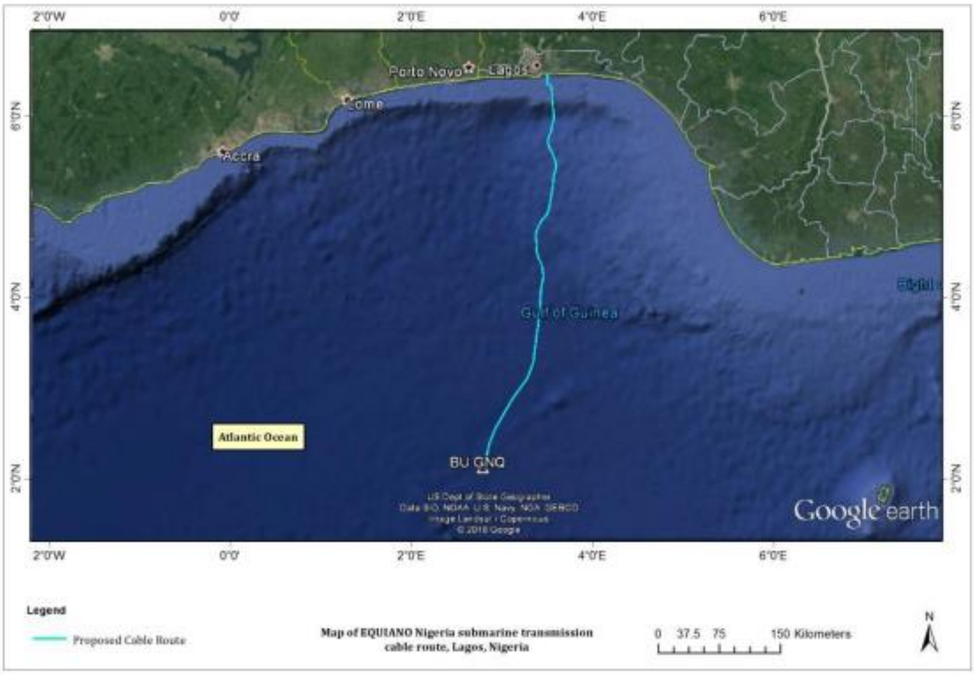

Figure 1.2: Proposed EQUIANO Nigeria Submarine Cable route up to the Landing station at Elegushi Beach, Lagos

A.1.3.1 Maritime Boundaries

According to United Nations Convention on the Law of the Sea (UNCLOS), the sovereignty of a coastal state extends beyond its land territory and internal waters to an adjacent area of sea. In Nigeria, this relates to maritime boundaries as shown in Figure 1.3. The maritime boundaries are divided into the following categories:

- **Territorial Waters (TW)**: According to Territorial Waters Act CAP TS LFN 2004, Nigeria territorial waters shall for all purposes include every part of the open sea within 12 nautical miles (~22.22 km) of the coast of Nigeria (measured from low water mark) or of the seaward limits of inland waters.
- **Contiguous Zone (CZ)**: The contiguous zone of Nigeria is the area beyond the territorial waters, but within a distance of 24 nautical miles (~44.45 km) from the baselines from where the area of Territorial Waters is measured. In this zone Nigeria can exercise the control necessary to; prevent infringement of its customs, fiscal, immigration, or sanitary laws and regulations within its territory or territorial waters; punish infringement of the above laws and regulations committed within its territory or territorial water.
- **Exclusive Economic Zone (EEZ)**: According to Nigerian Exclusive Economic Zone Act of 1978 CAP E17 LFN 2004, this zone refers to an area beyond and

adjacent to the territorial waters and which extends to a distance of 200 nautical miles (370.4km) from the baselines used to measure the breadth of the territorial waters. In this zone, Nigeria has sovereign rights in relation to the conservation or exploitation of the natural resources (minerals, living species, etc.) of the seabed, its subsoil and suprajacent waters and the right to regulate by law the establishment of artificial structures and installations and marine scientific research, amongst other things.

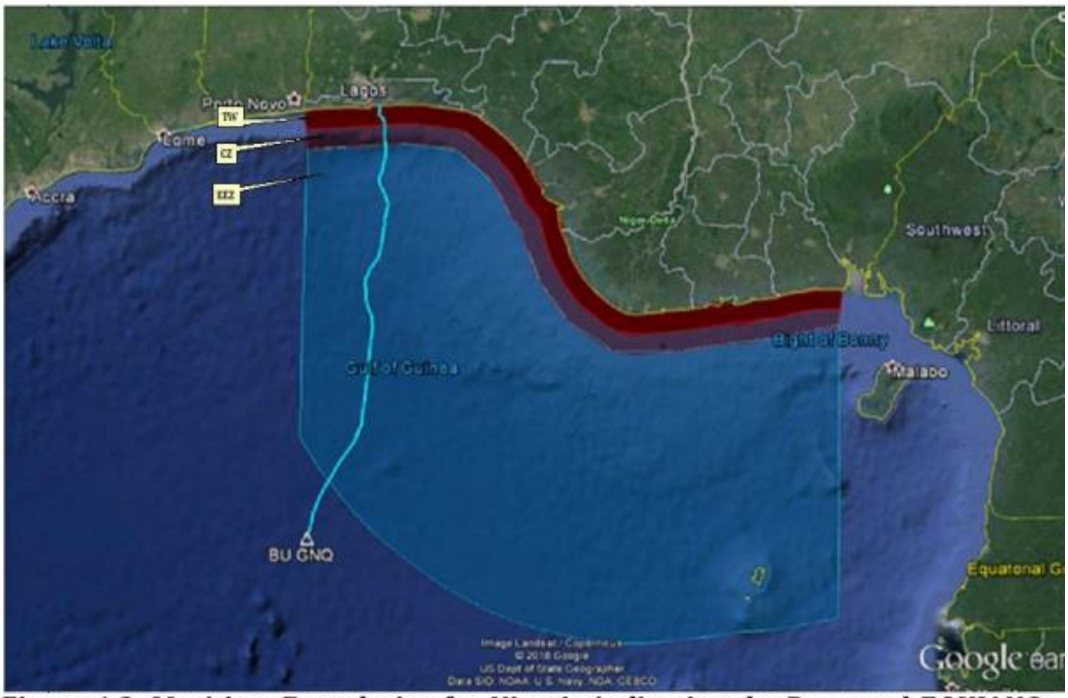

Figure 1.3: Maritime Boundaries for Nigeria indicating the Proposed EQUIANO Nigeria Submarine Cable route

A.1.3.2 Associated Facilities (Land-Based Infrastructure)

The ESIA study and the associated permit application relates only to the cable system seaward of a beach manhole. However, the overall cable installation includes the development of additional associated infrastructure where the cable lands, and connection to the wider WIOCC metro telecommunications system. This will be enclosed in a 2.068 hectares (ha) of land located adjacent to the beach that has been purchased by WIOCC comprising Plot 99 Maiyegun Tourism and Recreational Zone, Lekki Phase II, Lagos (see Figure 1.4). As stated above, a separate ESIA study is being considered for the land-based infrastructural components of the project. The associated facilities include the beach manhole, cable landing station, system earth, and connecting land cables; as well as local power generation, parking site offices etc. Land has been purchased to incorporate this infrastructure in the immediate area of the landing point provided above.

A brief description of the main associated facilities is provided as follows:

- **Beach manhole**: This a concrete utility vault where the marine portion of the cable will be connected to the terrestrial portion.
- **Cable Landing Station (CLS)**: This is typically a building that functions as a control centre for the cable system and where the submarine system is connected to domestic telecommunication networks. The CLS will incorporate a number of facilities such as site office, security room, energy centre, generator and diesel storage area, etc.
- **System Earth**: The System Earth (also called earth array) is required to provide an earthen ground for the cable.

Figure 1.4: General location of land-based infrastructure

A1.4 Project Justification

In the absence of submarine cable networks, telecommunication carriers have to rely on radio or satellite systems to carry bulky international traffic. However, this has many disadvantages among which are slower and less reliable connections. In contrast, submarine cables offer reliability and large carrying capacity (terabits per second) thus, allowing improved data access at a reduced cost.

A1.5 Project Activities

The project activities can be divided into pre-construction, construction, operation and decommissioning phases.

Pre-Construction Phase Activities:

- Desk-top studies (completed)
- Marine route survey (completed)
- ESIA study and approval
- Receipt of other relevant permits

Construction/Installation Phase Activities:

- Marine cable routing and installation using a specialized cable laying vessel
- Testing and commissioning

Operation Phase Activities:

- Data transmission
- Network infrastructure maintenance and occasional repairs

Decommissioning Phase Activities:

- Removal or abandonment of the submarine cable system

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

Environmental and Social Impact Assessment (ESIA) Study

Under the Nigeria Environmental Impact Assessment (EIA) Act No. 86 of 1992, WIOCC is required to carry out an ESIA study for the proposed submarine cable project. In view of this, WIOCC commissioned Bluedot Associates Ltd and EnvAccord to undertake the ESIA study for the proposed project.

In line with the requirements of the FMEnv, the ESIA will describe the proposed project, the potentially affected areas, assess the likely positive and negative impacts of the project and describe the mitigation and management actions required to address the impacts. The ESIA report, along with comments received from stakeholders will be submitted to the FMEnv for review and approval process.

A2.1 Overview of the ESIA Process

The ESIA process (Figure 2.1) aims to identify all the potential impacts of the proposed project; assess the significance of the impacts; and to present appropriate and cost-effective measures to mitigate the identified significant impacts. At this stage of the project, only the Scoping Phase is being carried out. The Scoping Phase includes:

- Identification of potential social and environmental impacts;
- Meeting with relevant stakeholders;
- Field visits and desktop reviews; and
- Preparation and Submission of Scoping Report and Terms of Reference to the FMEnv.

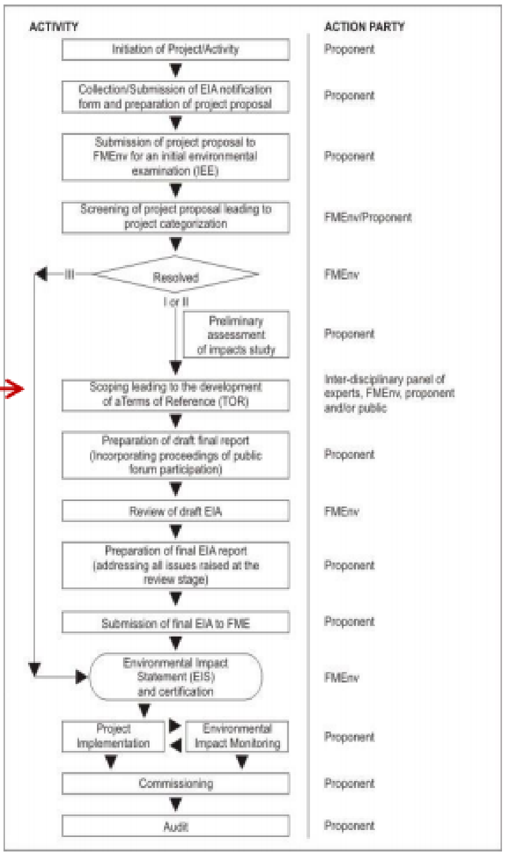

Figure 2.1: FMEnv EIA Process

Preliminary Impacts and Mitigation Measures

Preliminary Potential Impacts

The preliminary potential and associated impacts of the project identified at this stage include the following:

Coastal Processes

- Intertidal sediment disturbance and cable laying may have a localised impact on coastal processes during construction.

Surface Water and Sediment Quality

- Changes in the physical, chemical and biological properties of surface water and sediment from routine vessel discharges during cable installation.
- Potential decrease in surface water quality due to accidental spill or leakage of fuel from the installation vessel during cable laying. Potential increase in surface water turbidity and potential contaminant redistribution as a result of sediment disturbance.
- Disturbance to subtidal, intertidal sediments and soils seaward of the beach manhole.

Marine Ecology

- Potential impacts on marine organisms (disturbance, displacement, vessel collision risk, waste and water quality changes etc) during cable installation.
- Collision and entanglement.
- Long term alteration to seabed habitat and associated species.
- Disturbance to intertidal habitat.

Ambient Air Quality

- Potential for impact on localised ambient air environment through exhaust emissions from the cable laying vessel.

Noise and Vibrations

- Noise and vibration during cable installation activities due to vessel movement.

Waste Generation

- Waste generated during cable installation activities, if not properly disposed of may have negative impacts on aquatic resources.
- Indiscriminate disposal of sewage from the vessel into the waters.

Fishing and Fisheries

- Potential impact on fisheries due to loss of access during cable installation
- Potential damage to fishing gear.

Transport and Access

- Potential interference with other vessels (impact is localized).

Recreational Beach

- Landscape and visual impacts during cable installation works.
- Disturbance to recreational activities on the beach.

Occupational Health and Safety

- Potential impacts associated with the use of heavy-duty equipment during cable laying
- Man overboard risks etc.
- Health and Safety risk to public during construction in the coastal area.

Peoples Way of Life and Business

- Positive impacts to the local and national economy.
- Employment opportunities.
- Improved access to reliable and fast data networks for businesses.
- Enhanced communications and connectivity directly affecting local businesses, education and employment opportunities within the country.

<u>Mitigation and Monitoring Measures</u>

In the light of the preliminary potential impacts identified, appropriate mitigation measures have been incorporated in the Project design; and additional mitigation measures will be recommended in the ESIA report which will be put in place throughout the life cycle of the Project. The ESIA study will adopt the principles of the mitigation hierarchy, which means implementing a sequence of four key actions - 'avoid', 'minimize', 'restore', and lastly, 'offset'. All mitigation and monitoring measures will be set out in an appropriate Environmental and Social Management Plan.

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

"We would like to meet with you to discuss any opinions and concerns you may have about any of these potential impacts".

ESIA FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

We would like you to take part in this ESIA process so you can raise any issues and comments you may have about the Project. Your comments are a key part of the study to see whether the Project should proceed and it is important that we understand your comments so that they can be answered and dealt with in the ESIA.

To receive regular information throughout the ESIA process, you must register as an Interested and Affected Party. To register please send this form to WIOCC (through its consultant, EnvAccord) at the address given below. If you want to make any comments at this stage please use this form. Alternatively, please do not hesitate to send an email or write separately to the e-mail address provided below.

You can make additional comments for the study team to record on a separate page or on the reverse side of this form. Please post or fax this comment sheet to any of the addresses below as soon as possible and preferably on or before November 15th, 2019 so that we can take your comments into consideration in the ESIA. The comments could also be emailed to the address below.

Please fill in your details	
Name:	Organization:
Telephone:	Position:
Cell phone:	Email:
Address:	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Atanda Olaogun
Tel: 0803 458 8332
Email: aolaogun@envaccord.com
36B Oguntona Crescent, Gbagada
(Phase 1),
Lagos, Nigeria

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

Comments Form

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary comments that you have about this proposed project?

2. Do you have or know of any information that we should know for the ESIA (e.g. environmental information or community, social or economic information related to the project location and/or the project activities)?

Many thanks for your participation

4.1.2:

LIST OF IDENTIFIED STAKEHOLDERS FOR SCOPING

Stakeholder Group	Stakeholder Name	Stakeholder Level			Connection to the Project	Means of Notification and Engagement	
		National	Regional	Local		Circulation of Background Information Document (BID) and Notification Letter	Scoping workshop
Government institutions/ regulatory authorities (national, state and local)	Federal Ministry of Environment (FMEnv)	✓			Oversees EIA process and permitting in Nigeria.	✓	✓
	Nigerian Maritime Administration and Safety Agency (NIMASA)	✓			The Agency is responsible for effective Maritime Safety Administration, Maritime Labour Regulation, Marine Pollution Prevention and Control, Search and Rescue, Cabotage enforcement etc.	✓	✓
	Lagos State Ministry of the Environment		✓		The Ministry oversees the protection of environment in Lagos State. The landing station (BMH) for the proposed project falls within its jurisdiction.	✓	✓
	Lagos State Environmental Protection Agency (LASEPA)		✓		Responsible for enforcing environmental regulations in Lagos.	✓	✓
	Lagos State Ministry of Waterfront Infrastructure Development.		✓		Saddled with the responsibility of formulating and evaluating of policies relating to Waterfront Infrastructure Development.	✓	
	Eti-Osa Local Government			✓	The cable landing site falls in Eti-Osa Area of Lagos State.	✓	
	Nigerian Ports Authority (NPA)	✓			Has the responsibility for providing safe and navigable channel for common user areas.	✓	✓
Research institute	Nigerian Institute for Oceanography & Marine Research (NIOMR).	✓			This Institute is charged with responsibilities to conduct research into the resources and	✓	✓

Stakeholder Group	Stakeholder Name	Stakeholder Level			Connection to the Project	Means of Notification and Engagement	
		National	Regional	Local		Circulation of Background Information Document (BID) and Notification Letter	Scoping workshop
					physical characteristics of the Nigerian territorial waters and the high seas beyond. The institute has data relating to the aquatic biodiversity of the project area		
Local Community	Community leaders of Ikate (Elegushi) community			✓	The nearest local community to the cable landing site at the beach	✓	✓
	Youth leaders of Ikate (Elegushi) community			✓		✓	✓
	Women leaders of Ikate (Elegushi) community			✓		✓	✓
Potentially affected water users	Local fishermen (association representatives)			✓	May be directly or indirectly impacted by the project.	✓	✓
Non-governmental organization (NGO)	Nigeria Conservation Foundation (NCF)	✓			Registered NGO promoting environmental sustainability through advocacy and education awareness creation	✓	✓

4.1.3:

NOTIFICATION LETTERS

environmental accord

GENERAL MANAGER'S OFFICE
LAGOS STATE ENVIRONMENTAL PROTECTION AGENCY (LASEPA)
21 OCT 2019
RECEIVED
TIME.......
INITIALS.......

October 18, 2019

The General Manager,
Lagos State Environmental Protection Agency,
LASEPA Building,
Alausa, Ikeja,
Lagos State

Dear Madam,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

WIOCC Limited (WIOCC), a leading player in the deployment of carrier-scale, future-proofed network infrastructure in Africa, proposes to lay a submarine cable that will run along the West coast of Africa between Portugal and South Africa with branching units along the way that can be used to extend connectivity to other African countries. A branch is proposed to land in Nigeria at Elegushi Beach in Eti-Osa Local Government Area of Lagos State.

The proposed Equiano Nigeria submarine cable will extend approximately 520 km from branching unit in Nigerian water to the proposed landing point in Lagos. The project is aimed at improving communications capacity and internet services in Nigeria and across West Africa.

In compliance with the provisions of the Nigeria Environmental Impact Assessment (EIA) Act No 86 of 1992 (as amended by the EIA CAP E12 Law of the Federation of Nigeria, 2004) as well as the international best practices, an Environmental and Social Impact Assessment (ESIA) of the proposed project has been commissioned.

The ESIA study is currently at the Scoping phase and an important aspect of it is stakeholder consultation. The consultation would provide an opportunity for notifying the relevant stakeholders of the project intention and receiving valuable feedback and participation. As one of the identified key stakeholders, we humbly invite you to a **Scoping Workshop** scheduled as follows:

Date: Tuesday, October 29, 2019
Venue: To be communicated
Time: 11.00am

In addition, please find attached a Background Information Document (BID) containing background information about the proposed project and the ESIA process.

Please do not hesitate to contact the undersigned on 0803-458-8332 or aolaogun@envaccord.com should you require any clarification.

Thank you

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

environmental accord
...superior sustainability solutions

October 21, 2019

The Honourable Chairman,
Eti-Osa Local Government Area,
Victoria Island,
Lagos

Attention: The Head, Environmental Health Department

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Thank you

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

ETI-OSA LOCAL GOVERNMENT
CHAIRMAN'S OFFICE
RECEIVED
22-10-19

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

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...superior sustainability solutions

NIGERIAN INSTITUTE FOR OCEANOGRAPHY & MARINE RESEARCH V/I, LAGOS.
SIGN ...
DATE ... 22/10/19

October 18, 2019

The Executive Director,
Nigeria Institute for Oceanography and Marine Research,
Victoria Island,
Lagos

Attention: Head of Biological Oceanography Department

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Lead Consultant

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(Phase 1), Lagos, Nigeria.
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Email: info@envaccord.com
Website: www.envaccord.com

environmental accord
...superior sustainability solutions

October 21, 2019

The Representative,
Youth Leaders,
Ikate Community,
Lekki,
Lagos

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Thank you

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

ORIGINAL COPY RECIEVED BY ME. ELEGUSHI YUSUF. O
22/10/2019

Atanda Olaogun
Lead Consultant

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.
Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

environmental accord
...superior sustainability solutions

October 21, 2019

His Royal Majesty,
The Elegushi of Ikateland,
Lekki,
Lagos

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

WIOCC Limited (WIOCC), a leading player in the deployment of carrier-scale, future-proofed network infrastructure in Africa, proposes to lay a submarine cable that will run along the West coast of Africa between Portugal and South Africa with branching units along the way that can be used to extend connectivity to other African countries. A branch is proposed to land in Nigeria at Elegushi Beach in Eti-Osa Local Government Area of Lagos State.

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Date: Tuesday, October 29, 2019
Venue: To be communicated
Time: 11.00am

In addition, please find attached a Background Information Document (BID) containing background information about the proposed project and the ESIA process.

Please do not hesitate to contact the undersigned on 0803-458-8332 or aolaogun@envaccord.com should you require any clarification.

Thank you

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

the original copy of this letter was received by me mr Abraham Security on the 22 = 10 = 2019 17.00PM.

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

environmental accord
...superior sustainability solutions

October 21, 2019

The Representative,
Women Leaders,
Ikate Community,
Lekki,
Lagos

Dear Madam,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Thank you

ORIGINAL COPY RECEIVED by
MR. Chief Ayuba Elegushi
(The Eletu of IKATE LAND)

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

October 18, 2019

The Honourable Commissioner,
Lagos State Ministry of the Environment and Water Resources,
Alausa, Ikeja,
Lagos State

Attention: Environmental Management Department

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Thank you

Original copy received by me:
Kadri A.D (07033658578).
21/10/19.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
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October 18, 2019

The Director-General,
Nigerian Maritime Administration and Safety Agency,
4, Burma Road,
Apapa,
Lagos

MANAGEMENT
NIGERIAN MARITIME ADMINISTRATION
24 OCT 2019
RECEIVED

Attention: Head of Environmental Impact Assessment (EIA) Unit

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Time: 11.00am

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Thank you

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For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

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Email: info@envaccord.com
Website: www.envaccord.com

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October 21, 2019

The Director General,
Nigerian Conservation Foundation (NCF),
Lekki,
Lagos

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA: INVITATION TO SCOPING WORKSHOP

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Thank you

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For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

RECEIVED
24 OCT 2019
LAGOS

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

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October 18, 2019

The Honourable Commissioner,
Lagos State Ministry of the Environment and Water Resources,
Alausa, Ikeja,
Lagos State

Attention: Environmental Management Department

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For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Atanda Olaogun
Lead Consultant

HON. COMM. OFFICE
MINISTRY OF THE ENVIRONMENT AND WATER RESOURCES
LAGOS STATE
RECEIVED
Date 21/10/19 Time 3:41pm
Name Ayo Sign

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.
Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

OFFICE OF THE MANAGING DIRECTOR
RECEIVED
23 OCT 2019
N.P.A. HQ. LAGOS

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October 18, 2019

The Managing Director,
Nigerian Ports Authority,
26/28 Marina,
Lagos

Attention: Head, Health, Safety and Environment Department

Dear Madam,

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HONOURABLE COMMISSIONER
MINISTRY OF WATERFRONT, INFRASTRUCTURE AND DEVELOPMENT
21 OCT 2019
RECEIVED
INITIAL............ TIME 4:03pm

October 18, 2019

The Honourable Commissioner,
Lagos State Ministry of Waterfront Infrastructure Development,
The Secretariat, Obafemi Awolowo Way,
Ikeja, Lagos

Dear Sir,

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Lead Consultant

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36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

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4.2:

SAMPLE PHOTOGRAPHS TAKEN DURING THE SCOPING WORKSHOP

Plate 1: Opening remarks by the Managing Director, EnvAccord during the Scoping Workshop

Plate 2: Remarks by representative of the Honourable Minister, Federal Ministry of Environment, Abuja, during the Scoping Workshop

Plate 3: Remarks by representative of the Honourable Commissioner, Lagos State Ministry of the Environment and Water Resources

Plate 4: Presentation of the proposed project and ESIA process to stakeholders during the Scoping Workshop

Plate 5: Comments by a representative of Nigerian Institute of Oceanography and Marine Research (NIOMR) during the Scoping Workshop

Plate 6: Remark by one of the community leaders present at the Workshop

Plate 7: Representative of the Nigerian Ports Authority (NPA) asking questions during the Scoping Workshop

Plate 8: Remark by a representative of Nigerian Maritime Administration and Safety Agency (NIMASA) during the Workshop

Plate 9: Youth leader of Ikate (Elegushi) Community asking questions during the Workshop

Plate 10: The Managing Director of Bluedot Associates responding to comments during the Scoping Workshop

Plate 11: Group photograph of participants at the Scoping Workshop

4.2.1:

ATTENDANCE LIST OF PARTICIPANTS AT THE SCOPING WORKSHOP

WIOCC AFRICA'S CARRIERS' CARRIER	ENVIRONMENTAL ACCORD NIGERIA LIMITED 368 Oguntona Crescent, Gbagada (Phase 1), Lagos 0802-360-9591; 0813-636-3762 info@envaccord.com http://www.envaccord.com	ATTENDANCE SHEET	environmental accord

Project Title: Environmental and Social Impact Assessment (ESIA) of the Proposed Equiano Nigeria Submarine Cable Project in Lagos State, Nigeria: Scoping Workshop

Date: Tuesday 29th October 2019

Venue: May Hill Hotel, Lekki Phase II, Eti-Osa LGA, Lagos State

S/N	Name	Organization	Designation	Phone Number	Email	Signature
1.	Otesanya Oluwemimo	FMEnv	Regulator	08033904230	meetwenk@yahoo.com	
2.	Femi-Falaye T.	fmenv.	Regulator	08023020185	sumilo4u@yahoo.com	
3.	Kehinde Tinuade B	FmEnv	—	08084204505	angeltinuk@gmail.com	
4.	Onamuti O.O	LSMOE	Regulator	08027294553	oonamuti@lagosstate.gov.ng	
5.	Chinenye O. Aju-Nwankwo	NIMASA	Regulator	0813951367	Chinyaja@yahoo.com	
6	Izagboo Ify P.	NIMASA	Regulator	08037847406	ify912b@yahoo.com	
7	MOJEED AFOLABI	fisher man	—	08023223441	—	
8	ISIAKA YUSUF	—	—	07062883001	—	
9	BIRIT	—	—	08139457995	—	
10	EBINEZER	—	—	08175579999	—	
11	ELEGUSHI SHARAFA O	IKATE ELEGUSHI	REP. YOUTH	08022708552	SHARODL ELUSHI@YAHOO.C	
12	Omiwale Yetunde A.	LASEPA	Regulator	08023246960	yettyomhs@gmail.com	
13	Aileru Kola.	"	"	08023293375	Kolaaileru4u@gmail.com	
14	Alli-Afeke Olumide	"	"	08055268407	olubase2@yahoo.com	

WIOCC AFRICA'S CARRIERS' CARRIER	ENVIRONMENTAL ACCORD NIGERIA LIMITED 36B Oguntona Crescent, Gbagada (Phase 1), Lagos 0802-360-9591; 0813-636-3762 info@envaccord.com http://www.envaccord.com	**ATTENDANCE SHEET**	environmental accord

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S/N	Name	Organization	Designation	Phone Number	Email	Signature
1	BISIRIYU ABIOLA SULAIMAN	IKATE ELEGUSHI	YOUTH LEADER	08127427995	S.bisiriyu@yahoo.com	
2.	ELEGUSHI BILIKISU	"	WOMEN LEADER	08028343430		
3	ELEGUSHI IDRIS	"	REP. YOUTH	0812824829	04ebisiidris2@gmail.com	
4	TAJUDEEN. Yusuf. O	"	YOUTH	08028304754	Teejay-em@yahoo.com	
5	Aremu Monsurat I.	"	WOMEN REP	08067760997	Ebonymonsur007@gmail.com	
6	Tijani Ganiyat	"	WOMEN REP	09036650800		
7	NEIL COUSINS	BLUEDOT	EIA CONSULTANT		neil.cousins@bluedotassociates.com	
8	NIKKI POPOOLA	WIOCC	SALES DIRECTOR	09090144405	nikki.popoola@wiocc.net	
9.	OMOLUSHI RHODA	EnvAccord	SOCIAL SCIENTIST	08149438110	Technicalrides@envaccord.com	
10.	Olusegun Ige	" "	Driver to the M.D	08033566812	mails4samdu@gmail.com	
11.	Atanda Olagoke	EnvAccord	Lead Consultant	08034588332	aolagoke@envaccord.com	
12.	IBRAHIM SALAU	✓	MD	08023609591	isalau@envaccord.com	
13.	Taofeek Elumole	✓	GIS Specialist	08035159989	telumole@envaccord.com	

WIOCC AFRICA'S CARRIERS' CARRIER	ENVIRONMENTAL ACCORD NIGERIA LIMITED 36B Oguntona Crescent, Gbagada (Phase 1), Lagos 0802-360-9591; 0813-636-3762 info@envaccord.com http://www.envaccord.com	ATTENDANCE SHEET	environmental accord

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Date: Tuesday 29th October 2019

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S/N	Name	Organization	Designation	Phone Number	Email	Signature
1.	Chief MOORUF ELEGUSHI	IKATE ELEGUSHI HIGH CHIEF	REP. FAM IKATE	08023019970		
2.	Chief AYUBA ELEGUSHI	IKATE ELEGUSHI HIGH CHIEF	ELEGUSHI PRIVATE BEACH	08082576744	Ayubson 1120@yahoo.co.uk	
3.	Dr. Ogochukwu Agwu	NIOMR	Chief Research Officer	08023600176	ogoangola@yahoo.com	
4.	Mrs. Olapoju Bukunola	NIOMR	Senior Research Officer	08034043992	bukky.grace09@gmail.com	
5.	Dr. Akinnigbagbe Edward	NIOMR	Chief Research Officer	08057038267	tuye177@yahoo.co.uk	
6	AREMO R. A. ELEGUSHI	IKATE-ELEGUSHI	REP BEACH MAN	08083003770	Aremo Adeola EG1 gmail.com	
7	Chief Hakeem O. Elegushi	IKATE Elegushi	Rep Beachman	08098000141	hoelegushi@gmail.com	

WIOCC AFRICA'S CARRIERS' CARRIER	ENVIRONMENTAL ACCORD NIGERIA LIMITED 36B Oguntona Crescent, Gbagada (Phase 1), Lagos 0802-360-9591; 0813-636-3762 info@envaccord.com http://www.envaccord.com	ATTENDANCE SHEET	environmental accord

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S/N	Name	Organization	Designation	Phone Number	Email	Signature
1	KELVIN OMIHI	NIG. PORTS AUTHORITY	SNR. MGR.	08023188520	Kekebert@yahoo.com	
2	TIJJANI AHMED	NPA	Env. officer	07036520007	a1.tijjani@nigerianports.com	
3	Junde Adekoya	bluedot.		08086388323	muffyb22@gmail.com	
4	Titilope Badmus	N.C.F	Marine office	08071169720	titilope.badmus@ncfnigeria.org	

2.6:

SCOPING CONSULTATION FINDINGS

Stakeholder	Priority Issues	Quotes/Comments during Scoping Workshop	Response/How comments will be addressed in the ESIA
Federal Ministry of Environment, Abuja	Project overview, EIA process and stakeholder consultation	– Welcomed everyone present at the Workshop on behalf of the Honourable Minister, Federal Ministry of Environment, Abuja – Expressed the Ministry's interest in the proposed project, especially the area of potential or inherent impacts of project activities on the environment and people – Opinions shared will be key consideration for the progress of the proposed project; hence, stakeholders are encouraged to freely share their thoughts on the project. – Requested for clarification on some project aspects including CSR programs, number of workers that will be engaged during the installation phase, engagement of local workers during the installation phase, timeline for operation (working hours), and measures in place for adequate security	- Due to the short delivery time of the proposed project, activities are expected to be carried out during the day-time as well as in the night. Adequate security measures will be put in place to ensure safety of workers at all time - CSR is a vital aspect of WIOCC projects. There are plans for infrastructural development that will be beneficial to host communities under the project's CSR plan. These include rehabilitation of access road to the beach, employment opportunities for members of the community, amongst others. - Information of employment opportunities for the project will be documented in the ESIA report.
Nigerian Ports Authority (NPA)	Project overview, EIA process and stakeholder consultation	– Drew the attention of the project proponent and the ESIA consultant to compliance with local and	– Partnership with key stakeholders will be initiated to get necessary details and information that will ensure compliance with

Stakeholder	Priority Issues	Quotes/Comments during Scoping Workshop	Response/How comments will be addressed in the ESIA
		international laws and good international industry practice – Recommend post-commission impact assessment of the proposed project.	regulatory requirements and best practices. This practice will be sustained throughout the project's lifespan. – The impact assessment will cover the entire project life cycle.
Nigerian Maritime Administration and Safety Agency (NIMASA)	Project overview, EIA process and stakeholder consultation	– Sought clarification on safety of the fibre cable and coating technique to be used, methods of waste management, and types of surveys that will be carried out to access the impact of the project on the people and environment	- Existing information on similar projects such as the GLO submarine cable will be leveraged upon to create a detailed database for the proposed Project to ensure minimal environmental footprint and least safety risks - A project-specific waste management plan will be developed and implemented. The plan will be designed in line with the relevant local and international guidelines.
Nigerian Institute of Oceanography and Marine Research (NIOMR)	Project overview, EIA process and stakeholder consultation	– Recommends that appropriate surveys to learn of any inherent or potential effect of the proposed project should be carried out – Proper maintenance and monitoring scheme should be incorporated to ensure long sustainability of the project – Expressed concerns on the biodiversity effect of the cable installation process – Identified the need to consider water and seciment quality impacts during cable installation. – Requested clarification on separation of terrestrial ESIA	– The marine and terrestrial aspects of the proposed project are being handled by two different firms, ASN and WIOCC. Hence, two (2) separate ESIAs are being carried out. However, both firms are working together on the ESIAs as the final results are interconnected. – The longevity of the beach manhole will be monitored and consistently maintained to ensure the 25 years sustainability is achieved – The proposed fibre cables come with technologically advanced features when compared to the existing cables, hence, is more reliable and will offer better services – The selection of Elegushi beach as the preferred location is based on many desktop studies, including the need to spread out the

Stakeholder	Priority Issues	Quotes/Comments during Scoping Workshop	Response/How comments will be addressed in the ESIA
		study from marine ESIA study – Requested for evidence of data from desktop studies used as the basis of selection for the cable routes – Sought to know the justification for selection of Elegushi beach and not Badagry – Raised concern on the need to lay a separate cable since there were already existing underground cables laid by other actors few years back – Certainty on the 25 years longevity of the beach manhole due to coastal erosion. – Expressed concern related to electricity for marine wildlife	project away from the clustered areas – Minimum risk of electrical related impacts on biodiversity is expected from the fibre cable since the proposed cable is a telecommunication cable with little radiation of electrical magnetic fields. It differs from a power cable. – Minimal risk of water and sediment quality imoacts. – Low level impacts to biodiversity are anticipated.
Youth representatives from the Community	Project overview, EIA process and stakeholder consultation	- What are the impacts of the proposed project on economic activities? - Adequate measures should be put in place to ensure that environmental impacts such as noise and water pollution are mitigated.	- Waste and pollution streams associated with the Project installation and alteration in biodiversity would be managed following best practices - Also, the impacts due to noise and other pollution would be easily reversed since the timeline for the project is short. - Appropriate and cost-effective mitigation measures shall be proffered for all the potentially significant impacts of the project. Mechanism to monitor the implementation of the recommended mitigation measures shall also be put in place.
Elegushi Chiefs from Ikate Community	Project overview, EIA process and	- Appreciated the Project proponents for the initiative of	- There would be continuous consultation with the community and other

Stakeholder	Priority Issues	Quotes/Comments during Scoping Workshop	Response/How comments will be addressed in the ESIA
	stakeholder consultation	bringing the project to their locality - Expressed concern on how the duration of the project will disrupt economic and agricultural activities like fishing within the project area - Demand for proper mitigation of the disruption in economic activities which may arise as a result of the project activities - Requested that frequent contact and consistent meetings between the project proponents and the community are sustained	stakeholders. The scoping workshop is part of an early stage consultation which will be sustained throughout the Project lifecycle. - The footprint of the proposed Project is very small. Identified impacts will be properly mitigated.
Lagos State Environmental Protection Agency (LASEPA)	Project overview, EIA process and stakeholder consultation	- Applauded the Project initiative and encouraged sustainable use of environmental resources	

2.7:

WRITTEN COMMENTS FROM SOME STAKEHOLDERS

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

"We would like to meet with you to discuss any opinions and concerns you may have about any of these potential impacts".

ESIA FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

We would like you to take part in this ESIA process so you can raise any issues and comments you may have about the Project. Your comments are a key part of the study to see whether the Project should proceed and it is important that we understand your comments so that they can be answered and dealt with in the ESIA.

To receive regular information throughout the ESIA process, you must register as an Interested and Affected Party. To register please send this form to WIOCC (through its consultant, EnvAccord) at the address given below. If you want to make any comments at this stage please use this form. Alternatively, please do not hesitate to send an email or write separately to the e-mail address provided below.

You can make additional comments for the study team to record on a separate page or on the reverse side of this form. Please post or fax this comment sheet to any of the addresses below as soon as possible and preferably on or before November 15th, 2019 so that we can take your comments into consideration in the ESIA. The comments could also be emailed to the address below.

Please fill in your details	
Name: KELVIN OMIYI	Organization: NIG. PORTS AUTHORITY
Telephone: 08023188520	Position: SENIOR MANAGER
Cell phone: ↑ ↓	Email: kekebest@yahoo.com
Address: 26/28 MARINA, LAGOS	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Atanda Olaogun
Tel: 0803 458 8332
Email: aolaogun@envaccord.com
36B Oguntona Crescent, Gbagada
(Phase 1),
Lagos, Nigeria

BACKGROUND INFORMATION DOCUMENT FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

Comments Form

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary comments that you have about this proposed project?

The landable project of immense economic development to the community, State and the government of Nigeria.

2. Do you have or know of any information that we should know for the ESIA (e.g. environmental information or community, social or economic information related to the project location and/or the project activities)?

1) The project should comply with both local and international laws of the environment bearing in mind the project location as with the nation's navigational waters.
2) The project proponents should provide for a Post Commissioning Impact Assessment to test the efficacy of the EIA Report.

Many thanks for your participation

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Please fill in your details	
Name: CHIEF AYUBABABALOLA ELEGUSHI	Organization: COMMUNITY CHIEFS
Telephone:	Position: CHAIRMAN ELEGUSHI BEACH
Cell phone: 08183388706	Email: Ayubson1120@yahoo.co.uK
Address: IKATE ELEGUSHI	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Atanda Olaogun
Tel: 0803 458 8332
Email: aolaogun@envaccord.com
36B Oguntona Crescent, Gbagada
(Phase 1),
Lagos, Nigeria

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It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary comments that you have about this proposed project?

EASY ACCESS TO THE INTERNET
CREATION OF EMPLOYMENT OPPORTUNITIES
PROMOTE DEVELOPMENT WITHIN THE COMMUNITY

2. Do you have or know of any information that we should know for the ESIA (e.g. environmental information or community, social or economic information related to the project location and/or the project activities)?

MEETING WITH ALL THE COMMUNITY CHIEFS AND YOUTH OF THE COMMUNITY

Many thanks for your participation

"We would like to meet with you to discuss any opinions and concerns you may have about any of these potential impacts".

ESIA FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

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Please fill in your details	
Name: OWUKOKO AFOLABI	Organization: ~~HEAD OF~~ FISHERMAN ELEGUSHI
Telephone:	Position: HEAD
Cell phone: 08023223444 /	Email:
Address: (KAFE ELEGUSHI	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Atanda Olaogun
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(Phase 1),
Lagos, Nigeria

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Comments Form

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary comments that you have about this proposed project?

It's a very big project that will promote and development of the community

2. Do you have or know of any information that we should know for the ESIA (e.g. environmental information or community, social or economic information related to the project location and/or the project activities)?

Appreciate the fishermen provide some basic Amenities for the fishermen

Many thanks for your participation

"We would like to meet with you to discuss any opinions and concerns you may have about any of these potential impacts".

ESIA FOR THE PROPOSED EQUIANO NIGERIA SUBMARINE CABLE PROJECT IN LAGOS STATE, NIGERIA

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Please fill in your details	
Name: BISIRIYU ABIOLA SULAIMON	Organization: Ikate Elegushi
Telephone:	Position: Youth leader & Secretary of the beach
Cell phone: 08127427995	Email: S.bisiriyu@yahoo.com
Address: 28, OBA ELEGUSHI STR. IKATE ELEGUSHI ETI-OSA LAGOS	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Atanda Olaogun
Tel: 0803 458 8332
Email: aolaogun@envaccord.com
36B Oguntona Crescent, Gbagada
(Phase 1),
Lagos, Nigeria

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Comments Form

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary comments that you have about this proposed project?

- The Project is very good because it will bring development and embrace employment opportunity for youths in the community and the Lagos Government at large

2. Do you have or know of any information that we should know for the ESIA (e.g. environmental information or community, social or economic information related to the project location and/or the project activities)?

- Visitation to the Oba Elegushi palace to meet with all the chiefs and the entire Elegushi Community youth in order to have a hitch free project.
- Employment of some youth from the community will also be advisable.

Many thanks for your participation

APPENDIX 4.3:

SOME FIELD DATA GATHERING TOOLS

Focus Group Discussion Guide for Community Youths

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for the proposed Equiano Cable Landing Project in Eti-Osa LGA of Lagos State. Your honest answers to the questions will, in no small way, assist in ensuring that we have reliable information regarding the activities of youths in the community and their perspective on the proposed project.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment on the proposed Equiano Cable Landing Project in Eti-Osa LGA of Lagos State. This study is important in order to have baseline information of your community before the full operation of the proposed project. Your participation in this discussion is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will be used strictly for this EIA study alone. Kindly, fill the consenting form below and append your signature appropriately.

Socio-Demographic Characteristics of Respondents

Name of Community:______________________________

Date of Interview:______________________________

S/N	Name	Sex	Ethnic Origin	Educational level	Signature

Questions:

1. What are the roles and responsibility of the youths in the community?
2. What are the common health, security and environmental challenges facing youths in the community?
3. What are the economic activities common among the youths of this community?
4. How do the youths perceive the siting of the proposed cable landing project?
5. What are the common health problems that can be associated with the youths in the community?
6. What are the social vices in the community? ***Probe for the causes and magnitude of the vices.***
7. Are there any religions, cultural and communal crises affecting the youths in the community? ***Probe for the magnitude of the crises.***
8. Are there any grievances within the community? If yes, how do these affect the youths, what is the magnitude of the grievances and what has been done to address the situation?
9. What are the youth's expectations from this project?
10. What cultural festivals exist in the community? ***Probe for the taboos associated with them as well as the period of the year the festivals are celebrated.***
11. Any other information the youth in the community will like to provide on the proposed project?

Focus Group Discussion Guide for Fishermen in the Community

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for the proposed Equiano Cable Landing Project in Eti-Osa LGA of Lagos State. Your honest answers to the questions will, in no small way, assist in ensuring that we have reliable information about the fishing activities in the community and their perspective on the proposed cable landing project.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment on the proposed Equiano Cable Landing Project in Eti-Osa LGA of Lagos State. This study is important in order to have baseline information of your community before the full operation of the proposed project. Your participation in this discussion is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will be used strictly for this EIA study alone. Kindly, fill the consenting form below and append your signature appropriately.

Socio-Demographic Characteristics of Respondents

Name of Community:__________________________________

Date of Interview:______________________________________

S/N	Name	Sex	Ethnic Origin	Educational level	Signature

QUESTION

1. What are the major fishing rivers in the community? ***Probe for their histories***
2. How do fishermen access to the river?
3. Is the fishing river close to the proposed Cable Landing Site?
4. What are the challenges fishermen experience while fishing? ***Probe for causes***
5. Which period do fishing activities occur in the year?
6. How often do you fishing in a year?
7. Is there market for fishermen to sell their fishes within the community?
8. Is there any environmental issue around the fishing area?
9. Is there any taboo/belief associated with fishing in the community?
10. What are the rules and social expectations on the movement around the river area?
11. Common health problems among fishermen in the community
12. Is there an issue of flood in the community? ***Probe for possible causes and time.***
13. What are the security challenges the fishermen specifically experience in their fishing business? ***Probe for causes and proposed solutions***
14. What specific fish species do fishermen usually harvest in the river?
15. How often do fishermen fish in a year? ***Probe for reasons***
16. Fears about the project
17. Expectations from the project
18. How could this project impact your fishing activities?
19. How could the impacts be mitigated or improved?